Research Statement

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My primary research interest is applied econometrics with application to urban and real estate economics. I am particularly interested in analyzing spatial dynamics of the housing market. The combination of academic training and three years of professional experience working as a research assistant in the field of housing market analysis has led me to employ both qualitative and quantitative methods in relevant field research over space and time. My dissertation is concerned with modeling the spatial behavior of house price and its volatility. Although there is no spatial dependence in housing returns, I found the presence of strong spatial dependence in squared returns, leading to volatility clustering. I develop different models and conduct various tests and diagnostic checks for the validation of my models. I demonstrate the application of the proposed models using house price data in the Chicago metropolitan area. In this statement, I summarize three papers related to the spatial volatility and one paper which focuses on a more fundamental housing issue.

"A Flexible Model for Spatial Volatility with an Application to the Chicago Metropolitan Housing Market" (Job Market Paper)

I propose a flexible spatial volatility model for squared returns using a Box-Cox transformation for simultaneously testing space-varying volatility and its functional form. The maximum likelihood (ML) method is used to estimate this model and Monte Carlo simulations are conducted to investigate the finite sample performance of the ML estimator. Using housing price data from Chicago, I empirically demonstrate substantial evidence of spatial dependence in volatility and explicitly address the validity of a log-linear specification, after which I propose a new practical indicator, called *neighborhood elasticity*, which determines how volatility in one neighborhood is linked to that in surrounding neighborhoods. The average annual elasticity is found to be 0.4 across different spatial weight matrices, which can be used as a benchmark to compare different housing markets and a tool for policy makers to assist them to avoid volatility transmission and the risk of contagion in the housing market. Finally, to identify whether the neighborhood elasticity remains constant

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over time, adjusted quasi score (AQS) tests for testing the presence of temporal heterogeneity in spatial parameters in spatial panel data models are considered. The test results reveal that the neighborhood elasticity becomes homogeneous after controlling for both spatial and temporal heterogeneity in the intercepts of the model.

"Spatial Market Inefficiency in Housing Market: A Spatial Quantile Regression Approach", with Anil K. Bera (Revise & Resubmit, *Journal of Real Estate Finance and Economics*)

This paper explores the implication of spatial volatility in the context of market efficiency in finance literature. More specifically, this study investigates whether the housing market is spatially efficient by examining linear and nonlinear spatial dependence patterns in housing returns. The spatial ARCH-type model and its extension to the quantile model that allows for possible heterogeneous effects of spatial dependence are applied to house price data in the broader Chicago area. Our study reveals a number of interesting new insights into the spatial market efficiency of the housing market. Specifically we find: i) while housing returns are not correlated over space, squared returns, which represent volatility, exhibit significant spatial dependence, i.e., spatial market inefficiency and, therefore, the neighborhood housing returns contain information for spatial prediction, and ii) the degree of inefficiency varies over quantiles; the spatial dependence is conspicuously distinct from the lower quantiles to the higher quantiles with a gradual increasing trend.

"Bayesian Inference in Spatial Stochastic Volatility Models with An Application to House Price Returns in Chicago", with Süleyman Taşpınar, Osman Doğan, and Anil K. Bera (Under Review)

In this study, we consider a spatial stochastic volatility model in which the latent log-volatility term is specified through a spatial autoregressive process. Though there is no spatial correlation in the outcome equation (the mean equation), the spatial autoregressive (SAR) process defined for the log-volatility term introduces spatial dependence in the outcome equation. To introduce the Bayesian Markov chain Monte Carlo (MCMC) estimation approach, we transform the model such that the outcome equation is in the form of log-squared terms. We approximate the distribution of the log-squared error term in the outcome equation with a finite mixture of normal distributions such that the transformed model turns into a linear Gaussian state-space model, where the log-volatility equation constitutes the state equation. We develop an MCMC algorithm in

which the latent log-volatility term is considered as an additional parameter to facilitate the posterior simulation. Our simulation results indicate that the Bayesian estimator has satisfactory finite sample properties. We investigate the empirical validity of our specification by using the price returns of residential properties in the broader Chicago area for the years 2014 and 2015.

"The House Price-Supply Curve: A Spatial Panel Approach"

This paper investigates spillover effects of house supply on nearby house prices across the housing cycle. Over the past five years, housing inventory shortages have been a primary factor in rising house prices. At the same time, demand for housing has risen aggressively as the job market has improved and millennials are aging into homeownership. The combination of limited homes on the market with high buyer demand has pushed house prices above what they were at the peak of the housing boom in early 2006. The underlying reasoning behind this idea - low supply should lead to price increases - is clear and some influential research has strongly suggested the inverse relationship by applying matching models to the housing market. However, there is a surprising lack of empirical work done on this inverse relationship, in particular, at the level of the local housing market. Furthermore, no empirical research has addressed the role of spatial spillovers between different regions in the relationship. Using a spatial panel model for 77 community areas within the Chicago area between 2009 and 2018, the study shows substantial asymmetric spatial effects; for instance, how the nearby house supply can serve as a key determinant on house prices in a boom period. However, these effects may not hold during market downturn.

Future Research

My job market paper and its extensions point to some important policy implications in terms of dealing with housing market volatility. The general thrust of the argument in my research leads to the identification of *spatial volatility* which needs to be recognized and suggests that a more spatial approach to market intervention is appropriate and that regional planning has an important role to play in mitigating housing market volatility. In this regard, I would like to further extend my job market paper to examine the true nature of the housing market and any associated volatility using individual-level data on house prices and transactions. The plan also includes applying different types of house price measures, such as repeat sales price index and hedonic price index, and different data from other cities in the U.S. and abroad. Finally, it would be

interesting to see how well my model can predict neighboring volatility outside the study area.

As housing market behavior is not purely about economics but also about people and places, it is also necessary to take into account social and behavioral analyses using a qualitative approach in understanding patterns of housing market volatility. Ultimately, I plan to provide rigorous evaluations of housing policy interventions based on economic theory and modern econometric techniques to mitigate housing market volatility. As the factors driving differentials and volatility are on the demand side, my research will focus on demand-side policies aimed at rebuilding the fundamentals of the housing market at a local level. I am also interested in expanding my research focus and broadly pursuing policy-relevant questions in the field of real estate economics.