

# DISSERTATION PROPOSAL

Essays on Specification and Estimation of Models of Markets for Heterogeneous Housing

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Housing markets are central to the economy. Housing provides a fundamental need of all households and, for many households, serves as their largest investment. My approach treats an entire metropolitan area as a housing market. A central challenge in modeling these housing markets is the heterogeneity and unobservability of housing quality and the associated difficulty of separating quantity from price. My dissertation proposes a new approach to modeling heterogeneity both in quality of housing and preferences of households. The framework characterizes the determination of the price of housing as a function of quality for the entire housing distribution while treating quality as unobservable. Identification relies on multiple cross-sections of data for a given metropolitan area. The model characterizes the way in which the number of households, and the distribution of characteristics (income and family size) across households, gives rise to a distribution of demand for housing quality. The distribution of quality is fixed at a given point in time, and this distribution coupled with the distribution of demand gives rise to an equilibrium price function, called a hedonic price function, determining price as a function of quality for the entire distribution of houses in the market. The framework also characterizes the change in supply of each quality from period to period as a function of the change in equilibrium asset value of each quality type. This framework is then used to gain insight into the determinants of the change in houses of various quality types from period to period. The model also provides insights into the causes and effects of the recent housing market crisis in the U.S.

By its nature, house quality is not observed by the econometrician. One approach, from the hedonic literature, is to estimate a mapping from the observed characteristics to the house value. This approach assumes that housing can be characterized by a vector of characteristics, each having some well defined cardinality, and that unobserved heterogeneity is not systematically related to observables. However, measuring housing characteristics is in practice challenging, and strong assumptions are required for identification and estimation. The model in chapter 1 bypasses this step and provides a new method for estimating the price-quality frontier for housing, treating housing quality as unobserved by the econometrician. Heterogeneity among housing units is captured by a one dimensional (latent) index. One of Rosen's (1974) key insights is that the equilibrium pricing function can be characterized by the solution to a nonlinear differential equation. This insight is followed with a flexible parameterization of the model that yields a tractable closed form solution to the equilibrium price function. Conditions sufficient for identifying the parameters of the model are developed.

Chapter 2 presents an application of this model to study the housing markets using data from the American Housing Survey before and during the recent housing market crisis in the US. The Miami housing market provides an ideal setting for application of this model. Estimation of the model using three successive cross-sections of data for Miami reveals that the model fits well. The results provides new insights into the causes and effects of the dramatic run up in housing prices that occurred during the period leading up to the recent recession in the U.S. As a shorthand, the common parlance of terming this as "bubble" is adopted without endowing this term with any connotations as to whether investor behavior was or was not rational. The application focuses on the housing markets of Miami (FL) which experienced an average real appreciation of housing values of 65 percent during the period from 2002 to 2007. Changes in real income, housing supply and population growth can only account for a small fraction of the observed changes in housing values. Interest

and depreciation rates did not change much during that time period. The model accounts for these changes in housing values as arising from a change in investor expectations regarding future appreciation in rental value of housing. A high expected rate of appreciation resulted in a drop of the user cost factor of almost 50 percent from the pre-bubble level. The subsequent fall in housing prices indicates that expectations driving this fall in user cost were not realized.

Going beyond a single type of household presents additional challenges for estimation and identification. Chapter 3 will provide a new method for estimating the price-quality frontier of housing with unobserved housing quality and heterogeneity in households preferences. This model discretizes both price and quality. Rather than a closed form solution to the pricing function, a numerical solution to the differential equation characterizing the hedonic price function is obtained. This provides greater precision in fitting the data. The previous model will be extended by allowing for variation in household characteristics, such as household size, in addition to variation in income. I will explore alternative criteria for division of households into subgroups to identify key demographic characteristics that, in addition to income, give rise to differences in preferences with respect to housing. I will further extend the previous analysis by jointly estimating the model for several metropolitan areas. This will permit me to compare the distribution of housing qualities and the associated differences in quality prices across metropolitan areas. In addition, this will enable me to estimate the variation in price expectations across metropolitan areas and households, to better understand factors giving rise to differences in expectations about rates of appreciation of house values.