Chapter XIII

Geospatial Analysis for Real Estate Valuation Models

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Abstract

This chapter provides an overview of a major contemporary issue in real estate valuation — the use of geographical data to improve valuation outcomes. The spatial nature of real estate data allow the development of specialized models that increase the likelihood for better predictions. This chapter examines how using spatial data, with geographical information systems (GIS), can improve the accuracy of real estate valuation models. Contemporary theory in economics, planning, housing, and appraisal influences the model application that underlies the new field of GIScience and the use of Automated Valuation Models (AVMs) in practice. Exploratory methods of model development are also considered in the presentation of a case study along with a discussion of the changing history, development and future of AVMs and GIS.
Introduction

This chapter examines how spatial data and Geographical Information Systems (GIS) can be used to improve the accuracy of real estate valuation models. In recent years, there has been significant progress in the use of statistical models to value residential real estate. In particular, statistical models developed by academic researchers have been integrated into fast-developing Automated Valuation Model (AVM) technology. Historically, many municipal assessors have used a related technology for mass appraisals, Computer Assisted Mass Appraisal (CAMA). However, neither AVMs nor CAMAs fully exploit the potential of geographically related information to improve the accuracy of real estate valuation models.

AVMs and CAMAs attempt to model spatial and temporal variation in house prices. These models are used to mark residential property values to market, that is, to estimate the sales value of properties that have not been transacted recently. In particular AVMs are used by lenders to underwrite mortgage loans in lieu of full market real estate appraisals. The estimation process involves taking known sales prices and using this data to project the unknown. Academic researchers have developed statistical valuation models to do this. This methodology is being incorporated into AVMs and increasingly being used in the private sector.

There are two basic types of econometric valuation models used to estimate real estate market values. Hedonic models relate house prices to characteristics of the lot, the structure, and the neighborhood (Houthakker, 1952; Rosen, 1974). Repeat-sales models produce an index through linking sale prices from the same properties over time (Bailey et al., 1963; Case & Shiller, 1987, 1989). Hybrid models combine hedonic and repeat-sales specifications to obtain more efficient parameter estimates (Case, Pollakowski & Wachter, 1991; Quigley, 1991, 1995; Hill et al., 1997; Case, Pollakowski & Wachter, 1997). However, most AVMs to date do not incorporate specific information on location (latitude and longitude). The key to an accurate valuation model is precise location data. Location is essential for valuation of all classes of property. Location can be used as an explicit and fundamental element within the modeling process by utilizing autocorrelation based statistical methods and GIS.

The introduction of GIS technology into statistical property valuation models has great potential. When applied to a geo-coded dataset of single-family properties, this technology allows the user to estimate and exploit the spatial relationships in property values to build improved automated appraisal models. The result is a more expansive class of models with significantly more predictive power.

Traditional automated appraisal models postulate that the value of a property is a function of its physical and neighborhood attributes. These models typically estimate the statistical relationship between transaction price and such variables as square footage, lot size, number of bathrooms, frontage, age of the property, area income, and other neighborhood indicators. Models might also include time series methodology; indexing a given property’s value to a regional index of price change. While there is indeed a relationship between a home’s value and these aforementioned variables, this specification is incomplete.
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