# Structural change in housing submarkets in burgeoning real estate market: A case of Hangzhou, China

Zhang Ling [a,*], Eddie C.M. Hui [b]

[a] Zhejiang University, China
[b] HongKong Polytechnic University, HongKong, China

## ABSTRACT

Most studies about housing submarkets have focused on its definition and identification. Recently more attention has been paid to the structural persistence in housing markets, yet the explanation for submarket dynamic patterns is still limited. This paper examines the performance of housing submarkets in Hangzhou city of China, during the booming period of 1998–2009. The findings, based on both static and time series analysis, suggest that the structure of submarkets within the city is not stable. However, the relocation pattern, coupled with the trends in housing development, can explain the evolution of a submarket structure to some degree.

## Introduction

As various types of housing scatter around a city, it is more appropriate to study the city's house price dynamics, to evaluate a given house, or to create new policies in response to housing market conditions, under the framework of submarkets.

Housing submarkets are usually categorized according to their structure and spatial characteristics, as well as the socio-economic characteristics of inhabitants (Adair, Berry, & McGreal, 1996; Harsman & Quigley, 1995; Michaels & Smith, 1996). While earlier studies had mostly concentrated on the definition and identification of submarkets, later ones have gradually taken into account the structural persistence of housing market. Jones, Leishman, and Watkins (2002) find that price disparities among submarkets are robust and the market structure is stable in Glasgow. When stable long-term relationships among housing submarkets are established, some submarkets act as the "price leaders" which have leading dynamic tendency (Wang, 2004; Wilson, White, Dunse, Cheong, & Zurbruegg, 2011). But these findings mostly are applicable to mature housing markets where growth of housing stock is much lower than that in China.

In a burgeoning real estate market like that in China, a large number of quality houses have been constructed in the last 20 years to meet the immense demand. Different from mature real estate markets, a burgeoning market has some distinct features, such as 1) newly-built houses are prevalent in the housing market; 2) households are eager to move from welfare housing to larger houses in the private sector; 3) the quality of housing has been improving rapidly; 4) quick appreciation and low user-cost in China attract a lot of investment demand.

Hangzhou is one of the leading real estate markets in China, and is perhaps an epitome of the country's burgeoning real estate market in the near future. The paper attempts to analyze the structural evolution of and price movements in Hangzhou's submarkets. Unlike previous studies which generally divide a city's housing market into various submarkets by certain characteristics, the paper goes further by testing the robustness of Hangzhou's housing submarkets, using time series data spanning from 1998 to 2009. It looks into the submarkets through a number of versatile approaches: 1) a regression of hedonic model to identify the variables affecting house price, 2) a static analysis on hedonic models to trace the structural evolution of submarkets from 1998 to 2009, 3) a dynamic analysis to check both the lead-lag and long-term relationships amongst submarkets, as well as 4) a relocation flow analysis to find out how home purchase behaviors affect house price in various submarkets. This study shall provide insight on the driving force of price movements in Hangzhou, and could serve as a very useful reference for policymakers and developers to devise development strategies, for scholars to carry out further researches in China, or even for buyers to make purchase decisions. After this

* Corresponding author.
E-mail addresses: zlcivil@gmail.com (Z. Ling), bscmhui@polyu.edu.hk (E.C.M. Hui).

introductory section, Sections 2–4 review the theoretic and empirical studies about housing submarkets. Section 5 introduces the data and methodology deployed in this paper. Section 6–9 analyze the empirical results and discuss the findings. The last section concludes the paper.

## Identification and test of housing submarket based on hedonic model

Derived from Rosen (1974), the hedonic theory of housing postulates that housing services can be decomposed into many characteristics, including neighborhood, public service, and accessibility. The implicit valuation of these services is based on the utility of these characteristics.

Hedonic model is appropriate to test the segmentation of housing market and the existence of submarkets (Bourassa, Hoesli, & Peng, 2003; Straszheim, 1975). Typical research on housing submarkets often divides the overall market with certain methods and standards initially, for establishing separate hedonic price models for each potential submarket. There are mainly two approaches to categorize submarkets. The most common approach is based on prior information, building structure, spatial attributes, or a combination of both building structure and spatial attributes, are commonly used. Some researchers have attempted to subdivide the market by means of race (Palm, 1978), household income (Alkay, 2008) and others. Watkins (2001), however, criticizes that these classifications are often crude and the results are less than ideal. Another approach is based on information provided by the data itself through factor analysis, cluster analysis, and other methods. There is no consensus as to which approach is better than the other. Bourassa, Hamelink, Hoesli, and MacGregor's study (1999) to Sydney and Melbourne indicates that the statistical analysis produces submarkets that are better than the priori classification, though the improvement is not very significant. Their finding is limited by the quality of data available, such as the owner's estimate value but not the actual market price is used as the dependent variable. Watkins's (2001) research on Glasgow's housing market shows that studying spatial and structural factors together is better than studying them separately. In any case, dividing the housing market by spatial location is still the most commonly used method.

Having decided the approach, the Chow test is then used to find out whether there are significant differences between one equation and another (Allen, Springer, & Waller, 1995; Bourassa et al., 1999; Fletcher, Gallimore, & Mangan, 2000; Leishman, 2009; Watkins, 2001). It is a formal parametric test − if the $F$-test results of subsample show that there is a statistically significant difference in the coefficients, then sub-markets exist.

The method of hedonic model can identify static submarkets with the implication of competitive equilibrium. Nonetheless, ignoring the household decision-making and consumption process (Maclennan & Tu, 1996), this method is unable to explain the evolution of housing systems.

## The formation of spatial housing submarket and its boundary change

Unlike the hedonic method which studies submarkets based on implicit prices of house characteristics, another definition, based on the housing behavior of households, is better in explaining the formation of housing submarkets. Grigsby (1971) notes that a submarket consists of dwellings which represent relatively close substitution. By partitioning the housing stock into submarkets, he examines how dwellings are linked by patterns of household mobility.

Spatial submarkets are relatively self-contained because many families tend to move in the same submarket, partly due to the family's search path by the self-reinforcing effect (Rothenberg, Galster, Butler, & Pitkin, 1991). Jones, Leishman, and Watkins (2004) further enhance Grigsby's (1971) research by focusing on the spatial dimensions of submarkets and household mobility. Their study explains how search costs and information constraints may impose geographic limits on substitutability. Amongst the six submarket systems as identified by spatial location in Glasgow, five of which, with the only exception being the city center segment, record that more than 50 per cent of homebuyers relocated within the same locality while less than 10 per cent of whom moved to others. This confirms that migration is an important reason for the segmentation of housing market, and the persistent disparity of space underpins the formation of spatial submarkets.

However, it should be noted that substitutes for a given group of housing units might not be geographically contiguous to those units. Mobility may be induced by new housing supply. The availability of new residential buildings shall improve the average quality of housing of an area, and could be taken as a signal that this area has a positive prospect. This is expected to attract investments within the area or even in its neighborhoods (Galster, 1996). Considering that households seeking to change units will generally search in more than one neighborhood, location characteristics of these neighborhoods could affect household mobility and in turn the structure of submarkets. As such, submarket boundaries change over time. If the submarket equilibrium position changes, so does the housing submarket structure (Maclennan & Tu, 1996).

## The interaction among submarkets and long-term house–submarket structure

To untangle the evolution mechanism of housing submarkets, Rothenberg et al. (1991) points out that, since the submarkets are reasonably closely related to one another, it is rare that exogenous forces and events will affect only one of the submarkets at a time. Housing submarkets respond to demand or supply changes within themselves and between each other in systematic ways. This is supported by some empirical analyses based on VAR (Vector Auto Regression) and on VECM (Vector Error Correction Model), in which housing submarkets are found to interact with one another through short-term price dynamics. The VAR model has been proven to be especially useful for describing the dynamics of economic and financial time series. With additional restrictions, the standard VAR model becomes a VECM, which is usually applied with cointegrated non-stationary series. Allowing for short-run adjustment dynamics, the VECM builds into the specification of the cointegration relations so that it restricts the endogenous variables to converge to their long-run relationships. The cointegration term, also known as the error correction term, gradually corrects through short-run adjustments. Wang (2004) subdivides the Manhattan housing market by the number of bedrooms and finds that, when there is a stable long-term equilibrium relationship between some submarkets, the single-bedroom housing submarket will act as a leading indicator of the entire market, provided that such price change is not affected significantly by error correction of disequilibrium. Wilson et al. (2011) use stricter methods of rank test to identify price leader of submarket. The price leader of submarket is found to influence house prices in other submarkets without feedback.

In the long-run, there are three possible relationships between prices in two housing submarkets: an almost parallel change (i.e. cointegration), converge, or diverge (Tu, 1997). Jones, Leishman,