Housing Market Segmentation and the Spatially Varying House Prices

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Abstract: Market for housing contributes significantly to a country economy. As the market grows and become important, it attracts individuals as well as investors to get involve with the market. For individuals and investors, decision in buying a house is quite a complex task. There are many aspects that require careful consideration due to capital intensive nature of housing market. One of the aspects that is considered by homeowners is the neighbourhood quality and this subsequently link to the concept of housing market segmentation or housing submarket. Prior research have shown that through hedonic model, housing is priced by its bundle of characteristic that includes physical, locational, environment, legal and many more. This approach of house price modelling considers market as an aggregate. However, aggregate modelling may not be able to capture the heterogeneity of the housing characteristics due to the house price fundamentally varied spatially. Prior literatures suggest that the aggregate model might lead to serious inaccuracy in the house price estimation and thus, a disaggregated model should be considered. In order to form a disaggregated model, large area of housing market should be segmented into several distinct submarkets. This study is to evaluate prior research on housing market segmentation. There is inconsistency in current research in defining the housing market segmentation. Two main approaches; a priori defined approach and statistical approach are widely being employed in defining the submarkets. The inclusion of submarkets are found to be significant in most study related to housing market segmentation as it helps in improving the house price prediction accuracy.

Key words: House prices, submarkets, disaggregate model, spatial effect, legal

INTRODUCTION

It has been noted that there are quite significant numbers of prior research in housing economics that try to accurately model the house prices. This suggests that the great importance of housing market has been imposed in the economy; from regulators to financial institutions to investors and individuals alike. As shown by the 2007 financial crisis, the impact of housing market on economy has reached global scale by looking at its contagious effect, though indirectly. The most fundamental aspect of housing market is that it respond to an aggregate demand made by different individuals. Whether it is for occupation or investment, individual put great effort in searching for a desire house. Other than financial aspect and physical structure of housing, location is consider as one of the factors that has been given important weight when looking for a house. As a result all these aspects are then bundled to give price to a house. This is notably a basis for hedonic modelling theoretical framework in estimating house price.

As a result, it shows that house price determination is not simply an interaction between supply and demand as implied in standard neoclassical economics model. By focusing on one specific attribute such as neighbourhood, we would be able to uncover how house price was formed and link to housing market segmentation. By stressing that housing market as a neighbourhood that provides services and facilities, we are able to measure the differences of hedonic prices between one submarket to another. It is reasonable to expect that neighbourhood characteristic is considerably different from one submarket to another particularly when it comes to service and facilities. On the other hand, when it comes to submarket, Tu et al. (2007) argue that housing submarket combines neighbourhood that have similar characteristics. Therefore, this argument suggests that neighbourhood that shares similar services and facilities is consider located in one submarket. Such argument follow the definition as pointed by Bourassa et al. (2007) that define housing submarket in term of substitutability.

Accurate statistical approach in modelling housing prices has always been the research issue. Such level of accuracy in modelling the house price can only be attained through an in depth understanding on the structure and dynamic of the housing market. The debates

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on whether the housing market should be modelled either as an aggregate or disaggregate is evident based on earliest publication discussing this issue in the 1950s. Most literatures related to the modelling of housing market shows that the housing market could not be assumed unitary (Fletcher *et al.*, 2000). This is due to the significant differences in the model's parameter estimates of the respective attributes across space and time. One of the earliest studies related to the housing market modelling is Brummell (1981). The purpose of the study is to analyse the hypotheses that urban areas consists of separate housing submarkets. Recent study by Leishman *et al.* (2013) indicates that spatial aggregation model give rise to a misleading result. It argues that aggregate model or a single model in determining house prices across large area is not tenable especially for the urban housing market suggesting single model of housing price is inappropriate.

The housing market basically plays a significant role in the economy of developed country. In Malaysia, recent indicator has shown the significant contribution of housing market to Malaysia's economy output. Based from the Volume and Value of Property Transaction by Sub-sector Report provided by National Property Information Centre (NAPIC), value of transaction for housing sector in 2014 is RM 82,059.59 million which is 50.35% from the overall transaction value. The overall statistics report has shown that the housing sector has the highest value of transaction as compared to other sectors such as commercial and industrial. The Central Bank of Malaysia has also noted a significant impact of housing market on financial stability in its Financial Stability and Payment Systems Report 2012. It has been stated that bank lending is highly concentrated in the property market especially in the residential sector.

These indicators show that it is important for one to have a depth understanding on the working of local housing market. Prior studies have only focused on findings the appropriate model of housing price. This consequently lead to the importance of understanding housing submarkets characteristics and the variation of housing price in these submarkets has been neglected. As pointed by Tu *et al.* (2007), housing market should be characterised by a set of different but interrelated housing submarkets and hedonic price of each housing submarkets should be different from one another. Due to this, this study evaluate prior research on housing market segmentation particularly in the way they defined the housing submarkets.

HOUSING MARKET SEGMENTATION

Housing market segmentation (an overview): Prior research that relates to housing market segmentation have began since the 1950. It starts with the identification of housing submarket with the main purpose is to track changes in house price across submarkets (Leishman *et al.*, 2013). In the 1970s, the submarket studies change its focus to investigate the aggregation bias in the market-wide models. A study by Goodman (1978) is one of the earliest studies that test the existence of submarkets. This study applied covariance analysis to a group of houses located in New Haven SMSA and results yield from the analysis has shown significant differences in coefficient of the hedonic price structure across space and time for the study area. Besides, a nested analysis of covariance has also been conducted and it has confirmed that the coefficient of hedonic price structure is heterogenous across time and area. Basically this study has revealed the existence of submarket through the differences of the hedonic coefficient that will then result to dissimilarity in the hedonic housing prices.

Submarkets studies then focus on the best way to reveal clusters in the housing data. Leishman *et al.* (2013) posits that two ways of partitioning data in delineating the submarkets include the statistical methods and market experts. To date, literatures on housing market segmentation mostly focused on methodology to segment the housing markets as the characteristics of segmenting a housing market will be different and unique from other markets. This is supported by Bourassa *et al.* (2003); the characteristics of housing submarkets is depending on market it is operated. Supplementary to this, Goodman and Thibodeau (1998) states that submarkets normally exist due to factors such as differences in term of housing quality and type of neighbour hood or combination of both.

The concept of housing market segmentation: Housing market segmentation or submarket mainly composed of homogeneous type of property. This is noted by Adair *et al.* (1996) in which the housing market can be divided into homogeneous subsets. These subsets basically represent the submarkets. In creating submarkets or a number of homogeneous segments, the principle of stratification is widely acknowledged. The principal of stratification is based on two main approaches; the identification of distinct neighbourhoods and the identification of house groupings as regards to the physical characteristics of houses. Adair *et al.* (1996) posits that for the former approach of identification of distinct neighbourhood, houses are differentiated from one another based on the environmental or locational characteristics. On one hand, the later approach of identification is based on the physical charcteristics of houses such as lot size, built-up size, age, type of property and number of storeys.

Some literatures recognized the concept of substitutability and equilibrium in segmenting the housing markets. These include Bourassa *et al.*

(2003, 2007) and Leishman *et al.* (2013). As discussed in the earlier paragraph, the fundamental of segmenting the housing market is based on the homogeneity characteristics of the houses whereby the homogeneous houses are grouped together in a submarket. This is supported by Wu and Sharma (2012) whereby the submarket composed of a group of similar houses that are differed from other groups of houses. The concept of housing market segmentation whereby homogeneous houses are grouped together has become an important factor for one to understand the dynamics of housing market. This is because, each submarket will be quasi-independent from other and it exhibits different equilibrium price too.

Bourassa *et al.* (2003) posits that substitutability and equilibrium are the concept used in housing market segmentation. For the substitutability, it is related to a pair of goods whereby an increase in one side will lead to an increase for the other side. These pair of goods will be better substitutes when they have similarity in terms of their characteristics. In housing market context, goods represent houses and the similarity between the houses could be seen with regards to their physical and locational characteristics. The similarity in physical characteristics may include house type, house sizes and house age. For the locational characteristics, it is related to houses that located near to each other or located in the same housing scheme.

The other concept adopted in segmenting the housing market is equilibrium that based on the assumption of price of characteristics are constant across substitutes (Goodman and Thibodeau, 2007). It will then lead to the uniformity of house prices within submarkets as they consist of close substitutes. Leishman *et al.* (2013) explains that the price of houses in a submarket will remain distinct from another submarkets even in a long run term.

THE IMPORTANCE OF HOUSING MARKET SEGMENTATION

Leishman *et al.* (2013) posits the existence of submarket is considered important for one as it provides a framework to understand the market dynamics. Changes exist in one submarket affect the price changes in other submarkets. By understanding the submarkets structure, it assists parties such as stakeholders and investors in decision-making process. Wu and Sharma (2012) explains the existing of submarket assists the interested parties such as stakeholders and investors to focus on different issues. This is because, each submarket is different from one another due to the concept of submarket itself; submarket consists of similar group of houses which are different from another group.

Fundamentally, the housing submarket is significant in providing an accurate house price structure. Wu and Sharma (2012) supports that housing segmentation improves the accuracy of house price and substantially it assist in providing a more accurate price forecast. The accuracy of house price is considered important especially in the implications of house price index construction methods and mass appraisal valuation. Besides, housing market segmentation also helps in allowing a robust risk pricing for parties such as private sector investor and mortgage lender (Leishman *et al.*, 2013). The absence of housing market segmentation can undermine the accuracy of house price structure.

Goodman and Thibodeau (2007) note that when houses are assign to a submarket, the prediction accuracy used of the house price estimation are likely to be increased. The identification of housing submarkets also assists researchers to better model the spatial and temporal variation in the house prices. Due to these, housing market segmentation has been one of the considerations in improving the prediction accuracy of property price modelling. It is notes that locational characteristics of property have been the paramount challenge in modelling the property prices. Chen and Hao (2010) posits that most studies focused on the validity of the conventional hedonic regression which by this method is based on the Ordinary Least Square (OLS) assumptions. The OLS assumptions normally are found violated in the appraisal of real estate prices.

The OLS assumptions tend to show a strong pattern of spatial autocorrelation as property that is located near to each other, tend to have similar characteristics which then lead to a similar property prices. Basu and Thibodeau (1998) notes that house prices can be spatially correlated because houses that are located in the same neighborhood tend to have similar physical structural characteristics as they are being developed at the same time. Second, housing in the same neighborhood area tend to share similar location amenities. Both of these situations can be seen in most of the housing development concept in urban areas. Due to these situations, residuals produced by the hedonic regression are commonly spatially correlated.

It is necessity to properly define the attributes that may significantly affect the house prices. Such attributes include the physical and locational characteristics of the houses. For the former physical attributes, normally the data is much easier to be obtained and measured as it is publicly available data. This physical attributes may comprised of data on the floor area, lot area, number of bedrooms and building age. In contrast, data for locational characteristics are difficult to be measured and sometimes it is unobservable. Although, it is difficult to measure the locational characteristics of property,

incorporating it in the modelling is very important as it may influence the hedonic house price prediction accuracy.

Following this, many studies have been conducted in order to determine ways of incorporating location characteristics in the hedonic equations. One of the ways that consider the locational characteristics of property and helps in improving the prediction accuracy is by segmenting the housing market. The market segmentation is beneficial when data pertinent to locational and neighborhood characteristics are inadequate (Wilhelmsson, 2004). It is very essential to consider market segmentation in property price modelling as the absent of it may lead to spatial autocorrelation problem.

Defining housing market segmentation: Many studies have been carried out in order to identify the best way in modelling the housing submarkets. Basically, the housing submarket can be defined by using two main approaches. These are the statistical approaches and a priori defined approaches. For the statistical approaches, it includes statistical techniques such as hierarchical model, principal component analysis and cluster analysis to delineate the housing submarkets. The latter a priori defined approach is based on the market segmentation defined by the real estate experts. Most studies related to housing submarket have test the existence of submarkets by employing both of the stated approaches and results have shown the importance of considering housing submarkets in improving the prediction accuracy of the housing price model. However, to date there is still no single agreement on the best way to model the submarkets.

A priori-defined approaches: A priori-defined approach is one of the approaches employed in delineating the housing submarkets. This approach normally is locational based approach that is defined by the real estate experts. Studies conducted by Bourassa *et al.* (1999) and Chen and Hao (2010) have delineate the existing of housing submarket based on the administrative defined areas. Bourassa *et al.* (1999) defined the existing of housing submarket in Sydney and Melbourne, Australia based on the area classified by the National Housing Survey (NHS). The NHS has classified the area into five broadly concentric regions; termed core, inner, middle, outer and fringe. Results have shown that a hedonic price equations based on the five a priori defined submarkets are significantly better in estimating the house prices as compared to the single market equation.

By using evidence from Shanghai has employed a priori defined approaches as a way to define the submarket. The priori-defined approach is based on zone-defined by land authority; the North, South, East and West direction. This study is conducted in order to examined the improvement on the hedonic price prediction accuracy between a disaggregate model and the aggregate model. The study revealed that when submarket is considered in the hedonic price equation, it assists in increasing the adjusted R^2 value and decreased the Root Mean-Squared Error (RMSE) of the model. This has shown a disaggregate model perform better than the disaggregate model.

On the other hand, studies conducted by Watkins (2001) and Bourassa *et al.* (2003, 2007) have delineate the housing submarkets based on the real estate experts knowledge. Watkins (2001) focused on the Glasgow area to delineate the submarkets. The submarkets basically are the area grouped by contiguous postcode area and it is also based on the boundaries defined by the estate agents' listings. This study suggests that submarkets basically are formed through demand and supply processes.

Bourassa highlighted the value of practical knowledge of appraisers in defining the housing submarkets. Two sets of housing submarkets consist of sales group defined by real estate appraisers and submarket defined based on principal component analysis and cluster analysis are considered. The sales group defines submarkets are used as dummy variables. Besides, additional locational variables of water view, modernization, landscaping, driveway, quality of neighborhood and number of attached garage are also added in the third sample. The constructed models are compared in terms of the predictive accuracy. Results shown the inclusion of sales group dummy variables improves the prediction accuracy by 10-15%. Contrarily, statistically defined submarkets reduced the prediction accuracy by 5-7%. In addition, this study explains that location is the best criterion to define the submarkets.

Similarly with study conducted in 2003, Bourassa *et al.* (2007) employed the priori-defined submarkets that based on the geographical subdivisions by appraisers to define the submarket in Auckland. This study basically compared the submarkets defined by using spatial models such as geostatistical and lattice methods with the priori defined submarkets. Results have shown that a priori-defined submarket models assists in improving the accuracy of house price predictions better as compared to the spatial models as well as it is easier to be applied than the spatial models.

Data-driven approaches: With similar aim to define the housing submarkets in order to improve the predictive

accuracy performance of the hedonic regression, statistical methods such as hierarchical model, principal component analysis and cluster analysis have been used to construct the housing submarkets. Studies that used statistical methods of principal component analysis alone in identifying the submarkets is Watkins (2001). Based on the principal component factor analysis, important factors that characterize the data are identified. It has shown that housing market can be segmented based on the differences in dwelling structures. Besides, this study has compared the empirical performance of a standard hedonic regression with a segmented hedonic model. Results shown that housing market are best conceptualized as a set of quasi-independent submarkets.

The adoption of hierarchical model can be seen in studies conducted by Goodman and Thibodeau (1998, 2003). In 1998, the study conducted by Goodman and Thibodeau has introduced the concept of hierarchical linear modelling. Based on this concept, dwelling characteristics, neighborhood characteristics and submarkets are interacted to influence the house prices. Each dwelling used as the observation points are assigned to the longitudes and latitudes coordinates. In addition, they are also assigned to their respective elementary school zones. The hierarchical model adopted in this study composed of two levels in which level 1 is to determine the submarket based on the property structural characteristics. Later in level 2 the hedonic coefficient of the structural characteristics in level 1 model are let to vary across submarkets. Results produced have shown that quality of public education can be used as one factor to segmentize the metropolitan area and the hierarchical model adopted in this study assists in providing a useful framework to delineate the housing submarkets.

In 2003, Goodman and Thibodeau (2003) has used the similar hierarchical concept to determine the best model in producing accurate predictions of market values. In this study, four housing submarket models are constructed. These models include models with no housing submarkets, model that based on the zip code districts, model based on census tract and model based on GT procedure. All of the spatial disaggregation based on zip code, census tract and GT procedure improve the hedonic prediction accuracy. Nevertheless, GT submarket method performed better when the models are compared in terms of assisting in reducing the variance for the parsimonious specification that being implemented in property valuation. In addition, the GT submarket method can be easily implemented and programmed. This study revealed the significance of spatial disaggregation in improving the hedonic prediction accuracy.

Some studies have combined different statistical methods in defining the housing submarkets. Example of study that combined different statistical methods is Bourassa *et al.* (1999). This study, adopts the principal component analysis and cluster analysis to develop a statistical method for defining housing submarkets. The principal component analysis mainly is being used to extract a set of orthogonal factors from available house information that are used as variables. Later, by using cluster analysis that based on two types of clustering, agglomerative hierarchical clustering and K means clustering, the most appropriate composition of housing submarkets is determined. Results shown that statistically defined submarket produce significantly better result than a priori defined submarkets model and one single market model. This indicates that the hedonic prices vary across submarkets.

Study conducted by Wilhelmsson (2004) has applied cluster analysis in order to delineate the submarkets in Stockholm, Sweden. The inclusion of submarkets in the hedonic price equation assists in reducing the spatial dependency and improves the hedonic prediction accuracy. Houses that are located adjacent to each other are clustered into a submarket. The difference in this study as compared to others is, it includes the interaction variables in the model. Generally, the interaction variable is to allow the implicit price of living space to vary over submarkets. Results show that by incorporating the constructed submarkets, the predictive performance is improved. On one hand, the spatial dependency problem is reduced when administrative submarket and interaction variables are included.

There are also other statistical methods that can be used to delineate the existing of submarket in urban areas. This can be seen in the study conducted by Tu *et al.* (2007) where this study has used the hedonic residuals to define the housing submarkets. By defining the submarkets using the hedonic residuals, it basically clusters housing units that are spatially correlated with each other. Results show that the defined submarket structure can significantly improve the price prediction by 32.23% as compared to the whole market prediction. Recently, Hwang and Thill (2009) has used a fuzzy clustering method to identify the housing submarkets. A hedonic analysis has been applied in order to extract predictors of housing price. Then based on the fuzzy cluster validity index, optimal number of cluster is evaluated. Basically from the result of sum squared errors, the fuzzy clustering outperforms hard clustering.

Basically, from all of the past studies discussed above, various statistical methodologies have been

employed in order to delineate the housing submarkets. All of the methods used to identify the housing submarkets assist in improving the prediction accuracy of the house price model and the major important issue is, it helps to reduce the spatial autocorrelation effects. Thus, the consideration of submarkets in property price modelling is very important as it provides a better and more accurate price model that could benefits many parties especially in the mass appraisal valuation and also in the house price index construction.

HEDONIC MODELLING ADOPTION IN DETERMINING THE PROPERTY PRICES

Basis for hedonic modelling approach is originated from the regression technique. It involves Multiple Regression Analysis (MRA) which is applied when there is more than one independent variable included in the regression.The hedonic modelling approach is also known as the implicit price approach. According to Rosen (1974), based on the hedonic hypothesis, value or price of goods depends on its own attributes or characteristics. According to Ohta and Griliches, there is an assumption in hedonic hypothesis as follows:

> a commodity can be viewed as a bundle of characteristics or attributes for which implicit prices can be derived from prices of different versions of the same commodity containing different levels of specific characteristic

From the respective assumption, it can be concluded that the price of a product is derived based on the heterogeneous products from the same commodity. Each of the commodities comes with its own characteristics. The same assumption applies in determining house prices. In order to determine a house price, the price will be derived according to other house prices located in a same housing scheme. Based on Rosen's hedonic method, a good or a product is described by its characteristics or attributes. Thus, in the housing market context, a house is described by its characteristics such as the physical and locational characteristics.

HOUSING MARKET AND SPATIAL EFFECT

Housing market and spatial effect are related to each other especially in terms of the house pricing. The spatial effect if exists in the house characteristics or in the house pricing data may lead to the inaccuracy of the house price modelling. Literatures shown that the inclusion of submarkets in house price modelling could help in reducing the spatial effect problem especially for the spatial autocorrelation (Bourassa *et al.*, 2007; Wilhelmsson, 2004).

Gerkman posits that spatial effect can be defined as a relationship that exists between two points in a space due to the geographical proximity. The two points exhibit a similar value when they are located close to each other. Those points are considered as spatially dependent when there is a relationship between them, otherwise they are considered as spatially independent. In the housing market context, the points are pertinent to houses. That is when two houses are located in the similar area, the characteristics of those houses tend to be similar.

There are number of reasons to suspect the existence of spatial effect in the housing values. For example, houses located closer to each other tend to be developed at the same time, leading to a similar property characteristics. According to Gerkman, spatial effect can exist as a result of other proximity measurements such as commuting times, trade flows and commuting flows. Mainly, spatial effects are expected to exist when a sample of transaction data incorporates locational factor as one of the elements. Generally, there are two types of spatial effects namely spatial autocorrelation and spatial heterogeneity.

Spatial autocorrelation in house prices: Spatial autocorrelation which also known as spatial dependence can be defined as the coincidence of value similarity with locational similarity (Anselin, 1999). Gerkman (2010) notes that spatial autocorrelation can be seen in the dependent variable in a regression model. The dependent variables are dependence between observation points. In the housing market analysis, the dependent variable used in house price modelling is the house price. Thus, the spatial autocorrelation mainly will arise in the house price between observation points.

Houses located near to each other tend to be similar in terms of the house characteristics as the houses tend to be developed at the similar time. Generally, the spatial autocorrelation arises due to the interdependencies of points in a space. Gerkman supports the points could be interacted in a meaningful way. The interdependencies between those points can be seen in terms of the measures of closeness to location amenities (Basu and Thibodeuau, 1998). Examples of location characteristics that may affect house prices are neighbourhood characteristics, accessibility and proximity externalities.

Basu and Thibodeau (1998) posit that the house prices could be spatially autocorrelated in two forms namely the similarity in terms of development time and sharing the location amenities in the neighbouring area.

For the former reason, typically neighbourhood tend to be developed in the same time which will lead to the similarity in terms of the structural characteristics such as the house sizes, vintage and design features. The latter illustrates that neighbouring area normally tend to share the similar location amenities which include school, parks, police station and others.

Substantially, for housing market context, spatial autocorrelation could be specify as the existence of covariance in the error of the hedonic price estimation (Bourassa *et al.*, 2007). As pointed out by Bourassa *et al.* (2007), this type of spatial effect is closely related to the housing market segmentation concept. Submarket is based on the concept of substitutability and equilibrium, thus the characteristics of houses within a submarket are likely to be similar between one another. This will lead to the existing of correlation between the estimation errors. Bourassa *et al.* (2007) posits that the estimation errors could be reduced by controlling submarkets in the hedonic equation.

SPATIAL HETEROGENEITY IN HOUSE PRICES

Spatial heterogeneity is another type of spatial effects that may exist in property data. Fotheringham *et al.* (2002) explain spatial heterogeneity as a phenomenon whereby relationship between two variables in an observation point become unstable. In other words, spatial heterogeneity can be defined as variation in relationship over space.

Chen and Hao (2010) posit that most of the empirical studies related to property price modelling assumed the property market as a single market. By assuming the market as a unitary market, coefficient of the housing attributes is presumed to have a unique marginal price in which the coefficients are held constant across space. Nonetheless, this assumption is not consistent with the fundamental characteristics of property itself; the heterogeneity characteristic of property. The heterogeneity characteristics can be seen in terms of the structural, locational and neighbourhood attributes and this basically is due to the spatial immobility of housing (Chen and Hao, 2010).

Examples of spatial heterogeneity can be seen in relationship between house prices and distance to the Central Business District (CBD). Most of the previous studies show that houses located near to the CBD area will have higher price as compared to houses located further away from CBD. However, in certain area, this situation might be opposite. The relationship between house prices and distance to CBD area is no longer positive.

This is supported by LeSage in which relationship between house prices and distance to CBD may vary over location. In study conducted by LeSage on houses located in Lucas County, Ohio has shown that spatial heterogeneity exists in the relationship between house prices and distance to CBD. Houses with low prices located nearest to CBD and high priced houses located further away from the CBD. LeSage also posits that results for relationship between house prices and distance to CBD is contradicted with the Gauss Markov assumptions; mean and variance for sample data are constant across space.

CONCLUSION

A debate between the aggregate and disaggregate model can be seen in the study pertinent to housing market as early in 1950s. Most literatures have shown that considering the disaggregate model are significant in improving the house price prediction model. The disaggregate model is obtained by segmenting the housing market into few segment that is called as submarkets. The existing of submarket is not only important in providing a more accurate house price prediction, but it also assists parties such as local authorities, financial sector, developer and tenants in the decision making process of various housing sector. This is because the existence of housing submarkets assists one to understand the dynamic of the housing market and also the way the policy interventions work through the housing system. The significance of considering the submarket in house price modelling has led the submarkets to be one of the important areas in the housing market analysis context.

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