

MODELLING OF THE PROPERTY MARKET: THE MALAYSIAN EXPERIENCE

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ABSTRACT

Property market modelling is an attempt to understand behaviours of the property market where models present theoretical underpinning of the property market, which forms the micro foundation of property market behaviour. The abundant literature on it suggests the popular nature of the approach in understanding property market problems. Despite the problems encountered in modelling the property market, many more attempts being made to achieve more accurate models. The Malaysian experience in this field is relatively new but nevertheless it has significant contribution towards the development in the real estate research

Keywords: *Property market, models, hedonic, behaviour, Malaysia*

INTRODUCTION

Modelling of the property market has been extensively used in real estate research. Models are designed to explain property market behaviour and they are used in a specific situation. The resort to use models is that their explanation can be captured through the use of mathematical illustrations. In the Malaysian real estate context, there were several attempts made to use models to explain property market behaviour. This paper examines the literature on property market models to understand the extent of its application in real estate research. In doing so, the main problems and issues faced are highlighted. This will provide a clearer picture on the direction that can be taken when designing models in real estate research.

Property market modelling is an attempt to understand behaviours of the property market. Ball et al.,(1998) suggest that models present theoretical underpinning of the property market, which forms the micro foundation of property market behaviour. It started with first conceptualising the reality of the property market in terms of its functions, theories and assumptions. Explanations on behaviours of the property market are illustrated through outcome of analysis carried out with the help of various statistical techniques. In the global context this approach is popular and broadly used among real estate researchers.

The objectives of this paper are captured in the following manner. The next section will review the literature on property market models in the global context. It describes the basic concepts underlying the models and then discusses the empirical implications of the different models used and the situation in which it arises. Section three examines the usage of the property market models in the Malaysian real estate markets. The section will examine the problems faced as well as the implications faced by researchers. Section four characterises and analyses the usage and potential direction of models in the real estate research and the implication on the real estate sector. The final section concludes on the direction of property market models in the Malaysian real estate research.

LITERATURE REVIEW ON PROPERTY MARKET MODELS

The purpose of this review is to assess and to examine the trend of practice in property market modelling. A review on available literature suggests that early attempts to incorporate mathematical models in real estate problems about four decades ago. Rosen (1974) explains that a property encompasses of a bundle of attributes and these are implicitly reflected in property prices. Buyers and sellers evaluate these attributes separately before closing the deal for the sale and purchase of the property. In order to understand the weighting for the different attributes, hedonic modelling was used to

explain how each attributes made up the prices of the residential market. According to Malpezzi (2003), the method of hedonic equations is one way where expenditures on housing can be decomposed into measurable prices and quantities so as to enable comparisons and predictions of properties between identical and different dwellings in different areas.

Using the classical economic theory, Harvey (1996) illustrates the function of the property market through the changes in demand and supply. The property market acts as indicators, which sends signals to buyers and sellers through price changes. At equilibrium level price, demand would be equal to supply. As market is always changing, the increase in price would suggest increase in demand and market will be at disequilibrium. Increase in supply through construction activities will pull price down in the course of bringing market back to equilibrium. As construction takes considerable time, there will be a lag in supply. Hence, the market is always changing and the process of adjustment is a continuous process of readjusting demand and supply. The theoretical concept of the property market act as the basis of developing property market model. Ball et al., (1998) portrays the property market model as an interlinked market of four main activities. These are the development, investment, use and the land markets. They illustrated the market equilibrium and the adjustment process through the shocks in demand and development carried out to increase supply in response to demand. (Wheaton and DiPasquale (1996); Ball et al., (1998)) suggested that dynamic behaviour of the property market could be analysed by developing models illustrating the changes that takes place in each sector.

The user market is measured by rents paid by occupiers for business or dwellings. As markets move from equilibrium it will cause rents to rise or fall. There are a number of reasons that could cause a shift in the market equilibrium such as population increase, economic growth or economic recession. These changes in markets may trigger response on property stocks. Tse. and Love (2000) examined the inherent attributes of residential property values that are valued by consumers. These attributes are characterised into structural, physical, neighbourhood and environmental, in which they construct a model using transaction-based data to evaluate residential property values in Hong Kong. Analysis showed that the view of negative housing attributes are capitalised into house prices.

The finance market analyses the role of property as an investment assets. Performances of properties are distinguished through the analysis of yields or returns on property. The capitalisation rates are analysed through prices and rental movements. The two main ways in which capitalisation factors are determined are through the valuation rules and economic evaluation (Ball et al., 1998). The valuation rules rely on the professional valuation to determine the property market. In the economic evaluation, the annual rental flow is capitalised into net present value taking

into account depreciation and rental growth. In the investment market investors' particularly institutional investors rely on property market analysis to guide them in asset selection. As capital and property markets are different form of investment, investors are keen to know the performance of these markets and how they relate to each other. Keogh (1994) monitored and suggest that investors may switch investment these two mediums although it is difficult to track funds from property may switch to capital market when property investment does not perform.

In the investment sector estimating the time for properties to be in the market in important. Brown and Tien (2004) introduce the concept of the Equilibrium Time On the Market (ETOM). The concept focus on the speed or time the market takes to correct for information differences between open market valuations and traded prices. The model makes use of the present value (PV) framework using a time varying discount rate to measure the time take for the market to clear. The time taken for discrepancy between expected sellers price and open market valuations to converge is the ETOM. Using IPD property index data, they estimated the ETOM for seventeen-year period for investment portfolio in the UK is 8.40 months. Equally important in the property investment sector is the information on market changes. The construction price index is important to help investors to be informed of the property market condition. In this context, models have been developed to construct property index. The construction of property index are either appraised base or on sales transactions. According to Sau (2004), a survey on the price indices in some of the commonwealth countries many of the measures may be flawed owing to two issues. This suggests that although property market models are useful in many areas, its application is not without problems. These are discussed in the later part of the paper.

Turning to the development sector of the property markets, a number of models are designed to illustrate how development response to the dynamic market changes. Theoretically it is assume that the market will move from equilibrium level when the market is triggered with an increase demand from price and rent increase. Development will take place when demand exceeds supply in the existing stock and this continues until excess demand is satisfied. In identifying the development level, no development occurs where it becomes unprofitable for new buildings to be built (Ball et al., 1998). At this point, property values are equal to its replacement cost. In their analysis of the land market sector, they presented the different situation of property values, replacing cost and its effect on new office development. In a model of the urban housing market, Wheaton and DiPasquale (1996) illustrates the structural attributes and density of cities. Redevelopment of areas into new uses came into effect when the values of new development exceed the cost of conversion to the new use.

The development and redevelopment of properties can be made possible where land is available. The land market analyses the competition between different land uses. Land will be made available through the process of land conversion if there is demand for it. These are normally shown by rents or price increase. The pricing mechanism of the land market determines the allocation of land for development. In the analysis of land supply, restriction to it, which may affect development, and it is an important factor to consider. Restriction may be in the form of the planning regime. Theoretically planning /restrictive that significantly restrict the supply of land for new development is likely to reduce supply elasticity increase land and house prices and increase housing densities (Bramley 2003). Studies have shown that there are various measures adopted to assess planning restrictions (Bramley (1998); Malpezzi(1998)). In order to assess the impact of the planning system on the property market, Hui and Ho (2003) illustrates the model, which explore the effect of the land-use planning system on house prices in Hong Kong. The model first establishes the demand and supply equations to establish the market at equilibrium level. In their study, they analysed planning system variables such as usable floor area (UFA), land supply (LS), residential gross floor area under planning applications (GA), residential zones (RZ) and green belt/ open space (GB) and approval rate of planning applications (AR) relationship to house prices (HP). Using stepwise regression for a three-year period they suggested that the significance of approval rate of the planning applications supports the view that development control alters the structure of housing supply in a way, which may change the equilibrium price of housing.

The operation of the property market explained in the four inter related markets are also examined over time. The economy, population change and other market constraints, which are exogenous and have affected the dynamics of the property market as a whole, are also examined through property market models. Property market cycles are examined through models both in specific country and across various markets. Edelstein and Tsang (2007) modelled the dynamic changes that take place in four different cities in the USA. The aim is to develop and test a theoretical model of residential housing market cyclical dynamics. They contended that commercial real estate cycles are different from residential cycles. As for the market forces, they suggest that local fundamentals are important impact in explaining cycles. Other market cycles that were examined are the explanation to the British property cycles (Key et al., 1994). The cross border analyses of the housing market dynamics of twelve European countries suggest that it is possible to some degree to consider the European housing market as one market (Wigren and Wilhelmsson 2007). Using the stock-flow and error correction model, they illustrate that housing stock and macroeconomic determinants are robust across countries. Price and cost elasticity of housing supply are low while shocks on demand and supply have small effects on housing stocks.

Although the theoretical underpinning to property market models is relevant, application of it is not without problems. Gibb(2003) in his evaluation of the housing market models noted that the complexities of the housing market models are reflected in the different approaches to the housing market models. Basically two main approaches were considered namely the mono-centric spatial model and the filtering process, which focus on the process and the dynamics of the housing market. Both models demonstrate some strength and also weakness and as such extension of models and redefining markets remains a continuous process. Criticism of models centres on getting the best realism from models. Problems of the property market may arise from a number of situations such as the imperfect property market characteristics, existence of sub markets, location differences and other heterogeneous characteristics. Having acknowledged these difficulties, recent trends in property market models have moved towards addressing these issues.

Fletcher et al. (2000) in addressed the problems of property market models by testing the existence of sub markets. They use aggregate and disaggregate models to compare differences between actual and predicted house prices. The disaggregate models of the sub markets shows statistically significant though with small improvements. Watkins (1999) suggested that regression models would be subjected to bias if they fail to accommodate the existence of the housing markets. By comparing the empirical performance of a standard hedonic house price regression model for the city of Glasgow with a segmented model which acknowledged the underlying market structure which is the existence of sub markets for different dwelling types, shows that the standard error for of the segmented model is significantly lower than that of the market wide model. Hence to reflect the behavioural realities of the property market, a two-stage approach was suggested to the application of the MRA techniques to residential valuation. First is to follow the traditional institutional analysis to subdivide market structurally into different market segments. The second part is to separate the house price equations into each segment. Although market segments are an attempt to create the realistic feature of the property market, the concept of market segment could not be clearly define as each segment would be associated to the local characteristics.

Similar to the problem of market segments is the problem of location characteristics of the property market since the property market can also be segmented according to their locations. Kryvobokov (2007) modelled the property market at the micro level to extract location attributes that are most important for market value. Using empirical evidence of developed property markets, the meta-analysis is applied to extract location attributes and weigh their importance. Results suggest that it is possible to substantiate location attributes, which influence market value for different real estate types. In the question of the location effect, influences on neighbourhood and access appear to be dominating location. Rosiers et al., (2000) integrated neighbourhood and access attributes to sort out cross influences between both series so as to achieve an optimal model design with

minimal information loss. Its aim is to explain property prices on the basis of physical and neighbourhood related characteristics. Using hedonic model on global data bank, property information are located using geodetic co-ordinates, which are integrated into MapInfo GIS. Multi sources data such as schools, universities, colleges, shopping centres, remote sensing images, street grids, road and highway networks, power lines etc are located using appropriate reference system. Results shows that model have greatly improved with location and access factor being explained in property values. It suggests that the factor analysis used is highly efficient at sorting access and neighbourhood attributes. The method provides useful insights into the housing market dynamics of the region with findings in line with theoretical expectation.

Through out this review on the property market modelling, it was noted that research involving property market models have undergone various changes. All these attempts are directed towards achieving a reliable and accurate picture of the property market. The understanding on property market behaviours is vital for planning, development and investment purposes. The development of GIS has enabled market information to be integrated with location and to some extent it has enabled towards developing more accurate property market models.

PROPERTY MARKET MODELLING IN THE MALAYSIAN CONTEXT

In the Malaysian context, property market models are mostly discussed in the academic arena. It starts with the interest to adopt the multiple regression analysis in property market valuations (Fadilah and Fauzi (1991); Azhari (1987)). Its objective approach and its practicality in mass appraisal valuations have encouraged valuer s to consider the use of this method in valuations. Later (Azhari 1991) establishes and index to measure different types of house floors. Other models developed along the line are models of the Malaysia House Price Index (MHPI) initiated by the Valuation and Property Services Department (VPSD), the construction of land value maps (Azhari and Ghazali, 1994), the hedonic pricing model for Penang condominium market ((Chau and Chin 2002);(Chau, Chin et al. 2004)), the mass appraisal valuation model (Dzurikarnain et al., 1996), model to assess the micro and macro economic impact and the dynamics of the property market (Copper et al. (1995);WanZahari and Nasir (2002); Aminah (2002)) and the integration of hedonic pricing models with GIS (Hamid (2006a); Hamid (2006b); Suriatini(2006);Eboy, et al. 2006)). The following examines each these models in order to determine the diversity and depth of the research area.

In deriving at an index to measure different floor types Azhari (1991) argued that the variety of floor finishes in Malaysian houses suggest that floor finishes has an influence on values as this has been practiced by many valuers when undertaking property valuation exercises. The need to give objective adjustments on differences of floor

finishes and to improve on subjective valuation practice is the reason for deriving at this index. Using data from a sample of 322 double storey houses, randomly selected from twelve housing schemes in Johor Bahru, a model was created to assess value of residential units with different floor types. A linear regression, which assumes that a floor index, Y is a linear function of the flooring materials X , located at the respective position ($x^1, x^2, x^3 \dots x^n$) of those materials in a particular house. Regressing subjectively the assigned floor ratings against the floor finishes, a consistent floor type index was derived. The advantage of making objective valuation through regression models was later captivated in mass valuation for rating purposes. Applying the concept of MRA, (Dzurlkarnain et al. 1996) developed a model for valuing properties for rating purposes. The advantage of mass appraisal property valuation is that it can expedite manual valuation work.

The MHPI (VPSPD 1993) was first initiated in 1993 and finally came into force in 1997. The aim of creating the house price index is to establish a national price index to monitor the movement of house prices in Malaysia. The index should represent the overall housing markets and should be disaggregated by region and house type with individual indices for key markets and house type. The index may be used to formulate national economic policy with respect to housing and property development. The hedonic approach to price measurement was used and utilises a total of 170,000 property sales data. The dependent variable, price was regressed against independent variables both quantitative as well as qualitative to account for variations. Sampling procedure of average volume of residential transactions for 1990- 1992 were then categorised under district, types of houses, location and condition. The MHPI was officially accepted and used as a measure of house price change although certain limitations to it were acknowledged.

In line with the awareness of understanding the real estate markets, (Chau and Chin 2002) critically analyses the literature on hedonic house price model and applied it on the Penang condominium market in order to understand the property market structure. Based on previous researches, the main attributes affecting prices are categorised under location (L), structural (S) and neighbourhood (N). The model identified that condominium units in Penang are very homogenous and that represent a desirable characteristics for the application of the hedonic pricing model. The coefficient of the included attributes were significant and of the expected sign. Later (Chau, Chin et al. 2004), assesses the effect of the Asian financial crises (AFC) in 1997 on the real estate market. A regression analysis was carried out where price act as dependent variable and location (L), structural (S) and neighbourhood (N) act as independent variables. The regression for price variation for condominium market was selected and findings indicate that the market for 1998 reflects some disturbance caused by the financial crises. In another study, Hamid and Hamah (2002) examines the characteristics inflation hedging properties according to its neighbourhood and type. Evidence

showed that inflation-hedging characteristics of residential properties are different across geographic areas and property types. It disclosed that the inflationary characteristics of real estate can work differently at the local level.

In search for the explanation on the dynamics of the property market, models were also utilised to explain the nature and the forces that drives the market. The main macro economic factors affecting real estate market operations suggest that indicators such as the economy measured by growth domestic product(GDP), labour force, income level; and population exhibits direct relationship with the construction of the office development (Copper et al. 1995). In another area Aminah (2002) investigates the dynamics of the Malaysian real estate cycle to examine the closeness of the property cycles with the macro economy. Adopting linear relationship analysis, the macro economy seems to influence property market cycle movements. In the housing market sector, models are used to explain the dynamics of the Malaysian house prices (WanZahari and Nasir 2002). Using the correlation analysis and MRA, they analyses the relationship between house price and other variables that are related to house production such as building material index, consumer price index, GDP, housing stocks, composite index, population level and base lending rate. Although there is no straightforward relationship, the importance of the variables is significant.

In line with technological innovation and the problems related to hedonic models, many researchers have move towards integrating hedonic models with spatial elements. In order to improve the ability of the data base system, a land value map is suggested as it is able to illustrate the distribution of land values which can be utilised in many ways such as the growth pattern, market preferences and potential areas (Azhari and Ghazali 1994). The construction of land value map incorporates GIS with MRA, which may have the ability to show property values distribution in even if the property is not transacted. In addition, it is also able to portray past, present and future land value distribution.

One important characteristics of the property market is the existence of various sub market within the overall market. The need to address the importance of sub markets was also examined (Hamid 2006b)through the price segmentation of residential properties. Using the GIS and hedonic modelling, the GIS base price contour technique creates spatial dummy variables to segment residential property by determining neighbourhood characteristics. Results suggest the importance of neighbourhood in affecting residential property value with the central business district as a regional residential centre. The model explains 80 to 82 percent variation in property prices with the consideration of sub markets. In another study (Eboy et al. 2006) assesses the location influence on the rental value of shop houses. Using the Geographical Weighted Regression (GWR) enables exploration of spatial variation of the relationship of variables under investigation. The GWR that includes the data coordinates into the ordinary least squares, which will allow some form of spatial measurement to be made.

The GWR with the aid of GIS software highlights the sub-areas within the localities where rental values are higher or lower than in other sub-areas.

Throughout the construction of property market models, the hedonic pricing was the main approach in deriving the property market models. However hedonic models are subjected to a number of problems arising from the involvement of many variables representing relevant characteristics. One of the main problems that can distort models was the effect of spatial correlation. In a review on the literature on spatial autocorrelation (Suriatini 2006) acknowledged that the use of GIS in dealing with the problem. Though there are a few ways of dealing with spatial autocorrelation, the spatial weight matrix is more suitable for real estate analysis as it constitutes a number of factors underlying the economic behaviour of real estate. GIS has indeed broadened the way in which property market are analysed. It has facilitated the real estate sector in terms of public sector information management in support of property valuation (Nasir. 1999)

EVALUATION OF THE MALAYSIA PROPERTY MARKET MODELS

The above review of the property market models in the global context serves to mark the direction on the trend of development of research in property market models in Malaysia. Although the review constitutes only a small sector of the broad area, it has given the picture that there is practically no limit as to the use of models in real estate economic analysis. Despite of the weakness of the property market models, it still remain as one of the area that has received attention from researches in the real estate sector. The following evaluates the trend of the development of the Malaysian property market models in relation to the global development.

A look at the overall picture on the above review suggests that there is diversity in the use of models in real estate research although the number of research in a particular area is still small. Nevertheless there are still large gaps that need to be filled to understand about the property market behaviour. In terms of research depth, evidence showed that this is still lacking in almost every area that encompasses the property market. As many efforts are directed to the housing market, other areas are largely unexplored. The commercial property market have not received much attention while in the industrial property market, the institutional aspects of the market are investigated (Norhaya (2004);Norhaya (2006)). Other areas that require attention, which may affect both socially, and the economy is the research involving policy assessment. Policy is important as it may have significant effect on the property market and it act as a means to intervene into the market. It may have a short or long term effect either on one sector or the overall property market. As market sentiments can be affected by policy, it is important for models to be created to assess how it has influence the

property market.

Other areas which models are still lacking is in the investment sector of the property market. As international property investment has caught the attention from many investors, there is a need to create flexibility for property investment in Malaysia. The property market needs to be analysed critically and models can perform this function. (Ting 2002) analysed the benefits of diversifying residential property investment with other forms of property investment. With the housing index in place, it is timely for the rise of the commercial property market index. Hence the availability of information through index will give light into investment decision-making.

Throughout this review, it was noted that many researches on property market models address single market at the micro (Azhari (1991); Azhari and Ghazali (1994); Hamid, 2002 a); Dzurlkarnain et al. (1996)) and macro (Aminah (2002); WanZahari and Nasir (2002)) level. These micro and macro level analysis could be widened to compare how markets between different regions behave due to the difference in the property market structure. Cross-market analysis may be beneficial to fund managers, as they are able to distinguish between performing and non-performing markets. Other area in which models may be helpful in investment strategies is the ability to analyse property market performances, which would make property investment to a guided decisions.

Experience in property market modelling in the Malaysian context may be relatively new but it has captured some strength. An important contribution of models in the property market was the MHPI (VPSD 1997) act as a benchmark on the performance of the Malaysian housing market. Although faced with weaknesses it is the official source of reference to assess the performance of the housing market. Another important contribution derived from research on property market models was the development of CAMA (Dzurlkarnain et al. 1996). The system was tested in a few local authorities and it has proven to expedite mass property valuation. The benefits of automated valuation has increased efficiency and reduce cost involve in rating valuation exercises.

Similar to other property market modelling, modelling of the Malaysian property market models is subjected to many problems. Apart from the technical problems, models are also subjected to theoretical problems. One of the main problem of modelling is to determine the right functional form a model should take (Chau and Chin (2002); Gibb (2003)). Accordingly models can be in the form of linear, semi-log or log-log function. The determination of the selected function entirely depends on the how researcher thinks reasonable and in most cases affected by the value of R^2 . Although models are expected to provide explanation on the property market, sometimes they do not behave as it should be. The problem of getting accurate and reliable model is always hindered by a number of problems in terms of data as well as getting the right analytical tools. It is thus difficult to explain property market behaviour, which are subjected through a

number of interrelated subjective factors with through mathematical models where the power of explanation is limited. Hence theorising the property markets with closed mathematical models may not provide the best solutions to some problems. In property market modelling the availability of abundant data will facilitate the accuracy of results. Data such as property stocks, absorption rate, land supply, planning details, income level and demography are essential to be fitted into models. The problem with the local market is the availability of these data and in many cases it is difficult to get access these data particularly at the local level. Other technical problems that are common in property market modelling are problems of dealing with inaccurate models caused by multicollinearity, heteroskedasticity and spatial autocorrelations.

In Malaysia, property market models the use of property market modelling has gained popularity although there are problems to it. Researchers are aware of limitation of these models but for the purpose of property market measurement, models can provide objective answers as to property market performance. In dealing with routine and mass valuations, models provide fast and economic solutions.

CONCLUSION

This paper has basically reviewed selected literatures on property market modelling and assessed the development of property market modelling in Malaysia. Property market models are designed to explain the nature and behaviours of the property markets given the inherent characteristics of the property market. Models are important for researchers to explain various situations that arise from the market. As property market varies, so is the nature of models. Hence one model may work in one situation but not in another situation. The work of creating models in property research is a continuous effort and it may take in many different forms.

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