

MALAYSIAN HOUSING INVESTMENT INFORMATION PRICE MODELLING

By

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Abstract

Research on housing set out for various reasons but the focus of all research lies in the three main traits: price, affordability and ownership. Whilst affordability captures the attention of social scientist, an interest in property investment identifies price determinants and what actually paid for a house and whether the decision to invest in housing is guided by sufficient information.

This research aims at analyzing the impact of macro and micro determinant of house price in five selected location in Malaysia. A literature review reveals that house price is determined by an inter play of some macro factors such as income per capita. Twelve macro models proved that economic indicators are significant in explaining the price variation. The finding indicates that for all models, economic growth plays an important role in price but as the income-related variables are included in the model, income-related variables gained significance. Thus, the regression models led to a conclusion that price is greatly influenced by income and income-related factors.

While this finding pertains to the national and state level, local market is investigated via the development of hedonic equation. A total of twenty-six (26) models have been developed for five different locations in Malaysia. Transaction prices of secondary double storey terrace houses are regressed against the identified attributes and collected from secondary and primary sources. Appropriate statistical analysis has been performed to minimize any potential technical disability in the model development which may affect the interpretation ability. Stepwise regression process is employed to eliminate multicollinearity that might affect the stability of the models.

The analysis indicates that price is actually specific to a particular location. One location is greatly explained by building area, which means people are paying for larger area. Whilst in some other location, the price is significantly explained by the locational related factors. The findings for each location are quite consistent even though there is a tendency of shift in paying preference. For example Penang imposed higher implicit price observed in the model for distance factor, but in 2000s model shows that price is dominated by various factors. It shows that the implicit prices for each attribute vary from one year to another. Hence suggest that the price paid is not fixed but need adjustment from time to time.

The findings thus suggests that it is quite impossible to draw general conclusion for the local market as it is influenced by factors or attributes that pertains to or specific to the particular market.

Keywords: *house price modelling, macro and micro determinants and hedonic analysis*

1.0 INTRODUCTION

Housing has been a major focus of investigation for various reasons. Whilst social scientist view housing as social object, others may look at it as true or physic investment. In most urban areas, differential in house price has become popular area of research. It is normally accepted that house price is determined by the interaction of demand and supply. Whilst this is practically true in the open market, the restriction in terms of ceiling price set by authorities has resulted in the earlier statement become invalid. Assuming there has been no restriction and the free market is in operation, the price will obviously will be a function of price determinants hence the behaviour of price is explain by the determinants forces. Theoretical investigation deals with searching materials on price determination signals that the determinants could be of macro and micro. On one hand, the macro perspective explores the price as being dependent on the macro indicators such as the level of employment, rate of interest and the mobility of labours.

On the other, works on micro argue that house price is better explained by factors which are specific to the house itself. An assumption been made on the ground that housing is also a good upon which the price is also determined by the bundle attributes possessed by the good. The assumption is based on the price paid for a particular good is a sum of the implicit prices of the associated attributes whereas the hedonic equation used is a reduced-form equation reflecting both the demand and supply influences (Halvorsen and Pollakowski in Edmond, 1984). With the application of regression analysis, it is possible to derive the implicit price of each attribute, the hedonic price and the relative importance of each attribute has in determining the price of the good. An analysis should therefore reveal the price variation or the contribution of each determinant in overall price. The quantification thus can be a beginning to the effort of explaining or modelling what actually consumers or house buyers are paying for a house. Chin and Chau (2003) believe that buying a house involves a substantial capital outlay hence the buyers will shop around to acquire as much as information about the attributes of the units they desire before making the purchase.

This paper presents the findings of the research which aims at modelling the contribution of various factors in house price variation. Segregating the contribution of each house characteristics via hedonic function or price modelling enables the quantification of contribution of identified explanatory variables. An analysis of double storey terrace price variations in five selected localities reveals what actually the consumers or buyers in Malaysia are paying for that particular type of houses. A comparison between models developed across time and localities shows the composition of the house price is differ as time changes and how these changes affect the contribution of each factor will be discussed in detail.

2.0 HOUSE PRICE: DETERMINANTS AND DETERMINATION

The review begins with an examination of what is house price. It is important to note that when price is discussed, there are two forms of price: implicit and explicit. The combination of implicit prices is summed up the explicit price. The determination of implicit prices however requires thorough analysis and substantial amount of information pertain to the goods under investigation. The price, investors are willing to pay is related to the returns available on the alternative investments subject to wealth constraints. Prices observed in the market over time may embody different qualities and quantities of services in housing units. Hence price movements over time may in part reflect changes in composition of the bundle of services. Thus it is quite hard to clearly suggest the meaning of price as the joint purchase of assets and housing services cannot be easily separated. As a conclusion, market price for homes incorporates per unit investment and service demands and, overtime, possibly changing attributes- that is, the quantity of service or investment units.

The house price determination is associated with macro (market-related factors) and micro (house-specific factors). How do the researchers link these factors to the price? The first step to this is to establish theoretical background for the pricing theory. Thus, the review begins with identifying price determinants. The review will then followed by discussion on the utilisation of statistical tool as one of the approaches available to segregate the contribution of each variable hence enabling the quantification of perceived contribution in the overall price.

2.1 Macro Factors

A number of works addressed and analysed house price variation as influenced or explained by market-wide or macro factors. The inclusion of demand (degree of employment, disposable income, demographic characteristics) supply factors (number of house building in the previous period) in the analysis is obvious in a number of works. The longitudinal perspective makes macro factors such as interest rates, inflation rates and taxes become important price explanations. The present study using a temporal cross-section analysis emphasises on differences in characteristics among municipalities can explain the general shift in price level. Ozane and Thibodeau (1983) for example argued that a 40% difference between metropolitan areas in the USA in 1981 had a large impact on real income. Guisanni and Hadjimatheou (1991) and Ashworth and Parker (1997), relate regional house price variation in the United Kingdom with some macro indicators such as labour mobility and demographic. In addition to this, Green and Hendershott (1993) suggested that real price is determined by the willingness of the household to pay for a constant quality house. Changes in the quality of housing demanded will affect real price only to the extent that the long-run housing supply schedule is positively sloped. There are suggestions that age shifts (increasing age of baby boomers) and reduced tendency to marry might affect home pricing in complicated manner. They conclude that the evolving demographic forces are likely to raise house price not lower them.

L.B Smith (1974) developed an explanatory model of house price on a function of permanent income household, price of goods and services, the stock occupied homes per household, the stock of vacant homes per household, the cost of home mortgage credit relative to other credit and a measure of consumer inflationary expectations. Gabriel et.al. (1999) investigate house price differentials and dynamics in Los Angeles and San Francisco Metropolitan Areas. The study applied house price theory, including a model of compensating differentials, urban development and short-run housing price dynamics to explain the recent housing price patterns in the two cities. It was revealed that migration between metropolitan areas is important in explaining overall housing price dynamics for a given metropolitan area. It also shows that household mobility within metropolitan area tend to impose price pressures in the most supply-constrained places. Longer-run, persistent housing price differentials can

be partly explained by the distribution of housing quality and amenities within the areas, consistent with the standard theories of urban development which suggest that an analysis of factors specific to the residential property offers useful explanation to price variation. In addition to the above works, Berg (2000) found that in Sweden, simple VAR model was estimated with the price changes for family houses in the Stockholm area as a proxy for consumption growth and the change in the unemployment rate as endogenous variables and a number of exogenous macro variables. The study shows that change in the rate of unemployment has a strong effect on real house prices and consumption.

2.2 Micro Factors

Studies undertaken are commonly agreed that generally there are three major common determinants used to model or explain price variation. Chau et.al (2001) and So.et.al (1996), for example suggest that residential properties are multidimensional commodities characterised by durability, structural inflexibility and spatial fixity hence these characteristics determine price. Although it is quite impossible to get perfect information the decision to buy a house which involves a substantial capital outlay will be driven by an effort of gathering as much information as possible. The most commonly available information that are normally rely on purchasers can be broadly categorised into structural (physical characteristics), locational and neighbourhood attributes.

Structural or physical characteristics: Ball (1973) suggests that a house which has more desirable attributes would be reflected in a higher market price. Prices of properties are frequently related to their structural attributes. The attributes that are normally included in the analysis include floor area (Carol, et.al, 1996) based on the fact that buyers are willing to pay more for more space especially functional space. The heterogeneity of the houses has resulted in different attributes been used such as numbers of rooms (Fletcher, et.al.2000, Li and Brown, 1980), the number of bathrooms (Garrod and Willis, 1992 and Linneman, 1980). Other attributes include age which shown by Kain and Quigley (1970) as negatively correlated to house price as a result of increase in maintenance cost as well as a decrease in usefulness due to changes in technology and post-fordism. Among other attributes suggested are lot size, the existence of

basement, garage, patio and heating system (Forrest, Glen and Ward, 1996). Although the quality of structural on housing prices is quite hard to ascertain, some efforts have been made to include that in their works by the usage of condition of the features to signify the quality of the structural.

Locational attributes: the importance of location has long been recognised as main property price determination. The effect of location on property price on property price was examined by Gelfand et.al. (2004). It highlights the importance of spatial component in explaining prices. When the location is taken into consideration, homogeneity affects patterns of variation across space of time. The location of a property has been regarded in terms of fixed and relative locational attributes. This nonetheless is applicable when the location is anticipated to be influential. On one hand, some aspect of location can be accurately quantified, for example Follani and Jeminoz (1985) and Orford (1988) used fixed locational attributes with respect to the whole area and pertained to some form of accessibility measures. On the other hand some surrogate measures such as socio-economic class, social composition, and aesthetics attributes, pollution levels and proximity to local amenities are used by Dubin and Song (1990). Accessibility, which is normally measured in terms of access to the central business district have some influences on housing prices. The positive effect of transport accessibility on housing price has been demonstrated in Plamquist (1992), Ridker and Henning (1968), Adair et.al (2000) and So et.al (1996). So et.al (1996), for example show that buyers are willing to pay more for properties with easy accessibility to public transportation.

Good view is also associated with where the view amenity may not be uniform as it varies from type and location hence, the better quality of the view the higher the price. It is also demonstrated that cemetery is negatively affects the housing prices in Hong Kong (Tse and Cove, 2000). The view actually connotes death and bad feng-shui. In some areas, number of the house is also associated with good or bad feng-shui.

Generally, it can be concluded that house price is not only determined by the demand for the attributes of the dwelling units themselves, but also the area in which the properties are located. Location is the time-distance relationship, or linkages, between a property or neighbourhood and all other possible origins and destinations of people going to or coming from the property or neighbourhood. In other words, location is the relationship between the property and its surroundings. The most distant locations may have more attractive features and its surroundings.

Neighbourhood attributes: Additionally neighbourhood quality may affect the housing price. The difficult task will be to determine and ascertain the quality of the house but houses with these different neighbouring qualities could be implicitly valued through hedonic pricing. Neighbourhood specific-factors has been identified as important determinants of a site valuation explaining 15-50% of the standardised variation in valuation and inducing differential valuations as large as 100% between the structurally identical sites. Amongst neighbourhood attributes that are considered are socio-economic factors and the occupation of the habitant. Works that considered neighbourhood qualities includes Garrod and Willis, 1992 and Roe.et.al (2004) which include neighbourhood amenities on housing values and residential growth.

As discussed above, it is clear that structural, locational and neighbourhood are three major categories of factors considered in determining housing price. Having considered type of factors to be included, the next step is to illustrate how to model the housing price so as to be able to reveal the implicit price of each variable or factors included in that particular model.

2.3 Hedonic Analysis

Since the number and the nature of influences on house prices are large and heterogeneous, house prices cannot be simply determined by the individual characteristics for the dwelling itself. For the purpose of segregating and quantifying the impact of each factor, hedonic price analysis will be adopted. Hedonic analysis is a popular method for estimating the impact of characteristics of heterogeneous goods on their price and the values of these characteristics are

determined explicitly through regression analysis. The hedonic method is based on the assumption that heterogeneous goods are valued for their utility-bearing attributes or characteristics and the hedonic price is the implicit price of each attribute possessed by the goods. This implicit price of each attribute, the hedonic price and the relative importance of each attribute has in determining the price of the goods can be derived as the information on prices and attributes are made available.

It is important to note that each attribute contributes to the values of the good as the model specified that the goods per se, do not affect the level of their utility to a consumer but the goods possessed attribute that increase or decrease the utility. This can be applied to the housing as the house is valued for its characteristics or attributes such as building area etc. House price is viewed as consist of a bundle of attributes, each of which is integral to house prices. Each house owner is assumed to derive value directly from the property characteristics.

The above discussion shows that generally previous works suggest that housing price is determined by macro and micro (comprises of factors: physical, locational and neighbourhood). The categories thus assist in identifying variables to be collected for the development of price models.

3.0 METHODOLOGY

The methodology of the paper is based on two main approaches: an exploration of theoretical rationale on the issue under investigation and the empirical works which are guided by the findings of the literature search. The empirical enables the problems which were identified in the earlier works to be addressed and new problems identified and could be taken into consideration in related future works. Modelling house price seeks to segregate the impact or contribution of each independent variable in price variation employs the following:

- An identification of house price determinants: this is very important to the house price model development: Literature review carried out enables the

- Data collection: To limit the scope of the study, data collection and analysis are confined to a particular type of house in five localities (Kuala Lumpur, Ipoh, Penang, Johor Bahru and Kuantan) representing north, south, east and capital city. Double storey terrace has been selected due to the fact that the house is most frequently transacted in Malaysia. The data collected included floor area, land area, age of the house, and numbers of rooms, distance, and the quality of amenities, neighbourhood quality and type of holding. The information obtained from the dataset available in the National Property Information Centre (NAPIC) and some are observed through the site visits. In addition to micro. Macro data comprises of economy indicators which includes Gross Domestic Product(GDP), Base Lending Rate (BLR), stock index, employment rate gathered which later regresses against house price index (HPI).
- Model development: Five (5) models for each point of time are developed in this exercise. Each model will represent each region in Malaysia in the desired year. The models will cover Northern (Pulau Pinang), Central Region (Kuala Lumpur), Johor Bahru (Southern), Kuantan (Eastern region) and Ipoh (West). The Multiple regression analysis is utilised to develop for 6 points of time, 1990, 1995, 2000, 2002, 2003 and 2004. Nonetheless, some models are unable to be developed due to data constraints. The models derived from the basic equation of:

$$HP_t = a + b_1(x_1) + b_2(x_2) + \dots + b_n(x_n) + e \dots$$

Where HP_t is a house price at a particular time t

a is a constant

$x_1 \dots x_n$ is a set of macro and micro housing factors

$b_1 \dots b_n$ is the sensitivity of macro/micro factors on the price.

- Assimilation: findings are discussed and conclusion is drawn from the analysis.

4.0 MODEL DEVELOPMENT AND ANALYSIS

Before the discussion is directed further to the contribution of each determinant in the model, each model is assessed for its ability to explain the underlying phenomenon. Generally, the ability is measured by the level of R^2 and adjusted R^2 . The higher the R^2 and adjusted R^2 , the model is expected to have better explanation ability. The next issue is what would be the level to be accepted. It is suggested that the level to be accepted will be greatly depending on types of research performed. In the event of information is critical, lower R^2 and adjusted R^2 is tolerable. The R^2 and adjusted R^2 for models developed in this research are of greater than 70%. This is considered as adequate as the nature of data constraints in property industry. With the R^2 and adjusted R^2 the analysis proved that as determinants identified in theoretical been used in the model development, less than 30% of double storey houses price variation for each location are left unexplained, i.e. the variance is explained by determinants that not in the models.

4.1 Macro Models

The regression analysis performed on house indices as dependent variables with several macro indicators such as BLR, labour and spending-ability as independent variables. Twelve (12) models have been developed. The models are made-up of common variables: GDP, Employment, Unemployment and Consumer Index. Economy is found to be strongly contributed to price variation followed by unemployment, employment and consumer index. The GDP explains more than 80% of house price index variation in all models that leads to the conclusion that economy is what shapes the movement of house price in Malaysia. This is justified as the state of economy will influence others such as funding availability to own houses, the level of spending and inflation. As a result, the GDP can be very useful in explaining price phenomenon as market-wide factors are taken into consideration. The attempt to see the perceive importance of other factors has been for the purpose of isolating the impact of the variables; nonetheless it is quite difficult to do so. On the other hand, in some locations, the impact of these variables is quantifiable as they have been included in the equation.

MPI-TERRACE _{MAL}	= 97.33 – 0.148(Unemploy) – 0.523(GDP)	}	First Run
MPI-TERRACE _{EKL}	= -265.78 + 0.093 (Employ) +0.752 (GDP)		
MPI-TERRACE _{EJB}	= 656.96 – 0.502 (Cons_Idx)- 0.173(BLR) – 0.515(Unemploy) + 0.234(Employ) + 0.829 (GDP).		
MPI-TERRACE _{EP}	= -441.6 + 0.098(Unemploy) + 0.151(Employ) +1.040(GDP)		
MPI-TERRACE _{EKTN}	= 71.93 + 0.975(GDP)		
MPI-TERRACE _{LIPH}	= -146.23 + 1.036(GDP) +0.144(Employ) – 0.101(Unemploy)		

MPI-TERRACE _{MAL}	= 25.513 + 1.104 (Inc_Pcap) + 0.154(Inf)	}	Second Run
MPI-TERRACE _{EKL}	= -334.8 + 0.719 (Inc_Pcap) + 0.117(Employ) +0.044(Unemploy) +0.323 (GDP)		
MPI-TERRACE _{EJB}	= 597.4 + 0.917 (Inc_Pcap)-0.357(Unemploy) – 0.432(Cons_Idx)- 0.250(Employ)		
MPI-TERRACE _{EP}	= -838 + 0.813(Inc_Pcap) + 0.296(Employ) - 0.290(Inf) – 0.104(Share)		
MPI-TERRACE _{EKTN}	= -94.68 + 0.964 (Inc_Pcap) + 0.162 (Unemploy) + 0.128 (Cons_Idx) + 0.063 (Employ)		
MPI-TERRACE _{LIPH}	= -.284.45 + 0.978(Inc_Pcap) + 0.207(Unemploy) + 0.192(Employ) + 0.156(Cons_Idx)		

Whilst the attempt to counter the consumer-side factors, the models have been developed using factors or variables which are more related to spending and spending-driven and spending-ability. The models obviously replace the most significant variable, GDP with Inc_Cap. In all models, the significant explanation exceeds 60% and reach above 90%. Nevertheless, Johor Bahru price index shows the least contribution of Inc_Cap as other variables such as Employ also offers quite high explanatory ability in price.

4.2 Micro Models

A total of twenty six (26) models have been developed in the exercise. Models developed are discussed according to its locality.

a) Kuala Lumpur

The contribution of each variable in models is shown in Figure 1.0.

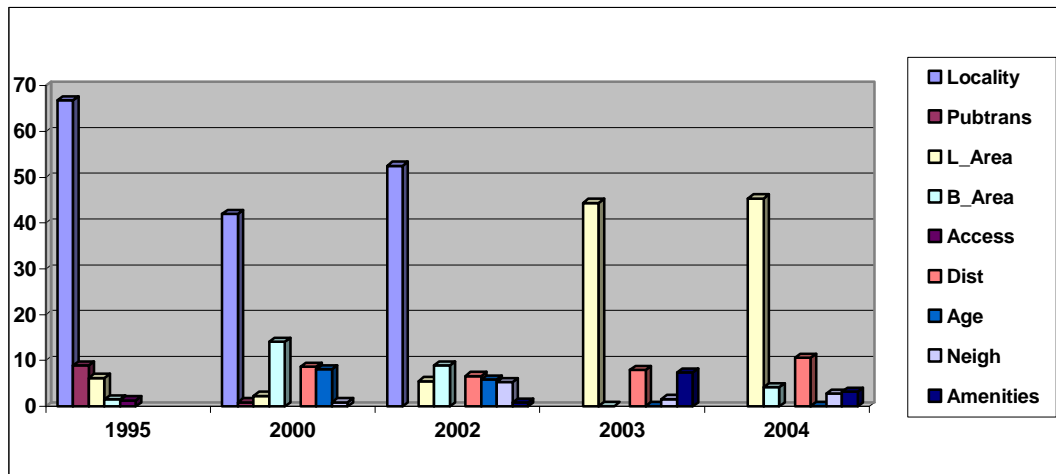


Figure 1.0: KUALA LUMPUR: THE CONTRIBUTION OF DETERMINANTS IN THE PRICE OF DOUBLE STOREY TERRACE HOUSES.

The double storey terrace house price for the city of Kuala Lumpur is explained by the same variables for all models. The level of contribution varies from one model to another, which signals that the influence of the factors or variables varies. Due to land scarcity, the land posits significant impact on house price. People are paying more for land area and building area. The analysis also reveals that the composition of price has also changed over time which implies that price is influenced by different factors at different point of time. Hence, the practise of assigning constant proportion of property elements in the valuation practise requires re-assessment as highlighted in this section that the proportion of factors' contribution change as time change.

In the City of Kuala Lumpur, vocational factors are proving to be important item or criteria paid for as it can be observed that greater proportion of price has been explained by this determinant. There is no doubt that the theory of *location, location & location* fits well in Kuala Lumpur market. Nonetheless, the neighbourhood and locational factors do contribute but at low levels. The

analysis also failed to include other physical characteristics of the houses such as the number of rooms and the types of holding. This has to some extent prove that statistically, the variables are not significantly influenced by the price of double storey terrace in Kuala Lumpur. This however should be carefully interpreted, as the variables may provide better explanation of price variation for Kuala Lumpur market.

b) Johor Bahru

Six models developed for Johor Bahru. The study shows that in many cases, utility-bearing characteristics explain substantial proportion in double storey terrace houses in Johor Bahru. In most cases, a blend of location and physical characteristics explain well the price variation. Nonetheless, in certain situation, the utility bearing models failed to explain the price for example, the gap of unexplained variation is very large for 1990 model. Hence, it is suggested that variation is explained by factors, which are not included in the model development. Although it is quite difficult to anticipate these external factors, as the model developed for different point in time, it is shown that 'time' did affect the pricing. Generally, it is a blend of location, environment and physical factors that explain the pricing of double storey houses in Johor Bahru. The statistical significance of a functional area in the model implied that these should be taken into consideration in the valuation process.

The measurement of locational and environment variables should be performed more accurately so as to explore the greater significance of the variables in the models. As the models present different levels of contribution of similar variables at different points in time, this suggests that time may influence the marginal contribution in price. Valuation therefore should take rigorous analysis to ensure that every variable are appropriately considered. The contribution of each variable in every model is shown in Figure 2.0.

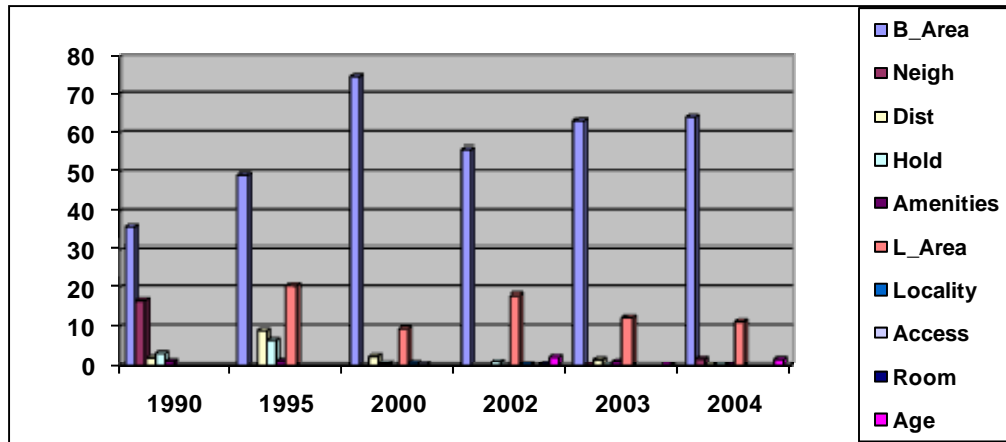


Figure 2.0: JOHOR BAHRU: THE CONTRIBUTION OF DETERMINANTS IN THE PRICE OF DOUBLE STOREY TERRACE HOUSES.

c) Ipoh

Six models have been developed for Ipoh. The more extreme scenario is exhibited in Ipoh's double storey terrace market as building area explains most of the price variance. This has statistically been proven that the price is actually determined by the area of the houses. This is especially true in 1995. 2002 has witnessed the introduction of land area, which is quite uncommon in the market. But the contribution of land area is quite significant this year compared to three years earlier.

Figure 3.0 summarises the contribution of variables in models developed throughout the research. The findings for the market in Ipoh are comparatively straightforward as there have not been any major changes. The finding consistently shows that Ipoh is typically a functional area orientated market. Buyers are paying high implicit price for building area

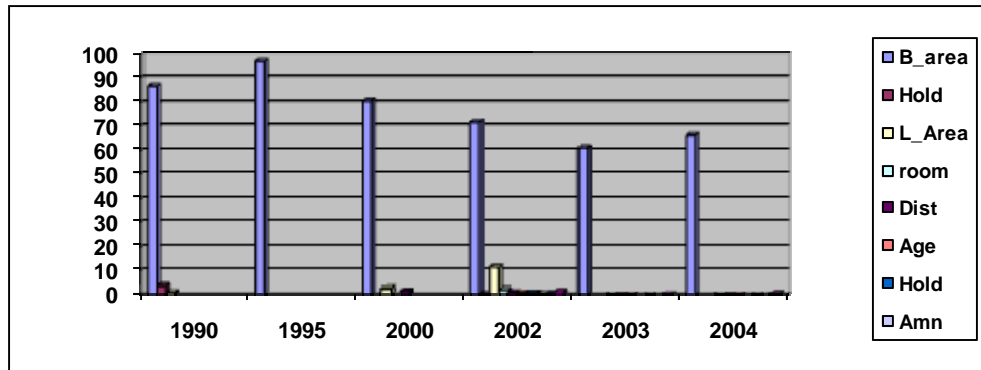


Figure 3.0: IPOH: THE CONTRIBUTION OF DETERMINANTS IN THE PRICE OF DOUBLE STOREY TERRACE HOUSES

d) Penang

Five models have been developed for Penang. Each model comprises a combination of identified determinants. There have been changes in factors that determine the prices for double storey terrace houses in Penang. Although the doubt will be on the reliability of 1990 model, the models for 2000 and 2002 provide useful indicators on the behaviour of house price in Penang at those times. Basically, the notion that price is determined by the factors identified in literature review are present here, but the level of contribution of each variable in each year differs from one model to another. The figure shows that the moderation of determinants' contribution takes place in 2002, 2003 and 2004. The dominant contribution becomes lesser compared to the 1990s. As a result, it can be concluded that for Penang, locational factors tend to dominate the price which leads to higher implicit price of these variables. This pattern nonetheless shifts in 2000s as price is paid for a mix of factors or determinants. The contribution of these determinants in each model is visualised in Figure 4.0.

Generally Penang's market is characterised by contradictory determinants from one year to another. In the earlier model, distance from the city centre explains price very well but the pattern changed in 2000. In this particular year, the combination of building area and locational-related factors determined price. Nevertheless, in 2002 land area dominated price determination. This is due to the fact that it is well established that the scarcity of land in the Penang Island would most be probably contributed to high price of houses.

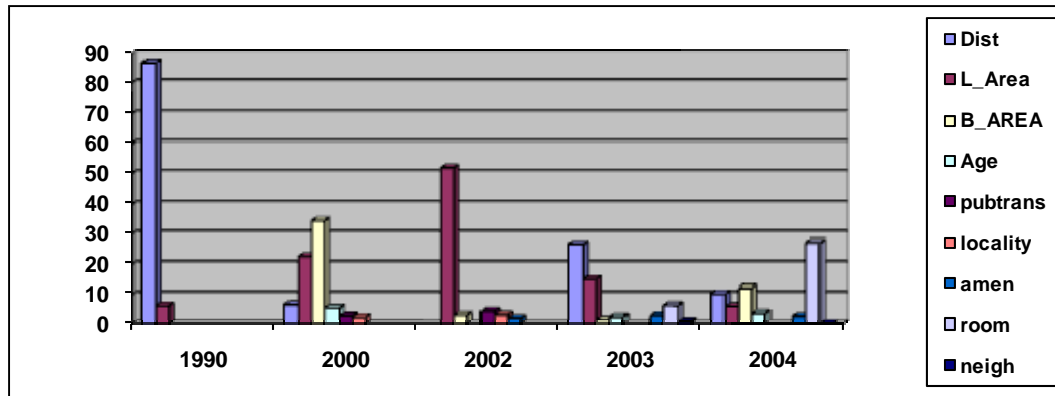


Figure 4.0: PENANG: THE CONTRIBUTION OF DETERMINANTS IN THE PRICE OF DOUBLE STOREY TERRACE HOUSES

e) Kuantan

Only four (4) models for Kuantan been developed in this research. The composition of Kuantan's models changed considerably as all models is compared. Nevertheless, the models exhibit the tendency to include physical characteristics of the houses as price determinants. In some cases, it coincides with other locations but to a certain extent, it presents unique situations. Let us say we consider the role of age. In this case, in Johor Bahru, age increases prices whilst in Kuantan, age appears to be quite significant in influencing the price but not in other locations.

Kuantan double storey houses market reforms substantially in two years. Figure 5.0 shows that as determinants, both models provide a combination of physical, locational and neighbourhood characteristics which is quite balance compared to other models. Nevertheless the proportion explained by land area diminished as compared to land, which becomes higher as time goes on. The proportion of price variation explained by land area increased tremendously from 25.1% (2000) to 56% (2004). In general, the models establish that land component explain price significantly and some cases, it dominates price greatly

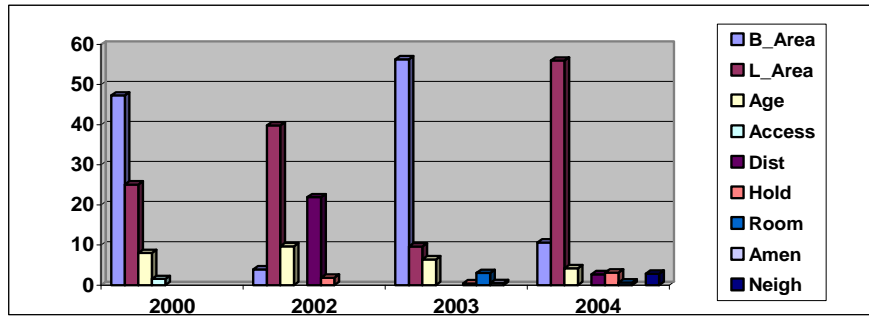


FIGURE 6.0: Kuantan: THE CONTRIBUTION OF DETERMINANTS IN THE PRICE OF DOUBLE STOREY TERRACE HOUSES.

4.3 An Analysis over Time

As the models developed, the contribution of each factor in the models has been identified and the implicit price has been determined via beta coefficient. The next step is to see the contribution of each factor in price as mapped alongside all locations or regions enabling an examination of the shifting in explanation in the same year for different locations. Figure 7.0 – 12.0 indicate that between markets in six different times 1990, 1995, 2000, 2002, 2003 and 2004. The price of double storey terrace houses is explained by the area of the unit. As in Figure 7.0, we can see that between the two markets in 1990, the features or factors constitute price differ from one market to another. In this case, Johor Bahru price is explained well by the building area whilst Penang by Distance from the city centre.

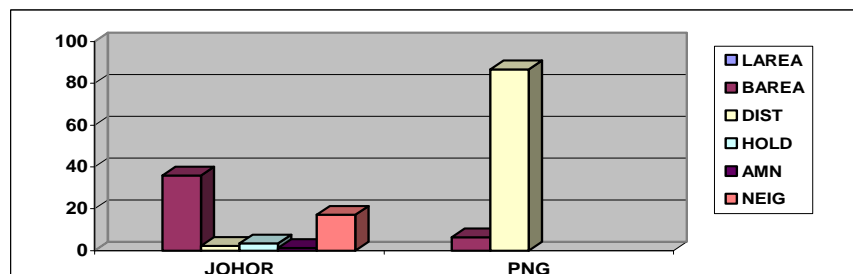


FIGURE 7.0: EXPLANATORY'S CONTRIBUTION, 1990

The above explanation pertains to two markets only, as the model for 1995 is considered. Figure 8.0 shows three regions, Johor, KL and Ipoh. Building area

has been a feature paid for the double storey terrace houses in Johor Bahru and Ipoh. Ipoh shows extreme influence of building area. There is a tendency amongst buyers to consider other variables hence pay for these variables.

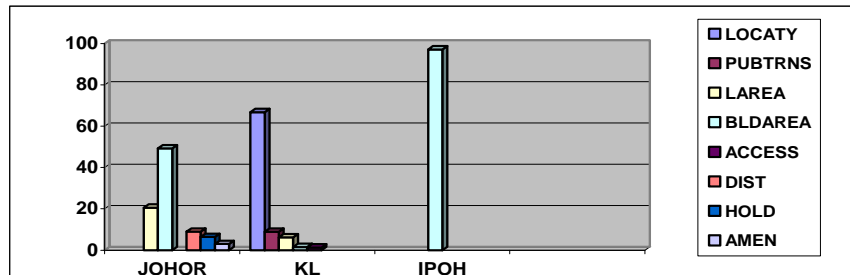


FIGURE 8.0: EXPLANATORY'S CONTRIBUTION, 1995

More information is made available in 2000 and more regions are taken into consideration. With four markets that show some agreement, building area becomes major determinant in double storey terrace house price. Nonetheless, the variable influences price at various levels. Figure 9.0 show that building area influences the price at very significant level in Johor Bahru and Ipoh but moderately in Penang and Kuantan.

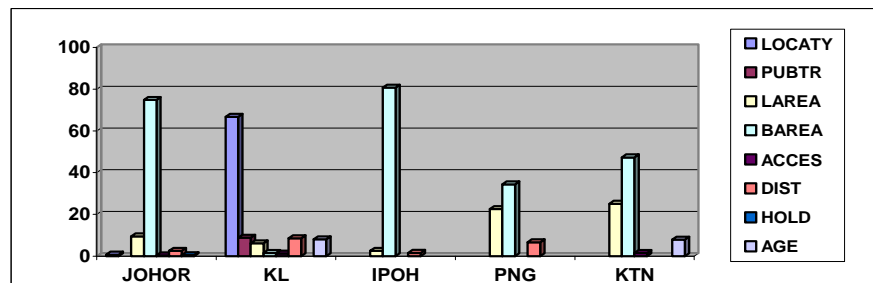


FIGURE 9.0: EXPLANATORY'S CONTRIBUTION, 2000

The contribution comes from Building Area is the most significant in all models in 2000 except the Kuala Lumpur model. This is followed by land area. The above explanation seems to change its pattern in 2002. In 2002, land area becomes significant in Penang, Kuantan and Johor. The possible reason for this has been discussed in the earlier section. Building area remained significant in Johor and Ipoh double storey terrace house prices in 2002.

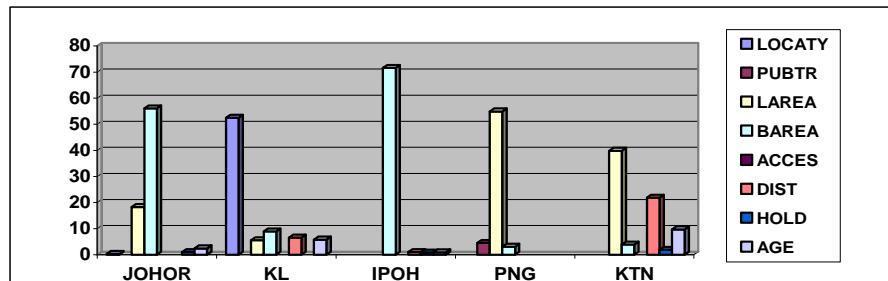


FIGURE 10.0: EXPLANATORY CONTRIBUTION, 2002

The above explanation is further tested in 2003. In 2003, more comprehensive data set enable more rigorous analysis to be undertaken. The early finding is consistent in 2003 as building area becomes significant contributor in price and commands the highest implicit price for Johor, Ipoh and Kuantan. Whilst for Kuala Lumpur and Penang, land area is proved a significant contributor in KL and Penang market.

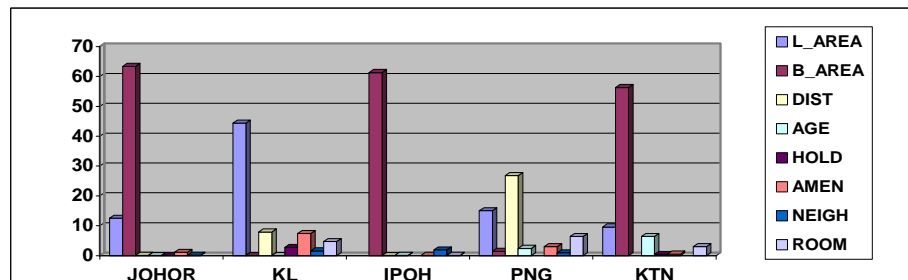


FIGURE 11.0: EXPLANATORY CONTRIBUTION, 2003

The Kuantan market shows an inconsistent explanation for the market in 2004. While Penang and Ipoh has not shown any varying pattern compared to 2003, the increase in contribution is significant in 2004. Changes in paying for the different features in a house are a clear case in Penang market.

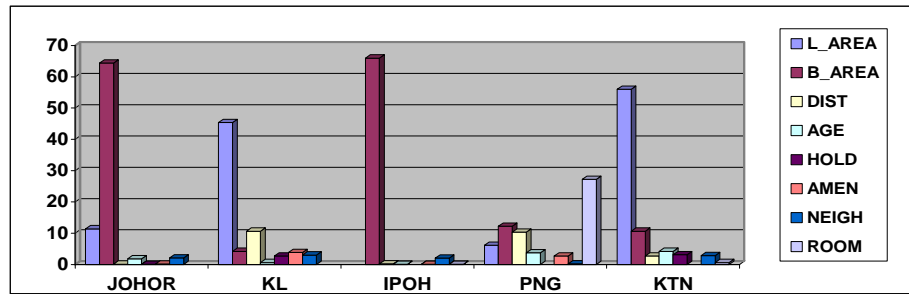


FIGURE 12.0: EXPLANATORY CONTRIBUTION, 2004

The research developed twenty six (26) models which aimed to explore the price variation in five selected locations. The following section discusses the general findings of the research.

5.0 OVERALL DISCUSSION

The research has explored the house price determinants. The review shows that house price is a function of physical, locational and neighbourhood attributes. Each attribute contributes differently to price and these implicit prices could be determined through hedonic function analysis. Although it is suggested that price is a function of these attributes, these may not suggest that all attributes will influence price. In certain occasion and market, some attributes such as physical will explain or dominate the price variation whilst in other cases locational contributes significantly to price. As the attributes have been identified, the models are developed in an attempt to plug in the attributes and identify which attribute is significant in price. Multiple regression analysis has been performed and a total of thirty-eight (38) models developed in this research.

Two major determinants have been considered in the research: macro and micro. This is based on the assumption that price is a function of macro factors (factors that are systematic to the market but influence price). There have been a number of studies, which attempted to explain price using macro indicators. The success of the attempt nonetheless is heavily dependent on the availability of relevant information at local level especially when the analysis is performed at

local level. In this research, the price index for terrace houses has been utilised and regressed with a series of macro indicators such as economic growth and spending-related factors.

The research has successfully associates price with macro indicators, which the analysis shows that it is income that explain price index. In all model, the explanation seems to be similar from one to another. In 2002, all models are well explained by income. Nonetheless, the contribution of explanatory differs from one town/city to another, i.e. the percentage explained by the same variable. In the first instance the models consider the growth of GDP as main determinants (which explain more than 80% of variation in price), it is spending ability that influence or explains the price variation in this research. Income Per Capita explains price very well. In all models, the findings are consistent as in all models price is explained by the same variables. Despite this, the level of contribution varies from one model to another.

The study shows that in many cases, utility-bearing characteristics explain substantial proportion in double storey terrace houses in five selected regions in Malaysia. In most cases, a blend of location and physical characteristics explain well the price variation. The model, thus enable an implicit prices of each feature included been identified. The beta coefficient reflects perceived contribution of each variable in the price, which approximated by the model. The composition of price for a double storey terrace in five selected regions is summarized in the Table 1.0.

When building area is taken into consideration, all models except Kuala Lumpur are commonly agreed the significance of the variable in explaining double storey terrace houses price variation. An analysis on Johor Bahru double terrace houses transactions shows that the contribution of Building area is consistent and being at high level since 1990. The contribution of greater than 30% obviously signalled the perceived importance of variable in explaining double storey terrace houses prices in Johor Bahru. Further discussion will be undertaken in the following section. The similar finding is

also takes place in Ipoh as the building component explains a large proportion of price of similar type of houses. In comparison, Ipoh market is more consistent in indicating the importance of building in price determination as the contribution range from 80.8% (2000), 71.5% (2002), 61.3% (2003) and 66% (2004). The finding however is inconsistent for Penang as the preferences changed over time had resulted in some year building area was significant in explaining price but at other time. Penang market has certainly proved the irregular pattern for various reasons that will be discussed later in this report. Whilst land and building areas are related to physical characteristics of the houses, other variable such as age is also become significant explanatory to price variation. Table 1.0 has proved the validity of age as factor that negatively affects the price pattern. In this case, in all locations except Johor Bahru, age is negatively correlated with price which means that price declines as the houses ageing. This finding is consistent throughout the models developed with an exception of Johor Bahru, where positive correlation is a true reflection of older houses fetch better price especially when they are located in prime areas. Is the number of room is capable of explaining price variation. In some location, for example Ipoh and Penang, the variable explains the price variation at low level.

In some regions, the models also prove that 'location' is still a significant contributing factor despite some suggestions that it might lose its appeal in price determination due to the improvement in the road and infrastructure system. The location, which is measured by closeness to the city centre, is still sought after despite current movement to the suburb. This section shows that the models consider utilities-bearing factors which fit hedonic function for houses as goods is valued for the benefit it offered. The models consider a quite balanced physical and locational variable. Although the consistency in term of variables include in explaining the prices, the marginal contribution, differ from one period to another.

Some evidences show the outfaced the existing 'location, location and location' theory which dominates the property market for a long time. The statistical analysis signals that despite priority to locate close the city or town centre, the buyers actually are paying more attention to functional area. In other words,

when buying a house, buyers are willing to pay higher for extra land and built up area. This finding, nonetheless does not suggest that location become insignificant in price but the implicit price is rather low or small as compared to other neighbourhood and physical attributes. .In some regions, the most probable reason for location less statistical significant is probably due to the fact that distance becomes less relevant variable to explain price variation as travelling become less troublesome. This is due to improvement in road network and easy access to car ownership.

6.0 CONCLUSION

In this research, it is shown that house price can be explained by micro and macro factors. The analysis of the house price index movement shows that price index is well explained by the nature of the national economic, as economic explains almost everything in all sectors with an exception that may be directly affected by economic and others may suffer 'lag-effect'. As this variable is more common at too market wide, specific consumer-spending variables proved to explain very high proportion of price index. This is useful so as to consider pricing process and a guide to future decision-making on residential development. Other factor-related to demand include UNEMP and EMP, which are also significant explanatory in the price that coincides with the theoretical findings.

The finding indicates that physical attributes in terms of building area become very important feature or factors paid for a house. The location-related factors such as distance from the city centre is also presented but at low level hence signifies the lesser emphasis in price paid for. Twenty six models developed show that the composition and the level of the contribution to the price paid are varies from one region to another. Thus imply that different attributes are priced differently when combined with other attribute and different factors pose different level of influence on price.

The primary intention of this research is to apply hedonic regression techniques to investigate house price in Malaysia to identify the significant contribution of the different attributes to house prices. The hedonic analysis explains reasonably well though not perfectly. The technique enable different attributes to be valued differently when combined with other attributes. It is found that different factors are found to pose different level of influence on price. The level of influence varies from one time to another and from one market to another. Therefore, each market should be dealt with differently when there is a need for valuation. Rigorous analysis on the issue will certainly helps the industry in producing better and accurate valuation that can be used in decision making.

Whilst this is quite useful in decision making, the practise of valuation would certainly benefit the findings that price at local level is better explained by the characteristics possessed by the house itself. The models for this reason had discovered that price is determined or influenced by three broad categories of characteristics. It is shown that for Kuala Lumpur, price is greatly influenced by location-related characteristics compared to models of Ipoh, Penang, Johor Bahru and Kuantan. Physical characteristics dominate price significantly but for Johor Bahru, the combination of the characteristics is considerably balanced in terms of factors contribution.

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