

ESTIMATING SELLING PRICE OF HOUSES USING
MULTIPLE REGRESSION

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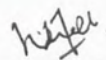
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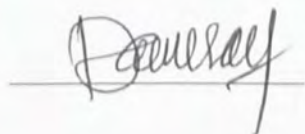
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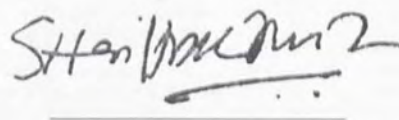
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ABSTRACT

The main purpose of this research is to obtain the best model in estimating the selling price of houses. In this research, method of multiple regression is being used. Parameters in the regression model are estimated using Ordinary Least Squares method. There are seven independent variables in this research. Two out of the seven independent variables are dummy variables. Thus, possible models with interaction variables up to fourth order are being considered. The best model is chosen according to the eight selection criteria. The best model obtained implies that the selling price of houses is influenced by both the individual variables and interaction variables. The best model is then ready to estimate the selling price of houses.

Key Words: multiple regression, Ordinary Least Squares, selling price of houses



ABSTRAK

Tujuan utama dalam kajian ini adalah untuk mendapatkan satu modal terbaik untuk menganggar harga jualan rumah. Dalam kajian ini, kaedah regresi berganda telah digunakan. Parameter dalam model regresi dianggar dengan menggunakan kaedah penganggar kuasa dua terkecil. Terdapat tujuh pemboleh ubah tidak bersandar dalam kajian ini dan antaranya terdapat dua pemboleh ubah patung. Semua model yang mungkin dengan pemboleh ubah interaksi sehingga peringkat keempat telah dipertimbangkan. Model terbaik dipilih dengan menggunakan lapan kriteria terpilih. Model terbaik yang dimiliki menunjukkan bahawa harga jualan rumah dipengaruhi oleh pemboleh ubah individu dan pemboleh ubah interaksi. Model terbaik tersebut sedia untuk menganggar harga jualan rumah.

Kata Kunci: regresi berganda, penganggar kuasa dua terkecil, harga jualan rumah



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CHAPTER 1

INTRODUCTION

1.1 Background

Shelter is one of the human basic needs. Shelter provides protection for human, such as wind, rain, heat and, animal. However, Podger (1982) has described that a house provides shelter from the element; some authorities interchange the word “shelter” and “housing” as if they are synonymous. Time has not diminished the dependence of man on shelter. The oldest examples are shelters within caves, followed by houses of wood, straw and rock; a few examples exist of houses built out of bones. With the advancement of science and technology, shelter comes in houses of bricks are commonly built.

In most of the developed countries, housing can be considered as the major and largest item in personal expenditure. Balchin and Rhoden (1998) have stated that housing is an important determinant of people’s life chances and, next to agriculture, housing normally constitutes the largest single land use. Thus, we may also conclude that housing is the humankind’s most essential material need apart of nourishment.



In fact, the durability of most houses is longer than many other durable assets. According to Miles (1994), most of the people can remember the lives of that first generation of new, suburban home-owners of the 1920s and 1930s, but we can only imagine the lifestyles of the Victorians who came before them; we can, however still live in the homes that were once theirs. It means that houses are more durable than the people who live in them.

1.2 House Selection

Every individual's preference in house selection is varying with different tastes. One will choose the house according to his or her preference. As mentioned by Miles (1994), the houses in which we live reflect our tastes and our resources; but they also mould our lives. From the economic view point, houses will be built as long as the quantity of demand on houses is greater compared to the equilibrium point.

We cannot deny that each individual's needs for housing and facilities will change with time. According to Parid (1982), changes in the family income level will change the way they spend on the house from time to time. Besides that, the new-born baby, marriage, or death will also affect the needs of space of the family. However, not everyone may afford to buy the house which is exactly same as what they desire. This is mostly because of amenity-rich houses are hard to get and the selling price is relatively high.

Consequently, Sumichrast *et al.* (2005) has stated that houses come in different styles, shapes and sizes. In fact, houses differ according to a wide variety of

attributes, such as location, amenities, house characteristics, and environment. Instead of the house attributes, selling price also plays an important role in the house selection. Therefore, people will buy the house by considering all the attributes and choose the one which is affordable and the most suitable for them.

1.2.1 Location

According to Shilling (2002), real estate is heterogeneous, no two parcels of real estate are exactly alike; at the very least, and each has a unique location. In other words, no two houses are alike. The location is the most important criteria in choosing a house, whether it is near to our workplaces, schools, churches, major roadways, shopping centres, and other urban facilities. Location and accessibility are both closely related. We may concern about the convenience of getting to or from a particular place. For example, we may go to the workplaces and schools more often compare to other places. Therefore, close proximity to schools and workplaces is more important in house selection. In addition, Sumichrast *et al.* (2005) has mentioned that crime varies widely in different areas. People will avoid from the neighbourhoods that are known for violent crimes and make sure that the crime rate in the neighbourhood is not sneaking up before they move in.

1.2.2 Amenities

Amenities refer to the swimming pools, health club facilities, park, party rooms, bike paths, community centres, a pleasant view or aspect and so on, which add to the satisfaction of the people who stay in the house. Referring to Sumichrast *et al.* (2005)

has described that the basic amenities for American are fireplaces, openness of design and energy-efficient homes. The floor layout is the most important factors among the openness of design to buyers. Energy-efficient homes refer to modern storm windows, storm doors that fit well, and air conditioning which are high-efficiency models and use less energy.

1.2.3 House Characteristics

Sumichrast *et al.* (2005) suggested that one should evaluate a house from the inside and outside, such as the kitchen, bathrooms, bedrooms, square feet of the house, the size of the garage, neighbourhood and so on. These are selected based on the individual needs and desirable. For example, someone who likes to cook will choose a house with a bigger size of kitchen, while people with a large number of family members will choose a house which contains the number of bedrooms which is sufficiently for their family. But a house buyer needs to evaluate a house through the eyes of future buyers so that he or she might get a best investment.

1.2.4 Environment

Referring to Balchin and Rhoden (1998), healthy housing is a primary objective of environmental health activities. Factors such as poverty, socio-economic status, life-style, and genetic predisposition will each have an impact on health, as well as the housing and the environment in which the individuals live. Legislation was introduced to solve the problems of the environment of housing area. The lack of sanitary, contaminated water supplies, gross overcrowding, and pollution are the causes of ill-



health. The environment of the housing area is very important because it has been recognized that poor housing is an important agent in the causes of ill-health.

1.2.5 Selling Prices

A bundle of multi-dimensional attributes of a house combine together to give a certain price. It is usually not possible for us to break up the house into its components and market them individually. Irwin (2004) has noted that in an average market, the selling price of house is around five percents less than the asking price or it will drop to ten percents in a bad market. Of course, in a hot market, the selling price is same with the asking price or even higher. With no doubt, the price of the houses sold is affected by the house attributes and the current market.

1.3 Statement of Problems

Shilling (2002) suggests that the best approach in appraising the selling price of houses is to identify similar, recently sold properties. Nevertheless, the problem arises when there is none of the similar houses had been sold at that time and the tool or standard approach in estimating the selling price is not available. It is more likely to get the best model in relating the selling price of houses and the house characteristics. Besides that, one would like to know which factor influence the house selling price and the behaviour of each factor, whether it will increase or decrease the selling price by increasing one unit of the factor. This model will save our time and energy in getting the estimated selling price of houses according to the house characteristics.

From the economic point of view, the selling price of certain product is closely related to the demand and supply of the product. Thus, the selling price of houses is strongly affected by the demand of the houses, or more specifically, the demand of the selected house characteristics. However, houses are differing according to a wide variety of house characteristics and which characteristic has significant contribution on the selling price is being concerned.

An older house may require a big amount of cost of repair. The items needing repair may be the electrical, plumbing, heater, air-conditioning systems and so on. Nonetheless, an update is needed since the design of an older house may be outdated. But some people will prefer to buy an older house because older house may have mature trees, gardens, and more land.

Today, everyone is looking for bedroom with privacy; each child expects to have his or her own room. As the families became larger, the demand for the number of bedrooms will be increased and vice versa. In addition, working couples are often needed an extra room for an office, computer room or library.

For those young couples who are raising children, they will prefer to buy a house with a big yard so that their kids may play around the house. Nevertheless, a big yard can fade for the families with no children. Therefore, they will prefer a smaller yard.

As mentioned above in section 1.2, different people have different needs towards the house and the needs will change from time to time. One might want to

know what the contribution of a specific characteristic is toward determining the selling price of houses.

1.4 Objectives of Research

This research is to study the relationship between the house selling price and the relative house attributes. The main purpose of this research is to estimate the house selling price using the multiple regression model.

The objectives of this research are:

- i. To estimate the house selling price using the best model.
- ii. To find out the possibility where house selling price depends on dummy variable(s).
- iii. To investigate the influence of each main factor on the house selling price.
- iv. To verify the effect of interaction variables on individual variables.
- v. To identify the significance of higher order interaction variables.

1.5 Importance of Research

Residential property is very popular, Haight and Singer (2005) has pointed out that every person needs a place to live in and would like to pass on something to his children and next generation; renting a residence is a wasteful of your financial resources in long term. We should buy a house rather than to rent a house if the amount of the rental is the same or not much differ from the money that we need to pay for the mortgage loan. We repay the loan and at the end the house is belong to us

but the rental that we pay out will not be recovered. For that reason, the estimated selling price for houses is vital in making the decision whether to buy or rent the house. Thus, the tool to appraise the selling price according to the characteristics of the selected house is needed.

For the housing agencies, they are concerned about the relationship between the selling price of houses and the house characteristics, such as lot size, number of bedrooms, the size of the yard, built-appliances, whether it has a swimming pool and so on. Agent would wants to know the contribution of a specific attribute is toward determining the selling price or asking price of the houses because agents would need to provide this type of information for the buyers and sellers according to the selected house characteristics.

Besides that, for those home owners who want to renovate their house, they would like to know the estimated selling price and determine whether they would be able to cover cost of renovation if they were to sell their house. The renovation firms and the building suppliers will market various products and set the price of their services and products according to this type of information.

1.6 Scope of Research

The research is based on the single-family houses. The observed data are the houses sold in the La Jolla and University City areas of San Diego in the year of 1984. This research is to study the data on multiple factors that will affect the price of the houses sold. Consequently, the method of multiple regression will be applied in this research.

The method that will be used in estimating the parameters in the multiple regression is Ordinary Least Squares (OLS) method.

1.7 Limitation

The main limitation of this research is the location of the houses being estimated. As mentioned above, the location will affect the house price. In other words, the selling price is varies for different location. Since the data is based on the houses sold in San Diego, the estimated selling prices will be more accurate for the houses around that area.

Besides that, this research is based on the data in year 1984. Meanwhile, this research will study on the house characteristics which will influence the selling price only. Other factors such as economic, financial and location are assumed to be constant. Therefore, data is being analyzed according to the economic in 1984. As a result, the selling price estimation for houses is more adequate for that time period.

Moreover, not all the physical attributes are taken into account. The research of this paper is to analyze the data on the selected physical attributes. Furthermore, it takes quite a long time if all types of houses are taken into account because there are too many types of houses in the market. This research will only concern on the single family houses. It also means that the estimation of the selling price is precise only for the single family houses.

The research of this paper should be using a geo-software such as S-plus or Variowin. These packages are equipped to deal with the spatial data as location is another important criterion in determining the house attributes. Due to time constraint, this research is not going to examine the spatial data and hence the data will be analyzed using the Statistical Packages for Social Sciences 13.0 (SPSS 13.0) and Microsoft Excel.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

House value will keep changing from time to time, either appreciation or depreciation of the house. Dubin (1998) has pointed out that the house change hands infrequently, yet the house value between sales needs to be estimated as accurate as possible because the estimated selling price will be used in many purposes such as second mortgages loan and home owner insurance. Therefore, most of the previous researches analyzed the effect of various determinants towards the house selling price estimation. In this paper, variable selection and model selection are very important and need to be identified in order to get the unbiased best model in estimating the house selling price.

2.2 Previous Researches

Selling price of houses is varying with the different types of factors. Some factors are obvious or significant while some others are not. Schulz and Werwatz (2004) have



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