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THE BEST MODEL AND VARIABLES AFFECTING HOUSING VALUES OF BIG CITIES IN INDONESIA

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ABSTRACT

The purpose of this study is to provide the best model and provide information on what factors affect the selling price of a house in two major cities in Indonesia, namely Surabaya and Denpasar. This study uses web-based survey data on one of the largest home sales sites in Indonesia. The data obtained were 110 houses and processed using Minitab software. Data analysis uses regression. The results obtained indicate that there are differences in factors that affect the selling price of houses in the two cities. The electric power factor (kilowatt hour) and land area (LSF) are both factors that affect housing prices in both cities. The contribution of this research can be additional information for consumers, developers, or property investors in the activity of demand transactions and offers for home sales.

Keywords: housing price, model, regression, big cities, Indonesia.

INTRODUCTION

Housing and settlements are basic human needs and have a strategic function. Strategic functions in question such as the center of family activities as well as for business businesses that are traded. Also, homeownership is an indicator of a country's economic prosperity (Bourassa, Hoesli, Scognamiglio, & Zhang, 2011). Housing demand is influenced by factors including the location of population growth, income, ease of funding, facilities, public facilities, home market prices, consumer tastes, and legislation. But fundamentally, housing demand is more due to the value of land and buildings (Bourassa et al., 2011). The property is the investment value, while the building is seen from the construction costs. Along with the lifestyle or lifestyle of a dynamic modern society, it is more likely to need a house with various facilities such as sports facilities (clubhouse), security, recreation in an area with a one-door entry and exit system, or also called a cluster.

The cities of Surabaya and Denpasar are one of the centers of economic growth with a relatively high rate of population growth in Indonesia. Population growth that occurs both naturally and through the process of urbanization causes an increase in housing demand. This encourages the growth of residential housing development in both cities, both simple houses, medium type houses to luxury housing.

Many companies or investors build various types of houses. Of course, by looking at market conditions or the desires of consumers like what they want, the company makes housing, which is undoubtedly following what is desired by consumers with a location that can be reached by consumers. Besides, the concept of green housing is also increasingly being developed. Houses with parks and green ecosystems are also included in the criteria desired by consumers (Wu, 2017). Based on this, it shows increasingly intense competition in determining the selling price of a house.

Houses in accounting are recognized as assets. However, housing has many features that make it distinct from other assets, like equity (Yusof & Ismail, 2012). Real estate is not only an asset but also a durable consumption suitable for households, providing shelter and other housing services. As a result, a house is often the most significant and most valuable asset of families and therefore accounts for a substantial share of household wealth. Because of that, and also because it is immobile and can therefore not easily be put out of a creditor's reach, it is also commonly used as collateral for loans, so that a large share of financial sector assets is tied to housing values.

Price is a condition that affects the number of goods purchased by consumers. Consumers often compare house prices in one location with other locations, so the price needs to be considered with housing prices in other places. Although the amount of low-cost housing always gets the attention of consumers, the negative impression of low quality on cheap housing prices is among the things considered by consumers. Cost also is a value attached to an item, and that value is expressed utilizing exchange.

House prices increase every year, so there is a need for a system to predict house prices in the future (Galati & Teppa, 2017; Ge, 2017; Meen, 2012; Oh & Lee, 2002). House price prediction can help the developer determine the selling price of a house and can help the customer to arrange the right time to purchase a house. Three factors influence the price of a house, which include physical conditions, concept, and location (Nur, Ema, Taufiq, & Firdaus, 2017) and (Sandbhor & Chaphalkar, 2016). House price as a Value that computed based on intrinsic variables is intrinsic, and the value calculated based on extrinsic variables is extrinsic (de Vries, 2010). Intrinsic value is the inherent worth of an item, which depends on its characteristics. Extrinsic value can also be defined as the segment of an item's quality that is assigned to it by external variables. Intrinsic variables affecting real property value include the area of the property, nature of the craft, the external and internal condition of the property, construction specifications, etc. Variables that define the present state of the property are identified as intrinsic variables. Extrinsic variables affecting real property value are variables of macroeconomic significance like gross domestic product, population growth, employment opportunities, other investment options like shares, bullion, etc. (Hilbers, Hoffmaister, Banerji, & Shi, 2008). Data availability and data quality significantly affect intrinsic and extrinsic in determining home values (Goodhart & Hofmann, 2007). Previous research says, in addition to the factors mentioned above, the value of a house can also be determined based on the developer (market selling price) and price based on Value of Selling Tax Object (NJOP) (Nur et al., 2017). The importance of location has long been recognized as the primary property price determination (Yusof & Ismail, 2012). Housing location affects the comfort of someone at home. The convenient location of the house is strategic and makes it easy for residents to go to their daily routine activities. In general, consumers like the strategic location of housing. In terms of establishing a company, site selection is also highly considered. Site selection is an essential competitive factor in attracting consumers or customers.

Bedrooms can have a peculiar effect on the value after controls are put into place for the living area. While more bedrooms might seem unambiguously positive, bedrooms can hurt floor plans. Bathrooms are a different matter; more are almost always better than fewer. Garages

practically always add value, as well. The other characteristics have variable impacts, depending on location (Y. Chang, Cutts, & Green, 2005).

Some research related to determining the value (value) of the house has been done. One of them was done by (Du, Wu, Ye, Ren, & Lin, 2018) in the city of Shenzhen, China. This research attempts to improve the understanding of values and spatial variations of landscape effects, especially landscape indexes, on housing prices in a large and growing Chinese city. Research by (Nur et al., 2017) focuses more on several tests that have been performed using linear regression and particle swarm optimization methods to perform house price prediction based on NJOP data. The modeling area includes Karang Besuki, Tunggulwulung, Lowokwaru, Puncak Trikora, Sumbersari, Dinoyo, Manggar villages. (Ozgur, Ph, Hughes, Rogers, & Parveen, 2016) Explain what factors would influence the price of the houses. Firstly, they did the preliminary analysis and chose 12 variables to predict the cost. Then they used the method of multiple linear regression to analyze how these factors affect the price of the houses. After the analysis, they chose seven variables (HOA, size, age, yards, floors, bedrooms, bathrooms) to include their models. The other article writing by (Al-Masum & Lee, 2019) show housing price in Sydney by macroeconomics indicators. (Y. F. Chang, Choong, Looi, Pan, & Goh, 2019) predict the housing prices in Petaling district, Malaysia and its six sub-regions with a set of housing attributes using a functional relationship model. The results showed the proposed model has a better fitting ability and prediction accuracy as compared to the hedonic model or multiple linear regression (Engle, Lilien, & Watson, 1985).

Compared to previous research, this paper will focus more on what variables will affect the selling price of houses in two major cities in Indonesia, namely Surabaya and Denpasar. This study uses regression analysis, and after finding the variables that affect, then the best model will be shown, which shows the selling price of the house.

The structure of this paper starts with the background of the study, then formulates the problem. The research method will explain the variables that affect the selling price of the house, along with the scale and definition of these variables. Furthermore, data processing and analysis will be carried out. The discussion in this paper will answer the problem statements that have been set previously. Conclusions and recommendations will be explained at the end of this paper.

RESEARCH QUESTIONS

Two problems must be tested in this study:

1. What variables affect the selling price of houses in Surabaya and Denpasar?
2. What is the best model that can be used to predict housing prices in Surabaya City and Denpasar City?

RESEARCH METHODS

Data collection is done by using independent observation through the website www.rumahku.com. Data were randomly collected and distributed in various cities in Surabaya and Denpasar. Data and information on housing sales obtained were 110 homes with details of 55 homes in the city of Surabaya and 55 homes in the city of Denpasar. All data is recapitulated using Excel. Processing and data analysis using Minitab software. Minitab to date has been

widely used by students in the scope of social science studies (Bryman, 2003) and (Kishore K. Pochampally & Gupta, 2016). This research is a case study (Pochampally & Gupta, 2014), specifically the cities of Surabaya and Denpasar.

Independent variables are categorized as two types: a) continuous independent variables (e.g., condition 1, condition 2, electrical, LSF, BSF, number of bedrooms, number of bathrooms, and public facility), and b) indicator of independent variables that provide supporting information about the unit in the form of an item or facility that is either present (1) or not present (0) in the unit (e.g., utilities, security, certificates, floods, material quality, carport, and road type).

Models for this study have been developed. The stepwise method is selected as it provides better justification for the variables included in the model. Each variable will be assessed and reassessed for its significance in the model or equation. The other important exercise in model development includes model testing and validating. The models are observed for the existence of multicollinearity and other problems that might affect the stability of the models developed (Yusof & Ismail, 2012).

In linear regression modeling now, the basic equation used is as follows:

$$Y = \alpha + \beta1.X1 + \beta2.\ X2 + \beta3.X3 + \beta4.\ X4 + \beta5.X5 + \beta6.\ X6 + \beta7.X7 + \beta8.\ X8 + \beta9.X9 + \beta10.\ X10 + \beta11.X11 + \beta12.\ X12 + \beta13.X13 + \beta14.\ X14 + \beta15.X15 + \varepsilon$$

INFORMATION

Y =	Sales Price	X8 =	Bathroom
X1 =	Utilities	X9 =	Security
X2 =	Condition 1	X10 =	Certificate
X3 =	Condition 2	X11 =	Flood
X4 =	Electrical	X12 =	Material quality
X5 =	LSF	X13 =	Carport
X6 =	BSF	X14 =	Public facility
X7 =	Bedroom	X15 =	Road Type

The constant α is called the intercept and the coefficient of ß1 until ß15 is the parameter estimate for the variable X. The ε is the error term. ε is the residual that cannot be explained by the variables in the model. Most of the assumptions and diagnostics of linear regression focus on the premises of ε (Ozgur, Ph, Hughes, Rogers, & Parveen, 2016). The Conceptual Framework of this research can be described as follow:

Variable and Indicator Definitions

In this paper, the response variable selected is the "sales price" of these houses, and the price is a numeric variable. At the same time, there are 15 variables used as the potential predictors, and they are utilities (evidence or not), condition 1 (km), condition 2 (km), electrical (kwh), LSF (m2), BSF (m2), Bedrooms (number of), Bathrooms (number of), Security (available or not),

certificate (available or not), flood (affected or not), material quality (disclose or not), carport (available or not), public facility (km) and road type (near main road or not). In this study, there are 110 houses separated in two cities (Surabaya and Denpasar) and they are observational subjects.

The scale used in this study is Nominal and Ratio. More complete, information related to variables, range, variable definitions, and measurement units can be seen in the following table.

Variable	Scale	Variable	Information	Indicator
Sales Price	Ratio	Y	Prices of homes for sale in the cities of Denpasar and Surabaya (in	In a million rupiah
Utilities	Nominal	X1	Water availability from PDAM or Non-PDAM	Dummy Variable 1 = PDAM 0 = Non-PDAM
Condition 1	Ratio	X2	Distance from home to the main street of the city	Kilometer
Condition 2	Ratio	X3	Distance from home to the mayor's office	Kilometer
Electrical	Ratio	X4	The amount of electricity in the house	Kilowatt-hour (kwh)
LSF	Ratio	X5	Surface Area	Meter square (m2)
BSF	Ratio	X6	Building Area	Meter square (m2)
Bedroom	Ratio	X7	Number of bedrooms	Unit
Bathroom	Ratio	X8	Number of bathrooms	Unit
Security	Nominal	X9	Security availability (cctv, security person, security gate)	Dummy variable: 1 = available 0 = no available
Certificate	Nominal	X10	Home ownership letter	Dummy Variable: 1 = available (SHM) 0 = other
Flood	Nominal	X11	Information on whether the home environment is flood-free or not	Dummy Variable: 1 = free of wave 0 = no free of flood
Material quality	Nominal	X12	Material house quality disclose, etc	Dummy Variable: 1 = disclosure 0 = no disclosure
Carport	Nominal	X13	Garage available	Dummy Variable: 1 = available 0 = no available
Public facility	Ratio	X14	The distance of houses to public facilities such as city offices, schools, hospitals, health centers, city parks, banks, and so on	Kilometer (km)
Road Type	Nominal	X15	Indicates whether the location of the house is on the main street of the city	Dummy Variable: 1 = Yes 2 = No

Sources: Proceeds, 2019

To assess the validity of the regression assumptions, residual plots are used. Appropriate transformations of the dependent or independent variable can be done by making changes to

the model until they are improved upon from previous problems. The estimated regression equation is then reported. Any outliers or influential values are being noted. If we find any prominent benefits, we remove them from the dataset, and a new report of the estimated regression equation is made without the influential values (Ozgur et al., 2016).

ANALYSIS AND DISCUSSION

Analysis and Discussion of Surabaya

Based on the results of data processing for the Surabaya area, the results obtained variables that affect the price of the house and its coefficient. The findings appear in the table as follows:

Variables that affect the selling price of homes in the city of Surabaya		
Variable	Affect	Coefficient
X3 (Condition 2)	-	160
X4 (Electrical)	+	1411
X5 (LSF)	+	27,15
X8 (Bath Room)	-	810
X12 (Material Quality)	+	1870
X14 (Public Facility)	-	1062

Based on the table, it can answer the problem formulation that was revealed earlier, namely: the variable that significantly affects the selling price of homes in Surabaya is the variable distance of the house to the Surabaya mayor's office. The closer the house is to the mayor's office, the more expensive the house will be. In addition, the amount of electric power (Kwh) and the land area also dramatically affects the selling price of the house. The higher the electrical power and the more extensive the land, the higher the selling price of the house.

An exciting result from the data processing is the number of bathrooms, which also dramatically affects the selling price of houses in the city of Surabaya. The less bathroom will affect the selling price of the house. This is influenced by the mobility of Surabaya City residents who concentrate more on their activities outside the home rather than inside the house so that the number of bathrooms is not of much concern. Besides that, Surabaya city residents only focus more on other aspects such as greening the house and land area.

In some large cities, the price of land every year becomes prohibitive, so that every meter of land will be used for more urgent needs. The number of bathrooms is not a top priority for the big city community, so the property is more for other things, such as bedrooms or living rooms. Thus, the number of bathrooms will reduce the selling price of the house. The land investment will be more profitable compared to investment in the number of bathrooms.

Material quality and public facilities also significantly affect the selling price of homes. Disclosure of the material quality of a house will provide complete information for consumers and significantly affect the selling price of the house. The full details on the quality of the house, the selling price of the house will be higher. As for the distance of the house from public facilities such as schools, banks, health services, schools and offices also affect the selling price of the house. Based on the results of data processing, it shows that the closer the house is to the public facilities, the higher the selling price of the house.

The best model to describe the factors that affect home sales in the city of Surabaya is as follows:

$$Y = -2218 - 160.X3 + 1411.X4 + 27{,}15.X5 - 810.X8 + 1870.X12 - 1062.X14$$

Analysis and Discussion of Denpasar

Based on the results of data processing for the Denpasar area, the results obtained variables that affect the price of the house and its coefficient. The results appear in the table as follows:

Variables that affect the selling price of homes in the city of Denpasar		
Variable	Effect	Coefficient
X4 (Electrical)	+	0,4453
X5 (LSF)	+	6,58
X6 (BSF)	+	4,23
X7 (Bed Room)	-	452
X9 (Security)	+	442
X10 (Certificate)	-	834
X13 (Carport)	+	1069

According to the table above, it can answer the problem formulation that was revealed earlier, namely: variables that significantly affect the selling price of houses in Denpasar City are the number of kWh of electric power, land area, building area, number of rooms, security, homeownership, and garage availability. Each interpretation of the results will explain as follows.

The higher the power used by the house in Kwh meal will determine the selling price of the house. This is following the area of land and buildings from the data obtained: the more land and buildings, the more expensive the selling price of the house.

Bali, as a tourism area and Denpasar as the provincial capital, is very concerned about the security element. The availability of CCTV, security, one gate system dramatically affects the selling price of the house. An adequate level of protection will increase the selling price of the house.

The availability of a garage (carport) also affects the level of house prices. In Denpasar alone, almost every house provides parking due to the level of vehicle ownership in Bali which is increasing every year. In one head of a family, there is even a vehicle that is a car and a motorcycle.

An interesting finding from the results of data processing is that the fewer the number of bedrooms, the higher the selling price of the house. That is because the community or residents in Bali have more than one house. Traditionally, the Balinese have their own homes (traditional houses) and homes for daily living. The original home outside Denpasar has more bedrooms than the house for activities (located in Denpasar). The house in Denpasar is only a place of transit or residence for one of their family members who works or studies in Denpasar. After their activities on weekdays, they will, of course, return to their original homes.

The letter of ownership of the right to a home is also an interesting finding from this study. Houses with non-SHM ownership will significantly affect the selling value of homes in the city of Denpasar. The policy of the Denpasar city government states that land located in Bali may not transfer ownership to parties other than the indigenous Balinese. Property that is in Bali and especially in locations close to attractions with ownership status is rent. With this lease,

developers and foreigners build houses on rental land for residences or guest houses. For this reason, the selling price of a house will be higher.

The best model to describe the factors that affect home sales in the city of Denpasar is as follows:

$$Y = 329 + 0{,}4453.\ X4 + 6{,}58.X5 + 4{,}23.X6 - 452.X7 + 442.X9 - 834.X10 + 1069.X13$$

CONCLUSIONS AND FURTHER RESEARCH

The conclusion obtained from this study is that the selling price of houses in two major cities in Indonesia, Surabaya, and Denpasar are both influenced by the amount of electricity and land area. While more factors are affecting the selling price of homes in Denpasar compared to Surabaya. In addition to the amount of electricity and land area, for the city of Surabaya, it is strongly influenced by the distance of the house to the mayor's office, the number of bathrooms, disclosure of information on the quality of the house and the length of the house to public facilities. While the area of the building also influences the city of Denpasar, in addition to electrical power and land area, the number of bedrooms, security, ownership, and garage.

Suggestions that can be given for further research is to expand the variables that affect the selling price of houses, such as adding macroeconomic factors (inflation, interest rates) and also consider pollution and road noise levels. Also, further research can add to the place of observation, not only two cities but more cities in Indonesia. It is hoped that with more variables being tested, it will provide a wealth of information and sources of knowledge for decision-makers regarding house prices in Indonesia.

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APPENDIX – RUN DATA SURABAYA

Method

Correlation type	Pearson
Number of rows used	55

Correlations

	SalePrice (Rp)	Condition 1 (km)	Condition 2 (km)	Electrical (kwh)	LSF(m2)	BSF(m2)	Bed Room
Condition 1 (km)	-0,031						
Condition 2 (km)	-0,102	0,319					
Electrical (kwh)	0,733	-0,113	-0,003				
LSF(m2)	0,858	0,011	-0,029	0,541			
BSF(m2)	0,799	-0,117	0,069	0,633	0,853		
Bed Room	0,374	0,052	0,009	0,168	0,577	0,462	
Bath Room	0,554	-0,078	0,053	0,444	0,638	0,666	0,568
public facility	-0,123	-0,091	-0,152	-0,017	0,008	0,009	0,008

	Bath Room
Condition 1 (km)	
Condition 2 (km)	
Electrical (kwh)	
LSF(m2)	
BSF(m2)	
Bed Room	
Bath Room	
public facility	-0,225

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-2218	1267	-1,75	0,086	
Condition 2 (km)	-160,0	68,8	-2,33	0,024	1,05
Electrical (kwh)	1,411	0,208	6,80	0,000	1,45
LSF(m2)	27,15	2,60	10,43	0,000	2,05
Bath Room	-810	383	-2,11	0,040	2,01
public facility	-1062	344	-3,09	0,003	1,12
material quality					
1	1870	736	2,54	0,014	1,09

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
2451,60	88,53%	87,10%	53,72%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	6	2226590359	371098393	61,74	0,000
Condition 2 (km)	1	32504034	32504034	5,41	0,024
Electrical (kwh)	1	277827703	277827703	46,23	0,000
LSF(m2)	1	654092411	654092411	108,83	0,000
Bath Room	1	26866549	26866549	4,47	0,040
public facility	1	57302276	57302276	9,53	0,003
material quality	1	38806057	38806057	6,46	0,014
Error	48	288495336	6010320		
Total	54	2515085696			

Fits and Diagnostics for Unusual Observations

Obs	SalePrice (Rp)	Fit	Resid	Std Resid	
10	5350	11299	-5949	-2,84 R	
19	48000	40180	7820	6,09 R	X
25	3100	9235	-6135	-2,70 R	
32	20000	22677	-2677	-1,63	X
45	3600	8225	-4625	-2,09 R	

R Large residual
X Unusual X

Appendix – Run Data Denpasar

Correlations

	SalePrice (Rp)	Condition1(km)	Condition2(km)	Electrical (kwh)	LSF(m2)	BSF(m2)
Condition1(km)	-0,251					
Condition2(km)	-0,306	0,406				
Electrical (kwh)	0,874	-0,201	-0,297			
LSF(m2)	0,873	-0,212	-0,322	0,766		
BSF(m2)	0,821	-0,221	-0,342	0,748	0,813	
Bed Room	0,572	-0,215	-0,277	0,582	0,678	0,808
Bath Room	0,593	-0,201	-0,165	0,592	0,521	0,740
public facility	-0,162	0,528	0,181	-0,147	-0,082	-0,125

	Bed Room	Bath Room
Condition1(km)		
Condition2(km)		
Electrical (kwh)		
LSF(m2)		
BSF(m2)		
Bed Room		
Bath Room	0,722	
public facility	-0,034	-0,137

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	329	585	0,56	0,576	
Electrical (kwh)	0,4453	0,0702	6,34	0,000	2,86
LSF(m2)	6,58	1,08	6,09	0,000	3,82
BSF(m2)	4,23	1,97	2,15	0,037	6,77
Bed Room	-452	114	-3,96	0,000	3,19
Security					
1	442	210	2,11	0,041	1,71
Certificate					
1	-834	421	-1,98	0,053	1,09
carport					
1	1069	438	2,44	0,018	1,18

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
558,674	91,82%	90,60%	85,08%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	7	164661533	23523076	75,37	0,000
Electrical (kwh)	1	12547560	12547560	40,20	0,000
LSF(m2)	1	11578751	11578751	37,10	0,000
BSF(m2)	1	1441609	1441609	4,62	0,037
Bed Room	1	4891588	4891588	15,67	0,000
Security	1	1384156	1384156	4,43	0,041
Certificate	1	1226442	1226442	3,93	0,053
carport	1	1864404	1864404	5,97	0,018
Error	47	14669478	312117		
Total	54	179331011			

Fits and Diagnostics for Unusual Observations

Obs	SalePrice (Rp)	Fit	Resid	Std Resid		
1	1200	381	819	2,16	R	X
2	8000	7516	484	1,23		X
8	3400	5097	-1697	-3,22	R	
14	9000	7511	1489	2,99	R	
21	1800	1379	421	1,14		X
22	2800	3221	-421	-1,14		X
27	3500	2473	1027	2,01	R	
51	400	1219	-819	-2,16	R	X

R Large residual
X Unusual X