

STATISTICAL INTERPRETATION OF LAND VALUE PATTERNS IN PADANG, INDONESIA

*Fitriana Syahar¹ Risky Ramadhan² Srikandi Putri³

¹Faculty of Social Science, Padang State University, Indonesia; ^{2,3} Padang State University, Indonesia

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ABSTRACT: The tendency of physical development of morphology in Padang City leads to the east part of the city thus influencing land value. This study presents a mathematical statistics interpretation to explain what factors influence the distribution of the land value and the estimated magnitude of the relationship, and then analyzing the land value patterns that the hypothesized of factors influencing the land value in the road route of Ampang - Kalawi - Pasar Baru - Kapalo Koto in Padang City in 2014. By using multiple linear regression models, the results show that natural disasters, distance from the Central Bussines District (CBD), distance from service facilities and land use change significantly influenced the value of the land. While the distance from the main road did not show a large contribution to the land value. This was evidenced by the significant value bigger than α determined as the degree of trust. The land value patterns formed small peaks (mini peaks) due to: (1) the role of transportation network and (2) the existence of public service facilities (growth center other than CBD). Empirically the distribution of the land value varied or gave the expression of "U" pattern with high land value approaching the CBD, then declined and rose again in areas approaching facilities of the public service (growth center other than CBD).

Keywords: Land Value, Natural Disasters, Accessibility, Land Use Change, Service Facilities, Land Value Patterns

1. INTRODUCTION

It is interesting to examine the land value in Padang City due to some reasons. Firstly, it is because of its function. Padang City has people growth which is continually increased from year to year. Data from Statistic Center Agency (BPS) of West Sumatera Province show that the number of growth was in the average of 1.2 % per year. Secondly, limited lands for physical development of the city are as the next reason. Almost half of the land areas or 49.48% are undulating with the degree of slope > 40%. If it is made into a development area, it certainly requires a lot of funds and high technology. Furthermore, the north of Padang City has a relatively flat landscape, but other facts say that Padang City is an area prone to the natural disasters (earthquake and tsunami). Therefore, people prefer to live in a zone that is relatively safe or far from the coast with high altitude after the government issued a map of the tsunami safe zone.

Central Bussines District (CBD) in Padang City is the center of many facilities and services for public which have density of buildings that as the development progresses. Because of the increasing of the crowds in CBD and the reduction of vacant land, the urban development moves outward to CBD horizontally (urban sprawl). BPS data show that in 1998 the highest population density of Padang City was in West Padang Sub-district which was 9.04% or close to 63,000 people / km². Then in 2008, the

total population density decreased to 7.1% or by 61,437 people / km². In the same year, the highest population density in Padang City moved to East Padang sub-district until the latest data was obtained in 2013 with a density rate of 9,677. Previous research that examined the direction of the development of Padang City in 2000 to 2010 using superimpose / overlay techniques also proved that the development of Padang City was dominant towards the eastern part of the city.

Based on the spatial plan of Padang City in 2010 - 2030, the development will be directed to the eastern part of Padang City which is prone disasters. By considering the field condition and the limited urban land, the land value is then increasing. Therefore, this research is conducted to investigate the land value patterns in the east part of Padang City which is in the road route of Ampang - Kalawi - Pasar Baru - Kapalo Koto. It is aimed to measure the correlation between the factors influencing the land value.

2. THEORY

2.1 Understandings of Land and Changes in Land Use

There are various definitions of land aroused by some experts with different backgrounds and perspectives. Most people get difficulties to define soil and land since because they seem the same but

different. Fallon defines the land as the top layer of earth made of weathered rock is the physical and non-physical environment related to its capacity for human life and welfare [1]. So, the land definition is wider than soil. The land is the physical landscape including soil, climate, topography, hydrology and natural vegetation. The land use can be defined as a form of human treatment toward it to fulfill their daily needs like agriculture, plantation, housing, etc. There are many factors influencing the changes of the land use in the city [2] such as the city activity system, the land development system and the environment system. Be aware or not, explicitly or implicitly, for individual or groups, in their actions will always cause certain land use patterns [3].

2.2 Land Value Patterns

Value is a monetary unit that attached to a property that is influenced by social, economy, politics, and physical factors which is stated in the price [4]. The land price is the value of the land measured based on the nominal price of the currency. The change of the land value with the land price is influenced by the factors that support the use, the capacity, and the economical productivity of the land [5]. Drabkin in [3] stated that the land value is an assessment on the land based on its economical capacity in relation to productivity and economical strategy. The land value is also horizontal spatial value or distance decay principle from the center based on Urban Growth Model [6]. So, it can be said that the land value is the realization of the land optimum capacity or productivity.

A pattern can describe the spatial shape of certain objects spatially. Berry [7] reveals that the land value patterns are influenced by the presence of the radial road and ring road intersection (mini peaks). Meanwhile, the city center is the main one called as grand peak. Even though the mini peaks were not in the city center, Berry states that the land value will be higher in comparison to the location closer to the city center. Chapin in [8] asserts that patterns and structure of the land use influence the rent and vice versa. Similarly, Von Thunen theory reveals that the land value patterns are determined by its accessibility strengthened by the graphic of the land rent and transportation function. The previous research [9] concludes that the land value will keep growing due to the denser population number, income increase, except due to the disasters threat around the land so that it is no longer profitable.

3. METHOD

Cluster random sampling was employed to limit the area that was studied since it was very large. To be more focus, buffering was implemented to the research object, that was road route from the

crossroad of East Alai – Ampang – Kampung Kalawi – Pasar Baru – Kapalo Koto with buffering width was 100 m on both right and left side of the road. This technique used Geography Information System (GIS). The respondent samples were taken randomly by using solving formulation which required the residents who lived in the buffering area in a long time as the landowners or representing the landowners that had conducted land sale and purchase in the research area.

Methods used to measure the influence of free variable toward the land value as dependent variable that were the regression method and the classic test assumptions such as normality test, multicollinearity, and heteroscedasticity of regression model which employed to avoid the probability of error or fulfilling the use regression standard. The following is the equation regression [10].

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \quad (1)$$

Based on the conceptual framework of the problems that have been mentioned previously, the research hypotheses were as follows.

H₁: Natural disasters (X₁) influenced the land value (Y)

H₂: Land distance to the city center (X₂) influenced the land value (Y)

H₃: Land distance to the asphalt road (X₃) influenced the land value (Y)

H₄: Land distance to the service center (X₄) influenced the land value (Y)

H₅: Land Use Change (X₅) influenced the land value (Y)

4. RESULTS

4.1 Regression Model and Hypothesized Factors Influencing Land Value

Through SPSS 19, the regression model and the hypothesized factors that influenced the land value have the estimation results as follows.

Table 1 Estimation results of factors influencing the land value in Padang

Influencing Factors	β
constant	5.507
tsunami disaster	0.743
distance from center of the city	0.901
distance from asphalt road	-1.491
land use change	0.485
distance from service facilities	-0.268

Source: data processing in 2014

Based on the estimation results on the table 1, the regression based on Eq. (1) can be written as follows.

$$Y = 5.507 + 0.743X_1 + 0.901X_2 - 1.491X_3 + 0.485X_4 - 0.268X_5$$

(6.615) (5.152) (1.491)
(2.695) (2.322)

$Y = 5.507 + 0.743$ (the tsunami disaster) $+ 0.901$ (the distance from CBD) $- 1.491$ (the distance from asphalt road) $+ 0.485$ (the land use change) $- 0.268$ (the distance from the service facilities)

Beta value was ranging from 0 to 1. The closer to 1, the stronger was significant or the bigger was the contribution. Not all variables were significant. The significant ones were the tsunami disaster, the distance from CBD, the distance from service facilities, and the land use change. Meanwhile, the distance from the asphalt road was not significant influencing the land value. The interpretations are:

- Based on the regression model, the constant was valued as 5.507. When all variables were valued as zero, then the value of those factors was 0. So, the land value was as much as constant as 5.507. By implementing antilog toward the constant, the land value was IDR 321,366.
- The hypothesized tsunami disaster influencing the land value had the result of the influence estimation as 0.743. If the land was one more unit away from the reach of the tsunami, then the land value was increasing 0.743. By conducting antilog toward coefficient, then the land value was IDR 1,778,279 on the assumption that the other factors were not changing.
- The distance from CBD had the coefficient as 0.901. Every one kilometer addition would result in the increasing of the land value as 0.901 or if antilog was applied to this coefficient, then increasing the land value as the effect of this factor was IDR 2,552,701 on the assumption that this factor was permanent.
- The estimation result toward the distance from the asphalt road was -1.491. If this factor was added to another one kilometer, then the land value would be decreased as 1.491 or by applying antilog to the coefficient would result in IDR 10,375. However in the regression model, the significant value of this factor was bigger than 0.05 which was 0.143 > 0.05. Hence, statistically this factor did not have significant contributions toward the land value.
- The land use change had the estimated result as 0.485 influencing the land value. This factor would result in the increasing of the land value as 0.485. By conducting antilog toward the result of the estimation, the land value would increase as IDR 981,748 on the assumption that the other variable had to stay remained or unchanged.
- The distance from the service facilities had coefficient regression as -0.268. Any one kilometer additional from this factor would have

negative impact toward the land value which was the decrease as 0.268. By conducting antilog to coefficient would result in IDR 981,748.

4.2 Test Results (t-Test)

The value of t-count as the regression results can be seen in table 2 as follows

Tabel 2 Test results of correlation coefficient

Free Variable	t-Count	Sig.
tsunami disaster	6.615	.000
distance from CBD	5.152	.000
distance from asphalt road	-1.491	.143
distance from service facilities	-2.322	.025
land use change	2.695	.010

Source: data processing in 2014

Hypothesis Test with t-test:

The criteria in accepting or rejecting hypothesis are:

- H_0 was rejected if t-count > t table and significant < 0.05.
- H_0 was accepted if t-count < t table and significant > 0.05.

The value of t-table was 1.682. The discussion of hypothesis test in partial was as follows.

Hypothesis Test 1: the tsunami disaster as a factor influencing the land value had t-count = 6.615. The significance level employed was 0.05; hence the decision was H_0 was rejected, since t-count > t-table, that was 6.615 > 2.018. It means that this factor was statistically significant influencing the land value.

Hypothesis Test 2: the distance from CBD has t-count = 5.152. The significance level employed is 0.05; hence the decision was that H_0 was rejected, since t-count was bigger than t-table that was 5.152 > 2.018. It means that this factor was statistically significant influencing the land value.

Hypothesis Test 3: the distance from the asphalt road with t-count = 1.491. The significance level employed was 0.05, t-count was smaller than t-table or 1.491 < 2.018, so it was determined that this factor was not fulfilling testing rules as the statistics estimation tool.

Hypothesis Test 4: the distance from service facilities had t-count which was bigger than t-table that was 2.322 > 2.018, the significance level employed was 0.05, so H_0 was rejected. It means that this factor was fulfilling testing rules and statistically significant.

Hypothesis Test 5: the land use change had t-count = 2.695 > t-table that was 2.018, hence it was determined that H_0 was rejected with significance level employed was 0.05. It was fulfilling testing result. It means that this factor was statistically significant influencing the land value

Table 3 The conclusion of hypothesis test

Hypothesis	Statement	Decision
H ₁	Statistically the tsunami disaster influenced the land value significantly	Ho rejected, H ₁ accepted
H ₂	Statistically the distance from CBD influenced the land value significantly	Ho rejected, H ₂ accepted
H ₃	Statistically the distance from the main road did not influence the land value significantly	Ho accepted, H ₃ rejected
H ₄	Statistically the distance from service facilities influenced the land value significantly	Ho rejected, H ₄ accepted
H ₅	Statistically the land use change influenced the land value significantly	Ho rejected, H ₅ accepted

Source: hypothesis test result with t-test in 2014

4.3 F Test Result (Simultaneously Test)

F-test was to obtain the contribution of the free variables a whole or in simultaneously toward the land value as the dependent variable as follows.

1. $H_0 = F_{\text{count}} < F_{\text{table}}$, so H_0 was accepted and H_a was rejected.

It means a whole that there was no significant influence from the free variables toward the land value.

2. $H_a: F_{\text{count}} > F_{\text{table}}$, so H_0 was rejected and H_a was accepted.

It means a whole that the free variable was statistically significant in influencing the land value as the dependent variable.

F-test value with the trust level of 95% showed that f-count was bigger than f-table $24.094 > 2.45$. So, the testing rule was fulfilled in a whole of the factors that was significant to have the contribution/influence toward the land value.

4.4 R² Value (Determination Coefficient)

Based on the regression result, it was obtained that the adjusted R square value was 0.741. So, the land value could be explained by the free variables for 74.1%. Meanwhile the rest of it was 25.9% which explained by the other variable that was not considered in regression model. R square value obtained explained that the model suitability was better since the value was showing number closer to 1 that was 0.74.

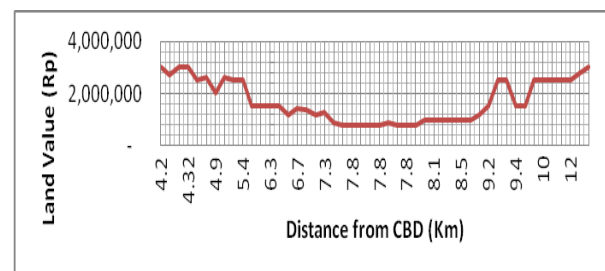
It was often recommended that in case there were two free variables. It was better to employ adjusted R square. This research employed 5 free variables. The value of adjusted R square was 0.711. This value revealed that used model was better in explaining the linear close relationship among variables together with dependent variables.

5. DISCUSSION

5.1 Land Value Patterns on Road Route of Ampang – Kalawi – Pasar Baru – Kapalo Koto in Padang City

The land value was different in each location due to the change of the owner orientation or the land user in managing the land. The price reflected the value of the property [11]. The land value in this research was stated in price (IDR) based on the transaction of sale or purchase occurring in the research area. The land value patterns were formed as the city developed which the theory being used was Berry's theory in [12] who revealed that not all the time certain area had the same condition.

Data of in-depth direct interview conducted in the observation location revealed that the land value (land price) was ranging from IDR 800,000 to IDR 3,000,000. Based on the land value dissemination graphic on figure 1, the land value patterns were almost forming a bent or U shape in which the highest land value was IDR 3,000,000 located in East Alai and Muhammad Hatta road in Pauah. Then, the land value was decreasing as IDR 2,000,000 to IDR 800,000 in areas of Ampang, Kampuang Kalawi, Durian Taruang, and Pasar Baru. Then, the lowest land value was based on sale/purchase transaction as much as IDR 800,000 on the road route of Durian Taruang – Pilla Tarok. The land value patterns or the land value distribution based on distance from CBD can be seen on the following graphic.



Source: primary data processing result in 2014

Fig. 1 Land value patterns graphic in east corridor of Padang in 2014

The land value patterns were varied based on the distance from CBD which was high patterns in the area close to the city, and then lower at the distance of 7 – 8 km from CBD and the land value rise again

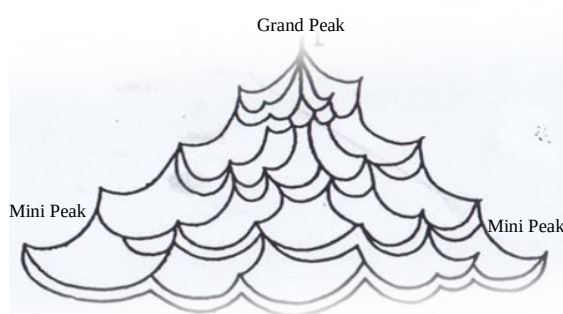
close to Andalas University which was the limit of research location. The Patterns formed in the research were different from the general patterns for area with the tendency of flat/homogeneity geographical condition. This theory stated that the land value tended to be high when it was close to CBD, and tended to decrease in the peripheral area. The following was the land value distribution table based on the research area route.

Table 4 Land Value on Road Route of (Ampang – Kalawi – Pasar Baru – Kapalo Koto) Padang City Based on the Transaction of the Community in 2014

No	Area	Land Value (Rupiah)
1	Kapalo Koto	3,000,000 - 2,500,000
2	Simpang Pasie	1,500,000
3	Pasar Baru	2,500,000
4	Bangdes	1,500,000
5	Villa Tarok	800,000 - 1,000,000
6	Durian Taruang	1,000,000 - 1,500,000
7	Kampung Kalawi	2,500,000
8	Ampang	3,000,000 - 2,500,000
9	Alai Timur	3,000,000 - 2,500,000

Source: primary data in 2014

Some factors causing the land value patterns above were, first, the geographical condition in. There were the natural barriers to the city development such as Ocean which borders Padang City in the West part. Second, the research area route through the road intersection (crossroad) such as By Pass Pasar Baru (Pauah) which caused the increasing of the accessibility degree which led to peak triggering (mini peaks) of the land value. The following is the illustration picture of the land value according to Berry (1963).



Source: Struktur Tata Ruang Kota (Yunus, 2002)

Fig. 2 Land value for big city

In line with Berry's theory which revealed that the transportation network played significant role in the forming of the land value patterns. The land value patterns were not the center one, but the variety one due to the low land value change into high.

Next, the distribution of the land value patterns were also explained in the theory of central market model 1 Distortion [13] or known as multiple core model theory by Harris and Ullman. The city was not only has the one activity, but there were many activities. The land value patterns were not centralized, but the other location with a lower value could turn into a higher value.

The other one was the government effort to move Padang City center to the peripheral area (RTRW of Padang City 2010 – 2023) which influenced the population movement to the East part (Suasti, et al. 2010). In addition, statics tendency land and the limit to its availability had trigger competition due to the demand of land by the community would be increased. This condition triggered the land value improvement.

In accordance with the previous research [14], the development of CBD in Padang City was in the higher land (the peripheral area). The land value in this research area was varied forming the "U" shape away from the city central caused by transportation network, city development policy, and geographical condition.

5.2 Factors Influencing the Land Value in Padang City (Road Route of Ampang – Kalawi – Pasar Baru – Kapalo Koto)

In this research, the factors that became the parameter of the land value influence: the tsunami disaster, the distance from CBD, the distance from asphalt road, the distance from service facilities, and the land use change. To reveal the strength or the free variable contribution in influencing the land value in the research area was by using multiple linear regressions with SPSS 19.

From the regression equation was obtained that there was a strong correlation between the factors. It means that the fluctuation of the land value could be explained together with the factors.

The coefficient of each factor was appropriate with the expectation that those factors were significant influencing the land value. Except was the distance from the asphalt road which was not as expected. It was because the results of the test (t-test) were not significantly influencing the land value. The coefficient determination results analysis showed that the great contribution of the free variables toward up and down of the dependent variable were also as the expectation. The factors were strongly influencing the land value 74.1 %. Thus, the factors mentioned above were considered as important factors influencing the land value. The results of the analysis of the correlations of the variables will be discussed in the table below based on the guidance to provide interpretation of correlation coefficient [15].

Table 5 Interpretation of coefficient correlation

Coefficient Interval	Correlation Level
0,0 - 0,199	very low
0,20 - 0,399	low
0,40 - 0,599	moderate
0,60 - 0,799	strong
0,80 - 1,000	very strong

Source: Sugiyono (2007:231)

5.3 Influences of Tsunami Disaster Factor toward Land Value

There is none of the areas on earth can get away from the natural disasters since it is in God's authority (Allah SWT). In this research, the intended disaster was tsunami. The results of the tsunami disaster regression in partial had influences in the land value with the trust level of 95%. It was evidenced that $t\text{-count} > t\text{-table}$ that was $6.615 > 2.018$. The coefficient regression of the tsunami disaster was obtained as 0.743. The farther was the location from the source of the tsunami disaster the higher was the land value which was improving to 0.743. The coefficient value was the regression result value which had yet to be antilog or return to the original land value in IDR. The result of antilog of 0.743 was IDR 1,778,279. Hence, if the farther was the location from the source of the tsunami, the higher was the land value estimation in IDR 1,778,279. This was in line with the research result [16] revealing the property market in the high risk of the tsunami disaster area tended to experience price sinking. Padang City with its geographical condition along with tsunami had a consequence to experience the movement of the land building from the city central to the peripheral area.

5.4 Influences of Accessibility to Land Value

Accessibility was an easy or difficult condition to be reached from other locations. The related element of the accessibility was the facilities of the transportation including its road, the condition and the public transportation. All of the above elements tended to be an individual consideration to choose better residence. Therefore, the land with high accessibility would encourage numerous people to possess it for the purposes of as living or business area. Of course, it influenced the land value. The observed and measured accessibility in this research was a) the land travel time from CBD and b) the distance from the asphalt road. The explanation is as in the following.

5.4.1 Distance from CBD

The coefficient value of the land distance from CBD was 0.901. The test showed that $t\text{-count} > t\text{-table}$ was $5.152 > 2.018$ which means that the distance from CBD had a significant influence

toward the land value with the trust level as 95%. The correlation type between those variables was unidirectional positive linear since any 1 km additional of the land distance would increase the land value as 0.901. In order to obtain the original land value in IDR, antilog was applied to the coefficient. The result of the 0.901 antilog was IDR 2,552,701 hence it can be stated that the farther was the land from CBD, the higher was the land price with the estimation of the improvement was IDR 2,552,701.

This result was different from the previous land values as stated by Thunen [3] which was by considering the distance factor determining the up and down of the land value toward CBD. A research [3] revealed that the land value was horizontal space value and the concentration theory that the highest land value was in the center of the city. It would be decreased when it was farther from the center of the city.

5.4.2 Distance from Asphalt Road

In this research, the distance from the asphalt road was suspected as the factor influencing the land value. The result of the coefficient regression showed that the distance was -0.128. The value of $t\text{-count}$ was -1.491 which was smaller than $t\text{-table}$ that was 2.018. And the significance was bigger than 0.05 which was 0.743. Then, the decision taken was the factor of the distance of the asphalt road was not significant in influencing which was bigger than 0.05 that was 0.743. The decision made was the factor of the distance from the asphalt road was not significant in influencing the land value with the trust level 95%.

The parameter testing was different from the other research results which stated that the factor of the distance from the asphalt result was influencing the land value. The other things that caused this factor was insignificant toward the land value was the numbers of the samples obtained were few. Some experts recommended 15 samples per predictor (free variable) to fulfill the regression test equation.

5.4.3 Influences of Distance from Service Facilities

The service facilities were provided by the government or the private sectors. They were including: educational service facilities, in this case was like Andalas University (UNAND) and State Islamic University (UIN) Lubuk Lintah, and trade/services like department stores.

The regression coefficient of this factor was -0.268. In the SPSS book for conducting a research [17], it was stated that the regression line had 3 possibilities: positive linear correlation, negative linear correlation, and no correlation. Based on the regression coefficient value, the variable association type correlation of the distance of this factor with this land value was negative. So, any additional 1

km distance from this factor would decrease the land value estimated as 0.268 or the coefficient antilog to reveal the correct land value resulted in IDR 595,662.

The result of $t\text{-count} > t\text{-table}$ was $2.322 > 2.018$. The distance of the land from the service facilities determined the land value with the trust level was 95%. So, the more was the distance of this factor, the lower was land value with estimation cost IDR 595,662 or otherwise. If the land location was closer to the service facilities, the land value would be increased with the estimation of IDR 595,662.

Similarly, [3] it was stated that the rental was the fee for the accessibility or the saving from the transportation fee. This would be linked to the building process to determine who had right to occupy the location. Thus, the land would have the higher price if it was close to the service facilities. This research result was in line with a research conducted previously [9] that the accessibility was the main factor influencing the land value in Tulungagung City. It became the main consideration in the land use plan as the basis in the city area development plan.

5.4.4 Influences of Land Use Change to Land Value

The land use change had a significant influence to the land value. It was proven from t-test which resulted in bigger $t\text{-count}$ comparing to $t\text{-table}$ $2.695 > 2.018$ with the trust level 95%. Considering the obtained regression coefficient for the land use change was 0.485. If the land use change was increasing, then it was estimated that the land value would be increased as also big as antilog of the coefficient as IDR 981,748. The condition above has a close relationship with many things. First, it was caused by the plan for moving the Padang City center to the peripheral city area/city east part (revision of RT/RW of Padang City 2008-2028). It was based on the disasters mitigation. Second, the land use change happened due to the presence of the service facilities which triggered the investment and other economic activities.

Numbers of research had proven that the land use change influenced the land value. One research [18] stated that there were two types of the land use change. First, the land use change was caused by the land value change. Second, the land use was permanent, but the land value was increasing due to the private investment climate. The second statement was in line with Wilcox in [19] that the intangible factors influenced the land value which was in immediate (by itself) and could not be controlled in the field. One of them was the speculation motive such as the land use change anticipation. Similarly, there was also a research investigating the factors that strongly influencing the dynamics of the land value in the area of Cipadu

[20] and one of them was the land use change with a commercial function.

6. CONCLUSION

Empirically, the land value distribution on the road route of Ampang – Kalawi – Pasar Baru – Kapalo Koto, Padang City in 2014 was varied. It can was shown in the “U” shape pattern with the high land value close to CBD and the lower land to the peripheral city area. The land value patterns had mini peaks as the effect of the transportation network influences and the presence of the service facilities. The land value of grand peaks was close to CBD area and in the area close to the service facilities. The form of the land value expression above was influencing by four factors that had proven to be significant in influencing the land value through the statistics test namely the tsunami disaster, the distance from CBD, the dieccstance from service facilities, and the land use change.

The magnitude influence of each factor was 0.799 in which the influence of the tsunami disaster toward the land value and it was supported by the community with 48% statement. 0.512 influence of the distance from CBD toward the land value and it was supported by the community with 28% statement. 0.282 influence of the distance from CBD toward the land value and it was supported by the community with 64% statement or most people supported that the distance to the service facilities was influencing the land value. 0.279 of the land value was influenced by the land use change factor and it was supported by the community with 67% statement. In conclusion, the community stated that the land use change or the land conversion was actually influencing the land value.

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