The Spatial Pattern of Urban Land Prices Determination in Indonesia

The Case of Surabaya, East Java

A Research Paper presented by:

Puspa Anggraini

(Indonesia)

in partial fulfilment of the requirements for obtaining the degree of

MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Economics of Development

(ECD)

Members of the Examining Committee:

John Cameron

Mansoob Murshed

The Hague, The Netherlands

August 2013

Disclaimer:

This document represents part of the author's study programme while at the Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

Inquiries:

Postal address:

Institute of Social Studies
P.O. Box 29776
2502 LT The Hague
The Netherlands

Location:

Kortenaerkade 12
2518 AX The Hague
The Netherlands

Telephone: +31 70 426 0460
Fax: +31 70 426 0799

Contents

List of Tables

List of Figures

List of Maps

List of Appendices

List of Acronyms

BPN	Badan Pertanahan Nasional
CBD	Central Business District
EDA	Explorotary Data Analysis
GDRP	Gross Domestic Regional Product
Gerbangkertosusilo	Gresik, Bangkalan, Mojokerto, Surabaya, Sidoarjo, Lamongan
GIS	Geography Information System
HGB	Hak Guna Bangunan
HM	Hak Milik
HP	Hak Pakai
OLS	Ordinary Least Square
PCA	Principal Component Analysis
SAR	Spatial Auto Regressive
TPA	Tempat Pembuangan Akhir
VIF	Variance Inflation Factor

Acknowledgement

For almost two years, I have been experienced many valuable things in academic and non-academic. Taking the opportunity to study in master programme in ISS give me better understanding about the diversity around the world.

By finishing my research paper, it means that my time as student is done. Hence, I would take this opportunity to write my gratitude to all the person that help me through joyful and difficult time. First, I would like to thank to my parents, my brother and sister for all of your support. Then, my deepest gratitude is to my friends from ECD group. In particular, thank you to my entire Indonesian student that has been my new family for the last two years.

Lastly, I would like to thank to all of my lecturers for the transfer of valuable knowledge. In addition, my gratitude is to my supervisor for the guidance, ideas and support, and my second reader for the valuable comment during my research paper period.

Abstract

This paper aims to examine the determinants of land prices linked to the spatial pattern of urban area in one of the largest city in Indonesia that is Surabaya. By using market-prices approach, this research incorporates 14 spatial variables and 4 non-spatial variables. The findings indicate that proximity to city centre is still significant in determining land prices in Surabaya. It fits with empirical findings from previous study such as Boston Dallas and Jakarta. Nevertheless, the R-squared of land prices and CBD is quite small indicating the urban structure in this city likely follow the polycentric city or multi-nuclei city. It also confirms that there is a decentralisation in urban economic activities in Surabaya.

Due to multicollinearity problem, regression in this research using four principal components. The result show that there are four significant independent variables which are first principle component (central area), fourth principle component (outer area), zoning for industry and collector road. Beside outer area, all the results can be supported by the descriptive analysis and previous studies. It is likely because the second component the consist of variables that tend to fall and rise with distance. In addition, land prices in central area tend to decline with distance. In term of zoning, industrial area has negative sign implying that this zoning has lower prices compared to trading/service zone. Coefficient for collector road has positive sign indicating that land plot in front of this road is appreciated higher values than located near local road.

Relevance to Development Studies

Urban structure and land prices have a link with development in one city. For instance, spatial pattern such as monocentric city that tend to accommodate city centre will likely cause the uneven development between central and periphery region. As a result, perhaps there are not equally distributed the provision of public services around the city. Some cities based on previous study such as Chicago, Istanbul and Berlin adopted that pattern in the early of 20^{th}-century which can be seen from the steeper land prices gradient. However, those metropolitan cities nowadays has transformed to polycentric city and experienced the declining of importance of central business district (CBD).

In addition, some study indicated that land prices in city centre still tend to relatively higher than in suburb area particularly in metropolitan area. Higher land prices are the burden for government to accelerate development in one city. It would be a restriction to build infrastructure such as road, parks and other public facilities in order to support economic activities. It is also disadvantage for citizen to get affordable housing. Related the note above, it is worthy to examine the pattern of urban structure in Surabaya as the second metropolitan city in Indonesia after Jakarta related to the dynamic of spatial pattern of land prices.

Keywords

Land prices determination, Spatial pattern of land prices, Surabaya, Indonesia.

Chapter 1
Introduction

1.1 Background

Land according to Koomen and Buurman (2002) has unique characteristics compared to other economic goods. The supply of land as a simple area is fixed, every parcel of land has a fixed location, and the use of a parcel of land affects the use and value of surrounding parcels. Similarly, Fujita (1989) stated that land is a complex resource with dual characteristics. First, land is a commodity in the usual economic sense, capable and being used in many ways. However, second, unlike other commodities, land is immobile. Therefore, each piece of land is associated with a unique location in geographical sense.

According to Harvey (1992) in his book *Urban Land Economics*, underdeveloped land or 'pure' land refers solely to natural resources in space. Thus, pure land can be regarded as being fixed in supply and therefore price inelastic. But, land prices, like the prices of other goods, are influenced by demand. Since land as a whole is a fixed supply provided by the nature, the earnings of 'pure' land are determined solely by demand.

Related to development, differing land use particularly in a city are closely related to with other factor. Land use in an urban area is driven by many factors such as market, social or political factors. Harvey (1992) wrote that a city begins for many reasons but economic forces are likely to be the major factor influencing the urban growth. That expansion changes the pattern of urban land use. In line with that, Barlowe (1978) quoted in Ai (2005) explains that the allocation and use of land resources are affected by the physical and biological, economic and institutional factors. Furthermore, the dynamic of urban growth does not just influence land use changes but also brings higher land prices for commercial use such as for malls replacing residential use over time.

Many scholars of urban economics have studied on land market and land values. The theories of land prices previously were taken from Ricardo and Von Thunen in 19th century. These theories become a foundation of urban land use and land values until now. Koomen and Buurman (2002) claim Ricardian land models explain the existence of land rents from differences in fertility or land quality. Land of a higher quality generates surpluses over land with a lower quality. These surpluses are paid as rent to the landlord due to competition in the land market and the market for agricultural products. In addition, Von Thünen's model is concerned with location and transportation costs, which as well as fertility, are characteristics of a particular land parcel. Though von Thünen merely analysed land use patterns, an important result of his model was the explanation of land prices.

In addition, Ricardian and Von Thunen's analysis according to Evans (1983) were only based on the demand for land and the fixed supply is

assumed. That argument supports the static theory of land price. Moreover, ibid (1983) suggest an alternative theory that incorporates supply side in the analysis of land value. Thus, it will enrich the land value study.

Moving to the importance of land prices information, a tabulation of urban land prices information is essential information for public or private sector. For government, the latest and accurate land price information is necessary to determine the expansion of infrastructure including the affordable housing or transportation infrastructure. It is also important for taxation system. In addition, private sector also uses the information for bank or financial institution to assess the property values.

Some studies tried to collect information of land prices using different approach such as market price or appraised price. However, Dowall and Leaf (1991:707) indicated that the detailed information on how land prices vary spatially within Third World cities was usually lacking. They added that no one knows the spatial shape of land prices from the city centre to the suburb. Furthermore, ibid (1991) argued there is still no adequate information how is infrastructure provision and land title interact and influence land prices pattern in growing Third World cities.

Noticing that, this study aims to examine the determinants and the spatial pattern of urban land prices in one of the biggest cities in Indonesia that is Surabaya. It is the second largest city in Indonesia after Jakarta, Surabaya inhabits more than 3 million people. This city is located in northern shore of eastern Java and accommodates the capital city of East Java. Regarding that, it is worthy to study about land prices pattern and determinant variables of land values in Surabaya. By knowing those, it will give more understanding about the characteristics of urban structure in Surabaya. Spatial pattern of land prices also can be used as an input for local government to impose zoning and land market regulation.

1.2 Problem Statement

For more than a decade, Indonesia has succeeded improving its economic growth and become one of the promising emerging countries. The vast area of land which is approximately 1.9 million km^2 and has a population of more than 240 million people are one of the driving factors the economic from supply and demand side. This leads to many investment opportunities in industrial or service sector. Undoubtedly, this factor brings an expansion of business district in large cities such as Jakarta and Surabaya, which are well known as trading/service or business cities. As a result, rapid land use changes occur and land prices are getting higher over time in Surabaya. However, transactions of land are market based and not officially determined since there is still no detail regulation related to land pricing in Indonesia, though there is zoning.

In addition, local newspaper *Kompas*, March 25 2011 reported that the land price in Jakarta increased about 30% and generally 10% for entire Indonesia. In Jakarta CBD that is *Sudirman-Thamrin*, the land prices constituted

almost 50 million per square meter. This phenomenon is not only in Jakarta but also in metropolitan city such as Surabaya.

Based on Navastara and Navitas (2012), housing in Surabaya is quite expensive because land availability is greatly decreasing. Consequently, higher land prices would be a burden for Surabaya's inhabitants to get affordable housing. Building infrastructure such as transportation, parks and road could be very expensive for the government as well. Moreover, increasing land prices would be an obstacle for the provision of public services.

1.3 Research Question

1.3.1 Main Question

It is interesting to examine which factors determine the land values in Surabaya. Some studies indicate that distances from CBD are still major factors affecting the land values in some metropolitan areas such as New York, Bangkok and Jakarta. By incorporating other factors, this research will trace 'What are the factors determining the land prices in Surabaya?'. This question will also help to answer type of urban structure of Surabaya whether it is concentric, polycentric or multinuclei city.

1.3.2 Sub-Question

The sub-question aims to seek the spatial pattern of land values in Surabaya which is 'do land parcels in Central Surabaya have the higher value than in suburban areas?'. By addressing this, it is expected that we can the characteristic of the spatial pattern of urban land prices in Surabaya.

1.4 Structure of the paper

The beginning of this paper consists of an introduction including background, problem statement and research questions. In chapter two, literature review will be presented containing basic theory of land price, factor determined land value from previous study and type of urban structure.

Chapter 3 shows the description of the study area in this paper which is Surabaya. Methodology and data description will be followed in the next chapter. It includes brief explanation of the data and the model. Then, results and analysis will be given in chapter five. Lastly the concluding remark will be drawn discussing whether Surabaya has different characteristics to other cities globally and its implication for local land policies

Chapter 2
Literature Review

2.1 Basic theory of land value

To begin with, we would like to introduce the connection between land value and rent. Theory of land price is closely related with rent particularly the rent of agricultural land. The theory of urban land value is developed from the theory of agricultural land pricing. Many scholars developed urban land price model from Ricardian and Von Thunen's work for agricultural land in 19th century. Based on Alonso (1974), the Ricardian theory of rent is based on the fertility and productivity of land. Even Ricardo presented theory about location, however, is focused on fertility of land. The theory of location then developed by Von Thunen which assessed the differential of location on land values. Over time, urban land price theory is largely developed from Von Thunen's study.

However, according to Evans (1983), as mentioned above the analysis of Ricardian economist emphasized only on the demand of land and the supply of land is ignored. Similarly, Von Thunen's theory also suggest of demand-driven land prices. That theory can be called *the static theory of the price of land*. Another theory is *the dynamic theory* that emphasizes differentiation between price of land and the rent of land. This theory suggests that the prices of the parcel of land depend upon the rents that may be obtained in the future years. Ibid (1983) also argued that those theories could not explain various features of land market because it is demand-oriented. He offered a new theory that is *the alternative theory* which include supply side into the determination of land price. By incorporating supply, the theory can explain that a tax on development will decrease the rate at which land is developed and lead to an increase in its price.

For Evans (1983), Von Thunen's theory focused on differentiation of the transportation cost to city centre for agricultural products. The rent that farmers are willing to pay will decline with the distance. In other words, any land very much further away from the city centre will not be cultivated and no rent will be paid. Taking to urban realities, according to ibid (1983), the Central Business District (CBD) is equivalent to the city centre in Von Thunen's model.

In addition, according to Koomen and Buurman (2002), the bid rent theory is based on microeconomic theory. It was mainly developed in the context of urban land uses and urban land values. Moreover, Fujita (1989) stated that the bid rent function approach that was introduced into an agricultural land use model by von Thunen (1826), and later extended to an urban context by Alonso (1964) is essentially the same as the indirect utility function approach, which was introduced into an urban land use model by Solow.

In addition, the bid rent function explains the relation between urban land uses and urban land values. In a very simplified view, households and companies make a trade off between the land price, transportation costs and the amount of land they use. Keeping in line with that, Cheshire and Sheppard (1993) stated that urban land theory suggests that land value result from a trade off between transport costs and accessibility. Similarly, Fujita (1989) also explained, any household moving to the city choosing the residential location will face a complex set of factors in making a decision. That is called trade-off problem between three factors : accessibility, space and environment amenities. Moreover, that household must also consider budget and time constraint.

2.2 Urban land price determinants and its analysis

Sufficient studies about urban land prices determination can be found taking case in developed and developing countries. The urban land studies in developed countries come from Brigham (1965), Peiser (1987) and Haughout, et.al (2008). Some researches in metropolitan cities in urban developing countries are conducted by, Dowall and Leaf (1991), Han and Basuki (2001) and Wisaweisuan (2001). According to Han and Basuki (2001:1843), the uneven distribution of land values has been attracted numerous studies in this area to examine the factors influencing land values. They use different approach and variables to examine factor influencing land prices. Below, we have presented some studies related to land valuation determination.

Author/title	City	Variables	Methodology
Developing countries			
Wisaweisuan (2001) / *Spatial characteristics of land prices in Bangkok*	Bangkok	Proximity from CBD, nearest sub centre and infrastructure condition	Non-linear regression
Dowall and Leaf (1991) / *The price of land for housing in Jakarta*	Jakarta	Distance to CBD, infrastructure provision and land tenure	Multiple regression analysis
Han and Basuki (2001) / *The spatial pattern of land values in Jakarta*	Jakarta	Distance to CBD, nearest highway, commercial establishment, zoning and flood risk	Stepwise multivariate regression model
Lewis (2007) / *Revisiting the price of residential land in Jakarta*	Jakarta	Proximity from city centre, road class, environment condition and land title	Linear regression, non-linear regression and incidental truncation model
Dowall (1992) / *A second look at the Bangkok land and housing market*	Bangkok	Distance to city centre	Non-linear regression analysis
Developed countries			
Haughout et.al (2008) / *The price of land in the New York Metropolitan Area*	New York	Type of property, condition of property, characteristics of transaction, intended use and transaction	Linear regression model
Ahlfeldt and Wendland (2008) / *Fifty years of*	Berlin	Proximity from CBD and travel time to CBD	Non-linear regression model and spatial

urban accessibility : the impact of urban railway network on the land gradient in industrializing Berlin			autoregresive model
Peiser (1987)	Dallas metropolitan area (non-residential)	Neighbourhood factors, microlocation attributes, development expectations, macrolocation, macroeconomics variables and physical site characteristics	Linear regression analysis
Brigham (1965) / *The determinants of residential land values*	Los Angeles county	Accessibility, amenities and topography	Linear regression model

From all the studies presented above, the distance to city centre or CBD is obviously the most popular variables in land valuation model. According to Harvey (1992:223), "the CBD is the optimum location for shops, commerce and services for, as the focus of inter-city transport, it has the greatest accessibility. Competition for the limited space produces peak land values and intensity of development in the form of skyscrapers or multi-storey buildings".

Distance to city center has become a dominant factor influencing land prices in one city. There are some examples from developed countries related to that. Brigham (1965) found that the price falls about four or five cents per square foot per every one mile increase in distance from the CBD. In line with that, Case and Mayer (1996) studied housing prices dynamic within metropolitan area found that the distance to Boston which is the city centre was also associated with the pattern of price changes. The results indicate that house prices increased at a greater rate, the closer a town was to Boston. Recent study from Houghwout, et.al in 2008 found that vacant land prices in the New York Metropolitan Area were seen to decline with the distance from the CBD. Nonetheless, the findings can be different for non-residential area. Peiser (1987) which conducted a studies of non-residential land values in Dallas found that distance to the CBD was only significant determinant for office land but not for industrial land.

Similar findings related to the importance of city centre are also found in developing countries such as the studies from Dowall and Leaf (1991), Han and Basuki (2001), Lewis (2007) in Jakarta and Wisaweisuan (2001) in Bangkok. They found that the distance from Central Business District (CBD) is a dominant factor to explain land value variation. Along with these findings from Jakarta, the satellite city of Jakarta that is Bekasi also experience the similar relationship. Yowaldi (2012) found that the prices have negative relationship with land price, when the distance to CBD increase the land value declines.

In addition, Wisaweisuan (2001) explain that the importance of city centre in land price variation indicate that a city supports the model of monocentric assumption or core-dominated city. Mostly the results of these

papers reflect the neoclassic assumption of land price that indicate the positive association between land price and the distance from city centre. Furthermore, Ibid (2001) wrote that in neoclassical economics, market mechanism allocates pieces of land to users on the basis of the bidding process. In other words, the person who gives maximum bidding will always win the competition and be able to get the piece of land for his or her intended use.

Another interesting feature from some studies is related to the change of land price gradient in urban area. Land price gradient indicate the importance of CBD to land prices. In the early of 20th-century in Chicago, based on Yeates and Garner (1971) quoted from Han and Basuki (2001:1843), distance variable (CBD) alone explain 75% of land values variation. Then in 1960, the distance could only expain 10% of the land price. Similar result can be seen from Berlin, Ahlfeldt and Wendland (2008) using dataset from 1890 to 1936 found that a declining of land price gradient from a 77.5% in 1890 to 39.7% in 1936. These findings indicate the land gradient became flatter and there is an increase in land values variation. Declining of the land gradient from city centre is most likely due to the improvement of transportation modes and agglomeration economy.

Declining importance of CBD over time can also be found in cities in developing countries. For instance, in Jakarta, Lewis (2007:2191) reported that the influence of the proximity to city centre has apparently become less important overtime. Previous study from Dowall and Leaf (1991) showed that 62% of land price variation can be solely determined by the distance from city centre. Ten years later, Han and Basuki found that the effect of CBD decline. Ibid (2001) found only 30-45% of land price variation can be explained by distance from CBD. The development of Jakarta has been reduced the spatial linked between land price and city centre. It implies that there could be an expansion of business districts in the periphery area of Jakarta.

The reduction of land prices gradient in some cities above indicates the change of urban land structure from monocentric to polycentric city. This transformation is most likely influenced by the improvement of transportation network. Berlin and Istanbul experienced the transformation into polycentric city. Based on Ahlfeldt and Wendland (2010), Berlin followed monocentric pattern in 1890 and by 1936 the city structure became more complex and resembling present-day polycentric cities. Istanbul also follow the similar pattern with Berlin. According to Ciraci and Kundak (2000), "Istanbul has been changing its monocentric structure to the polycentric structure". Ibid (2000) also explained the advantages of turning into polycentric in Istanbul which are there is a deduction of transportation charge between the residential areas and the CBD, reduce the consumption of fuel and the environmental pollution.

It could be said that the flatter of land price gradient moves in the same direction with the phenomenon of flattening out which reflects the impact of increasing mobility and the decentralisation of urban activities. According to Dowall (1992) comparing land prices gradient in Jakarta, Bangkok and Karachi found that those cities have experienced a pattern of flattening out. Bangkok's

land prices gradient is flattening out as suburban land prices increase faster than those in city centre. Based on Dowall and Leaf (1991), Jakarta's gradient is far steeper than those recently estimated for Bangkok and Karachi are. These differences are because of transportation accessibility and the patterns of the density found in the cities. The analysis about the declining importance of CBD and flattening out are very interesting to incorporate in Surabaya's land price analysis. However, due to the dataset in this research only one period, we cannot include that kind of analysis.

Even the data does not allow us to analyze the effect of flattening out or the declining of CBD effect on land prices variation to suburb area, our sub research question tries to examine the differentiation of land value variation between central and non-central part of Surabaya. We adopt this question from Han and Basuki's paper in 2001, where one of the purposes is to examine the spatial pattern of land prices in central and non-central of Jakarta. By using non-parametric tools that are Kruskal-Wallis and Mann-Whitney test, they found that that land prices were not uniformly distributed among central and non-central districts in Jakarta. In line with that finding, Navastara and Navitas (2012:1) which examine the impact of residential land development in Surabaya found that "the dynamics of land prices in Surabaya is quite disproportionate". By using dataset from May 2010 and September 2011, ibid (2012) found that land values are only concentrated in three major assistant areas which are East Surabaya, South Surabaya and West Surabaya.

Besides the distance from city centre or CBD, some studies try to incorporate other distance and non-distance variables that might affect land prices variation in their analysis. Distance or spatial variables consist of the distance from nearest commercial buildings, openness area and nearest highway. Non-distance variable including microlocation, macrolocation, travel time to city centre, development expectation and macroeconomic variables.

Public transportation is closely linked with accessibility for resident travelling to the city centre and other places. Ahlfeldt and Wendland (2008) examine the travel time gradient found that there was a slight changes of travel time gradient over time in Berlin. There is a connection between this result to the flattening of land gradient. It indicates that transportation innovation promote the the attractiveness of outlying area. There is an establishment of business district in the peripheral area and hence the flattenning out of land gradient instead of travel time gradient.

Other variable related to accessibility is the proximity to the nearest highway. Han and Basuki (2001) found the negative sign of the nearest highway to land values in Jakarta. It implies the greater the distance from the nearest highway, the lower the land prices are. It is related to the unreliable public transportation in Jakarta; hence, the residents choose a house that is close to a highway.

In term of zoning, the findings from Haughwaout, et.al. (2008) showed that residential property was found to sell for a slightly higher price than commercial property; industrial land commanded a significantly lower price than land designated commercial or residential. Keeping in line with that

result, Han and Basuki (2001) also found that a *kelurahan* (the lowest level governmental region) in Jakarta with over 50% of its land for commercial zoning had the higher level of land values than the one with other utilization.

In addition, street size does matter based on Peiser's study (1987) in Dallas Metropolitan Area. He found that street size was significant for both industrial land and office land. Industrial land with frontage on a major arterial is 43% higher, and that with expressway frontage is 68% higher, in value than industrial land on a minor street. The premium for office land on major arterials was about 38% higher than that on minor streets. Ibid (1987) also examined macroeconomic variables in his research. Using dataset of unemployment rate, change in unemployment, interest rate and change in interest rate from 1978-1982, he found that commercial land value is more likely to be influencing by macroeconomic condition compared to office and industrial land. It is more likely that commercial land tend to influencing quickly by worsening macroeconomic condition. Examining the role of macroeconomic variable to land prices is worthy to study; however, it is likely need time series dataset. Thus, this research does not include this variable.

Other determinants of land values, which found in some journals are the infrastructure provision and land tenure. It can be found in journal from Dowall and Leaf (1991) while taking case of Jakarta. The effect of infrastructure was significant, which increases almost 50% to land prices. In addition, they found that parcels of land with registered title, which can be right-of-ownership or right-of-building, are 45% more valuable than those with weak claim are. Furthermore, land title has a role intervening how the infrastructure affect land values. It is because of clear title grants more secure tenure and can be used for collateral in order to get bank credit.

Related to pollution, based on Ridker and Henning (1967) quoted from Smith and Huang (1993) found that there is negative relationship between property values and air pollution. Another factor that linked with land price determination is openness area. Paper written by Shultz and King in 2001 has grouped the openness area into 5 categories. They found that the signs on the coefficients indicate that proximity to the large protected natural areas, golf courses, and Class II wildlife habitats, as well as the percentage of vacant and commercial land use, positively influences housing values. In contrast, proximity to undeveloped and neighbourhood parks, Class I wildlife habitats, as well as percentages of industrial land use and high levels of housing density, negatively influences housing values. Regarding to the environment neighbourhood, Mahan, et.al (2000) found that the size of the nearest wetland increases house values.

One thing that is interesting to note in land valuation discussed above is related to the methodology. Based on the list of literatures mentioned earlier, there are two models commonly used in land values study. One of them is non-linear regression that can be found in Dowall (1992). Other assumes that land prices have linear relationship with distance, and then use the straightforward linear regression model such as Houghwaut et.al (2008). In addition, Lewis (2007) taking Jakarta as a case use both linear and non-linear

regression in his model and found that land price gradient in both model is not remarkably different.

Another model that recently examined the relationship between land prices and other variables particularly distance variables is spatial autoregressive model. Ahlfeldt and Wendland (2008) traced out the land and travel time gradient by comparing two models which are non-linear regression and spatial auto regressive (SAR) model. SAR is used to reduce spatial dependency among distance variable.

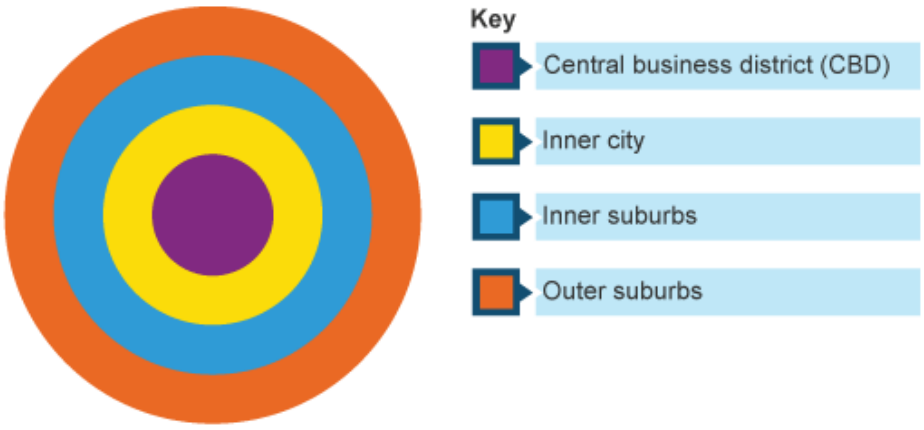
2.3 Type of urban structure

Type of urban land use pattern is closely related to land prices. Stated in Harvey (1992) that 'land uses determine land values and not vice versa'. Therefore, knowing the pattern of land use is essential to understand land value in this research. The general pattern of land use according to ibid (1992:222) is the reflection of the demand and supply of the sites. Below, we explain briefly 6 urban structure models which are :

1. Concentric zone theory or monocentric

   According to Harvey (1992), this theory emerged from the examination of the historical development of Chicago in the 1890s by E.W. Burgess (1925). In essence, this model explains urban social within urban area. Figure 2.1 show the concentric zone.

   Figure 2.1 Concentric urban zone

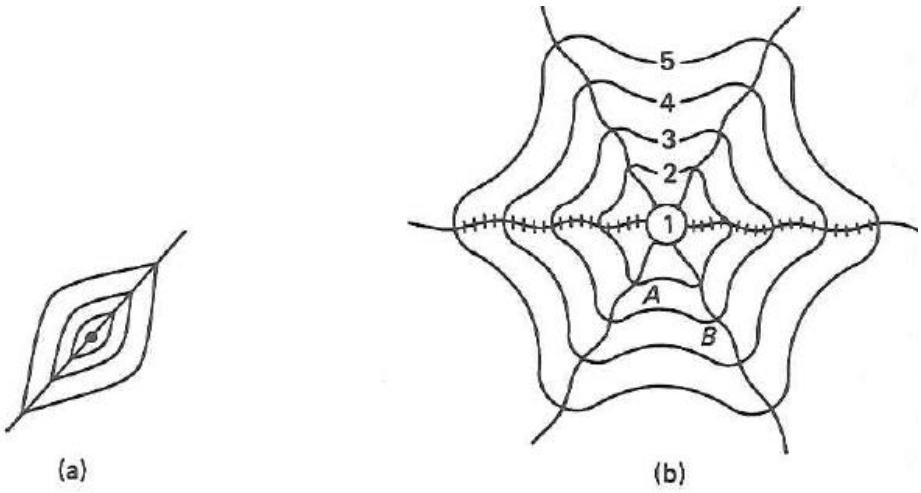


   Source **: Bitesite BBC**

   Four broad zones were postulated according to Bitesite BBC : (1) The CBD; (2) The inner city, containing working-class population living in this area with few amenities such as park ; (3) the inner suburbs, as transportation modes improved and became cheaper the suburban areas emerged containing newer and more spacious house; (4) the outer suburbs, identified by good housing, amenities and environment. According to Harvey (1992), this theory is lack of detail and fails to include various aspect of special accessibility.

2. The radial or axial development theory

Figure 2.2 The radial urban zone



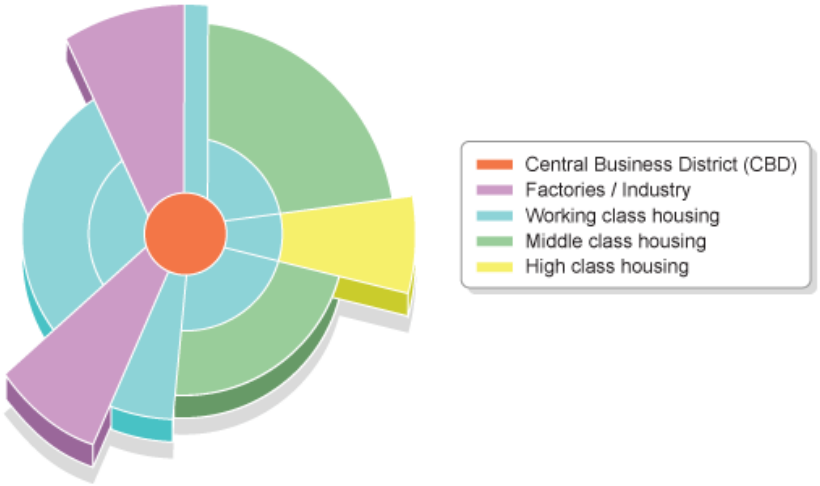
Source **: Harvey (1992)**

According to Harvey (1992), this theory generally modifies the concentric zone model by include topographical features. Figure 2.2 show the radial development that for example including the river which could distort concentric zone as showed in figure 2.2 (a). The existence of the river will cause the road and rail constructions to adjust it, and hence the zone to assume a starfish shape. In summary, whilst concentric zone based on the proximity in term of distance, axial theory is based upon accessibility in terms of time, etc. (Harvey, 1992)

3. Cost of friction hypothesis
   R.M. Haig (1926) developed this theory based on the Von Thunen model. Harvey (1992) explained that this theory examined land values related to transportation cost saved in different sites. The interesting thing from this theory is that in any urban area competition will tend to produce the land use pattern that minimises total sites rents and transport cost for that area as a whole. (Harvey, 1992)

4. The wedge or radial sector theory
   The radial sector model was the famous work of H.Hoyt (1939) and it is the extending model of concentric model by allowing the development model of a more irregular pattern.

Figure 2.3 Hoyt sector model

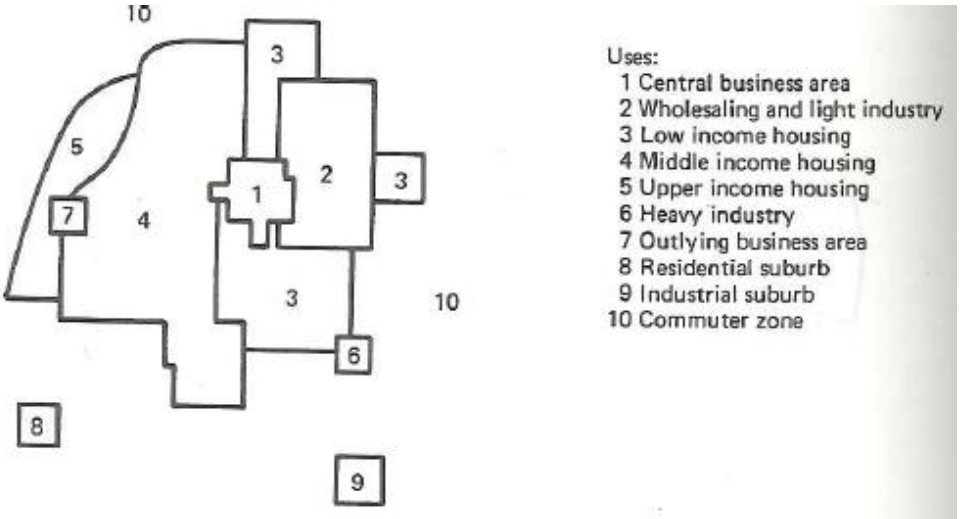


Source **: Bitesite BBC**

Figure 2.3 show the land use pattern is segregated by the social housing class. Based on Harvey (1992), residential sector radiate outwards the CBD constraining manufacturing or wholesaling into other sector. Therefore, residential areas are segregated by income.

5. Multiple-nuclei theory
C.D. Harris and E.L. Ullman in 1945 in the article "The nature of the cities" developed this ecological model. The theory still departed from concentric zone model but takes the view that large cities have a structure which is essentially nuclear.

Figure 2.4 Multi-nuclei urban model



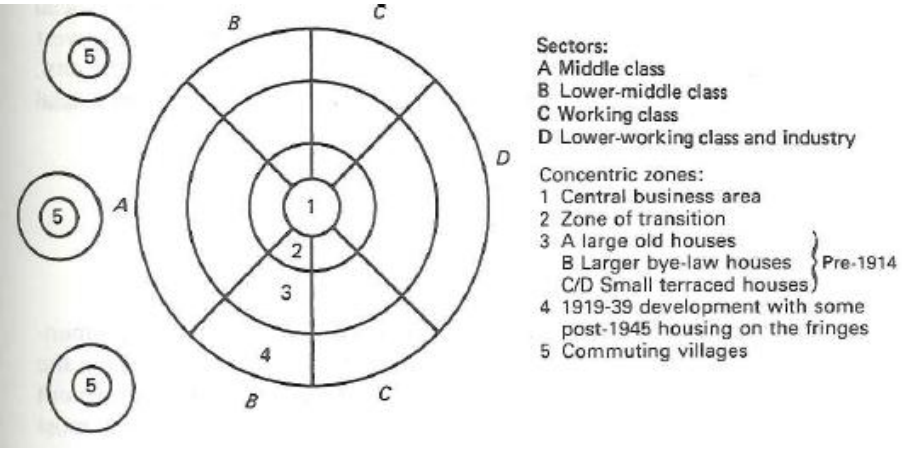
Source **: Harvey (1992)**

The figure 2.4 above shows the multi-nuclei model where there is a tendency of agglomeration. Some nuclei emerged as a minor settlement

before city growth or developing. The growth of population supports a suburban shopping, business centre and industrial area. In addition, high rents in the CBD force firms to move to the periphery area and the reliable accessibility also lead the households and firms to concentrate in a particular location. (Harvey, 1992)

6. Sector-zone theory
   P.H. Mann (1968) developed this model taking British city as a case but this theory considerably originated from a USA city. It is a combination of concentric and sector zone and emphasizing on the social structure of the area. Based on Harvey (1992), the locations of high-income residence is in the west of the city and while the low-income to the east and near the industrial sector. The figure 2.5 presents the sector-zone model.

Figure 2.5 Sector zone model



Source **: Harvey (1992)**

Chapter 3
Background of Study Area

Surabaya was officially established in 1293 and is the capital city of East Java province. Surabaya is a coastal city that is located on the northern shore of eastern Java along the edge of the Madura Strait. The regional border of this city can be seen below :

North: Madura Strait
East : Madura Strait
South : Sidoarjo Regency
West : Gresik Regency

This city forms parts of a greater metropolitan area which is called *Gerbangkertosusilo* including Lamongan to the northwest, Gresik to the west, Bangkalan to the northeast, Sidoarjo to the South and Mojokerto and Jombang to the southwest. In 2008, Greater Surabaya Metropolitan Area or Gerbangkertosusilo has an area of around 10.332 km^2 and the population is 11.625.512 people. It is counted 50% contribute to the regional income in East Java Province. Map 3.1 below present the region of *Gerbangkertosusilo*.

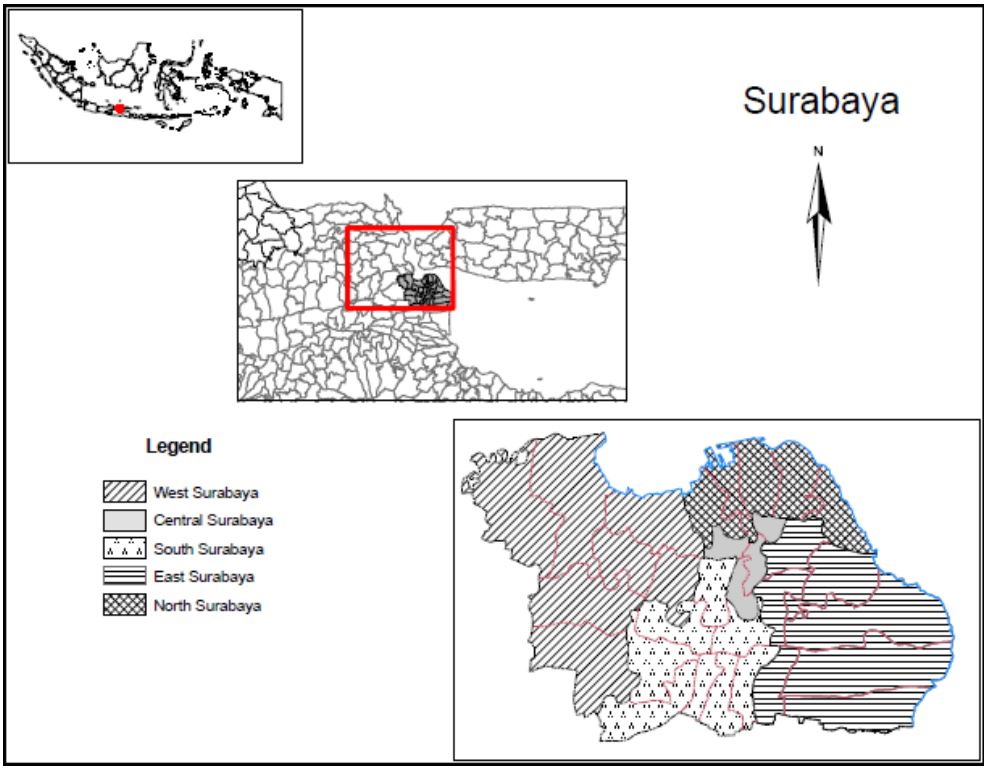
Map 3.1 Great Metropolitan Surabaya Area

Source **: National Land Agency**

From all of the *Gerbangkertosusilo* regions, Surabaya has a relatively high economic growth compared to the others. Moreover, it contributed to more than 26% to regional income of East Java in 2008. Surabaya obviously has an importance role in East Java's economic as a whole. It has been a connector between west and east region of Indonesia through *Tanjung Perak Port* since a long time ago. In addition, economic condition in this region is slightly better compared to others. Based on Statistics Indonesia, the economic growth in Surabaya in 2011 was 7.52% and that number was higher compared to East Java and national growth. In addition, the economic condition mostly depends on trading and service. The structure of its economy was driven by tertiary sector that accounts to 60.61% of Gross Domestic Regional Product (GDRP) in 2011.

Geographically, this city has 5 major assistant areas which are North, South, West, East and Central Surabaya, 31 districts and 163 Sub-districts. The administrative map of Surabaya is presented below.

Map 3.2 Administrative Map of Surabaya



Source **: Author's illustration based on land values and land use maps**

Based on municipality's data, the number of Surabaya inhabitants in June 2013 is 3.163.645 person. It keeps increasing overtime as the population growth between 2000 and 2010 is 0.63% per annum. Population Density in this region 7.966 people per km2, 8,642 people per km2 in 2000 and 2010 respectively, and the most dense area in Surabaya is in South Surabaya.

The characteristic of physical land in Surabaya is mostly flat land with the inclination less than 3% and 20% of the Surabaya's area have low wave with inclination about 5-15%. In addition, land use can be grouped into two

major factors that are agriculture and non-agriculture. The latter utilization accounts 30.076,30 ha from the total area that is 36.508,39 ha. Further, according to Sari (2011) the land cover for residential area has increased over time which 4.907 ha in 2002 to 5.595 ha in 2009.

Chapter 4
Data and Methodology

4.1 Data

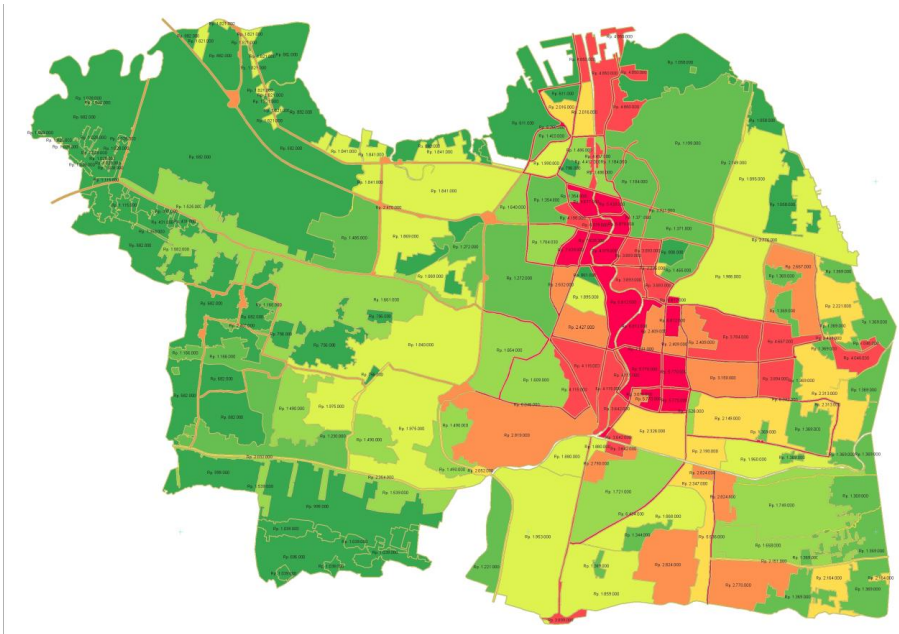
In this research, we use secondary spatial and textual data. Constructing spatial data is quite challenging. Firstable, employing Google Earth and other sources of information in order to determine the exact location of independent variables are. Then, Arc GIS (mapping software) is applied to process land value map, zoning map, land use map and spatial images. It is also used to measure the distance between all samples to predictor points and layout all of the maps. Lastly, converting the spatial data into textual data by using textual software.

Below, detail information is given related to the data :

1. Land value map
   This map is obtained from National Land Agency's land valuation survey in 2011. Land values in this survey are based on market price. The procedure of land valuation survey can be seen as follow :
   - Delineating the land price zone based on the utilization of land using aerial photo mapping or satellite image, land use map, zoning map, registration land map and administration map. In every zone, the land price are expected relatively the same or not diverse.
   - To collect the market land price in every zone then samples are determined. Samples are the parcel of land that give the information of transaction and bidding price in the last 24 months for non-agriculture land and 48 months for agriculture land. The transaction and bidding price can be obtained from the local government officer.
   - Samples are chosen by stratified random sampling technique. For every zone, at least 3 samples are taken. The vacant land is preferable to choose as a sample. The samples should be fairly distribute in every zone and should be fit with the utilization/zoning of land.

   In Surabaya's survey, they took 392 observations. All of the observations we take as our samples; hence, the unit of observation in this research is parcels of land. This dataset have a weakness of the accuracy of land use. As stated above that they are taken the samples based on the existing land use but there are some mistakes in plotting it. For example, it is clearly from satellite image that the existing land use is industrial area but they wrote as residential zone. Map 4.1 below show the output of Surabaya's land valuation survey in 2011.

Map 4.1 The land valuation map



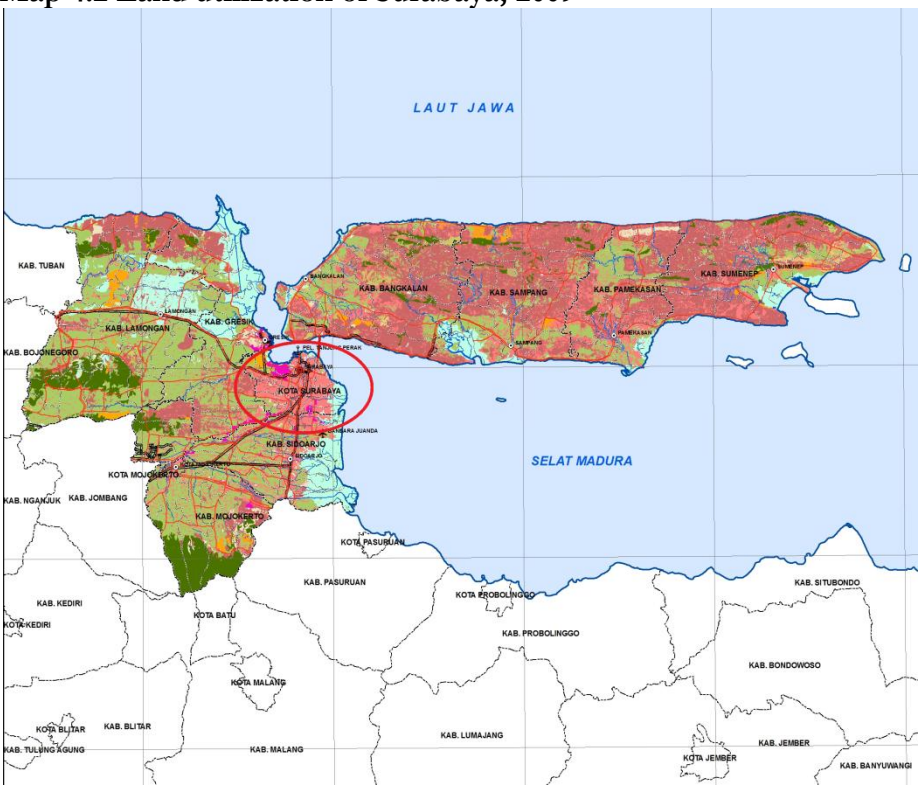
Source **: National Land Agency's land valuation survey**

The red area indicates the highest price and the dark green is the lowest. The other colours indicate the middle range of prices. In addition, the west shape (mangrove forest) is omitted in this map because this survey differ an ordinary region and a particular region such as forest. They have not surveyed and counted for mangrove forest value yet.

2. Satellite images
   This data is necessary to plot the independent variables such as public facilities, openness area, port, and other images. It is also used to examine the accuracy of other maps such as land value or land use map. Satellite images are taken from Google Earth 2013.

3. Land use map.
   Based on regulation, land use is the land cover of the earth. This map is surveyed in 2009 and divided the area into 7 existing utilizations of land in Surabaya that are industry, residential, agriculture (rice field) and agriculture (annual crop), farm, inland water and open area. However, only four categories of land use are recorded the samples in this study which are industry, residential and agriculture for rice field and annual crop.

Map 4.2 Land utilization of Surabaya, 2009

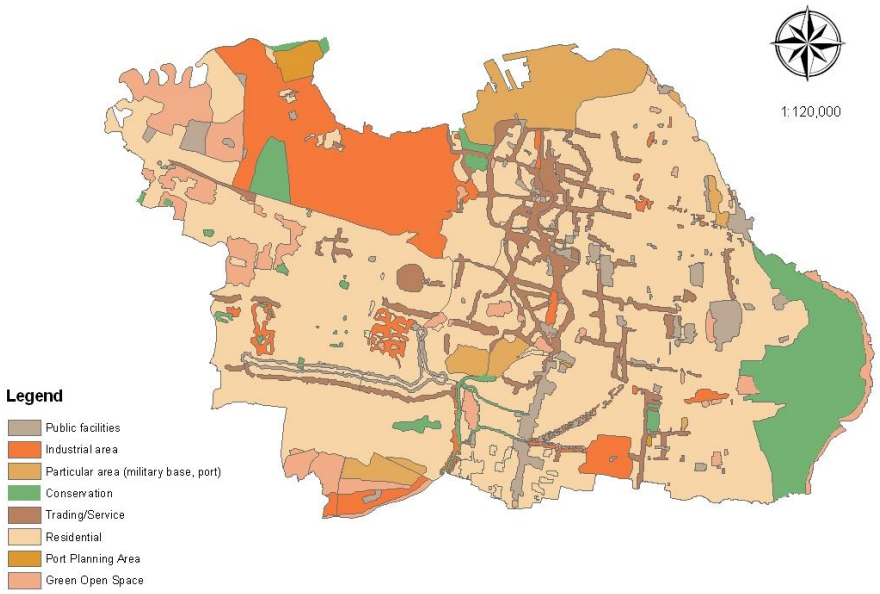


Source **: National Land Agency (BPN)**

Map 4.2 indicate that more than two third of the existing land use is for residential area which is shown by dark pink. The other utilizations is shown by bright pink (industrial area), bright blue (inland water) and green (agricultural). Some utilization cannot be seen clearly since the scale of the map and the area of those utilizations is small.

4. Zoning map indicates the expected zoning/spatial planning for this city for 5 years. This map is supposed to revise in 2012 but until now the arrangement have not imposed yet in local parliament. It is created in 2007 consisting eight zones, which are industrial area, green open area, residential area, trading/services area, public utilities, port-planning area, particular area (military zone, port) and conservation area (lake). The samples are located in seven of eight zoning designation except for extended port-planning zone.

Map 4.3 Zoning Map of Surabaya



Source **: National Land Agency (BPN)**

As stated in Lewis (2007) that local authorities plan urban land uses poorly in Jakarta. That situation is not different with Surabaya's condition. Zoning regulation is often ignored and violated both by the residents and by the government. For instance, green open space based on regulation is supposed about 30% from total area in a region. However, according to municipality data, the green area in 2011 is approximately 20.25%. Even though the data indicate there is still lack of green area, there is a significant progress on it. In 1995, total green area was accounted only 3.172 Ha or 9.6% of Surabaya's area.

5. Land title or land tenure

Quoted from Dowall and Leaf (1991), property rights are weakly defined in Indonesia. There are three types of land title for resident in Indonesia which are right of ownership (*hak milik*/*HM*), right to build (*hak guna* bangunan/*HGB*) and right to use (*hak pakai*). Those titles are registered by BPN (Badan Pertanahan Nasional) or National Land Agency. However, some parcels are still not registered. Therefore, we designated land tenure into two categories which are registered and not registered. In this dataset, there are two registered titles recorded that are right-of-ownership and right-to-build types of land tenure.

We would explain briefly about HGB and HM. Right of ownership is hereditary right, the strongest and the most complete right over land that can be posed only by Indonesian citizen. Right of ownership can be removed if the land falls to the government due to revocation for public purposes, voluntary acquisition, abandoned land, and foreigner ownership.

HGB means that the holder can establish buildings on land, which is not his/her, own within period of 30 years. By considering the concerned parties' request and the condition of buildings, the right of building can be extended for another 20 years. This right can be removed due to expiration period, inappropriate conditions with the terms, released by the holder, revocation for public purposes, abandoned land, and foreigner ownership.

6. Road Class

Road variables are closely linked with the accessibility of residence to travel. In this study, road class consist of 4 classes depends on which part of parcel located in the type of road. The classes of road are more specifically explained below :

1 = footpath (2-3m)
2 = local road (2-6m)
3 = collector road (4-12m)
4 = artery road (8-12m)

Footpath is the road that only can be used by pedestrian; Local Street is the street that is primary served vehicle with speed low and short route; collector road is the public street that serves traffic from local road to arterial road; artery road is the high capacity urban road.

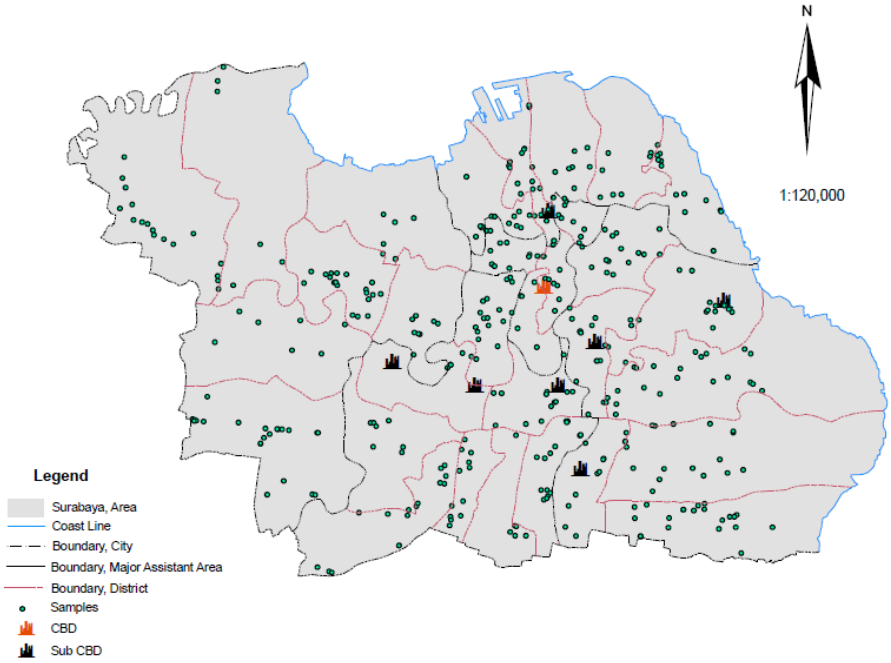
7. CBD (Central Business District) and sub CBDs

Surabaya, as the second largest city in Indonesia, experienced fast development in trading sector. Therefore, the municipality of Surabaya identified seven Central Business Districts which are :

1. The Kembang Jepun CBD, was the eldest trade region in the Surabaya city
2. Tunjungan – Embong Malang - Basuki Rahmad CBD
3. Ngagel CBD, was the relocation from the industry region
4. Kertajaya CBD
5. Jemursari CBD
6. Mulyosari CBD
7. Mayjen Soengkono – HR Mohammad CBD

Of seven CBDs, we appointed Tunjungan as the centre of Surabaya's CBD. The reason lies of the choice because there are shopping centres and hotels in that area. Furthermore, there is Tunjungan Plaza which is the new icon and the biggest shopping centre in Surabaya. The others we chose as sub-CBDs. For Mayjen Soengkono and HR Mohammad, we divided into 2 sub-CBDs. Therefore, there are seven sub CBDs in the map. A property's distance from the central business district is measured from the property in question to a point in the middle of the central business district.

Map 4.4 Location of CBD and sub-CBDs

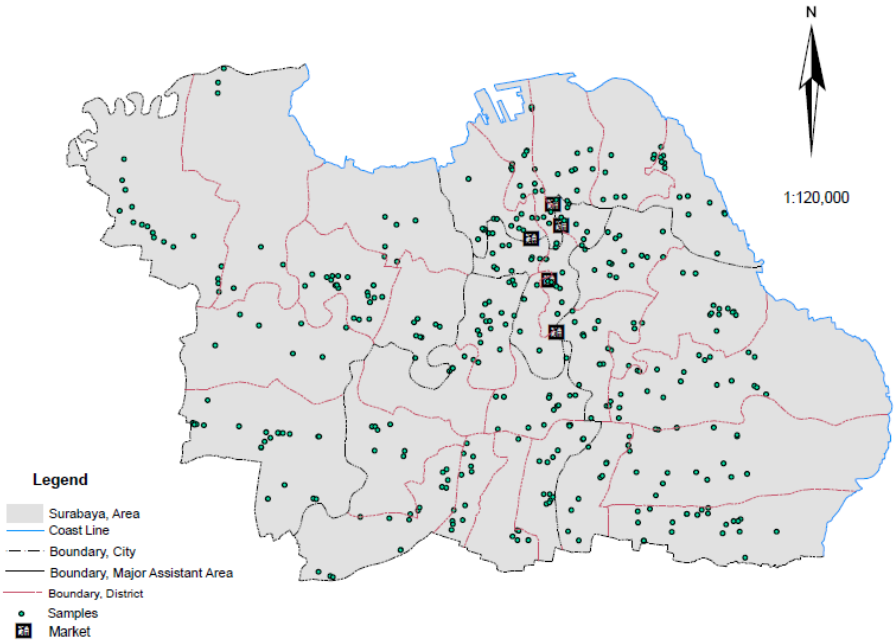


Source **: Author's illustration based on land values and land use maps**

8. Distance from traditional market

   As stated above that economic of Surabaya is driven by trading and service sector. Hence, we include trading places or market as one of our variables. Recently, many malls and plazas established in Surabaya but traditional market still exist and contribute to the economic. Traditional markets that we chose are the markets with the highest transaction. They are *pasar atum, pasar turi, pasar keputran, pasar pabean and pasar genteng*. The location of those markets is quite near to city centre as we can see in map 4.5 below.

Map 4.5 Location of traditional market



Source **: Author's illustration based on land values and land use maps**

9. Distance from public transportation infrastructure
The near distance from public transportation indicates the accessibility of people to travel to other places. Surabaya also has complete public land, sea and air transportations that could serve the local, regional and international trip. One thing that is worthy to note that structure economic of Surabaya is depended upon industry and trade sector. Then, transportation infrastructure that carrying the products outside Surabaya is imperative. Thus, I chose four modes transportation that serve people and products to other regions of Surabaya which are port, bus and train station and one essential bridge which is Suramadu bridge or *Jembatan Suramadu*.

There is one port in Surabaya which is *Pelabuhan Tanjung Per*ak built in 19th century. It is one of gateways of Indonesia, which becomes collector and distribution of goods from and to eastern Indonesia. International Juanda Airport is located in Sidoarjo that is the satellite city of Surabaya and part of Surabaya Greater Metropolitan Area. Even located in Sidoarjo, this airport mainly served people who are going to Surabaya.

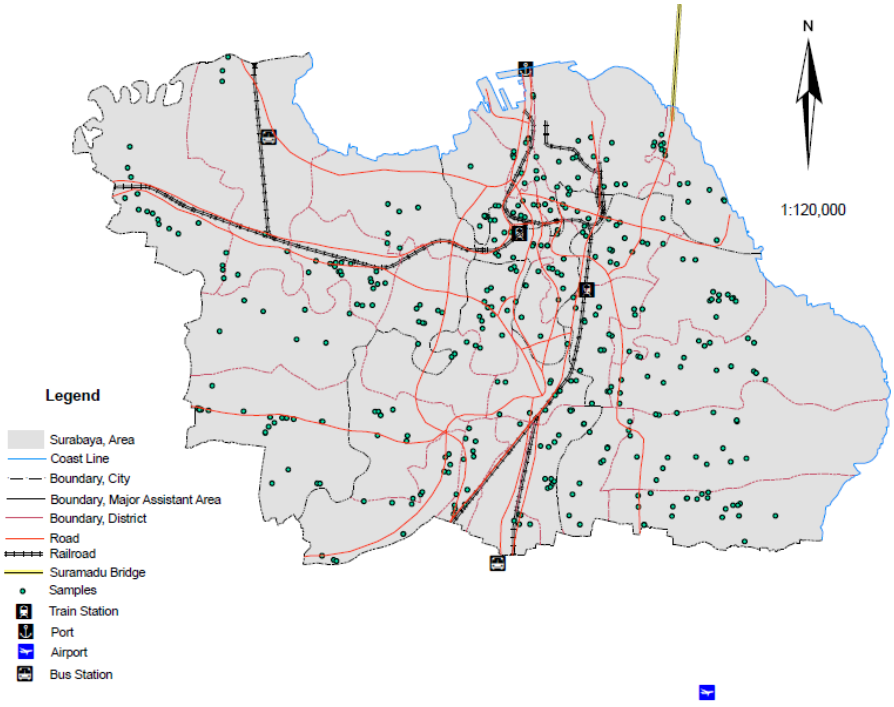
Only two bus stations that we include in this research considering those are the major bus station type A. They are *Terminal Purabaya* and *Terminal Tambak Oso Winangun*, which serve local and regional routes. However, Purabaya, the biggest bus station in Surabaya, is not located in Surabaya. It is located in Sidoarjo, precisely near the south border between those cities.

Similar with bus station, we only counts two train stations that are *Stasiun Gubeng* and *Stasiun Pasar Turi*. Gubeng serve the routes going to

south parts of Java whereas Pasar Turi serves the trains that are going from Surabaya to the north regions of Java.

Jembatan Suramadu is the first bridge that connecting two islands in Indonesia which are Java and Madura. Suramadu stands for Surabaya Madura Bridge linking Surabaya in the east of Java to Bangkalan, Madura. It is essential to stimulate the economic growth in Madura. Not only as connector, this bridge is also known as the new icon tourism of Surabaya.

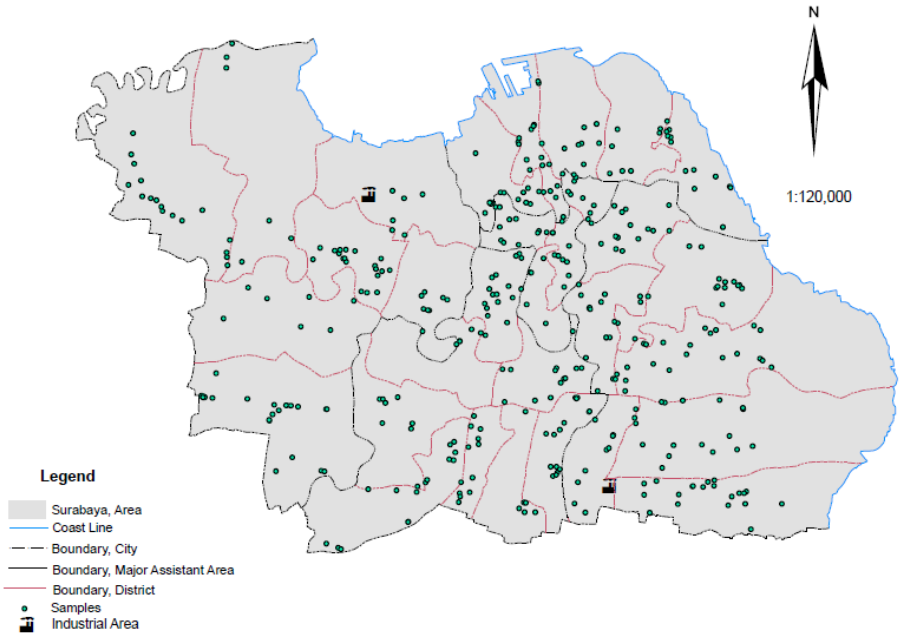
Map 4.6 Location of public transportation and infrastructure



***Source* : Author's illustration based on land values and land use maps**

10. Distance from industrial area (pollution indicator)
    Two industrial zones in Surabaya are *Rungkut* and *Tambak langon-Kalianak-Margamulya.*

Map 4.7 Location of industrial area

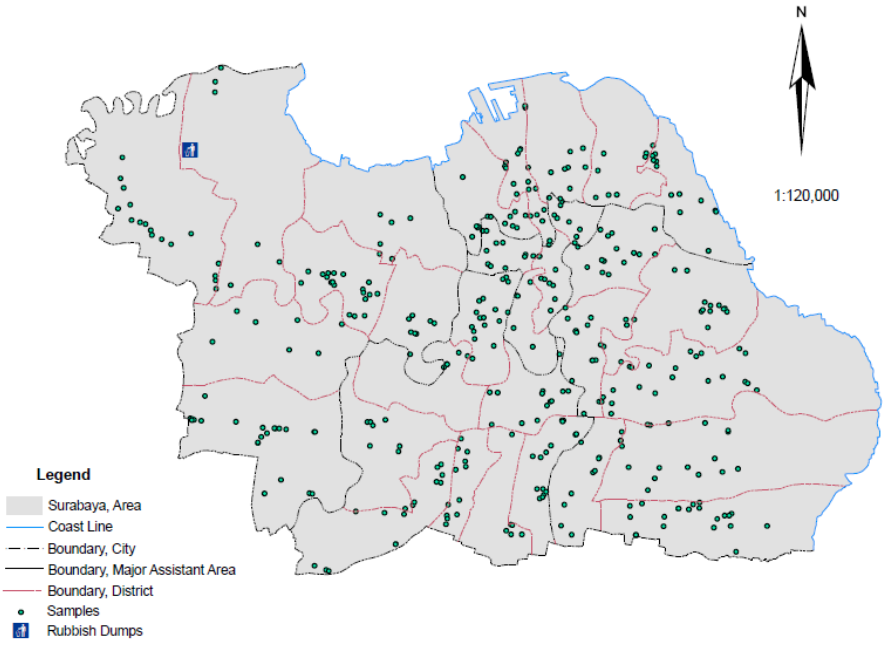


***Source* : Author's illustration based on land values and land use maps**

11. Distance from rubbish dump

    Along with the increase of population in Surabaya, the volume of bargage also increases over time. Furthermore, location of rubbish dump site become a problem. Until October 2011, open dumping land (TPA) was located in Sukolilo district but local people parry all of garbage. Nowadays, Surabaya has one active location of open dumping land, which is called *TPA Benowo*. It is located in the fringe of this city that is in Benowo district, West Surabaya. The large area is approximately 26 Ha and it can accommodate waste more less 2,390 tons per day.

Map 4.8 Location of final disposal site

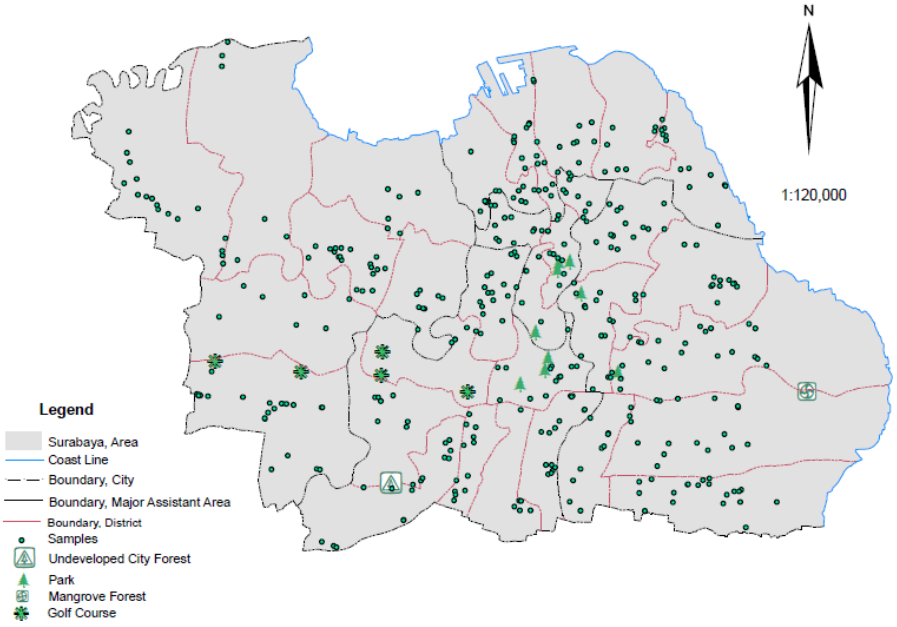


Source **: Author's illustration based on land values and land use maps**

12. Distance from openness area

Openness area is related with amenities. Openness area in this research consists of public parks, golf courses and undeveloped city forest, mangrove forest. There are 9 city parks including in this study and those are mainly located in city centre. In addition, 4 private golf arenas are existing in Surabaya. In fact, there are two undeveloped city forest, which are *Balas Klumprik* and *Pakal*. Due to the location of *Pakal* is not clear enough in municipality's website so that we only include *Balas Klumprik* in this study.

Map 4.9 Location of openness area



Source **: Author's illustration based on land values and land use maps**

4.2 Methodology

In analysing the spatial pattern of land value distribution and determinant in Surabaya, firstly, we will digitise the points (samples) in land value map and then divided into 5 sub-regions (districts). The attributes in every point then are analyzed by applying geographic information systems (GIS) software. GIS mapping functions, together with descriptive statistics, are used to plot and analyse the spatial patterns of the various variables such as distance from CBD and other variables.

Regarding model in land valuation studies, Ahfeldt and Wendland (2008) suggest that land value might be well described by an exponential function of the distance to CBD. The exponential functional relationship is usually estimated using the well-established log-linear specification :

$$\log(LV_{it}) = \alpha - \beta distCBD_{it} + \varepsilon_{it}$$

LV is land value; *a* corresponds to the log of land value in the city center; β is the percentage change in land value as one move 1 km away from the CBD and ε_{it} is an usual error term.

Lewis (2007) also use log-linear specification for basic land prices model that can be written as follow :

$$\ln\left(\frac{P_i}{A_i}\right) = ln\beta_0 + \gamma lnA_i + \beta_1 x_{1i} + \sum_{j=2}^{n} \beta_j x_{ji} + \varepsilon_i$$

where, Pi is the price of land i; Ai is parcel size; x_{1i} are the distance of land to the city centre; x_{ji} are additional determinants of the unit price of land; β_j are the associated coefficients to be estimated; and ε_i is the error term. This model has been used of many studies including for Jakarta, which is Dowall and Leaf in 1991.

Therefore, in this study we use natural logarithm transformations to address the main question. The multiple regression models is applied to evaluate the relationships between the land values with various independent variables. The model can be written as follow :

$$\begin{aligned}\ln V = {} & \beta_0 + \beta_1 C + \beta_2 M + \beta_3 SC + \beta_4 R_1 + \beta_5 R_2 + \beta_6 R_3 + \beta_7 LU_2 + \beta_8 LU_3 \\ & + \beta_9 LU_4 + \beta_{10} LU_4 + \beta_{11} Z_1 + \beta_{12} Z_2 + \beta_{13} Z_2 + \beta_{14} Z_3 \\ & + \beta_{15} Z_4 + \beta_{16} Z_5 + \beta_{17} Z_6 + \beta_{18} P + \beta_{19} L_1 + \beta_{20} PO \\ & + \beta_{21} BS + \beta_{22} TS + \beta_{23} AP + \beta_{24} SB + \beta_{25} PK + \beta_{26} UF \\ & + \beta_{27} GC + \beta_{28} MF + \beta_{28} R + \varepsilon\end{aligned}$$

In addition, natural logarithm transformations for land price and distance variables aiming for convenient means of transforming extreme value differentiation in land values and the distance.

Table 4.1 Dependent and independent variables

Variables	Detail
Dependent variable	
Price/square foot(V)	Price per square foot in Rupiah
Independent Variables	
• Distance from CBD (C)	Direct linear distance from CBD
• Distance from traditional market (M)	Direct linear distance from traditional market
• Distance from sub CBD (SC)	Direct linear distance from sub CBD
• Location of road (R)	Dummy (E_{r1})=1) for footpath Dummy (E_{r2})=1) for artery Dummy (E_{r3})=1) for collector road road
• Land Use (LU)	Dummy (E_{lu2}=1) for agriculture (field rice) Dummy (E_{lu3}=1) for industry Dummy (E_{lu4}=1) for residential
• Zoning (Z)	Dummy (E_{z1}=1) for conservation area (lake) Dummy (E_{z2}=1) for green open area Dummy (E_{z3}=1) for industrial area

	Dummy (E_{z4}=1) for particular area (military zone, port) Dummy (E_{z5}=1) for public utilities, Dummy (E_{z6}=1) for residential area
• Pollution (P)	Direct linear distance from industry area
• Land title (L)	Dummy variable denoting for non-registered (0) and registered (1)
• Distance from public transportation	Direct linear distance from port (PO) Direct linear distance from bus station (BS) Direct linear distance from train station (TS) Direct linear distance from airport (AP) Direct linear distance from Suramadu Bridge (SB)
• Distance from rubbish dump	Direct linear distance from rubbish dump/final disposal site (R)
• Distance from openness area	Direct linear distance from parks(PK) Direct linear distance from undeveloped city forest (UF) Direct linear distance from golf courses (GC) Direct linear distance from mangrove forest (MF)

For sub-question, we will examine the question using the Mann-Whitney and Kruskal-Wallis test to confirm whether land value in central district differ from suburban area.

4.3 Data description

As stated above that the number of samples is 392 observations spreading in 5 major assistant area and 31 districts. Table 4.2 show the summary statistics of the data. It is clearly seen that the land prices are highly distant between the minimum and maximum. Mean value of land price in this research is Rp 2,334,994. It is similar with the finding from Navastara and Navitas (2012) which evaluate land prices dynamic in Surabaya. Ibid (2012) found that overall land prices are dominated by 2 to 3 million rupiah per square meter.

Table 4.2 Summary statistics of land values in Surabaya

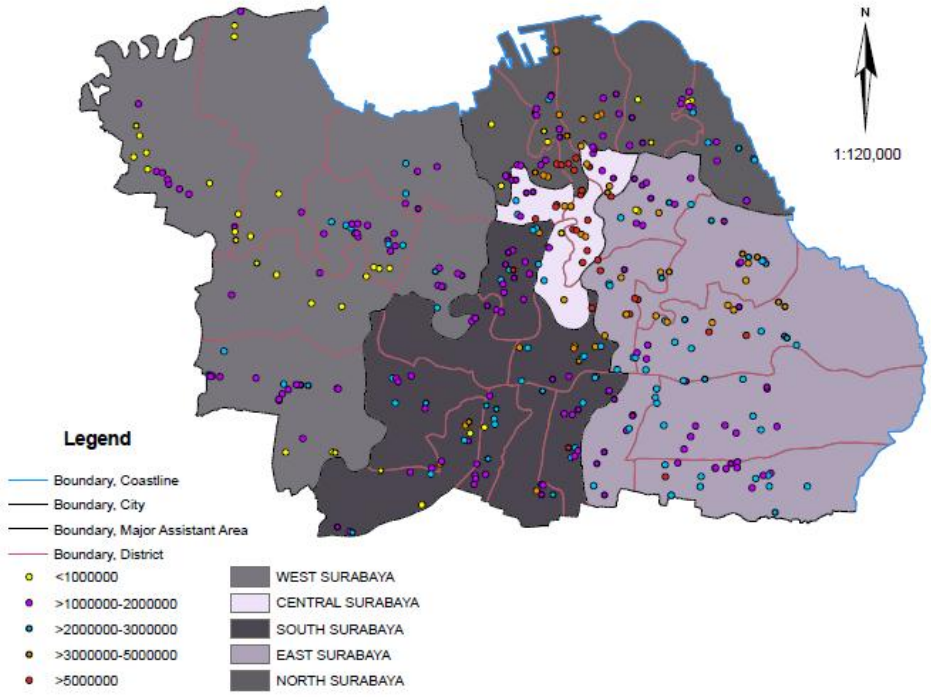
Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent					
Price/m2 (Rp)	392	2,334,994	1,585	431,288	8,721,607
Independent					
Distance from CBD (m)	392	6,051	3,355	266	15,072
Distance from sub CBD (m)	392	3,002	2,210	13	11,638
Distance from traditional market (m)	392	5,047	3,483	46	14,153
Pollution					
Distance from industrial area (m)	392	5,681	2,328	831	11,230
Public Infrastructure and Transportation					
Distance from train station (m)	392	5,430	3,370	298	13,761
Distance from bus station (m)	392	7,929	2,851	1,546	14,816
Distance from port (m)	392	10,371	3,991	918	18,172
Distance from airport (m)	392	14,969	4,536	5,377	27,438
Distance from Suramadu Bridge (m)	392	10,182	4,546	599	19,240
Distance from rubbish dump	392	13,598	4,571	2,163	23,821
Openness Area					
Distance from park (m)	392	4,340	3,205	152	15,446
Distance from golf course (m)	392	5,702	2,842	353	11,499
Distance from mangrove forest (m)	392	11,227	4,984	1,639	24,936
Distance from undeveloped city forest (m)	392	9,040	3,540	225	16,147

Source **: Author's elaboration based on land values data**

Moreover, the near distance for some independent variables are quite diversed. It can be noticed in proximity to Juanda Airport, *Jembatan Suramadu*, *TPA Benowo* and mangrove forest. It is due to the location of those variables are in the fringe of Surabaya Greater Metropolitan Area, hence the near distance from samples are quite diverse.

To get better understanding about the distribution of land prices, map below is presented to see the range of prices. We divided the samples into 5 group which the highest number samples is in red (more than Rp 5 million) and the lowest is in the bright yellow (less than Rp 1 million). It also indicates that the higher land value concentrate in the central and the lower is in the outlying area of Surabaya. Moreover, the higher land prices in Surabaya move from central region to north, south and east part of this city.

Map 4.10 Distribution of land prices



Source **: Author's illustration based on land values and land use maps**

Table below presented detail information related the distribution of land prices among the samples.

Table 4.3 Distribution of land prices

Category	Obs	Percent	Average prices (Rp)
< Rp 1,000,000	41	10.46	758,587
Rp 1,000,000-2,000,000	171	43.62	1,484,821
>Rp 2,000,000-3,000,000	100	25.51	2,337,644
>Rp 3,000,000-5,000,000	46	11.73	3,842,016
>Rp 5,000,000	34	8.67	6,465,114

Source **: Author's elaboration based on land values data**

Of 5 categories, more than half or almost 70% of the samples are mostly distributed in the mid range group which are between Rp 1 million to Rp 3 million. Only less than 20% of the samples are accounted in the lowest and highest level of land prices.

To know the differences of land value in central and suburban area in Surabaya, the summary statistics is presented below.

Table 4.4 Summary statistic of land value in central and non central area

		Non-Central				
	Central	Overall	North	West	South	East
	(n = 35)	(n = 357)	(n=64)	(n = 87)	(n = 89)	(n = 117)
Minimum	961,527	574,256	611,317	431,288	583,779	670,638
Maximum	8,674,385	6,166,464	8,378,282	2,876,298	8,721,607	7,364,722
Range	7,712,858	5,592,209	7,766,965	2,445,010	8,137,828	6,694,084
Mean	3,709,336	2,148,794	2,665,849	1,408,694	2,165,936	2,560,272
Standard Deviation	2,532,620	1,169,213	1,887,377	592,559	1,212,153	1,390,254

***Source* : Author's elaboration based on land values data**

Table 4.4 shows that land values in the central area constitute the highest mean value that is around Rp 3.7 million per square meter. The overall land prices of non central is approximately 2,1 million rupiah per square meter. Furthermore, the non-central region that is West Surabaya reports the lowest prices. In essence, there are a substantial different between central and non-central land prices.

Another interesting thing from table 4.4 is that one of the land parcels in South Surabaya recorded the highest prices. In line with that, Navastara and Navitas (2012) found that South Surabaya accounted highest level of land prices growth compared to other regions. It indicates that there are growing middle class residential in South Surabaya.

Chapter 5
Result and Analysis

5.1 Descriptive Analysis

Before examining the result by regression analysis, we will describe the data with Exploratory Data Analysis (EDA). This tool helps to analyze the main characteristics of the data with visual methods such as graphs and tables.

5.1.1 CBD and land price

City centre has become the major features in urban land prices studies. Based on some studies, the CBD usually has important role in determining land prices. Before using regression, we will examine the prices distribution to city centre based on the samples characteristic that can be seen in table 5.1. Then, to get further understanding, we use spatial figure by creating four rings of land prices surrounding the CBD.

Table 5.1 Average land prices based on the distance to the CBD

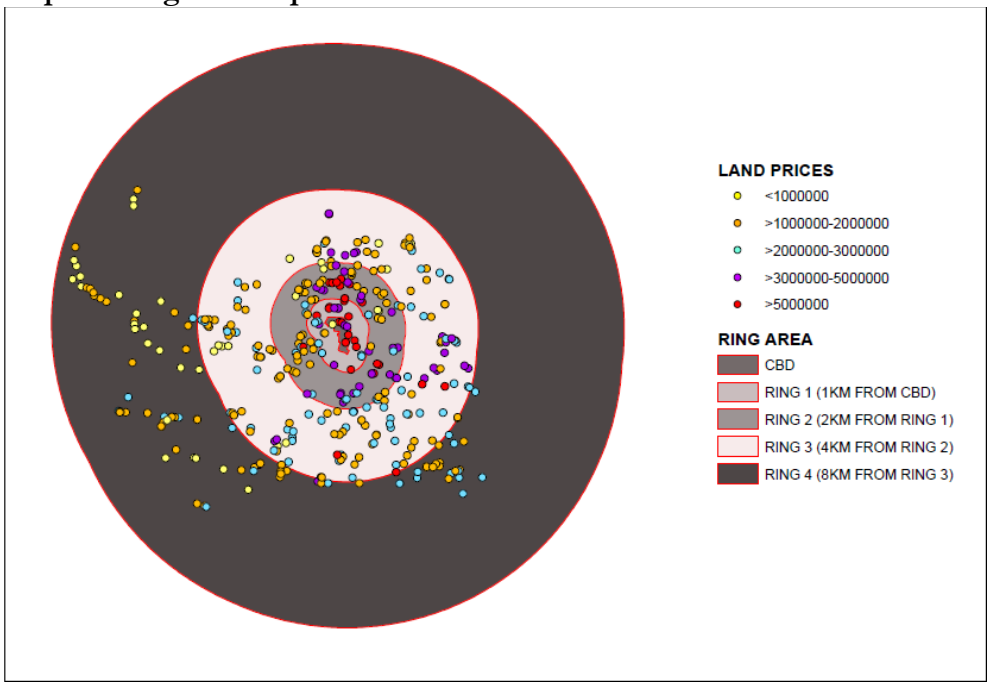
Distance (km)	Freq	Percent	Average Prices
0-5	172	43.88	2,841,990.57
5.1-10	164	41.84	2,128,500.49
10.1-15	56	14.29	1,382,520.57

Source **: Author's elaboration based on land values data**

Table 5.1 show that land prices tend to decline with distances to city centre. The higher distances from CBD, the prices are getting lower. This finding in line with other studies from Peiser (1987), Dowall and Leaf (1991), Han and Basuki (2001), and Haughwaout (2008) which also found that the land values declined with the distance from city centre.

Related to the pattern of the samples and CBD, we created land prices ring map. There are four rings that in every ring have different large of area. The first ring has the smallest area and the outer ring/the fourth ring has the largest area. This map mainly adopted from the ring zones of the Paris city, which the area to the outer is getting larger. Further analysis will be given related to the outliers in our samples.

Map 5.1 Ring of land prices distribution to CBD



Source **: Author's illustration based on land values data**

It is clearly seen that in the first ring the land prices are more likely vary than other circles. The pattern of the land prices in map tend to gradually decline with the proximity to city centre. Parcels of land that are located in CBD show the highest prices indicated by the red point. However, there is one sample in yellow one that is very unlikely expected to locate there.

Table 5.2 shows the mean, minimum and maximal values of samples in every circle. There are five parcels that are exactly located in CBD area (*Tunjungan – Embong Malang - Basuki Rahmad*). Furthermore, the samples are mostly located in third and fourth ring that is located in the fringe area of Surabaya.

Table 5.2 Summary statistic of land prices' ring

Ring	Freq.	Mean	Min	Max
CBD	5	5,859,939	961,527	8,078,195
1	23	4,583,458	1,639,369	8,721,607
2	94	2,821,256	670,638	8,378,282
3	170	2,101,295	513,308	6,558,450
4	100	1,581,802	431,288	5,536,754

Source **: Author's elaboration based on land values data**

By noticing table 5.2 And map 5.1, it can be said that in CBD there is one parcel that has extremely low value compared the other four samples. The land price of that sample is less than one million rupiah per square meter. In contrast, the mean value of the samples located in CBD is almost 6 million rupiah. In addition, there are five samples that the land prices are substantially different from the other parcels in the first ring.

Table 5.3 Detail information of outliers

No	Ring	Prices (Rp)	Land Tenure	Land use	Road class	City
1	CBD	961527	HGB	Residential	Local	Central Surabaya
2	2	819902	HGB	Residential	Local	East Surabaya
3	2	670638	HGB	Residential	Local	East Surabaya
4	2	934268	HM	Residential	Local	East Surabaya
5	2	940734	HM	Residential	local	North Surabaya
6	2	863580	HGB	Residential	local	North Surabaya

***Source* : Author's elaboration based on land values data**

After consulting with satellite images of outliers using Google Earth 2013 which can be seen in Appendix 1, we are hardly to determine what factor cause those land plots have outlier prices. It is difficult to predict without conducting the real survey why those observations were distant from the rest of the data. Nonetheless, there are some predictions that we would like to explain related to that :

1. Conflicting land

   There would be a case that the landowner does not control or abandoned the land for many years. Even though there is a regulation that the owner should control its land, some landowners violate that. As a result, other people illegally occupy and control that parcels. That would be a problem for the owner to sell the land due to the complicated land controlling problem.

2. Land title life span and zoning regulation

   The land tenure of the outliers are right-of-ownership (HM) and right-of-building (HGB). We only examine relation of HGB due to this right has a life span. HGB title is granted by the National Land Agency for an initial period of up to 30 years and is extendable for a subsequent 20-year period. Perhaps, the HGB title for parcels above is almost expired and need to re-administer. There would be a cost to extent it. Another thing that likely related to is the interaction of land title and zoning regulation. It is possible that local government plans to change the city spatial planning in that area. That causes the uncertainty for HGB right's holder and they sell the land for cheap prices.

3. Physical factors

   Physical factors such as located in the block that prone to flooding, slum area and prone-fire could be lower the land prices. As suggested in Han and Basuki (2001) that a *kelurahan* with flood risk are likely has lower value compared to a *kelurahan* without that risk.In addition, the lower land prices could be influenced by the existence of home industry in the neighbourhood. Since small home industry such as Batik also likely produces pollution.

   Another physical factor that could be affected is the parcels are located near military base, intelligent or secret agency's office. It is possible based

on some experiences of people living near Indonesia intelligent office in Jakarta that they experience bad signal of communication. There would be some services such as internet or phone that are likely disturbed by located near that kind of office.

5.1.2 Non-distance variables

There are four non-distance variables in this study, which are land use, zoning, road type and land title. Land use and zoning have some similarities since in arranging zoning policy; existing land utilization is one of the inputs.

Table 5.4 Average land price based on land use and zoning classification

Category	Freq	%	Average Price/m2 (Rp)
Land Use			
Agriculture, Annual Crop	8	2.04	1,543,553
Agriculture, Rice Field	7	1.79	1,134,726
Industry	14	3.57	1,780,731
Residential	363	92.6	2,396,958
Zoning			
Conservation Area	2	0.51	1,488,029
Green open space	18	4.59	1,790,148
Industrial Area	15	3.83	1,694,799
Particular Area (Military, Port)	10	2.55	3,131,690
Public facilities	15	3.83	2,795,569
Residential Area	273	69.64	2,169,642
Trading/Services	59	15.05	3,205,664

Source **: Author's elaboration based on land values, land use and zoning data**

Industrial area in land use classification is consisted of agricultural industry, trading and service, whereas for zoning map, the data differentiate the industrial area and trading/service. It is because the nature of dataset of land use obtained from the entire of East Java Province. Meanwhile, zoning map is obtained for Surabaya city. Therefore, zoning map is more detail in classifying than land use.

There are two major features that interesting to explain from the table above which are residential, industry and trading/service area. Land prices for residential area in both land use and zoning utilization record relatively higher prices compared to other classifications. Furthermore, for land use classification, it is accounted as the highest land price. As it was suggested in literature from Haughwaout, et.al (2008) that residential plots in New York were sold with higher prices compared to other categories.

For zoning, the highest values are the area designated for trading/services (commercial land). This finding is similar with the condition in Jakarta based on Han and Basuki's paper in 2001. Ibid (2001) found that area which design for commercial zone was likely have the higher value. In other words, both cities commanded higher land prices for commercial zoning than other classifications.

Table 5.5 show the distribution of land prices relative to the road class and land title. Of the 4 road categories, most of the samples are located near or in the front of local road. In addition, the parcels that located near or in front of artery road recorded the highest prices. It is likely that road type does matter to land prices in Surabaya. That finding is in line with the paper from Peiser (1987) indicating that non-residential land plots in major arterial are higher than in the minor street.

Table 5.5 Average land prices related to road class and land tenure

Road Class			Land Title		
Category	**Freq**	**Average Price/m2 (Rp)**	**Category**	**Freq**	**Average Price/m2 (Rp)**
Footpath	17	1,949,406	*Registered*		
			• HGB	117	2,468,307
Local	286	2,250,026	• HM	271	2,279,527
Collector	81	2,627,329	*Non Registered*	4	2,193,479
Artery	8	3,232,066			

Source **: Author's elaboration based on land values data**

Table 5.5 above indicate that mostly samples are already registered or have official land title. There are two types of registered land tenure in the samples, which are right to build (HGB) and right of ownership (HM). Only four samples have not registered yet. Moreover, parcels that have registered land title commanded slightly higher prices compared to non-registered parcels. Parcels with registered land title in Jakarta according to Dowall and Leaf's journal published in 1991 are 45% more valuable than those with non-registered. From explanation above, Surabaya has the same pattern related to land tenure that registered land title has the higher prices that non-registered parcels.

In addition, land plots that registered as HGB get higher values than HM. The drawback of land plots with HGB is that the holders should re-administer before the span of the certificate end. However, apparently the Surabaya's resident does not take into account HGB or HM. In addition, many real estate developers nowadays sell a house with HGB title since the state cannot grant the right of ownership to private sector. However, the buyers as individual can convert the certificate from HGB to HM in the next few years.

5.1.3 Distance variables

We identified 13 distance variables except proximity to CBD in this analysis that are related to public transportation and infrastructure, openness area and final disposal site (rubbish dump). We divided the variables into two categories which are the prices tend to increase and decrease with distance. It is necessary to distinguish the variables in order to see the different feature of land prices between them.

Distance to port, train station, Suramadu Bridge, industrial areas, parks, markets, mangrove forest and golf courses are likely to decline with distance. However, for mangrove, Suramadu Bridge, industrial region and golf courses in the middle range (5.1-10 km) account the highest prices. It we look back to the map in chapter 4, those variables are located in the suburb area of Surabaya but the proximity to city centre is in medium distance, which around 7 to 10 km (table 5.6). In other words, there is likely intercorrelation of land prices between the distances of these variables to city centre. Below, we present the proximity of 13 variables to city centre

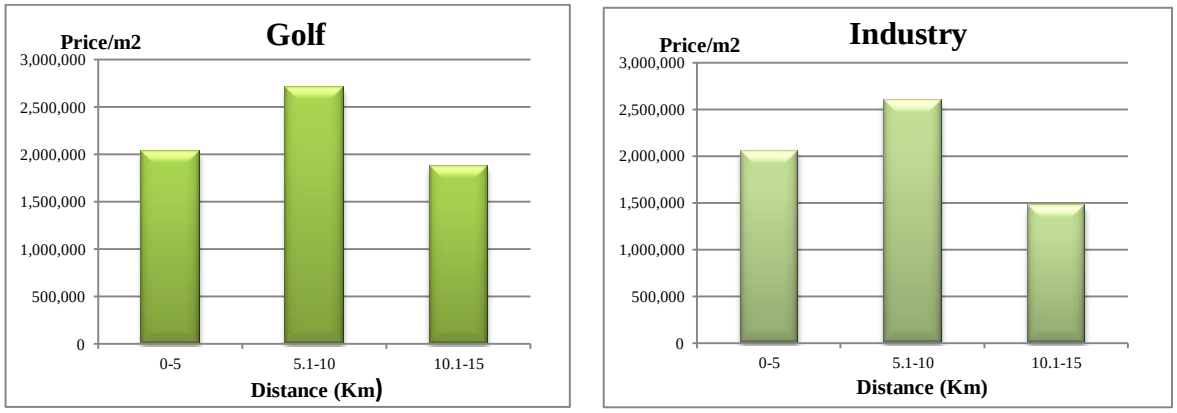
Table 5.6 Average distance from variables to CBD

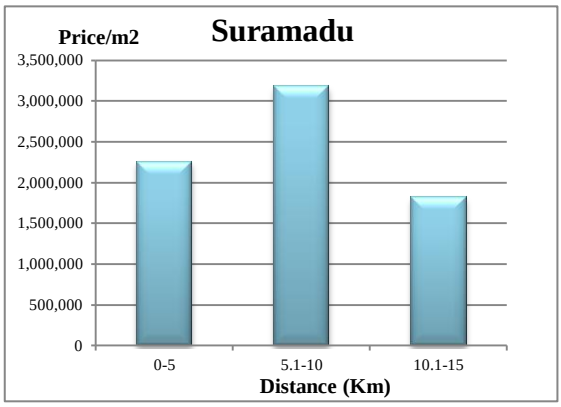
Variables	Distance (m)
Undeveloped city forest	**9,330.47**
TPA Benowo	12,980.04
Bus station	16,196.54
Parks	*2,402.15*
Train Station	*1,058.77*
Port	**7,145.75**
Market	*1,744.42*
Golf courses	**7,997.11**
Industrial Area	**7,325.17**
Mangrove	**9,949.37**
Airport	15,404.23
Sub CBDs	*4,481.05*
Suramadu	**6,977.65**

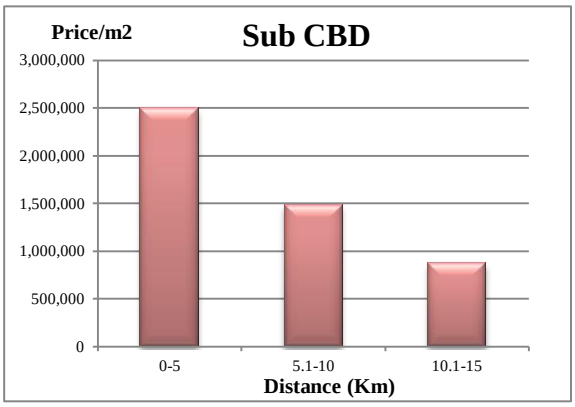
Source **: Author's elaboration based on land values data**

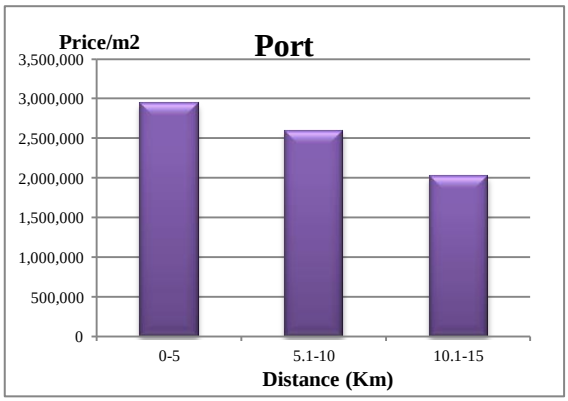
Table 5.6 indicates that some variables are located far away from CBD signed by normal case. Variables that close to CBD which in range (0-5 km) signed by italic case and variables that the proximity in the middle range signed with bold case. Further illustration distance variables that the prices falls with distance can be seen in figure 5.1.

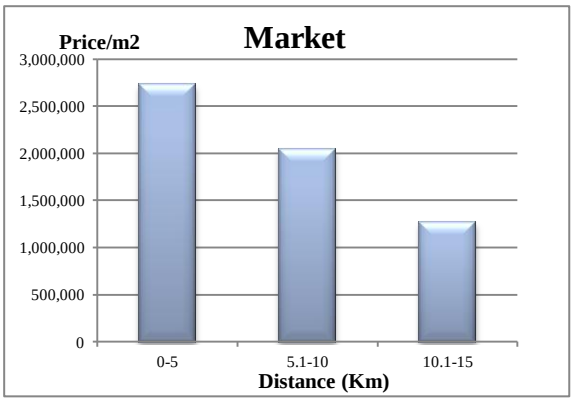
Figure 5.1 Land prices that decline with distance

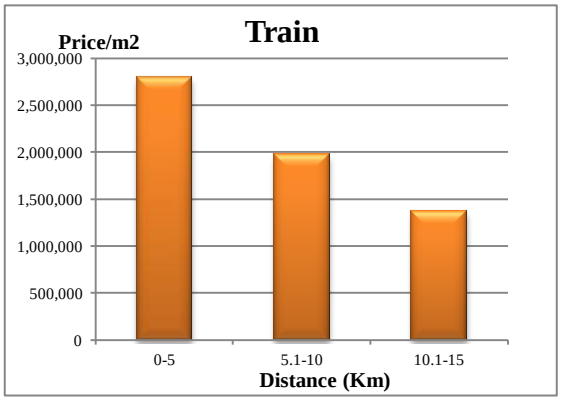


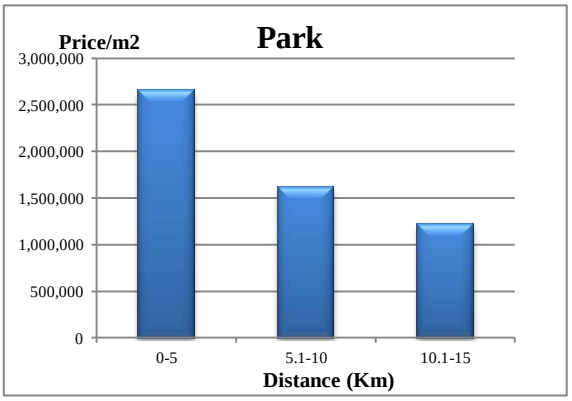


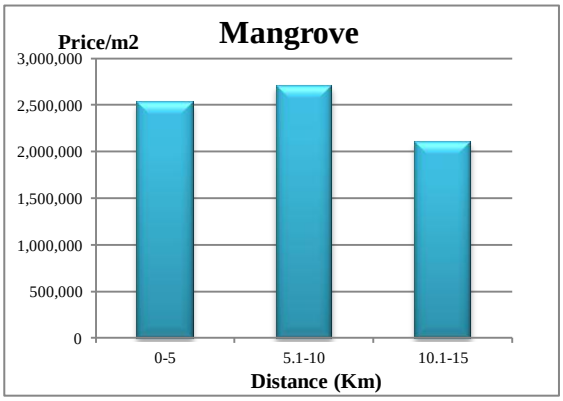










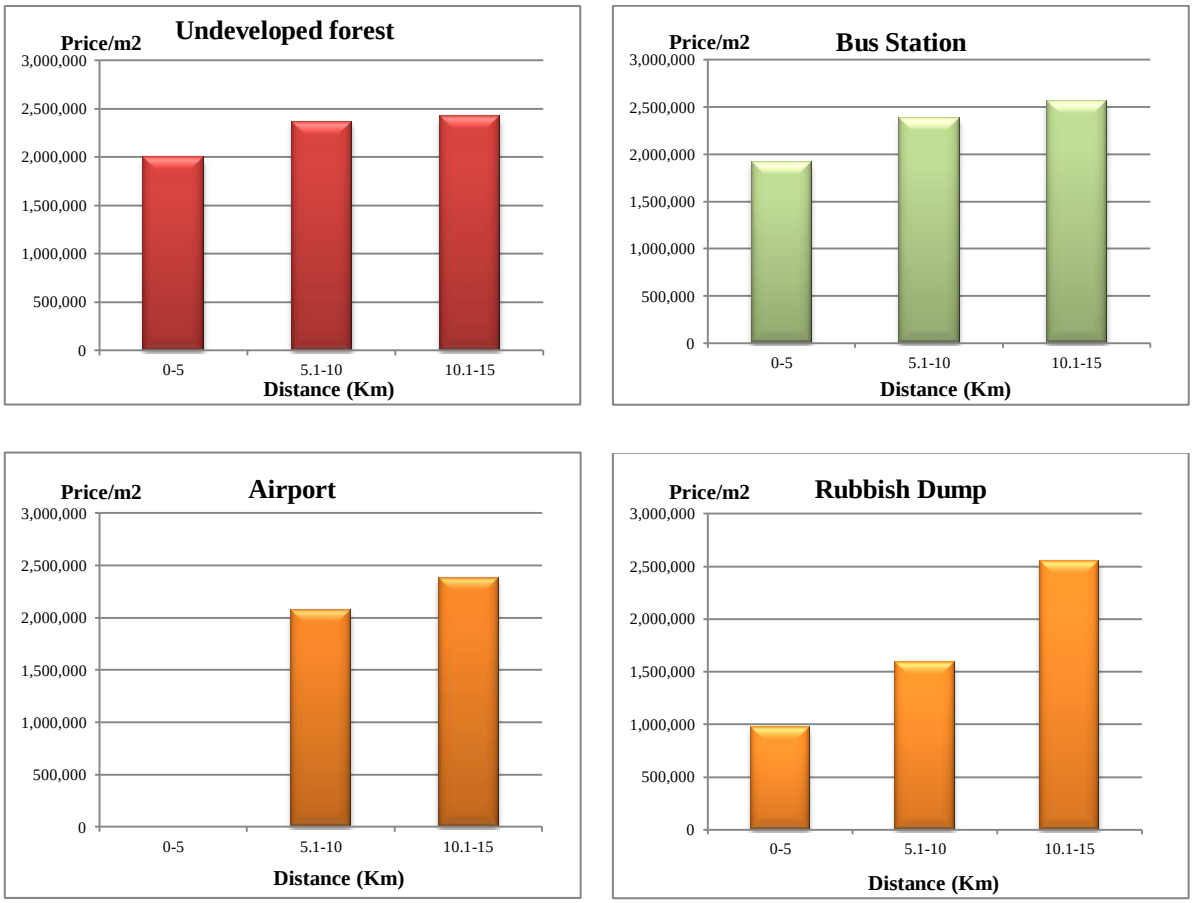


Source : Author's elaboration based on land values data

Land prices related to proximity to port, train stations, markets, parks and Sub CBDs fall gradually with distances. The reason behind that is these variables are located near the CBD except port that located in the middle range (7 km) if we consult the map in chapter 4 and table 5.6. As a result, the bar chart for *Tanjung Perak Port* in figure 5.1 is quite steeper compared to train stations, parks and sub CBDs.

The opposite direction with figure 5.1, the bar charts below present four distance variables that land prices are likely to increase with distance.

Figure 5.2 Land prices that rise with distances



Source **: Author's elaboration based on land values data**

Figure 5.2 show that undeveloped forest, bus stations, rubbish dump and airport are the variables that tend to increase the land prices with distance. Location factor could be a reason why these variables tend to increase with distance. Furthermore, the interaction of those variables and the proximity to city centre could be one of the factord of the increasing trend of land prices with distance. Location of bus stations, one of the bus stations that are *Terminal Purbaya*, is not in Surabaya but in Sidoarjo regency (satellite city of Surabaya) and *Terminal Tambak Oso Winangun* is in suburban area of Surabaya. In addition, the location of airport is in Sidoarjo and quite far from Surabaya so that there are no samples are located 0-5 km from airport.

For undeveloped forest, the location is in South Surabaya and quite far to the city centre. Rubbish dumpsite is also located in periphery area that is West Surabaya, which is the region that accounted the lowest level of land prices compared to other regions in Surabaya. Moreover, the land parcels near final disposal site tend to increase substantially with distance. It is likely due to environmental reason since people are unlikely to choose and avoid living in the sites near open dumping area.

5.1.4 Central and non-central analysis

Examining the spatial pattern of central and non-central in Surabaya, we use non-parametric Mann-Whitney and Kruskal-Wallis test.

Table 5.7 Result of Mann-Whitney test

	Obs	Rank sum	Expected
Non-central	357	68152	70150.5
Central	35	8876	6877.5
z	-3.124***		
Prob > z	0.0018		

***indicates significant at the 1 percent level

This z-value confirms that there is a statistically significant difference between the distributions of the land prices of central and non-central region. After comparing the rank sum and the expected rank sum, the rank of land prices for central area is higher compared to non-central area. Therefore, the central group has the higher prices than non-central area

Table 5.8 Result of Kruskall-Wallis test

City	Obs	Ranksum
West Surabaya	87	10323.5
Central Surabaya	35	8876.0
South Surabaya	89	17796.5
East Surabaya	117	27147.0
North Surabaya	64	12885.0
chi-squared	61.7 with 4 d.f	
Probability	0.0001***	

***indicates significant at the 1 percent level

The results from Kruskal-Wallis test indicate to reject null hypothesis that is the samples of all groups come from identical population. It confirms that the chi-squared with four degree of freedom is significantly different from zero. It implies that land prices in 5 major assistant area are not equally distributed. This finding is also supported from Navastara and Navitas (2012) which found that the outlying region in Surabaya that is South Surabaya, West Surabaya and East Surabaya dominated the land prices growth in the period 2010 to 2011. It implies that there is uneven growth of land prices in Surabaya. Furthermore, ibid (2012) also found that South Surabaya experienced the

highest growth suggesting that development of new housing in that region is more massive than other regions.

Along with that, land values among central and non-central districts in Jakarta also were not uniform in Jakarta based on Han and Basuki (2001). They found that at 1 percent level, the prices in central districts were statistically higher than non-central districts. Furthermore, the land values were not uniformly distributed among non-central districts.

5.2 Regression result and analysis

In this part, the regression result and its discussion will be presented as follow.

5.2.1 Regression of land prices and CBD

This partial regression only accounts one independent variable that is the CBD. The reason is that some studies put this variable as the main analysis. In addition, it is also interesting to see the relationship between land values and the CBD in Surabaya and compared to the results with other cities such as Jakarta. This regression use robust standard error to remove heteroskedasticity problem.

Table 5.9 Regression result of land prices and CBD

Variable	Coefficient	t-stat
Constant	17.452	45.41***
ln dist CBD	-0.349	-7.87***
R^2	0.1716	

***indicates significant at the 1 percent level

This regression result indicate that coefficient of CBD in Surabaya is negative and significant suggesting that land values decline with the distance from city centre. The coefficient of CBD is -0.349 implying that 10% increase of proximity to city centre is likely decline the land prices, on average, by 3.5%. Similarly, taking example from Jakarta in Dowall and Leaf (1991) paper show that land values and distance from CBD is negative and highly statistically significant.

In addition, the R-squared for Surabaya is 0.17 implying approximately 17% of land prices variation can be explained by the distance from city centre. If we compared to other findings, this value is quite small. Dowall and Leaf (1991) indicated that 62% of variation in land values in Jakarta can be solely explained by the distance from CBD. Furthermore, there was a reduction of the variation related to CBD in Jakarta based on Han and Basuki study in 2001. They found there is a declining of the importance of city centre in Jakarta. Moreover, ibid (2001) confirmed only 30-45% of land prices variation can be determined by the proximity from city centre. In other words, land price gradient become flatter over time in Jakarta. Flattening of land price gradient also found in Berlin based on research from Ahlfeldt and Wendland (2008). Nonetheless, the finding from Jakarta and Berlin are still higher than in Surabaya.

Wisaweisuan (2001) wrote that the importance of city centre to land prices indicate that the urban structure of one city support the model of monocentric assumption or core dominated city. Considering the finding from Surabaya, the R-squared is quite small compared to other city. It indicates that this city does not follow core dominated city structure. Moreover, it could be said that the pattern of urban structure in Surabaya followed multi-nuclei city or polycentric assumption. However, we cannot say that Surabaya has transformed to polycentric city such as Istanbul (Ciraci and Kundak (2000)) and Berlin (Ahlfeldt and Wendland (2010)). Since, we do not have any spatial history data of land prices there.

In addition, the lower of R-squared above indicated there is a decentralisation of urban activities in Surabaya. This argument is supported by Navastara and Navitas (2012), which study land prices dynamics in Surabaya. They found that residential development moves to suburb area of Surabaya which are East Surabaya, South Surabaya and West Surabaya. Furthermore, if we notice in chapter 4, there are seven sub business districts spreading in Surabaya.

To know the other variable that influence land prices variation in Surabaya, we incorporate other variables in the next regression.

5.2.2 Pooled regression

The relation between dependent and all independent variables can be seen in the result of pooled regression below. It shows that CBD, the significant variable in land prices study, is not statistically significant. The variables that significant are distance from sub-CBD, bus station, Suramadu Bridge, industrial area and open dumping site, zoning (industrial area), and road (collector).

Table 5.10 Pooled regression result in land value determination

Variables	Coefficient	t-stat
ln dist CBD	-0.146	-0.94
ln dist sub CBD	-0.119	-2.62***
Transportation		
• ln dist train	-0.076	-0.71
• ln dist bus	-0.294	-2.34**
• ln dist port	0.018	0.09
• ln dist suramadu	0.342	3.34***
• ln dist airport	0.235	0.88
Openness		
• ln dist parks	0.062	1.05
• ln dist golf	0.057	0.62
• ln dist mangrove	-0.206	-1.49
• ln dist undeveloped forest	0.049	0.59
ln dist market	-0.144	-1.36
ln dist rubbish dump	0.511	2.79***
Pollution		

• ln dist industrial	0.177	2.08**
Road		
• R1 (footpath)	-0.075	-0.63
• R2 (artery)	0.194	1.05
• R3 (collector)	0.164	2.25**
Land Title		
• lt1 (non-registered)	0.042	0.47
Zoning		
• Z1 (conservation)	-0.344	-1.67
• Z2 (green open area)	-0.156	-1.13
• Z3 (industry)	-0.379	-2.42**
• Z4 (particular area)	0.144	0.87
• Z5 (public utilities)	-0.033	-0.23
• Z6 (residential)	-0.113	-1.28
Land use		
• lu2 (agricultural, field rice)	-0.080	-0.38
• lu3 (industry)	0.415	1.88
• lu4 (residential)	-0.028	-0.18
Constant	9.787	1.81
R-squared	0.367	

***indicates significant at the 1 percent level; **indicates significant at the 5 percent level.

After examining the regression above, we found that the result violates the OLS assumptions of multicollinearity. It implies that multiple regression model contain high correlation between independent variables; hence, the coefficient regression is biased. To avoid those, principal component analysis (PCA) can be applied to reduce some variables from equation. Appendix 2 indicates the result of multicollinearity test using VIF (variance inflation factor). A VIF of 5 or 10 above indicates high multicollinearity. The result shows that 10 of 14 distance variables constituted high score of VIF that are more than 5.

5.2.3 Principal component analysis (PCA)

The aim of PCA is to find uncorrelated variable; hence avoid multicollinearity issue. In essence, PCA ensure the linear combinations chose have maximal variance. We conduct PCA only for distance variables that are most likely correlated with each other. There are three steps in doing PCA which can be seen below.

Step 1 : Examine the eigenvalues to determine how many principle components can be retained.

Table 5.11 Eigenvalues, and the proportion of variation explained by the principal components.

Component	Eigenvalue	Proportion
Comp1	5.628	0.402

Comp2	2.990	0.214
Comp3	2.076	0.148
Comp4	1.127	0.081
Comp5	0.586	0.042
Comp6	0.545	0.039
Comp7	0.342	0.024
Comp8	0.239	0.017
Comp9	0.120	0.009
Comp10	0.114	0.008
Comp11	0.086	0.006
Comp12	0.074	0.005
Comp13	0.045	0.003
Comp14	0.029	0.002

From the proportion of Eigenvalues, the first four components account more than 80% of variance. Therefore, four components should be considered.

Step 2 : After determining four principal components, running PCA with four components. Next, we can look at the coefficients for the principal components. In this case, since the data are standardized, within a column the relative magnitude of those coefficients can be directly assessed.

Table 5.12 The principal component coefficients

Variable	Comp1	Comp2	Comp3	Comp4
Ln dist CBD	**0.466**	-0.033	0.091	-0.004
Ln dist market	**0.456**	-0.060	0.002	0.041
Ln dist train	**0.441**	-0.047	-0.035	0.069
Ln dist park	**0.432**	0.187	0.201	0.076
Ln dist Sub CBD	*0.360*	*0.125*	*0.044*	*0.123*
Ln dist rubbish	-0.058	**-0.553**	-0.068	0.190
Ln dist mangrove	-0.042	**0.538**	-0.243	0.037
Ln dist airport	-0.036	**0.511**	-0.001	0.217
Ln dist golf	0.096	-0.135	**0.631**	-0.165
Ln dist undeveloped city forest	0.045	0.030	**0.625**	-0.172
Ln dist suramadu	*0.113*	*0.047*	*-0.271*	*-0.217*
Ln dist port	*0.237*	*-0.233*	*-0.252*	*-0.002*
Ln dist industry	0.082	0.009	-0.233	**0.805**
Ln dist bus	-0.040	-0.138	0.109	**0.481**

Values greater than 0.4 have been bold

Interpretation the principal components based on which variables are most strongly correlated with each component (the numbers that are large in every column). The first component are corelated with some of the observed variables. The remaining components that are extracted in the analysis display the same two characteristics: each component accounts for a maximal amount

of variance in the observed variables that was not accounted for by the preceding components, and is uncorrelated with all of the preceding components.

Due to distance from Sub-CBDs, Suramadu Bridge and port are not correlated with other variables, and then we exclude those variables, and then run the PCA from step 1. Table 5.13 show the principle component coefficient with 11 variables

Table 5.13 the principle component coefficient with 11 variables

Variable	Comp1	Comp2	Comp3	Comp4
Ln dist CBD	**0.5254**	-0.0368	0.0221	-0.0009
Ln dist market	**0.5047**	-0.0655	-0.0574	0.0197
Ln dist train	**0.4994**	-0.0591	-0.1011	0.0480
Ln dist park	**0.4520**	0.1984	0.1717	0.1039
ln dist rubbish	-0.0311	**-0.5944**	-0.1275	0.1796
Ln dist airport	-0.0739	**0.5362**	0.0831	0.2401
Ln dist mangrove	-0.0400	**0.5302**	-0.2126	0.0184
Ln dist undeveloped city forest	-0.0315	0.1060	**0.6807**	-0.1004
Ln dist golf	0.0255	-0.0828	**0.6285**	-0.1091
Ln dist industry	0.0628	0.0000	-0.1548	**0.7970**
Ln dist bus	-0.0824	-0.1214	0.1822	**0.5178**

Values greater than 0.4 have been bold

Step 3 : Component Summaries

- First Principal Component Analysis
  The first principal component is a measure of the distance of market, train and CBD, and parks. If we look back to the map in chapter 4, the location between those variables is quite near to each other. All variables are positively related as the signs are positive.
- Second Principal Component Analysis
  The second principal component is a measure of the distance of airport, mangrove and rubbish. All of the signs are positive implying those variables positively related. Furthermore, consulting the map in the previous chapter, we suspect the distance all of the samples to these variables are likely not very different. If we see the mean distance from table 4.2, it can be seen that the mean value of those variables are not distant.
- Third Principal Component Analysis
  The variables of the openness area that are proximity to golf courses and undeveloped city forest are correlated in third PCA.
- Fourth Principal Component Analysis
  The fourth principal component is a measure of the proximity of industrial area and bus station.

5.2.4 Regression using principal components

From the result of the PCA, we would group the principle components above based on the mean distance that can be shown in table 4.2. The first PCA is

grouped as center area, the second PCA as the outer area and the third and fourth as the middle area 1 and 2. Below regression result is presented by incorporating principal component and non-distance variables.

Table 5.14 Regression result using principle components

Variables	Coefficient	t-stat
Component 1 (central area)	-0.115	-7.140***
Component 2 (outer area)	-0.110	-6.640***
Component 3 (middle area 1)	-0.030	-1.450
Component 4 (middle area2)	-0.006	-0.270
Road		
• R1 (footpath)	-0.022	-0.190
• R2 (artery)	0.258	1.370
• R3 (collector)	0.173	2.440**
Land Title		
• Lt1 (non-registered)	0.080	0.770
Zoning		
• Z1 (conservation)	-0.132	-0.910
• Z2 (green open area)	-0.161	-1.170
• Z3 (industry)	-0.351	-2.420**
• Z4 (particular area)	0.189	1.140
• Z5 (public utilities)	-0.078	-0.520
• Z6 (residential)	-0.138	-1.550
Land use		
• Lu2 (agriculture, field rice)	-0.069	-0.350
• Lu3 (industry)	0.273	1.250
• Lu4 (residential)	-0.051	-0.320
Constant	14.595	80.750***
R-squared	0.305	

***indicates significant at the 1 percent level; **indicates significant at the 5 percent level

There are four independent variables that are significant from table 5.6 which are principal component 1 (center area), principal component 2 (outer area), zoning (industrial area) and road class (collector). R-squared is 0.305 suggesting that this model can explain 30.5% of land prices variation.

Distance from first component is negative and statistically different from zero. The coefficient of this variable suggests that any 10% increase in distance from centre area, the land values falls about 1.12%. This result fits with theory and other empirical studies from Brigham (1965), Case and Mayer (1965), Haughwaut et.al (2008), Dowall and Leaf (1991), Han and Basuki (2001) and Wisaweisuan (2001). They found that any increase to the proximity to city centre will likely decline the land prices in urban area.

The result from second component comes from three distance variables that are rubbish dump, airport and mangrove. The second

component that are groupped as distance variables in outer area get regression's coefficient, which is negative and significant. It can be interpreted that any increase of distance from outlying area will decrease land prices. The coefficient is -0.110 that suggest that 10% increase of distance to outer area likely fall the land prices, on average, 1.10%. This result is obviously unexpected because we suspect that the farther away from outlying area, the prices will increase.

The underlying argument that can be given for unexpected sign is that if we see again the figure 5.2, the prices for mangrove variables tend to fall with distance. However, the other variables (airport and open dumping site) tend to increase with distance. The location of those variables are likely also influence the result except for open dumping site since the variables located in the area that is likely has lower value which are West Surabaya. Mangrove forest is located in east of Surabaya and not too far from CBD. Airport is located in southeast of Surabaya and the distribution of land prices in the middle range to the outer range is not quite differ. From the analysis above, the mixed of these variables in one component result in unreliable sign of the regression's coefficient.

Road also has an effect in land prices. The coefficient of R3 (collector) is positive indicating that land prices of parcel located in front of collector road is higher than located in local road. Based on Peiser (1967) which trace out the determinants of land prices in non-residential area in Dallas found that road type is significant for both industrial land and office land. Industrial land with frontage on a major arterial is 43% higher, and that with expressway frontage is 68% higher, in value than industrial land on a minor street.

In addition, zoning for industrial area is significant and negative. It implies that plot in industrial area has lower price compared to trading/service land parcel. It is likely because trading/service zone in city spatial planning map is located in city centre. Furthermore, the industrial zone is designed in the fringe region of Surabaya. The finding from Jakarta also shows similar result. As stated in Han and Basuki (2001), *kelurahan* that more than 50% of its area is designated for commercial land use was likely having higher value compared to other utilization.

Chapter VI
Conclusion and recommendation

6.1 Conclusion

As mentioned by Dowall and Leaf (1991) that "detailed information as to how land prices vary spatially within Third World cities is usually lacking". Hence, this research try to examine the spatial and non-spatial factors influencing the land prices pattern in one of the biggest in Indonesia which is Surabaya. This study use market-based prices dataset to determine what factor that likely influence land prices. It also aims to examine the spatial pattern of land prices and in Surabaya.

Concerning the data and its interaction with CBD, it tends to some observations move in the opposite direction. We identified six samples that the land prices are extremely low or the values are very distant to others. Addressing why those samples have the outliers prices from others without conducting real survey is difficult. Nevertheless, some predictions are given which are related to conflicting land, physical factor, land title and zoning regulation.

We design 14 distance variables and 4 non-distance variables that likely have an impact on land prices. Land prices for 10 distance variables tend to decrease with distance and others are likely rise with distance based on descriptive analysis. In term of non-distance variable, land use and zoning category indicate that land parcels for residential purposes accounted relatively higher prices. Nonetheless, land plots designated for trading/service (commercial) get the highest prices. In addition, the parcels that have not registered yet commanded lower prices compared to registered land. In addition, road class also influence the land prices. The land plots in front of collector road are appreciated with higher prices.

Even the urban growth is seemingly distributed to suburban area in Surabaya, the result from Mann-Whitney and Kruskal Wallis test confirms that land prices between central and non-central area of Surabaya are not equally distribution. It is undoubtedly that there is still uneven distribution of land prices. Thus, land parcels near city centre are still appreciated higher prices than in non-central area.

Based on some studies in urban land prices, the distance from CBD still significantly affects the land prices in the cities in both developed and developing countries. Similar with other cities such as New York and Jakarta, city centre has significant effect influencing land prices in Surabaya. The regression result between land values and the CBD is negative and significant implying that the increasing proximity from city centre, the lower the land prices are. However, the R-squared for Surabaya is quite smaller compared to its counterpart that is Jakarta. Only 17% of land prices can be solely explained by the distance from city centre in Surabaya. Han and Basuki (2001) indicate

that 30-45% of land prices variation in Jakarta can be explained by CBD. This finding suggests that rapid urban growth is likely distributed to outlying region of Surabaya.

As stated that above that R^2 in Surabaya is smaller than Jakarta, it is likely that urban planning in Surabaya tend to adopt polycentric city. It can be seen that local government in Surabaya appointed 7 business districts spreading around the city. The emergence of sub business districts indicates there is a decentralisation of urban economy or agglomeration economy. As a result there is an increase in land prices variation which denoted by a lower R-squared.

Incorporating all independent variables that are 14 distance variables and 4 non-distance variables in regression analysis, result in multicollinearity problem. Hence, principal component analysis (PCA) is applied to reduce variables which are highly correlated. Based on PCA result, four principal components can be included in the regression. Those principal components can be grouped into central, middle and outer area. Conducting regression with the principle components result in the significant of four independent variables which are first principal component or centre area, second principal component or outer area, zoning for industrial area and collector road.

It can be concluded that the regression result by incorporating principal component fit with the findings from other journals except fo the principle component 2. This component consists of three variables that are open dumping site, mangrove forest and airport. Those variables have different pattern of land prices. The parcels near mangrove forest tend to decline prices whereas others are likely increase with distance. As the consequence, this coefficient regression is unexpected. In addition, the R-squared in this model is 0.3337 implying that 33.37% of land prices variation can be explained by this model.

Overall, the findings of this research related to distance to city centre does not differ with other studies. CBD still influence the land prices variation in Surabaya, similar with the findings from other city such as New York, Dallas, Jakarta and Bangkok. However, the magnitude of CBD in Surabaya is quite smaller compared to other cities. It indicates that this city does not follow monocentric assumption. It is interesting to examine in the future land prices study related to agglomeration economy and urban decentralisation in Surabaya.

Regarding to future research in land prices determination; it is interesting to examine the phenomenon of the declining importance of city centre and the flattening out in urban activities over time. Furthermore, examining spatial history of land use and transportation network can sharpen the analysis of urban land prices. Instead of using direct linear distance from transportation modes, travel time probably can be used in future study. In addition, it is worthy to incorporate social variables such as crime and poverty rate, social economic class in land prices study. It could be interesting to see the interaction of social variables to dynamic of urban land prices. Macroeconomic variables could be considered in future study. Since land as an

asset is closely related with credit bank and other macroeconomic variables. In term of methodology, spatial econometrics could be applied to further study to enrich the discussion and findings in urban land prices study.

6.2 Recommendation

Dowall and Leaf (1991) stated that land market fast-growing Third World cities is terribly disorganised. It can be seen from land market in Indonesia. The transaction of a parcel depends on the free market based on the highest bidding. As a result, a gradually increase of land prices in urban area cannot be controlled. It would be a problem in the future for government and residents. Since higher land prices are likely a restriction in building public utilities or infrastructure.

In addition, the pattern of land prices in Surabaya shows that this city does not follow the pattern of monocentric city. Since there are an establishment of sub CBDs around the city, transfer urban growth to outlying area in Surabaya. Recently the concentration of residential growth based Navastara and Navitas (2012) move to non-central area implying there is an improvement in accessibility and shortened distance to urban area in Surabaya. It also indicates of the improvement of public service provision in the periphery area.

It is suggested that detailed zoning in the future to support the equal development between central and non-central area in Surabaya. The provision of green open spaces could be increased in this city. Moreover , the expansion of infrastructure in the outlying of Surabaya could be accelerated to support the economic activities. Hence, the uniformly development will likely avoid sprawl pattern in this city.

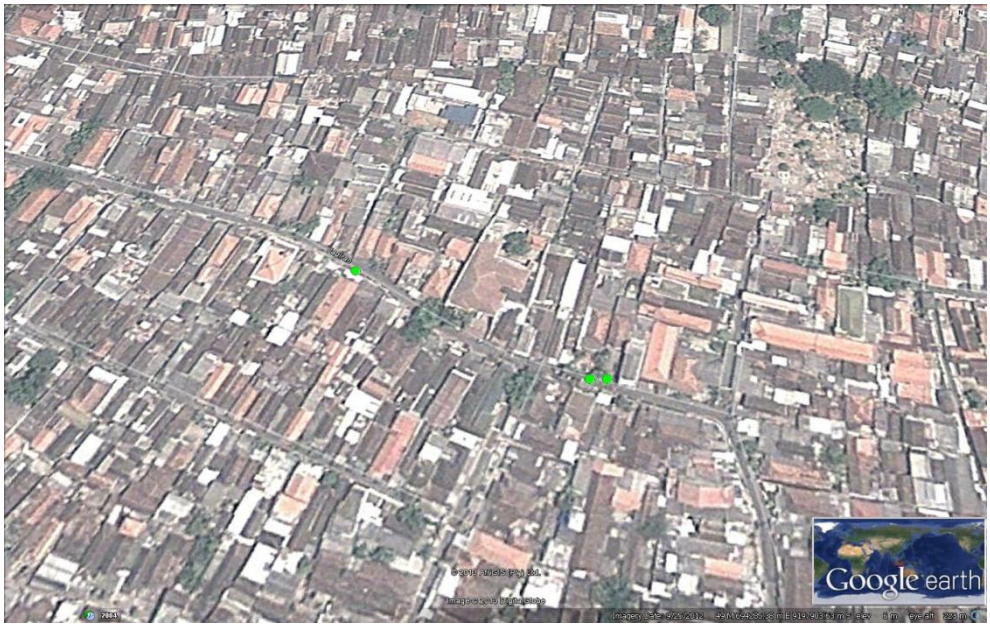
Appendices

Appendix 1 : Satellite images of the outliers

Outlier 1

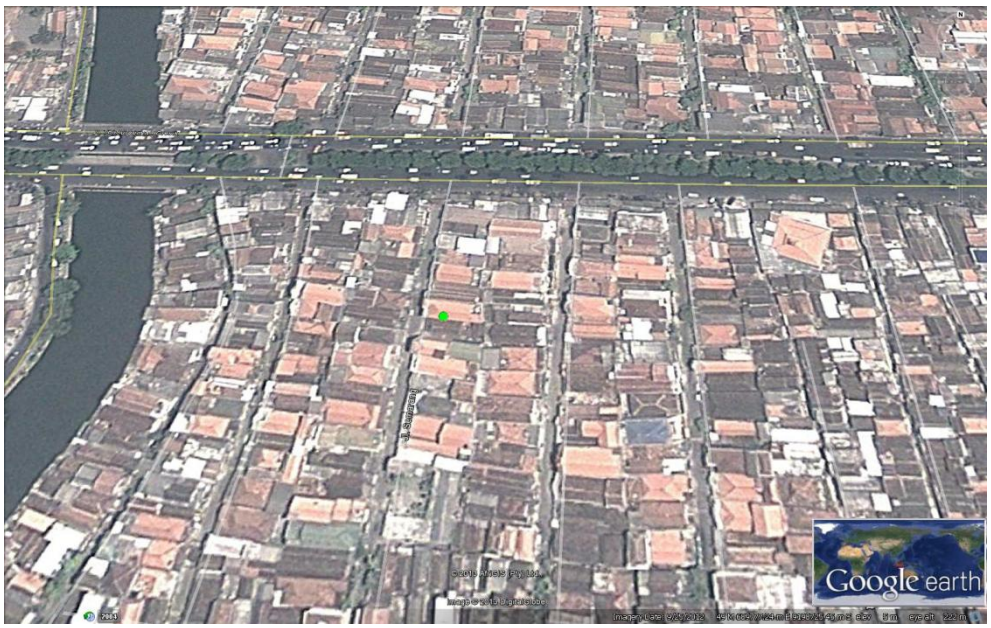
Green bullet indicate the parcel's location

Outlier 2, 3 and 4



Green bullet indicate the parcel's location

Outlier 5



Green bullet indicate the parcel's location

Outlier 6

Green bullet indicate the parcel's location

Appendix 2 VIF result

Variable	VIF
ln dist airport	19.58
ln dist rubbish	16.74
ln dist market	14.38
ln dist port	7.13
ln dist Suramadu	6.09
ln dist CBD	13.12
ln dist mangrove	9.64
in dist train	8.46
ln dist bus	7.02
ln dist park	4.89
in dist undev forest	5.36
ln dist golf	5.07
in dist industrial area	3.65
ln dist sub CBD	2.75
Lu3	4.08
Z3	2.27
Z6	2.09
Z2	1.55
R3	1.37
Z5	1.3
R1	1.27
Z1	1.25
Z4	1.26
Lu2	1.96
R2	1.1
Lu4	3.81
Tenure1	1.07
Mean VIF	6.28

References

Ahlfeldt, G. M. and Wendland, N. (2008) 'Fifty Years of Urban Accessibility: The Impact of Urban Railway Network on the Land Gradient in Industrializing Berlin', University of Hamburg Working Papers from Chair for Economic Policy No 23. Hamburg.

Ahlfeldt, G. M. and Wendland, N. (2010) 'How polycentric is a monocentric city? The role of agglomeration economies', Accessed 18 August 2013 <http://mpra.ub.uni-muenchen.de/id/eprint/24078>.

Ai, P. (2005) 'Residential Land Value Modelling, Case Study of Hankou, China'. Master thesis, International Institute for Geo-Information Science and Earth Observation, Enschede.

Alonso, W. (1964) *Location and Land Use*. Cambridge : Harvard University Press.

Case, K.E., and Mayer, C.J., (1996) 'Housing price dynamics within a metropolitan area', *Regional Science and Urban Economics,* 26 : 387-407.

Ciraci, H. and Kundak, S. (2000)'Changing Urban Pattern Of Istanbul; From Monocentric To Polycentric Structure' ERSA conference papers from European Regional Science Association (August 2000).

Cheshire P., and Sheppard, S. (2005) 'The Introduction of Price Signals into Land Use Planning Decision-making: A Proposal', *Urban Studies* 42: 647.

Dowall, D.E., and Leaf, M. (1991) 'The Price of Land for Housing in Jakarta',*Urban Studies*, 28(5) : 707-722.

Dowall, D.E. (1992) 'A Second Look at the Bangkok Land and Housing Market' Urban Studies 29(1) : 25-37.

Evans, A.W. (1983) 'The Determination of the Price of Land', *Urban Studies* 20 : 119-129.

Fujita, M. (1989) *Urban Economic Theory Land use and city size*. Cambridge : Cambridge University Press.

Han, S.S. and Basuki, A., (2001), 'The Spatial Pattern of Land Values in Jakarta', *Urban Studies*, 38(10) : 1841–1857.

Brigham, E.F., (1965) 'The Determinants of Residential Land Values', *Land Economics*, 41(4) : 325-334.

Harvey, J. (1992) *Urban Land Economics*, Hampshire : MacMillan.

Haughwout, A., Orr, J., and Bedoll, D., (2008), 'The Price of Land in the New York Metropolitan Area', *Federal Reserve Bank Of New York*, 14(3).

Koomen E. and Buurman J. (2002) 'Economic Theory and Land Prices in Land Use Modeling', paper presented at the 5th AGILE Conference on Geographic Information Science, Palma (Balearic Islands Spain)(25-27 April).

KS3 Bitesite BBC (2013) 'Settlement in Urban Area', accessed from <http://www.bbc.co.uk/bitesize/ks3/geography/spaces/settlement_urban/revision/4/>

Laoli, N. (2011) 'Harga Tanah di Jakarta Naik di Atas 30 Persen', 25 March, accessed from <http://entertainment.kompas.com/read/2011/03/25/14105972/Harga.Tanah.di.Jakarta.Naik.di.Atas.30.Persen

Mahan, B.L., Polasky, S., and Adam, R.M., (2000) 'Valuing Urban Wetlands: A Property Price', *Land Economics*, 76(1) : 100-113.

Navastara, A.M. and Navitas P. (2012) 'Impact of Residential Land Development towards Land Price Dynamics in Surabaya', paper presented at the 11th IRSA International Conference (July 2012).

Peiser, R.B., (1987) 'The Determinants of Nonresidential Urban Land Values, *Urban Economics*, 22 : 340-360.

Sari, L.I.P., (2011) 'Evaluasi Perkembangan Tutupan Lahan Dan Pertumbuhan Penduduk Menggunakan Regresi Linier di Surabaya Timur', Master Thesis, Institut Teknologi Sepuluh Nopember, Surabaya.

Shultz, S.D., and King, D.A., (2001) 'The Use of Census Data for Hedonic Price Estimates of Open-Space Amenities and Land Use', *Real Estate Finance and Economics*, 22:2/3 : 239-252.

Smith, V.K., and Huang, J.C. (1993) ' Hedonic Models and Air Pollution: Twenty-Five Years and Counting', *Environmental and Resource Economics,* 3: 381—394.

Wisaweisuan, N. (2001) 'Spatial Characteristics of Land Prices in Bangkok', Thammasat Review, 6(1) : 142-176.

Yowaldi, (2012) 'The Relation between Land Price and Distance to CBD in Bekasi', Master thesis, International Institute of Social Studies, The Hague.