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# The Impact of Land Use Regulation on Land Values: Case Study of Ngaglik District, Indonesia

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**Abstract**. Many local governments are now facing the challenge to provide urban infrastructure adequately due to the global trend of rapid urbanization. The implementation of the land value capture policy may provide an alternative financial resource for the provision of urban infrastructure. However, it is difficult to separate which part of the increment is resulted from the public action—thus it can be captured—, and which part is resulted from private action. This study aims to investigate the effect of the public action in term of land use regulation on land value. The effect of the enactment of the Sleman Regency Spatial Plan is examined in the Ngaglik District as the case study area using the Hedonic Price Model (HPM). The finding shows that the enactment of the Sleman Regency Spatial Plan has a significant effect on the land value in the case study area. This regulation has created a positive effect on land value due to its amenity and scarcity effect.

## 1. Introduction

Urbanization has become a global trend. According to UN-Habitat, half of the global population currently live in the urban area. This number is predicted to increase, with around sixty percents of the urban population is estimated to live in the urban area in 2030 [1]. This situation has raised a challenge for the local government, especially in the Global South Cities. They have to deal with several urban problems, such as the lack of affordable housing and the lack of basic infrastructure. This situation has demanded local government to increase their capacity thus they will be able to manage the phenomenon of rapid urbanization.

Many cities in Indonesia has also faced the trend of rapid urbanization. Yogyakarta, a city located in the south part of Java, is an example of a city in Indonesia which has to deal with this phenomenon. Its urban area has physically expanded to its surrounding area, which is the administrative territory of Sleman and Bantul Regency. Together with several parts of Sleman and Bantul Regency, it has formed a conurbation area namely Kawasan Perkotaan Yogyakarta (Yogyakarta Urban Agglomeration Area/KPY).

The rapid urban expansion which occurs in the KPY area is not followed by the provision of the adequate urban infrastructure. As it has been highlighted by the Ministry of Housing and Public Infrastructure in 2003, the number of urban infrastructure such as water and sanitation system in Sleman-where the rapid urban expansion mostly occurs-is insufficient [2]. Local government in Sleman has to deal with this circumstance since the provision of basic urban infrastructure has become the responsibility of the local government at regency level.

The demand on sufficient urban infrastructure has brought another challenge, which is to provide an adequate financial resource for the provision of public infrastructure. Local government in Sleman needs to find an alternative resource of revenue generation other than the inter-governmental transfer. One possible option is by implementing the land value capture policy.

The basic principle of Land Value Capture policy is to capture some parts of the land value increment as the result of public actions to be utilized for the provision of public infrastructure [3].

There are two types of public action that may influence land value. First is the installation of public infrastructure, especially public transportation infrastructure and the second is the enactment of land use regulation which allows some part of the urban area to grow in the high intensity.

However, the proponents of the land value capture policy itself have been facing difficulties to implement this policy. It is due to the difficulties to figure out the part of land value increment that is resulted from public action thus it can be captured back for the public purpose [4].

Regarding the effect of the installation of public transportation infrastructure, the evidence is relatively clear. A literature review by Smith and Gihring [5] and a meta-analysis conducted by Debrezion, et al [6] show that the provision of public transportation infrastructure could generate land value uplift. Those findings are also supported by the case studies conducted by Mulley and Tsai in Sydney [7], and Ibeas, et al in Santander, Spain [8].

In contrast with the impact of public transportation infrastructure, the impact of land use regulation on land value is still debatable. One reason is that land use regulation itself has various forms [9], which may be different from one place to another. Another reason is due to its complexity and it is not always quantifiable [10]. This has caused the effect of land use regulation on land value could not be generalized and really depends on the local context.

Previous studies regarding the impact of land use regulation in the form of Urban Growth Boundary (UGB) show that the land use regulation may cause land value uplift. A simulation by Brueckner shows that the enactment of UGB may restrict land supply thus creating land value increment in the area delineated as urban area [11]. His argument is supported by Jaeger, et al with a case study in Portland, Oregon, who also concludes that the enactment of UGB would cause scarcity effect and amenity effect in the designated urban area thus it may give positive effect on land value [12]. Ball, et al who conducted a case study in Melbourne also provide an evidence regarding the positive effect of land use regulation on land value thus confirms Brueckner's argument [13].

On the other hand, Cho, et al came into different result when they measured the impact of the Urban Growth Boundary in Knoxville, USA [14]. He found that the enactment of UGB encourage development in the designated urban area but does not cause land value uplift. It is due to the land use regulation itself which is addressed to manage growth for the long-time span, thus it might be too early to measure the impact.

Since the effect of land use regulation on land value is context-bonded, it is interesting to examine the impact of land use regulation on land value in Indonesia. This research examines the effect of Sleman Regency Spatial Plan 2011-2031, which has been enacted in 2012, on the land value.

The spatial plan stipulates the spatial structure plan of Sleman Regency, which aims to indicate which area that will be the centre of social and economic activity at the national, regional, and local level. The highest hierarchy in the spatial structure plan of Sleman Regency is the area named as Pusat Kegiatan Nasional (National Activity Centre/PKN). The PKN area will bear the urban function as the centre of social and economic activity at the national level. This area consists of all KPY area in Sleman Regency.

The area delineated as PKN is prepared to be the growth centre in Sleman. Based on the spatial plan, it is allowed to develop high rise building, medium and high-density housing, and commercial activity in the PKN area. The high intensity of social and economic activity is also permitted in this area. On the contrary, no social and economic activity at a large scale can be developed in the non-PKN Area. The land use conversion is very limited outside the PKN Area to maintain its function as the agricultural land.

This spatial plan is expected to take effect on land value. The enactment of this kind of regulation may result into what is so called by Alterman as "windfall" [3]. According to Brueckner, when this type of land use regulation is enacted, the demand for land in the area where the high intensity of development is allowed will be high [11]. Since the urban land value is mostly driven by its demand side rather than the shift in the supply of land, the enactment of Sleman Regency Spatial Plan is expected to increase the demand for land in the PKN area thus resulting into land value uplift in the PKN Area.

Due to lack of official data regarding land transaction in Sleman Regency, a limited area is selected as the case study area. Ngaglik district in Sleman Regency is selected as the case study area. Among six districts in Sleman Regency which are delineated as the part of Kawasan Perkotaan Yogyakarta, Ngaglik district could provide an interesting case to be examined. Physical development rapidly occurs in this district, especially along the Provincial street which connects Yogyakarta City Centre with the recreational area in Kaliurang, Yogyakarta. The physical growth is also stimulated by the existence of a notable university in the north of Ngaglik District, which is Universitas Islam Indonesia.

Even though the physical development in this district happens in almost similar scale, only south part of this district is delineated as the part of KPY. This situation is match with the concept of the imaginary city proposed by Brueckner to examine the impact of UGB. Therefore, for the purpose of this study Ngaglik District is selected as the case study. The result of this research is expected to be the scientific basic for the implementation of land value capture policy in Sleman Regency, especially regarding which part of land value increment that can be captured back for the public purpose.

## 2. Method

As it has been highlighted by Cheshire and Sheppard, the form of land use regulation differs from one place to another [9]. This makes the effect of land use regulation on land value may vary. The effect of land use regulation on land value thus could not be separated from its context. Therefore the co-variance case study approach is selected as the research strategy [15]. By utilizing co-variance case study approach, this research could isolate the effect of the enacted spatial plan on land value in the case study area from other factors that may influence the land value, such as the distance from the Central Business District (CBD), the proximity to public facilities, and the physical attribute of the parcel of land itself.

The dataset used in this research is a panel data consists of the information regarding the transaction price of a plot and a set of plot characteristics. Since the data of land transaction price is not publicly open, the data was collected by conducting a field survey. There are 253 data of land transaction during the period of 2006-2016 in the case study area. The data regarding the distance of the plot to the Yogyakarta City Centre and to the nearest public facilities was collected by conducting a spatial analysis using GIS Software. The data is then pooled to be analyzed.

The model performed in this research is the model for panel dataset. Due to the limited number of data that could be collected, it is only possible to perform a Pooled Least Square (PLS) analysis. The statistic test was run using STATA Software. There are two steps on running the statistical modelling. At the first attempt, the dependent variable was regressed with all the independent variables except the interaction variable. At the second attempt, the interaction variable was included.

## 3. Data and Result

### 3.1. Land Value Fluctuations in Ngaglik District

In order to investigate the effect of the Sleman Regency Spatial Plan on land value, it is important to take a look at the fluctuation of land value in the case study area. Based on the data of land asking price in Ngaglik district, the land value in the case study area tends to increase during the period of 2009-2015.

The sub-districts in the PKN area have experienced land value uplift at the higher rate rather than the sub-district outside the PKN area. During the period of 2009-2011, the difference of the average land value between sub-districts which are delineated as PKN area (Sariharjo, Sinduharjo, and Minomartani) and sub-districts which are delineated outside the PKN area (Sukoharjo, Sardonoharjo, and Donoharjo) is not too significant. It has been tested through the Mann-Whitney U Test, which is resulted in the p-value of 0.024.

The difference of land value between the area delineated as PKN area and the area outside PKN area is getting more significant in 2012. By utilizing the Mann-Whitney U-Test to examine the gap of

land value in both area, the p-value for the difference in land value between PKN area and non-PKN area is 0.001.

Finally, when the similar test is performed to examine the gap in land value between PKN Area and Non-PKN area, the result shows that the difference is getting more significant. The test resulted in the p-value of 0.000. It is also can be observed in Figure 2, which shows that the gap in land value between PKN and Non-PKN area becomes greater since 2012.

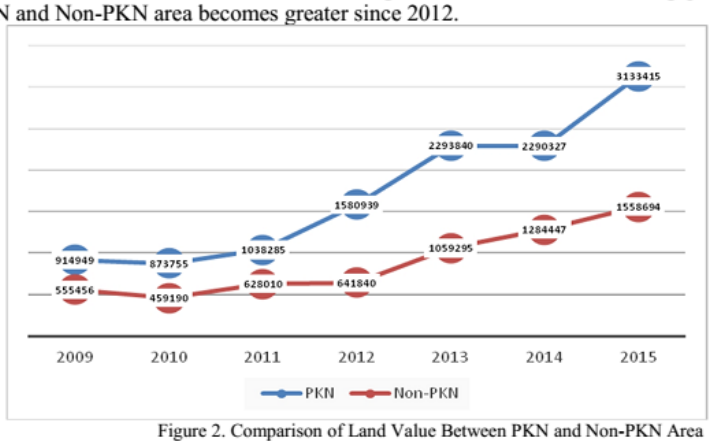


Figure 2. Comparison of Land Value Between PKN and Non-PKN Area

This condition meets the situation depicted by Brueckner in an imaginary city [11]. When a land use regulation-which allows some part of the urban area to grow in a high density and intensity while limiting other parts to grow- is enacted, a gap of land value between the developable area and non-developable area will be more significant. This is due to the high demand of the developable land while the supply of developable land is limited. This creates what is so called as scarcity effect.

Even though the comparison of land value between the PKN and non-PKN area may confirm the theory proposed by Brueckner, the further examination is still needed to investigate whether the land value gap has resulted from the enactment of the Sleman Regency spatial plan or from the other factors that may influence the land value.

### 3.2. The Effect of Spatial Plan on Land Value

Even though the analysis on the land asking price data shows that there is a significant land value uplift in the PKN Area after the enactment of Sleman Spatial Plan, this could not automatically be attributed to the enactment of the land use regulation. Therefore, this research performs a statistical model based on Hedonic Price Model (HPM) to figure out whether the land value uplift is the result of the enactment of the land use regulation or there is another factor that has a strong influence on land value. HPM is proposed by Rosen in 1984 and it is usually used for the valuation of real estate property [16]. HPM is utilized to figure out the intrinsic factor that determines land value. According to Rosen, the value of a real estate property is determined by a set of its explicit and implicit characteristics. This model itself is based on Multiple Linear Regression Analysis.

The land value is determined by several factors, such as its physical characteristics, its absolute and relative location, demographic characteristics, the availability of amenity, and the land use regulation. In the model, the land value is treated as the dependent variable, while the physical characteristics of a plot, absolute and relative location, demographic characteristics, and the availability of amenity are treated as the independent variable. The complete list of both dependent and independent variable could be seen in Table 1.

The variable used for measuring the impact of the land use regulation is an interaction variable between the time of the transaction and the indication of the plot location based on the Sleman

Regency Spatial Plan. The assumption here is that the land value uplift will be more significant after 2012 because of the enactment of the Sleman Regency Spatial Plan which delineates some parts of the case study area as the part of PKN Area while the others are not. The variable used to measure the time of the transaction is a dummy variable which has the value of 1 if the plot was transacted after 2012 while 0 if the land was transacted before 2012. The variable used to measure the indication of the plot location is also a dummy variable, which has the value of 1 if the plot is located on the PKN Area, while 0 if it is located outside the PKN Area.

Table 1. List of Variable and Indicator

| Variable | Indicator | Value of Indicator |
|---|---|---|
| Land Value (Dependent Variable) | 1. Land price per square meter | Land asking price per square meter in Rupiah (Rp.) |
| Legal and Physical Characteristics | 1. Size of the transacted plot | Size of plot denoted in square meter (m2) |
| | 2. Dummy variable of Status of land as it is written in the land certificate | The data has the value of one (1) if it has a status of Sertifikat Hak Milik (SHM) Pekarangan, while the other will have the value of 0. |
| Location factor | 1. Distance from Yogyakarta City Centre | Distance from Yogyakarta City Centre denoted in kilometres (km) |
| | 2. Dummy variable of Road Status share a side with plot under a transaction | The data has the value of one (1) if a plot is located on the side of Provincial Road, while the others, which are neighbourhood road and the local road will be given value 0. |
| Availability of Amenity | 1. The Dummy variable for road quality | Dummy variable of road quality, with the asphalted road is given value 1 while the others will have value 0 |
| Distance from Public Facilities | 1. Distance from nearby elementary school | Distance to nearby elementary school both privately and publicly owned school denoted in kilometres (km) |
| | 2. Distance from nearby traditional market | Distance to nearby traditional market which is denoted in kilometres (km) |
| | 3. Distance from the nearby bus terminal | Distance to nearby bus terminal denoted in kilometres (km) |
| Location Factor | 1. Distance from Yogyakarta City Centre | Distance to the "zero point" of Yogyakarta City Centre, denoted in kilometres (km) |
| | 2. Dummy Road Status | The data has the value of one (1) if a plot is located on the side of National and Provincial Road, while the others are given the value of zero (0). |
| Demographic Factor | 1. Population density | Population density in the area where the transacted land is located, denoted in people per hectares (people/ha) |
| | 2. Percent population with a university degree | Percent population with a university degree in the area where the plot is located |
| Land Use Regulation | 1. Dummy variable indicates plot location based on RTRW Kabupaten Sleman 2011-2031 | Denoted as a dummy variable, with plot located inside urban area is scored as 1 and outside urban area is 0 |
| | 2. Dummy variable indicates the timing of land transaction whether it was before or after the enactment of RTRW Kabupaten Sleman 2011-2031 | Denoted as a dummy variable, with the plot was transacted after 2012 is scored as 1 and before is 0 |
| | 3. Dummy variable as the interaction between dummy indicates the location of the plot and dummy year | Denoted as a dummy variable, with the plot which was under transaction after the enactment of New Spatial Plan and located inside designated urban boundary has the value of 1 and the other is 0. |

Source: Author's Analysis, 2018

The result of the statistical modelling could be seen in Table 2, with the p-value for each variable is written in the parentheses.

Tabel 2. The Result of the Regression Analysis

| Independent Variable | | (1) | (2) |
|---|---|---|---|
| Physical Characteristics | Lot Size | -17.19208 | -16.41746 |
| | | (0.581) | (0.591) |
| | Dummy Land Status | 336244.3 | 404114 |
| | | (0.066) | (0.026)** |
| Absolute Location Factors | Distance from Yogyakarta City Centre | -106679.9 | -169673 |
| | | (0.242) | (0.065) |
| | Dummy Road Status | 2143158 | 2093111 |
| | | (0.000)** | (0.000)** |
| Relative Location Factors | Distance from the nearby public market | 124745 | 168030.7 |
| | | (0.543) | (0.406) |
| | Distance from the nearby Elementary School | 423349 | 353882.4 |
| | | (0.187) | (0.262) |
| | Distance from the nearby Bus Terminal | -260108 | -226297.3 |
| | | (0.029)** | (0.055) |
| Amenity Factors | Dummy Road Quality | 284026.4 | 322255 |
| | | (0.081) | (0.044)** |
| Demographic Characteristics | Density | -17.46776 | -65.31572 |
| | | (0.841) | (0.451) |
| | Percent of Population with a University Degree | -3479604 | -3610427 |
| | | (0.578) | (0.556) |
| The Enactment of Land Use Regulation | Dummy Year | 708965.2 | 271648 |
| | | (0.000)** | (0.186) |
| | Dummy Urban Boundary | 445459.4 | -267175.7 |
| | | (0.470) | (0.680) |
| | Dummy YearXUrban Boundary | | 941422 |
| | | | (0.002)** |
| Constant | | 2383074 | 3194302 |
| | | (0.021)** | (0.002)** |
| R-Square | | 0.4976 | 0.5177 |
| Adjusted R-Square | | 0.4724 | 0.4913 |

Source: Author's analysis, 2018

As seen in Table 2, several variables have the p-value lower than 0.05. This means that those variables are the significant factors in determining the land value in the case study area. In the model 1, the dummy variable of road status, distance from the bus terminal, and the dummy year variable have the p-value lower than 0.05. In the model 2, there are some shifts on p-value. The p-value of the land status and road quality become lower than 0.05 in the model 2. On the other hand, the p-value for the distance from the bus terminal has changed into slightly higher than 0.05, while the p-value for the road status remains at below 0.05.

This finding confirms the theory regarding the determinant of land value. As it is shown by the dummy road status variable, location factor is an important factor in determining land value. The interpretation of this variable is that if a plot is located beside the Provincial Road it will have a higher value than the others. In Yogyakarta itself, most of the commercial activities grow along the Provincial and National Road. The land along those Roads are valuable for doing economic activities. According to the Bid-Rent Theory proposed by Alonso, the commercial activity is the actor that can bid higher than their competitor [17]. It is due to their ability to generate profit from their activity.

Legal status also has an important role in determining land value. Even though it is not significant in the Model 1, its p-value is not far beyond 0.05. In the model 2, its p-value turns below 0.05. This result shows that the plot with Sertifikat Hak Milik-Pekarangan (deeds of ownership of a developable land/SHM-P) has a higher value than the others plot which does not have similar legal status.

The model also confirms the impact of public transportation hub on land value. The variable which measures the distance of each plot to the bus terminal has a p-value lower than 0.05 in the

model 1, and slightly higher than 0.05 in the model 2. It also has a negative sign, which means that if a plot is located further from the bus terminal, its value will be lower. This finding confirms the previous study regarding the impact of public transportation hub on land value. The existence of the public transportation hub brings a positive externality because it may increase the level of accessibility of the plot.

Finally, the variable used to measure the impact of the enactment of the Sleman Spatial Plan also shows the p-value lower than 0.05. The shift of Adjusted R-Square value in both model has strengthened its function as an interaction variable. Since the p-value is lower than 0.05, this variable may also become an explanatory variable for the dependent variable, which in this case is the land value. This means that the enactment of the land use regulation is a determinant factor of land value in the case study area.

This finding confirms the argument of Fainstein and Alterman regarding the impact of public action in term of land use regulation on land value. This spatial plan indicates the location where the physical development is allowed. The spatial plan also indicates the type and intensity of social and economic activity. Based on Alterman, this type of regulation may create a "windfall", in form of land value uplift [3]. This type of land use regulation may increase the land value in the area where the high intensity of development is allowed.

The enactment of a land use regulation may take effect on land value due to its scarcity effect and amenity effect [18]. Since the spatial plan stipulates the intention of the local government to restrict the land use conversion from the agricultural land to the developable land, this spatial plan has limited the supply of the developable land. This may cause what is so called by Jaeger as the scarcity effect.

Moreover, the land use regulation also stipulates the intention of the local government to upgrade the urban infrastructure in the PKN Area. The plot inside the PKN Area has an advantage in form of the availability of urban infrastructure. This could make the demand on the plot inside the PKN Area will increase. This could create what is so called as the amenity effect.

Those two effects of the enactment of a land use regulation are considered to give a positive effect on land value. The scarcity effect reduces the supply of developable land, thus it can be said to have an impact on the supply side. Meanwhile, the amenity effect increases demand on the developable land, thus it can be said to have an impact on the demand side. The shift on both demand and supply side over the developable land is the possible explanation of why the enactment of land use regulation may give a positive impact on land value.

## 4. Conclusion

Land value is determined by many factors. An important factor that determines land value is the public action. It is believed that the land value uplift occurs mostly due to the result of the public action. Accessibility improvement through the development of public transportation infrastructure and the enactment of the land use regulation are two types of public action that may create land value uplift.

The finding from this research confirms the theory regarding the effect of the public action in term of land use regulation on land value. The enactment of the Sleman Regency Spatial Plan has caused a significant land value uplift in the area delineated as PKN-Area (Urban Agglomeration Area). The evidence for this finding is the data of land asking price and the result of statistical modelling.

The pooled data of land asking price shows that the gap between the land value inside and outside the PKN-area has become wider since the enactment of the Spatial Plan in 2012. This condition meets the theory proposed by Brueckner, who argues that the land use regulation that aims to restrict physical development will create land value increase in the area where the development is allowed.

The result of the statistical analysis through Hedonic Price Modelling (HPM) is also in compliance with the aforementioned analysis. The enactment of the spatial plan-which is treated as an interaction variable- has a significant impact on land value in the case study area. The coefficient of this variable has a positive sign, which means that the enactment of the spatial plan has brought a

positive effect on land value for the area inside the PKN-Area. This finding supports the argument regarding the impact of land use regulation on land value.

Even though the result of this study shows its suitability with the theory regarding the effect of the public action on land value, the limitation of this study should be acknowledged. First, regarding the selection of the research method. This research utilizes the case study as the research method. This means that the result of this study is strongly context-bounded. The generalization of the result is limited only for the case study location. Second, regarding the data availability and the scope of the study. It is recommended that this research may be replicated in the future by utilizing the official data regarding the property value. This official data is used to conduct a better statistical modelling to figure out the intrinsic characteristics of land value. It would be better to cover a wider area in the future. Since this regulation is applied in the whole of Sleman Regency, it would be better to examine its effect in the whole area of Sleman Regency too.

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