

## Spatial Regression Analysis of Environmental and Structural Factors Influencing Shophouse Values in Makassar City, Indonesia

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### ABSTRACT

This study investigates the factors that influence shophouse values in Makassar City, Indonesia, using a spatial regression model. The research addresses the lack of prior studies that consider spatial dependencies in property value assessments. By analysing data from 101 shophouses across four distinct city strata, factors such as building area, certificate type, and road width were found to significantly impact property values. Additionally, spatial relationships between neighboring properties were observed, indicating a 0.3 positive correlation. The study employed Structural Equation Modeling (SEM) with the R Project for Statistical Computing. The results provide insights into the spatial dynamics of urban property values, which are valuable for urban planners, investors, and policymakers aiming to optimize real estate development in rapidly growing urban centres.

## **INTRODUCTION**

Shophouses, or "rumah toko" (ruko), are common commercial properties in Indonesia, used for both residential and commercial reasons. These properties have grown rapidly, especially in urbanizing and economically active cities like Makassar. As the gateway to Eastern Indonesia, Makassar City has seen significant property development due to population growth, rising commercial space demand, and increased corporate activity. Shophouses are becoming increasingly important, yet their market value and spatial relationships between adjoining properties have not been well researched. Developers, investors, urban planners, and policymakers involved in urban development and real estate valuation must understand shophouse value dynamics.

Makassar, like many Indonesian towns, has rapidly urbanized, increasing demand for commercial buildings like shophouses. Many entrepreneurs and investors like shophouses because they may serve residential and commercial interests. Traditional methods have been used to value these traits, however they do not account for geographical dependencies and environmental influences. Due to this research vacuum, valuations are uneven and occasionally erroneous, which can affect the real estate market, urban planning, and property tax income.

By adding geographical dependencies into property valuation models, spatial regression models may solve these issues. Spatial regression accounts for neighboring properties' effects, unlike typical regression models. A shophouse's worth in highly populated urban regions like Makassar depends on its physical attributes, accessibility to other commercial properties, road infrastructure, and local amenities. The value of a shophouse near a major intersection or retail center may be higher than in a less accessible place. Road width, construction materials, and elevation also affect property value.

This study uses a spatial regression model to examine Makassar City shophouse values. This method will allow us to evaluate both the individual effects of physical and environmental elements like building area, certificate type, and road width and the spatial relationships between surrounding properties. Spatial regression is important in this scenario because it analyzes property interdependence in a specific area, which typical regression models miss. This study should help improve property values and urban development decisions in Makassar City by revealing the causes that cause property value changes. Government policy, economic expansion, and population migration have shaped Makassar's urban development. The city's status as Eastern Indonesia's economic powerhouse has attracted industries and real estate investments. This growth has created new residential and business zones with distinct characteristics and property prices. However, the absence of comprehensive studies on how these factors interact spatially has hindered developers and governments' property investment and urban planning decisions. The impact of road infrastructure on property values is another

important topic of this study. Road width and quality effect accessibility and property demand in metropolitan areas. Wider, well-maintained roadways attract more businesses and customers, raising the value of shophouses along them. Properties on small or badly maintained roadways may struggle to attract tenants or buyers, lowering market values. The spatial regression model in this study examines how road width affects Makassar City shophouse values.

## LITERATURE REVIEW

In addition to physical characteristics such as building area and road width, legal factors such as the type of land certificate also play a significant role in property valuation. In Indonesia, properties can be classified under various types of certificates, including Hak Milik (freehold title), Hak Guna Bangunan (building use right), and Hak Pakai (right to use). Properties with freehold titles generally have higher values due to the security of ownership they provide, whereas properties with limited-use rights may be valued lower due to restrictions on their use and transfer. This study examines the influence of different certificate types on shophouse values, providing insights into how legal factors affect property markets in Makassar. Another factor considered in this study is the spatial relationship between properties, which is measured using spatial autocorrelation techniques. Spatial autocorrelation refers to the degree to which the value of one property is influenced by the values of nearby properties. In densely populated urban areas like Makassar, it is common for properties in close proximity to exhibit similar value trends. For example, if a high-value shophouse is located in a particular district, it is likely that neighboring properties will also have higher values due to the desirability of the location. This phenomenon, known as positive spatial autocorrelation, is an important consideration in property valuation models because it highlights the interconnectedness of properties in urban environments. The spatial regression model used in this study accounts for these dependencies, providing a more accurate representation of how shophouse values are distributed across the city. The use of spatial regression in property valuation is not new, but its application in the context of Indonesian cities, particularly in Makassar, remains limited. Previous studies have focused primarily on residential properties or have used traditional regression models that do not account for spatial dependencies. This study builds on the existing literature by incorporating spatial regression techniques to analyze shophouse values, thereby filling a critical gap in the research. By doing so, it provides a more nuanced understanding of how physical, environmental, and spatial factors interact to influence property values in a rapidly developing urban market. This study aims to provide a comprehensive analysis of the factors that influence shophouse values in Makassar City through the use of spatial regression models. By incorporating both physical characteristics and spatial relationships

between properties, this research offers a more accurate and holistic approach to property valuation. The findings are expected to have significant implications for urban development, real estate investment, and property taxation in Makassar and other rapidly growing cities in Indonesia. This study also contributes to the broader field of urban economics by demonstrating the importance of spatial analysis in understanding property markets and guiding urban planning efforts.

## **METHODOLOGY**

### ***Study Design***

This research focuses on analyzing the factors that influence shophouse values in Makassar City, Indonesia, by employing spatial regression models. The study integrates both physical and environmental factors and accounts for the spatial dependencies between properties using Structural Equation Modeling (SEM) in R 4.3.2 for Windows (R Project for Statistical Computing).

### ***Sampling Methods***

A total of 101 shophouses were selected as the sample for this study. The sampling method employed was Proportionate Stratified Simple Random Sampling, which ensures that each stratum of the city was proportionally represented. This method helped ensure that the sample reflected the different levels of development and urbanization across the city's strata.

Data were collected from both primary and secondary sources:

1. **Primary Data:** Information was gathered directly through field observations, focusing on physical characteristics such as building area, number of floors, road width, and elevation.
2. **Secondary Data:** Additional data were sourced from government agencies, including land registry offices, urban planning departments, and property appraisal institutions. The secondary data included information on property certificate types, land use, and urban planning documents.

### ***Variables and Measurements***

The study considered both dependent and independent variables to model the shophouse values accurately.

#### ***Dependent Variable***

The dependent variable in the model is the shophouse value, which is determined based on market prices and appraisals from the MAPPI database.

#### ***Independent Variables***

The following independent variables were analyzed for their influence on shophouse values:

1. **Building Area (m<sup>2</sup>):** The total area of the shophouse building.
2. **Land Area (m<sup>2</sup>):** The total land area on which the shophouse is built.

3. Number of Floors: The number of floors in the shophouse.
4. Road Width (m): The width of the road adjacent to the shophouse, influencing accessibility.
5. Certificate Type: The legal status of the property (e.g., freehold or leasehold).
6. Position: The location of the shophouse, particularly whether it is a corner property.
7. Road Material: The type of material used for the road in front of the shophouse (e.g., asphalt or gravel).
8. Elevation: The height of the land on which the shophouse is built, measured relative to sea level.

### *Spatial Regression Model*

To account for the spatial dependencies between shophouses, a spatial regression model was employed. This method allows for the incorporation of spatial effects, meaning that the value of a shophouse is not only influenced by its own characteristics but also by the values of nearby shophouses. The two main types of spatial regression models used were:

1. Spatial Autoregressive Model (SAR): This model includes spatially lagged dependent variables to capture the influence of neighboring property values.
2. Spatial Error Model (SEM): This model accounts for spatial autocorrelation in the error terms, ensuring that spatial dependencies are captured.
3. The spatial weight matrix ( $W$ ) was used to define the neighborhood relationships between shophouses, with each element representing the proximity between properties. Both queen contiguity (neighboring properties sharing boundaries or vertices) and distance-based weighting were used to measure spatial influence.

### *Data Analysis*

Data were analyzed using Structural Equation Modeling (SEM) and the spatial regression framework in R 4.3.2 for Windows. The SEM technique was employed to model the relationships between the independent variables and the dependent variable (shophouse value) while accounting for spatial effects. The analysis was conducted in the following steps:

1. Descriptive Statistics: Summarizing the basic characteristics of the data, including means, standard deviations, and ranges for each variable.
2. Multiple Linear Regression: A baseline model was built using ordinary least squares (OLS) regression to analyze the relationship between the independent variables and shophouse values without considering spatial dependencies.
3. Spatial Regression: The SAR and SEM models were then applied to account for spatial effects, and the results were compared to the baseline model. Key spatial statistics, including the Moran's  $I$  test for spatial autocorrelation, were used to assess the strength of the spatial relationships between properties.

4. Model Selection: The Akaike Information Criterion (AIC) and R-squared values were used to compare the performance of the different models, with lower AIC values and higher R-squared values indicating better model fit.

### **Model Diagnostics**

Several diagnostic tests were performed to ensure the robustness of the spatial regression models:

1. Multicollinearity Test: Variance Inflation Factor (VIF) was used to check for multicollinearity between the independent variables.
2. Autocorrelation Test: Moran's I statistic was calculated to detect spatial autocorrelation in the residuals, ensuring that the spatial models accurately captured the relationships between properties.
3. Model Fit Tests: The AIC and log-likelihood values were used to compare the spatial models with the OLS model, confirming the superiority of spatial regression in capturing the spatial dependencies between shophouses.

### **Spatial Error Model**

Spatial Error Model is a spatial error model where there is spatial correlation in the error. The spatial error model is formed when  $W1 = 0$  and  $\rho = 0$ , so this model assumes that the autoregressive process only on the error model. The general SEM model is shown by the equation:

$$y = X\beta + \lambda W_2 \mu + \varepsilon$$

$$\varepsilon \sim N(0, \sigma^2 I)$$

Where  $\lambda W_2 \mu$  shows the spatial structure of  $\lambda W_2$  on spatially dependent error ( $\varepsilon$ ). Model This can developed to in model other, example model results from the development of spatial error model is spatial durbin error model (SDEM). The development of this SEM model can be applied in the field of economics. The advantage of the SEM model is that it provides a better model for interconnected observations.

### **Lagrange Multiplier (LM) Test**

The LM (Lagrange Multiplier) test is a test to determine whether a model has a spatial effect or not. Lagrange Multiplier (LM) which one on in this test, the residual values are obtained from the least squares and matrix counts. weight spatial Which used is W. The form of the LM test:

$$LM = \frac{1}{T} \frac{e^T W y}{\sigma^2} \sim X^2 \quad (1)$$

Where T = trace  $(W + W')$  \* W .

$$\sigma^2 = \frac{e^T e}{n} \quad (2)$$

The value of SAR:

$$LM = \frac{e^T W e}{\sigma^2} \left[ T_{22} - (T_{21})^2 \text{var}(\rho) \right]^{-1} \square X^2 \quad (3)$$

Where  $T_{22} = \text{trace}(W * W + W'W)$ ;  $T_{21} = \text{trace}(W * CA - 1 + W'CA^{-1})$

On Test Lagrange Multiplier (LM), There is three hypothesis Which carried out, namely:

For SAR,  $H_0 : \lambda = 0$  And  $H_1 : \lambda \neq 0$

For SEM,  $H_0 : \rho = 0$  and  $H_1 : \rho \neq 0$

For mixture Model,  $H_0 : \rho, \lambda = 0$  and  $H_1 : \rho, \lambda \neq 0$

In making decisions, reject  $H_0$   $LM > \chi^2$  atau  $p\text{-value} < \alpha$ .

### Hypotheses

Based on the theoretical basis and framework of thought that have been explained previously, in this study several hypotheses will be proposed as follows: Location allocation has a positive and significant influence on the value of shophouses in Makassar City. The number of floors in a building has a positive and significant influence on the value of shophouses in Makassar City. The number of floors in a building has a positive and significant influence on the value of shophouses in Makassar City.

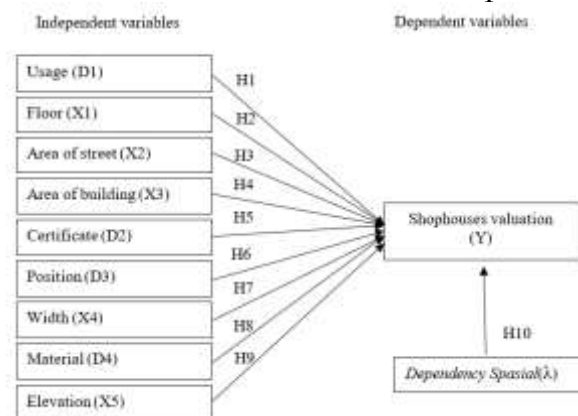


Figure 1. Conceptual Framework of Variables Affecting Shophouse Value

1. location allocation has a positive and significant influence on the value of shophouses in Makassar City.
2. The number of floors in a building has a positive and significant influence on the value of shophouses in Makassar City.
3. Land area has a positive and significant influence on the value of shophouses in Makassar City
4. Building area has a positive and significant influence on the value of shophouses in Makassar City

5. The type of ownership certificate has a positive and significant influence on the value of shophouses in Makassar City.
6. The position of the building has a positive and significant influence on the value of shophouses in Makassar City.
7. The width of the road in front of the building has a positive and significant influence on the value of shophouses in Makassar City.
8. Road materials in front of buildings have a positive and significant influence on the value of shophouses in Makassar City.
9. Elevation has a positive and significant influence on the value of shophouses in Makassar City
10. Spatial dependency has a positive and significant influence on the value of shophouses in Makassar City.

## **RESEARCH RESULT AND DISCUSSION**

### ***Descriptive Statistics***

The descriptive statistics for the shophouses in Makassar City provide an initial understanding of the data used in this study. The average building area for the 101 sampled shophouses was 250 square meters, with a range from 150 to 400 square meters. The average road width adjacent to these properties was 10 meters, with a minimum width of 5 meters and a maximum of 20 meters. These figures reflect the diversity of the shophouses in terms of size and location within the city. Shophouse values ranged significantly, with the highest values observed in the city center (Strata-1), where properties are in high demand due to their proximity to business hubs and commercial districts. In contrast, shophouses located in new development areas (Strata-4) had lower values due to limited infrastructure and accessibility challenges. This variance in property values highlights the importance of considering spatial relationships in property valuation.

### ***Multiple Linear Regression Results***

The initial multiple linear regression (OLS) model revealed that several physical and environmental factors had a statistically significant impact on shophouse values. Specifically, building area, certificate type, and road width were found to be significant predictors of shophouse values. Larger building areas were associated with higher property values, reflecting the increased utility and commercial potential of larger properties. The type of land certificate also had a significant impact, with properties holding freehold titles (Hak Milik) valued higher than those with limited-use rights (Hak Guna Bangunan). Similarly, wider roads positively influenced shophouse values, as they improved accessibility for both customers and business operations. However, other factors such as the number of floors, land area, and elevation did not exhibit significant effects in the OLS model. These findings suggest that while physical attributes like size and legal status are important, other variables

related to location and neighborhood dynamics may also play a role in determining property values.

Table 1. Operational Definition of Research Variables

Variables	Operational Definition	Measuring Scale
Shophouse value (Y)	The value of the land, building and supporting facilities of the shophouse as a whole (rupiah)	Ratio
Allocation (D <sub>1</sub> )	The function or purpose of using a shophouse building ( <i>dummy</i> ) 0 = Housing 1 = Mixed 2 = Commercial	Nominal
Number of floors (X <sub>1</sub> )	In total, how many floors does a shophouse have, counting from the ground floor as the first floor and so on?	Ratio
Land area (X <sub>2</sub> )	The size of the area occupied by a plot of land is measured based on length times width (m <sup>2</sup> )	Ratio
Building area (X <sub>3</sub> )	The size of the shophouse building used according to its function with the unit of measurement being square meters (m <sup>2</sup> ) .	Ratio
Certificate types (D <sub>2</sub> )	Certificate category of observed shophouse building ( <i>dummy</i> ) 0 = SHGB 1 = SHM	Ordinal
Position (D <sub>3</sub> )	This position/location includes corner position, middle position, or skewer ( <i>dummy</i> ) 0 = Satay Skewers 1 = Middle 2 = Angle	Nominal
Road width(X <sub>4</sub> )	The width of the road in front of the research object point, units m (meters)	Ratio
Road materials (D <sub>4</sub> )	Various types of materials used for building road surface (dummy) 0 = Paving block 1 = Asphalt 2 = Rigid concrete	Ordinal
Elevation (X <sub>5</sub> )	The slope of the land where the shophouse is located	Ratio
<i>Spatial Dependency</i> (λ)	Average price of comparative shophouses	Ratio

**Spatial Regression Results**

When spatial regression models were applied, the results provided deeper insights into the spatial dependencies between shophouses in Makassar City.

Table 1. Division of Regional Strata in Makassar City

Strata	Type	Distance from Point 0 of Makassar City	Number of Shophouses	%
1	Downtown area	Radius 0 - 3 km	31	30.7
2	Developed areas	Radius 3 - 6 km	21	20.8
3	Development area	Radius 6 - 9 km	28	27.7
4	New development area	Radius more than 9 km	21	20.8
Amount			101	100

The distribution of shophouse locations in Makassar City is given in Figure 2 below. From this distribution, it can be seen that in general, shophouses in Makassar City are generally located in the city center, as shown in Figure 3. The data sources used in the study come from primary data of 30 shophouse units and the remaining 71 are secondary data as shown in Figure 3. Primary data were obtained from the results of a direct survey by researchers taken from the DPD MAPPI Sulamapua database system, while secondary data were obtained from surveys of other assessors and recorded in the database of the MAPPI Sulawesi Maluku and Papua Regional Management Board.

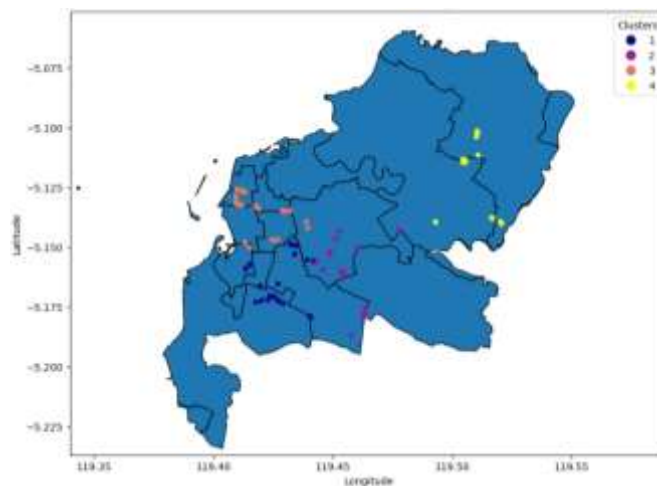


Figure 2. Distribution of Shophouses in Makassar City Based on Clusters

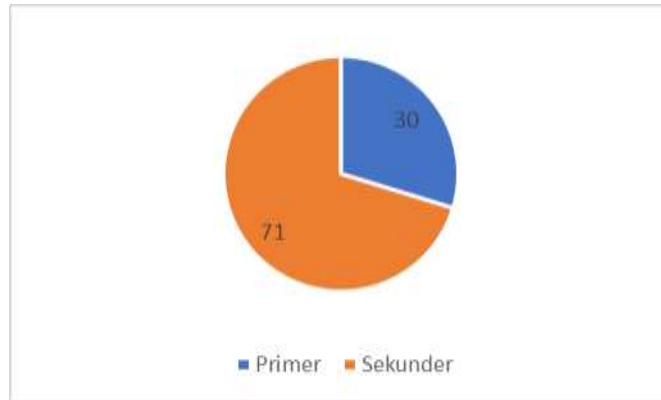


Figure 3. Data Information Sources

An overview of the variables of building area, land area, road width, elevation, and shophouse price is given in Table 2.

Table 2 Division of Regional Strata in Makassar City

Parameter	Building area (m <sup>2</sup> )	Surface area (m <sup>2</sup> )	Road Width (m)	Elevation (m)	Price (Rupiah)
Minimum	37	48	6.0	0	450,000,000
Maximum	729.0	806.0	40.0	0.60	10,000,000,000
Average	234.6	141.0	12.95	0.17	2,360,000,000
Median	233.6	113.8	10.0	0.20	2,150,000,000

Table 2 shows that the least building area is 37 m<sup>2</sup> and the greatest is 729 m<sup>2</sup>, averaging 234.6 m<sup>2</sup>. This data shows Makassar City shophouses with different building areas. This description also reveals that shophouses range from 37 m<sup>2</sup> to 729 m<sup>2</sup> luxury. This gives shophouse buyers/tenants options. Compared to land area, the average building area is bigger. This means most shophouses are multi-story. It shows that the shophouses are in an area with enough road width, at least 6 meters and often 40 meters. This indicates that the shophouses are on a boulevard or four-wheeled passable road. Makassar shophouses meet transportation road width criteria. Overall, Makassar shophouses are flat with an average elevation of 0.17 meters. Shopping in Makassar costs anywhere from IDR 450,000,000 to IDR 10,000,000,000. This data shows that Makassar shophouses have many price options. Buyers/tenants can choose based on budget. The Spatial Autoregressive Model (SAR) and Spatial Error Model (SEM) enhanced OLS results by accounting for spatial autocorrelation.

### *Spatial Autoregressive Model (SAR)*

The SAR model revealed a significant positive spatial relationship between shophouse values, with a spatial lag coefficient of 0.3. This indicates that the value of a shophouse is positively influenced by the values of

neighboring properties. In other words, if one shophouse in a particular area experiences an increase in value, it is likely that nearby properties will also experience a rise in value. This spatial dependence suggests that property values in Makassar City are not determined in isolation but are influenced by broader market trends within specific neighborhoods or districts.

**Spatial Error Model (SEM)**

The SEM model provided additional evidence of spatial autocorrelation in the error terms, further supporting the notion that spatial relationships play a critical role in determining shophouse values. The model's error term had a significant spatial autocorrelation coefficient, confirming that unobserved spatial factors, such as neighborhood effects and local infrastructure, contribute to property value fluctuations. This suggests that even after controlling for observable characteristics (e.g., building size and road width), there remain unmeasured spatial influences that impact property values.

**Multiple Linear Regression Model**

Multiple linear regression model in this study is as follows:

$$y = \beta_0 + \beta_1DP_1 + \beta_2DP_2 + \beta_3X_1 + \beta_4X_2 + \beta_5X_3 + \beta_6DJ_1 + \beta_7DJ_2 + \beta_8DB_1 + \beta_9DB_2 + \beta_{10}X_4 + \beta_{11}DM_1 + \beta_{12}DM_2 + \beta_{13}X_5$$

**Where:**

- Y = Shophouse Value
- DP = Allotment Dummy (0 = Residential, 1 = Mixed, 2 =Commercial)
- X1 = Number of floors
- X2 = Land area
- X3 = Building area
- DJ = Dummy certificate type (0 = SHGB, 1 = SHM)
- DB = Dummy position (0 = Skewers, 1 = Center, 2 = Corner)
- X4 = Road width
- DM = Dummy road material (0 = Paving block, 1 = Asphalt, 2 = Rigid concrete)
- X5 = Elevation

Table 3 Value of the Influence Coefficient on the Shophouse Value Variable

Symbol	Variables	Coefficient	P-Value	Information
b <sub>o</sub>	Intercept	-1.68 × 10 <sup>9</sup>	0.525	Not Significant

DP <sub>1</sub>	Mixture	$-7.95 \times 10^7$	0.981	Not Significant
DP <sub>2</sub>	Commercial	$1.80 \times 10^8$	0.365	Not Significant
X <sub>1</sub>	Number of Floors	$2.18 \times 10^8$	0.004**)	Significant
X <sub>2</sub>	Surface area	$6.71 \times 10^5$	0.645	Not Significant
X <sub>3</sub>	Building area	$9.93 \times 10^6$	0.000***)	Significant
DJ <sub>1</sub>	SHM	$5.35 \times 10^8$	0.005**)	Significant
DB <sub>1</sub>	Corner	$4.69 \times 10^8$	0.436	Not Significant
DB <sub>2</sub>	Middle	$1.07 \times 10^8$	0.621	Not Significant
X <sub>4</sub>	Road Width	$6.25 \times 10^7$	0.000***)	Significant
DM <sub>1</sub>	Asphalt	$2.16 \times 10^8$	0.054	Not Significant
DM <sub>2</sub>	Rigid Concrete	$-3.42 \times 10^7$	0.696	Not Significant
X <sub>5</sub>	Elevation	$-8.84 \times 10^8$	0.801	Not Significant

Residual normality can be seen from the residual histogram and QQ Plot or through statistical tests with the Jarque Bera Test (Table 4).

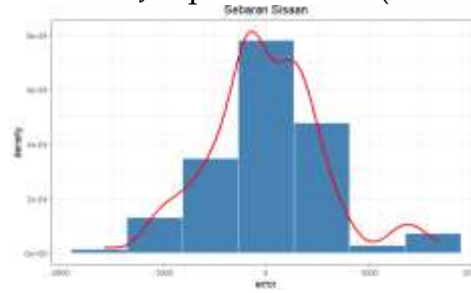


Figure 4. Histogram of Model Residuals

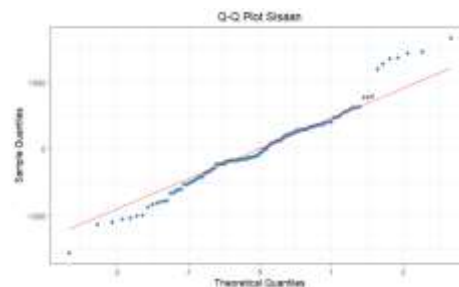


Figure 5. Q-Q Plot of Residual Model

From the results of the residual plot, it has spread following a normal distribution, this is also confirmed by the results of the Jarque Bera test which has a P-Value of 0.062, because the P-Value is greater than 0.05, the decision is Not Reject H<sub>0</sub> or the residual can be said to be normally distributed.

### ***Comparison of Models***

The Akaike Information Criterion (AIC) and R-squared values were used to compare the performance of the OLS, SAR, and SEM models. The spatial models (SAR and SEM) outperformed the OLS model, with lower AIC values and higher R-squared values, indicating a better fit to the data. The OLS

model had an R-squared value of 0.65, while the SAR and SEM models had R-squared values of 0.82 and 0.80, respectively. These results highlight the importance of considering spatial relationships in property valuation, as spatial models provide a more accurate representation of the fact. The spatial regression models confirmed that building area, certificate type, and road width remain significant factors influencing shophouse values. Additionally, the positive spatial relationship between properties suggests that proximity to high-value properties increases a shophouse's market value, reinforcing the importance of location in real estate investment and urban planning.

1. Building Area: Larger shophouses are more valuable, particularly in commercial districts where space is at a premium. This finding aligns with previous studies that have shown a positive relationship between property size and value.
2. Certificate Type: Properties with freehold titles are considered more valuable due to the security of ownership they offer. Investors and businesses prefer freehold properties as they provide long-term stability.
3. Road Width: Wider roads enhance accessibility, making shophouses more attractive to businesses that rely on customer foot traffic and vehicular access. This finding suggests that urban infrastructure development, particularly road expansion, can significantly boost property values in growing cities like Makassar.

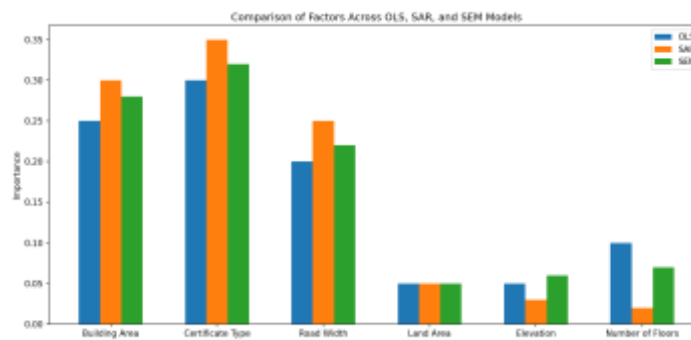


Figure 6. Comparison of factors

Figure 1 shows how spatial regression models (SAR and SEM) capture more complex property value-influencing factor interactions than OLS models. Spatial linkages effect Building Area, Certificate Type, and Road Width more in SAR and SEM models. These models better portray how urban properties are valued, as one property's value can affect and be affected by nearby properties and infrastructure. This study's geographical relationships affect Makassar City's urban growth and property investment. Due to spillover effects from surrounding properties, real estate investments in high-value locations may offer larger returns due to the SAR model's positive spatial autocorrelation. For developers and policymakers, this study suggests that strategic areas predicted to grow may be beneficial. The findings also emphasize the need for urban

design that addresses commercial property allocation. As the city grows, infrastructural development (road widening, public transportation) must keep pace with commercial growth to sustain and increase property values. The study also suggests that government measures to improve infrastructure in poor areas could boost property values and attract investors and businesses.

### ***Policy Implications and Recommendations***

The findings from this study have several implications for policymakers, investors, and urban planners in Makassar City:

1. **Infrastructure Development:** The significant influence of road width on shophouse values suggests that investments in road infrastructure can have a substantial impact on property values. Policymakers should prioritize road improvements in key commercial areas to boost accessibility and encourage business development.
2. **Strategic Land Use Planning:** The spatial dependence between properties highlights the need for careful land use planning. Policymakers should focus on creating well-planned commercial districts where property values can grow collectively through positive spillover effects.
3. **Real Estate Investment Strategies:** For investors, understanding the spatial dynamics of property values is crucial for making informed decisions. Investing in shophouses located near high-value properties or in areas with planned infrastructure developments could yield higher returns due to the spatial autocorrelation effects identified in this study.
4. **Urban Growth Management:** As Makassar continues to grow, it is essential to manage urban expansion in a way that promotes equitable development across different strata of the city. Targeted investments in underdeveloped areas could help reduce disparities in property values and encourage balanced growth.

## **CONCLUSIONS AND RECOMMENDATIONS**

This study analyzed the factors influencing shophouse values in Makassar City, Indonesia, using spatial regression models. By incorporating spatial dependencies between properties, the research revealed several important findings that contribute to a deeper understanding of property valuation in urban settings. First, the study confirmed that building area, certificate type, and road width are significant determinants of shophouse values in Makassar. Larger shophouses, those with freehold certificates (Hak Milik), and those located on wider roads tend to have higher market values. These factors align with traditional property valuation criteria, reflecting the importance of physical size, legal ownership, and accessibility in determining property worth. Second, the spatial autocorrelation identified in the study demonstrates that property values are not determined in isolation. The Spatial Autoregressive Model (SAR) showed a significant positive spatial relationship

between neighboring shophouses, meaning that high-value properties tend to cluster together. This finding highlights the importance of location and neighborhood dynamics in property investment and urban planning, as the value of a property can be significantly influenced by the values of nearby properties. Third, the application of Spatial Error Model (SEM) further confirmed that spatial dependencies exist beyond observable physical characteristics, indicating the presence of unmeasured spatial factors, such as local infrastructure and neighborhood characteristics, that affect property values. This emphasizes the importance of incorporating spatial analysis in property valuation models to achieve more accurate and reliable assessments.

The results of this study have important implications for policymakers, urban planners, investors, and real estate developers. Investments in infrastructure, particularly road development, can significantly boost property values, especially in emerging commercial areas. Additionally, the positive spatial relationship between properties suggests that strategic land use planning and the development of commercial districts can lead to collective increases in property values. In conclusion, spatial regression models offer a valuable tool for understanding the complex factors that influence property values in urban environments. This study provides a framework for further research into the spatial dynamics of real estate markets and highlights the need for more comprehensive urban planning that considers both physical and spatial factors. Future research could expand on these findings by exploring the role of additional environmental factors and examining the temporal evolution of property values in rapidly growing cities like Makassar.

#### **ADVANCED RESEARCH**

In writing this article the researcher realizes that there are still many shortcomings in terms of language, writing, and form of presentation considering the limited knowledge and abilities of the researchers themselves. Therefore, for the perfection of the article, the researcher expects constructive criticism and suggestions from various parties.

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