



Impact of Zoning Changes on Property Values in West Sulawesi: A Difference-in-Differences Analysis

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Abstract

This study explores how zoning regulations affect property values in West Sulawesi to understand the impact of zoning changes on real estate markets. The objectives include identifying the relationship between zoning modifications and fluctuations in property values and comparing areas that undergo zoning changes with those that do not. The study uses a quantitative research design and conducts a Difference-in-Differences analysis using secondary data from local property transactions, zoning maps, and demographic statistics from 2013 to 2023. The sample encompasses 150 neighborhoods throughout the province, offering a thorough perspective on local market dynamics. The results indicate a statistically significant positive correlation between zoning changes and rising property values, implying that updated regulations can effectively boost real estate market performance. The study also accounts for external factors, such as infrastructure development and local economic conditions, which significantly influence the outcomes of zoning changes. This research adds to the existing urban planning and property economics literature by demonstrating how zoning regulations can stimulate local economies and guide policy decisions. A key contribution of this study is its comparative analysis of property value changes in areas with and without zoning updates, providing valuable insights into the influence of zoning on property values in developing regions while emphasizing the importance of a holistic approach in assessing zoning impacts.

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Introduction

The rapid development of urban areas has made property valuation a crucial aspect of regional planning and development (Ratcliffe et al., 2021). In many regions, including West Sulawesi, land-use regulations significantly influence property values, especially those related to spatial planning or zoning policies. Zoning regulations determine the allowable uses of land and play a pivotal role in shaping the spatial distribution of economic activities, residential areas, and commercial developments (Ellickson et al., 2020). Prior studies have demonstrated that changes in land-use policies, such as converting agricultural land to residential or commercial areas, often increase property values in transition regions. For instance, research by Chikukwa and Matamanda (2024) highlighted that land values surged after new zoning regulations were implemented in urban fringe areas, driven by enhanced accessibility and commercial potential. Similarly, Freemark (2023) found significant increases in property prices following the rezoning of land for commercial use in coastal regions.

Zoning regulations have also become a critical focus in urban economics for their influence on property markets, land use, and economic growth. Globally, research indicates zoning policies may yield benefits and challenges, with their effects shaped by the financial and spatial dynamics of the region. For example, Brouwer and Trounstone (2024) examined how restrictive zoning in U.S. metropolitan areas increased property values by limiting supply but led to socioeconomic exclusion and inefficient land use. Rodríguez-Pose & Storper (2020) highlighted zoning's role in urban sprawl, emphasizing how its effects depend on market conditions and enforcement levels. In developing regions, zoning's impacts often diverge. Otieno (2024) identified the economic drawbacks of restrictive zoning in high-productivity areas, particularly its role in exacerbating regional inequality. Similarly, Goldman and Narayan (2020) linked zoning to speculative property value surges in rapidly growing areas, often disrupting local economies.

While these studies provide valuable insights, most focus on metropolitan contexts, leaving a gap in understanding zoning's effects in rural or developing regions. For instance, Webster et al. (2020) pointed out that zoning in peri-urban and rural areas often needs more economic planning rigour typically found in cities, resulting in unpredictable outcomes in the property market. For example, research by Nguyen and Kim (2020) has shown that insufficient zoning policies in areas transitioning from rural to urban can destabilize property markets, impacting both landowners and investors. Likewise, the study by Sun et al. (2020) highlights that well-defined zoning regulations play a crucial role in enhancing land-use efficiency and maintaining property value stability.

The unique blend of rural and urban areas in West Sulawesi provides an interesting opportunity to examine how zoning affects property values across different socioeconomic contexts. Previous research, such as that conducted by Yang et al. (2022), has emphasized the significance of contextual factors in the effectiveness of zoning, especially in regions experiencing rapid development. However, more comparative studies need to analyze changes in property values in areas that have undergone zoning updates versus those that have not, particularly in emerging regions like West Sulawesi. This research aims to fill this gap by drawing on insights from foundational studies to investigate the complex effects of zoning in mixed rural-urban settings.

This study builds upon prior research by focusing on the specific dynamics of zoning changes in West Sulawesi, Indonesia, and employs a robust methodological approach to address the identified gaps. It utilizes a Difference-in-Difference (DiD) analytical framework, a powerful tool for isolating the causal effects of policy changes over time. It incorporates external factors such as infrastructure development and local economic conditions. By comparing regions that have experienced zoning changes with those that have not, this research contributes to a nuanced understanding of zoning's effects on property markets in areas with varying development levels. Furthermore, this study adds to global discussions about equitable growth, sustainable land use, and economic inclusivity by demonstrating how zoning policies affect developing regions differently from established urban centres.

The study specifically compares property value changes in areas with zoning updates versus those without. This comparative approach in a mixed rural-urban setting is relatively unexplored, especially in regions like West Sulawesi with diverse socioeconomic conditions. This study's primary contribution lies in its detailed empirical analysis and comparative perspective, which expand the understanding of zoning's implications in non-metropolitan settings. This research aims to provide actionable insights for policymakers and stakeholders involved in regional planning and sustainable development by bridging global urban studies with local rural dynamics.

Literature Review

The impact of land-use regulations, particularly zoning, on property values has been extensively studied across various contexts, highlighting its critical role in shaping urban growth and real estate markets. Zoning policies dictate the permissible uses of land, influencing property values through land availability, accessibility, and infrastructure improvements. For instance, Domingo et al. (2021) found that zoning changes raising economic use classifications, such as converting

agricultural land to commercial or residential purposes, significantly increase property values. This effect is particularly pronounced in areas with improved accessibility and infrastructure, emphasizing zoning's interplay with external developments. Similarly, Han et al. (2020) examined zoning in China, showing that restrictive zoning policies limit land supply, increase property values, and exacerbate housing affordability challenges in densely populated urban areas.

Freemark (2020) provided further evidence of zoning's role in regional disparities in property values, noting that areas undergoing zoning revisions often experience accelerated property value appreciation compared to those without changes. Shertzer et al. (2022) found that zoning's impact varies significantly depending on local economic conditions, infrastructure, and law enforcement in suburban and rural contexts. Their research indicates that zoning-induced property value changes are more muted in less urbanized areas, aligning with Davis (2021), who reported that rural and suburban regions typically experience more minor price fluctuations than urban areas following zoning adjustments. These studies highlight the context-dependent nature of zoning's effects, which this research aims to explore further in West Sulawesi.

Soria et al. (2020) investigated zoning's influence on urban land use, utilizing multi-scenario simulations in Mexican cities to demonstrate how zoning plans can preserve land resources and promote sustainable urban growth. This perspective aligns with Rahman and Szabó's (2021) findings, which emphasize the potential of digitized zoning strategies to optimize land use efficiency and support sustainable development. The connection between zoning and broader socio-economic outcomes is also evident in studies by Yu (2024) and Brouwer & Trounstine (2024), who demonstrated that restrictive zoning practices contribute to rising property values, urban sprawl, and social inequities in high-demand regions. These findings underscore zoning's dual role as a driver of economic growth and a source of social and economic disparities.

Despite these comprehensive investigations, most studies predominantly focus on metropolitan areas with well-established real estate markets. For example, Freemark (2023) identified significant property value increases in urban areas following zoning changes, often driven by limited land supply and rising demand. However, fewer studies have explored how zoning impacts property values in less urbanized or developing regions like West Sulawesi. Research by Webster et al. (2020) noted the unpredictable outcomes of zoning in peri-urban and rural areas, where economic planning rigour is often weaker. This observation is particularly relevant to regions like West

Sulawesi, where zoning's effects may manifest differently due to mixed urban and rural characteristics.

This study addresses the gap in the literature by focusing on zoning's impact in West Sulawesi, examining both urban and rural settings. It compares property value changes in areas affected by zoning updates with those unaffected, offering a nuanced understanding of zoning's role in regional real estate dynamics. Additionally, the research builds on theoretical frameworks from urban economics and sustainable development, contributing to global discussions on equitable growth, sustainable land use, and economic inclusivity. By incorporating specific regional variables, this study enhances the contextual understanding of zoning's implications, bridging existing gaps between urban-focused studies and the unique challenges of developing regions.

This literature review establishes the foundation for analyzing zoning's varied effects, emphasizing the need for localized investigations to complement global findings. By situating West Sulawesi within this broader discourse, the study seeks to provide insights with both theoretical and practical relevance.

Method

This study employs a comparative research design to examine the impact of zoning regulation changes on property values in West Sulawesi. The research focuses on comparing property prices in areas affected by zoning changes with areas where no changes have occurred, allowing for the analysis of the effects of land-use regulation on property value dynamics.

The object of this research is the property market in West Sulawesi. The sample consists of two groups of regions. Group 1 includes regions where zoning changes have occurred, such as areas rezoned from agricultural to residential or commercial use. Group 2 consists of regions with stable zoning where no land-use regulation changes have occurred over the last ten years. The sample selection follows a purposive sampling method, where regions known for significant zoning updates will be contrasted with regions that have maintained their original zoning regulations. This approach allows for a clear comparison of the impact of zoning changes on property values.

Operational Definition and Measurement Variables refer to how a concept or variable is measured and operationalized in research to be used objectively and consistently (Haucke et al, 2021). Operational Definition is a specific explanation of how an abstract concept or variable is translated into a form that can be measured or observed (Goertz, 2020). This ensures that other researchers can measure the variable empirically and consistently. Measurement Variables refer to

the variables used in research and how they are measured (Hahs-Vaughn & Lomax, 2020). This includes the units used to measure the variable and the measurement time. Operational Definition and Measurement Variables in this study are as follows:

Table 1. Operational Definition and Measurement Variables

No.	Variable	Description	Measurement
1	Zoning Change	Refers to the modification of land-use regulations in a given region.	Categorized into two groups: areas with zoning changes and those without.
2	Property Value	The average price per square meter of land or property in each region.	Measured over five years to capture pre- and post-zoning change impacts.
3	Control Variables	Infrastructure development, economic growth, and population density in each region.	Proximity to major roads, availability of public services, regional GDP, and population density.

The study primarily explores the effects of zoning changes on property values, considering zoning modifications as the intervention of interest. These modifications are categorized into two groups for analysis: regions that have undergone zoning changes and those that have not. This categorization allows for a comparative and impact analysis of how zoning influences property prices (Freemark, 2020).

The dependent variable in this research is property value, which is assessed by the average price per square meter of land or property within these regions. The analysis spans a five-year period to capture both the pre- and post-zoning change effects, offering insights into the dynamic impacts of zoning on property values (Siegan, 2020).

Additionally, the study incorporates control variables such as infrastructure development, economic growth, and population density to isolate the zoning effect. Infrastructure development, measured by proximity to major roads and availability of public services, directly affects land desirability and value (Vichiensook et al., 2021). Economic growth is represented by regional GDP, which reflects the overall economic health and influences investment and demand in property markets (Tham et al., 2021). Lastly, population density, which can significantly sway property demand and values, is also considered, highlighting how denser areas may command higher property values irrespective of zoning changes (Murray & Limb, 2023). These factors are assessed using measurable indicators, such as distances, availability of public services, GDP figures, and population

data, which helps maintain consistency in the analysis.

Next, the data for this study will be collected using secondary data from reliable sources. Property price data will be gathered from real estate listings, local government records, and national property price databases to view property values in different regions comprehensively. Information on zoning regulations will be sourced from local government regulations, development plans, and land-use maps of West Sulawesi, ensuring accurate identification of areas where zoning changes have occurred. Socioeconomic data will be obtained from the Central Statistics Agency (BPS) and relevant local government publications, including economic growth, population density, and infrastructure development. These diverse data sources will enable a thorough analysis of the impact of zoning changes on property values.

This study's analysis uses comparative statistical methods to identify differences in property values between regions experiencing zoning changes and those without. This section details the statistical approaches and elaborates on their application in the research to ensure clarity and reproducibility.

The data analysis in this study employs comparative statistical methods to examine the impact of zoning changes on property values, emphasizing descriptive statistics and the Difference-in-Difference (DiD) methodology. Descriptive statistics are used to summarize and present data trends, including averages, frequencies, percentages, and distributions, offering a clear view of property values, zoning changes, and relevant control variables like location and demographic factors. This analysis highlights patterns and variations through visual aids such as tables and charts, allowing for a foundational understanding of the data structure (Remler & Van Ryzin, 2021; Cooksey, 2020).

To assess causal relationships, the study employs the DiD approach, which measures the impact of zoning changes by comparing property value changes over time between regions with and without zoning modifications. Key variables include property prices (Y_{it}), zoning changes ($ZoningChange_t$), and periods ($Time_t$), with an interaction term to capture the combined effect. The analysis assumes parallel trends between treatment and control groups in the absence of zoning interventions, a critical prerequisite for isolating the zoning effect. Control variables, such as infrastructure and population dynamics, are incorporated to address potential confounding factors (Griffin et al., 2021; Goodman-Bacon, 2021).

The DiD model's effectiveness lies in its ability to evaluate policy impacts while mitigating selection bias. The results will highlight how zoning changes influence property value dynamics,

considering regional and temporal variations. By defining key terms and detailing the data collection process, the analysis ensures clarity and replicability, aligning with best practices in policy and economic research (Roth et al., 2023; Basu & Small, 2020). This comprehensive approach provides valuable insights into the interplay between zoning policies and real estate markets in developing regions. The DiD equation is expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 ZoningChange_i + \beta_2 Time_t + \beta_3 (ZoningChange_i \times Time_t) + \epsilon_{it} \quad (1)$$

The analysis utilizes a Difference-in-Differences (DiD) framework to estimate the causal impact of zoning changes on property values. The dependent variable Y_{it} represents the property price in region i at time t . The key explanatory variables include $ZoningChange_i$, a dummy variable indicating whether a zoning change occurred in region i (coded as 1 if a change occurred and 0 otherwise), and $Time_t$, a dummy variable representing the time period (coded as 1 for the post-change period and 0 for the pre-change period). The interaction term $ZoningChange_i \times Time_t$ captures the differential effect of zoning changes over time, isolating the policy's impact on property values. Finally, ϵ_{it} represents the error term, accounting for unobserved factors that might influence property prices. This model allows for a robust comparison of property value trends between regions affected by zoning changes and those that were not, both before and after the implementation of zoning policies.

To test the hypothesis, a t-test will be performed to assess whether there is a statistically significant difference in property prices between the two groups (regions with and without zoning changes). The DiD model will also be used to estimate the magnitude of zoning changes' effect on property values. The research hypothesis is as follows:

H0: Zoning changes do not significantly affect property values in West Sulawesi.

H1: Zoning changes significantly positively affect property values in West Sulawesi.

The data used in this study was collected from various reliable sources to ensure comprehensive analysis (see Table 2). Zoning Change data was obtained from local government records, which detail amendments to land-use regulations, including reclassifications such as transitions from agricultural to residential or commercial use. These records were reviewed from official zoning plans, public notices, and legislative documents specifying the timing and locations of zoning changes. Property Value data was sourced from real estate listings, encompassing average property prices per square meter. This data was collected through online real estate platforms,

property market reports, and municipal transaction records, and it was cross-referenced with professional valuation reports to validate accuracy. Infrastructure data, reflecting proximity to major roads and public services, was derived using GIS (Geographic Information System) data provided by local governments. Spatial analysis was employed to calculate accessibility scores based on distance and travel times to essential services like transportation routes, schools, and healthcare facilities. Economic Growth information, represented by annual GDP growth rates, was extracted from Indonesia's Central Statistics Agency (BPS). This data came from regional economic reports and sectoral breakdowns of GDP, verified against development plans and statistical publications. Lastly, Population Density figures were gathered from BPS, utilizing census records and mid-year population estimates. Demographic survey data and geographic mappings were used to calculate the number of people per square kilometer in each study region. This multi-sourced approach ensures the data's reliability and robustness for analysis.

Table 2. Data Description

No.	Variable	Description	Source
1	Zoning Change	Change in land-use regulation (Dummy: 1 if changed, 0)	Local government records
2	Property Value	Average property price per square meter	Real estate listings
3	Infrastructure	Proximity to major roads, public services	Local government data
4	Economic Growth	Annual GDP growth in each region	BPS
5	Population Density	Number of people per square kilometer	BPS

Result and Discussion

The study results compare property values in West Sulawesi between areas that underwent zoning changes and those that remained unchanged. The analysis using the Difference-in-Difference (DiD) method highlights significant differences in property values while controlling for infrastructure, economic growth, and population density.

Descriptive analysis revealed that regions experiencing zoning changes saw property values increase by an average of 15% compared to areas without such changes. The most significant increases occurred in areas rezoned for commercial or residential use, reflecting heightened demand and economic potential. These results align with Landis and Reina (2021), who found that rezoning for higher-value uses raises property prices significantly.

The model's goodness-of-fit was assessed, yielding an R^2 of 0.72 and an adjusted R^2 of 0.68, indicating that the model explains 68% of the variance in property values after accounting for the number of predictors used. The R^2 and adjusted R^2 values firmly fit the Difference-in-Difference (DiD) model, confirming its effectiveness in capturing the variance in property values attributable to zoning changes and other factors. Among the control variables, infrastructure emerged as the most significant determinant, with properties located near major roads and public services experiencing the highest increases in value, likely due to enhanced accessibility and convenience. Economic growth also positively influenced property values, reflecting the region's broader economic activities and investor confidence. However, the effects of population density were context-dependent. At the same time, it boosted property values in urban areas due to higher demand, and it had a negligible impact in rural areas, possibly due to limited economic activity or development. These findings underline the importance of infrastructure and economic growth in driving property value changes and the nuanced role of population density based on regional characteristics.

The analysis further explored the differential impacts of residential and commercial zoning changes on property values. Areas rezoned for residential purposes saw moderate price increases, primarily driven by heightened demand for housing and the proximity to essential amenities such as schools and parks, which enhance livability. In contrast, areas undergoing commercial rezoning experienced more significant price hikes, reflecting the higher profitability and development potential of land designated for business activities. This suggests that commercial zoning changes typically result in greater property value appreciation than residential ones, underlining the critical influence of economic activities on land valuation. These findings highlight the complex and context-dependent nature of zoning impacts on property markets.

Table 3. Difference-in-Difference Estimation Results

Variable	Coefficient	t-Statistic	p-Value
ZoningChange	0.080	2.75	0.006**
Time	0.045	2.20	0.029*
ZoningChange × Time	0.150	4.10	0.001**
Infrastructure	0.067	3.45	0.002**
Economic Growth	0.035	1.80	0.075

The Difference-in-Difference (DiD) analysis confirmed the hypothesis that zoning changes significantly affect property values. Based on Table 3, it shows that the interaction term between zoning changes and periods was positive and statistically significant, indicating that properties in

areas with zoning modifications experienced more rapid price increases over time compared to those in regions without zoning changes. This finding is detailed in Table 3, which shows a coefficient of 0.150 for the interaction term, with a p-value of 0.001, suggesting a significant effect.

Several econometric checks were performed to detect potential biases or specification errors in the model and ensure the robustness of the results. The results of these tests indicate that the model is well-specified and reliable. First, the multicollinearity test using the Variance Inflation Factor (VIF) revealed that all VIF values were below the threshold of 10, suggesting no significant multicollinearity among the independent variables (Gujarati & Porter, 2010). Second, the heteroskedasticity test using the Breusch-Pagan test produced a p-value of 0.312, more significant than the 0.05 significance level, indicating no evidence of heteroskedasticity in the model (Wooldridge, 2016). Lastly, the autocorrelation test using the Durbin-Watson statistic yielded a value of 2.05, falling within the acceptable range and suggesting no issues with autocorrelation in the residuals (Feng, 2022).

Regarding the control variables, economic growth showed a positive coefficient of 0.035 with a p-value of 0.075, indicating a marginally significant positive effect on property values. However, it was not statistically significant at the 5% level. Meanwhile, population density had a coefficient of 0.005 with a p-value of 0.22, suggesting that it did not significantly impact property values in the studied regions. These findings underscore the importance of economic growth in influencing property values. At the same time, the lack of significance for population density suggests that other factors may play a more prominent role in property value changes in these areas. The econometric checks confirm the model's validity, ensuring that the results are not driven by model misspecification or bias.

The positive interaction effect between zoning changes and time confirms that properties in regions where zoning regulations were updated experienced significant price growth. The effect was even more pronounced in areas with improved infrastructure, suggesting that zoning changes and infrastructure developments accelerate property value increases.

The findings highlight that zoning changes create opportunities for land use optimization, thereby driving up demand for properties in rezoned areas. This is consistent with the theoretical framework provided by Rodríguez-Pose and Storper (2020), which suggests that introducing more economically viable zoning regulations results in higher land values. Additionally, areas benefiting from better infrastructure further amplify the positive effects of zoning changes, as seen in studies by Zhou et al. (2022).

Zoning changes led to an overall increase in property values. The rate of increase varied significantly depending on the region's infrastructure development. In areas with limited infrastructure, the impact of zoning changes was relatively muted, reflecting the critical role that accessibility and services play in maximizing the economic benefits of land-use regulation changes. This aligns with the findings of Gao et al. (2020), who observed that zoning regulations have varying effects based on the region's economic conditions.

This research provides a novel contribution to the literature by focusing on a region that has been underrepresented in studies of zoning and property values, namely West Sulawesi. Previous studies have focused mainly on urbanized regions or developed economies, leaving a gap in understanding how such regulatory changes impact property values in more rural or developing areas. By filling this gap, this study offers practical insights for policymakers in developing regions like West Sulawesi, suggesting that zoning changes can significantly influence property markets if accompanied by infrastructure improvements.

The results of this study suggest that local governments should consider zoning updates as a strategic tool for regional development, particularly when aligned with infrastructure investments. This dual approach can stimulate property markets and encourage investment, ultimately benefiting the overall economic growth of West Sulawesi. However, careful planning is necessary to ensure that zoning changes do not result in unintended consequences such as housing affordability issues or uneven development. This study introduces the idea that zoning changes when implemented in tandem with infrastructure upgrades, offer a pathway to enhancing property values and regional economic growth in developing areas like West Sulawesi.

Conclusion

This research aimed to investigate the impact of zoning regulations on property values in West Sulawesi, specifically by comparing areas that experienced zoning changes with those that did not. Using a Difference-in-Differences analysis, the study revealed that regions with zoning changes saw significant increases in property values, underscoring the positive influence of zoning on property value growth. This study contributes to the existing literature by filling a gap in research concerning zoning effects in developing regions, particularly in mixed rural-urban contexts. It highlights zoning as a crucial tool for enhancing real estate markets and fostering local economic development, especially when paired with supportive infrastructure initiatives. From a policy perspective, the findings suggest that zoning reforms, along with incentive-based housing programs

and public-private partnerships (PPPs) for infrastructure funding, can effectively promote balanced and sustainable regional growth. Additionally, engaging communities in the planning process can help ensure that zoning policies align with local needs and garner public support. However, the study does have limitations due to its reliance on secondary data, which restricts a deeper analysis of local property market dynamics. Future research should focus on primary data, explore economic and demographic shifts, and assess how collaboration among stakeholders, public perception, and local economic conditions influence the effectiveness of zoning. These insights could further inform urban planning initiatives and support equitable, sustainable development.

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