

KETIMPANGAN PEMBANGUNAN DAN KONVERGENSI EKONOMI DI KAWASAN BODETABEK: ANALISIS DETERMINAN OUTPUT EKONOMI TAHUN 2018-2024

DEVELOPMENT INEQUALITY AND ECONOMIC CONVERGENCE IN THE BODETABEK REGION: AN ANALYSIS OF THE DETERMINANTS OF ECONOMIC OUTPUT, 2018-2024

Loula Lourinsa^{1*}, Nenik Woyanti²

¹Economics, Faculty of Economics and Business, Diponegoro University; Indonesia

²Economics, Faculty of Economics and Business, Diponegoro University; Indonesia

*Korespondensi: loulalourinsa@students.undip.ac.id

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ABSTRAK

Pembangunan ekonomi di kawasan Bodetabek memiliki peran strategis dalam mendukung pertumbuhan ekonomi nasional, tetapi konsentrasi aktivitas ekonomi, investasi, tenaga kerja, dan infrastruktur yang tidak merata berpotensi mempertahankan ketimpangan antarwilayah. Kondisi ini semakin penting dikaji setelah pandemi COVID-19 karena pemulihan ekonomi kawasan metropolitan tidak berlangsung secara merata. Penelitian ini bertujuan menganalisis ketimpangan pembangunan, menguji β -convergence dan σ -convergence, serta mengidentifikasi pengaruh investasi, tenaga kerja, dan infrastruktur terhadap regional real GRDP di kawasan Bodetabek. Penelitian menggunakan data sekunder kuantitatif dari delapan kabupaten/kota selama 2018-2024. Analisis dilakukan menggunakan Indeks Williamson, β -convergence, σ -convergence, dan regresi data panel dengan Fixed Effect Model (FEM). Hasil menunjukkan bahwa ketimpangan pembangunan masih tergolong tinggi. Analisis β -convergence tidak menunjukkan konvergensi, ditandai koefisien beta positif dan tidak signifikan, sedangkan σ -convergence menunjukkan bahwa penurunan kesenjangan antarwilayah belum berlangsung secara berkelanjutan. Hasil regresi menunjukkan bahwa investasi berpengaruh positif dan signifikan terhadap regional real GRDP, yang menunjukkan pentingnya akumulasi modal dalam meningkatkan kapasitas ekonomi regional. Sebaliknya, tenaga kerja dan infrastruktur tidak berpengaruh signifikan, mengindikasikan bahwa partisipasi tenaga kerja dan panjang jalan dalam kondisi baik belum cukup menjelaskan variasi regional real GRDP antarwilayah.

Kata Kunci : Ketimpangan Pembangunan, konvergensi Ekonomi, Indeks Williamson

ABSTRACT

Economic development in the Bodetabek region plays a strategic role in supporting national economic growth; however, the uneven concentration of economic activity, investment, labor, and infrastructure may perpetuate interregional disparities. This issue has become increasingly important following the COVID-19 pandemic, as economic recovery across metropolitan areas has not been evenly distributed. This study aims to analyze development inequality, examine β -convergence and σ -convergence, and identify the effects of investment, labor, and infrastructure on regional real GRDP in the Bodetabek region. The study uses quantitative secondary

data from eight districts/cities covering 2018-2024. The analysis employs the Williamson Index, β -convergence, σ -convergence, and panel data regression using the Fixed Effect Model (FEM). The results show that development inequality remains relatively high. The β -convergence analysis provides no evidence of convergence, as indicated by a positive and statistically insignificant beta coefficient, while σ -convergence shows that the reduction in interregional disparities has not occurred consistently. The panel regression results indicate that investment has a positive and significant effect on regional real GRDP, highlighting the importance of capital accumulation in strengthening regional economic capacity. In contrast, labor and infrastructure have no statistically significant effects, indicating that labor force participation and road length in good condition are insufficient to explain variations in regional real GRDP across the study areas.

Keywords: *Development Inequality, Economic Convergence, Williamson Index*

1. INTRODUCTION

Economic development is an important pillar for national welfare and growth, but has not been fully able to reduce inequality between regions (Alfaris, 2024). However, this growth has not fully reduced development disparities between regions. Data from the Central Statistics Agency (BPS, 2024) shows that inequality in the distribution of national expenditure remains in the moderate to high category, influenced by the concentration of economic activity in certain regions, particularly Java (Damayanti, 2016). Regions with a strong economic base tend to attract investment and infrastructure more easily than weaker regions (Simanjuntak & Widodo, 2025). In this context, the Bodetabek area, as a buffer zone for Jakarta, plays a significant role in national economic growth, but equitable development across regions remains a challenge.

The calculation of economic development inequality in the Bodetabek region for the 2018-2024 period uses the Williamson Index (IW) based on 2010 ADHK per capita GRDP data and population to measure disparities between regions and serve as a basis for formulating more equitable development policies. The Williamson Index indicates that development inequality across Bodetabek remains substantial and fluctuates over the 2018-2024 period, declining until 2020 before increasing again through 2024.

The theoretical explanation of regional inequality and convergence can be understood through several complementary perspectives. Solow's growth theory (1956) suggests that differences in capital accumulation and labor availability influence regional output, while diminishing returns to capital provide a theoretical basis for the possibility of convergence when lower-income regions accumulate capital at a faster rate. Regional convergence theory, particularly the framework developed by R. T. Barro & Sala-i-Martin (1992), further explains that economies with lower initial income may grow faster than those with higher initial income, leading to a catching-up process. However, this convergence mechanism may not occur automatically. The New Economic Geography perspective emphasizes that economic activity tends to concentrate in locations with better market access, infrastructure, and economic connectivity, while agglomeration theory explains how the concentration of firms, investment, labor, and supporting infrastructure can generate productivity advantages in already-developed locations. These mechanisms are particularly relevant to Bodetabek, where proximity to Jakarta may generate strong agglomeration effects while simultaneously creating uneven regional economic opportunities.

These theoretical perspectives provide the basis for examining both the convergence process and the factors associated with differences in regional economic output.

Accordingly, this study measures development inequality using the Williamson Index, tests B-convergence and σ -convergence to assess the dynamics of interregional income disparities, and examines the effects of investment, labor, and infrastructure on real GRDP using panel data analysis.

Inequality occurs because opportunities and growth potential are not evenly distributed, so that developed regions are better able to attract investment, skilled labor, and quality infrastructure than other regions (Harsono et al., 2025). This phenomenon is evident in the Bodetabek area, where development is concentrated in areas closer to Jakarta, leaving other regions facing limited access to investment and development barriers (Parmadi et al., 2025). The Bodetabek area is a real example of this phenomenon, because even though the entire area is close to the national growth center, development is concentrated in certain areas, especially those closest to DKI Jakarta, causing other areas to face limited access to investment and development obstacles (Hidayadi & Niam, 2022).

The distribution of GRDP at current prices across Bodetabek districts and cities provides an initial indication of differences in regional economic contributions during 2018-2024. This distribution helps illustrate the concentration of economic activity within the metropolitan area.

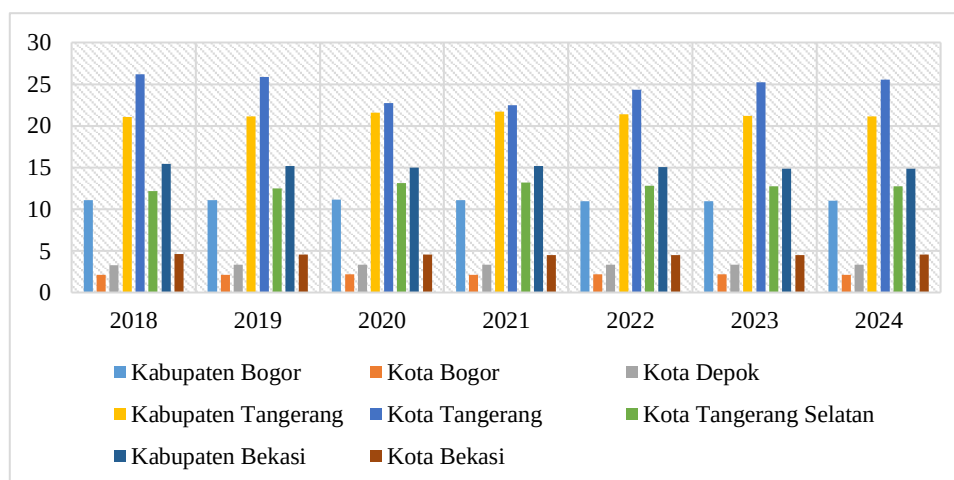


Figure 1. Percentage Distribution of GRDP Based on Current Prices (%) Bodetabek 2018-2024

Source: BPS Bodetabek 2018-2024

Figure 1 shows that Tangerang City, Tangerang Regency, and Bekasi Regency account for relatively larger and more stable shares of Bodetabek's GRDP, reflecting the concentration of economic activity in areas with strong industrial and service bases. In contrast, Bogor City and Depok City contribute smaller shares, indicating persistent differences in regional economic capacity.

The urgency of examining inequality and economic convergence in the Bodetabek region has increased following the COVID-19 pandemic, as the disruption affected labor mobility, investment, and regional economic activity. Evidence at the national level indicates a decline in income variation across provinces during 2018-2023, but does not provide strong evidence that lower-income regions consistently grew faster than higher-income regions (Kusumastuti et al., 2025). This finding suggests that a reduction in income disparities does not necessarily imply a sustained catching-up process. Such a distinction is particularly relevant for Bodetabek, where districts and cities are economically

interconnected but differ substantially in economic structure, accessibility, investment capacity, and development conditions. Therefore, examining both interregional inequality and β -convergence and σ -convergence is necessary to determine whether the relatively integrated metropolitan economy is accompanied by an actual narrowing of regional disparities during 2018-2024.

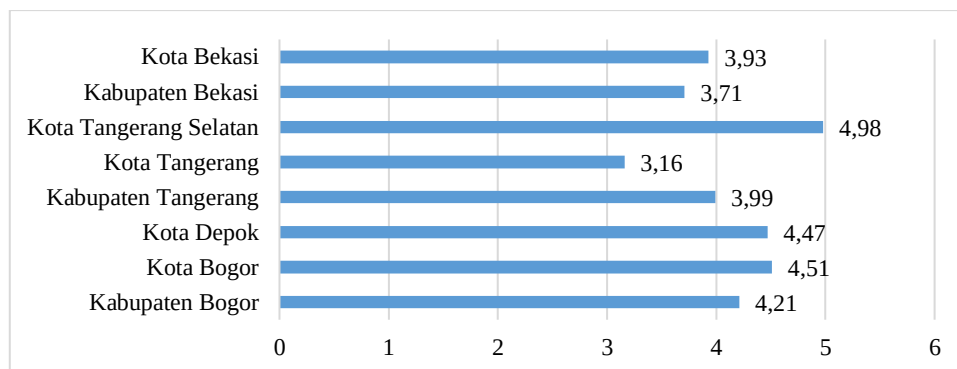


Figure 2. Average GRDP Growth Rate per Capita 2018-2024 (%)

Source: BPS Bodetabek 2018-2024

Based on Figure 2, the per capita GRDP growth rate in Bodetabek (Greater Jakarta) shows inter-regional variation, with South Tangerang City, Bogor City, and Depok City having the highest growth rates, while Tangerang City and Bekasi Regency have lower growth rates. Figure 2 shows variation in per capita GRDP growth across Bodetabek, with South Tangerang City, Bogor City, and Depok City recording relatively higher growth rates, while Tangerang City and Bekasi Regency show lower rates. These differences indicate that economic growth has not been uniform across the metropolitan area and provide an empirical basis for examining whether lower-income regions have experienced a sustained catching-up process.

Differences in investment, labor, and infrastructure capacity provide additional context for understanding variations in regional economic output across Bodetabek. Investment is concentrated in Bekasi Regency and Tangerang Regency/City, while investment in Bogor and Depok tends to be lower and more fluctuating. Similar differences are observed in labor force conditions and infrastructure capacity across districts and cities, particularly during the pandemic. These variations are theoretically relevant because capital accumulation, labor availability, accessibility, and infrastructure can shape regional productive capacity. Accordingly, investment, labor, and infrastructure are incorporated into the panel analysis to examine their effects on regional real GRDP.

Previous empirical studies provide important evidence that regional inequality and convergence are not uniform across Indonesia, but their findings also reveal several limitations. Earlier studies such as (Wibisono, 2003) and (Suryadimulyo & Kuncoro, 2008) provide evidence on regional inequality and convergence at broader geographical scales, demonstrating the importance of differences in initial income and regional economic structure. More recent studies, including (Zega et al., 2022), extend convergence analysis to specific regional contexts, while (Kusumastuti et al., 2025) show that reductions in income variation across Indonesian provinces do not necessarily imply that lower-income regions grow faster than higher-income regions. These findings indicate that a decline in inequality and the existence of convergence are not necessarily equivalent processes. However, most previous studies focus on national, provincial, or individual regional settings and do not specifically examine the interaction between inequality and convergence within an

integrated metropolitan area characterized by strong economic linkages and spatial agglomeration. Moreover, limited attention has been given to the Bodetabek region during the 2018-2024 period, which encompasses pre-pandemic, pandemic, and post-pandemic conditions, while simultaneously considering investment, labor, and infrastructure as factors associated with regional economic output.

This study contributes to the literature by providing an integrated empirical assessment of development inequality, regional economic convergence, and the factors associated with regional economic output in the Bodetabek metropolitan area. Specifically, it combines the Williamson Index to measure interregional inequality, β -convergence and σ -convergence to assess the catching-up process, and panel data analysis to examine the roles of investment, labor, and infrastructure in explaining differences in real GRDP across districts and cities. By focusing on the 2018-2024 period, the study also captures regional economic dynamics before, during, and after the COVID-19 pandemic. This integrated approach provides a more comprehensive understanding of why strong metropolitan economic linkages do not necessarily translate into convergence and equitable development across all regions of Bodetabek.

Based on the theoretical perspectives and empirical gaps discussed above, this study develops a conceptual framework linking the determinants of regional economic output with development inequality and economic convergence in the Bodetabek region. The framework positions investment, labor, and infrastructure as factors associated with differences in real GRDP, while the resulting regional economic disparities are examined through the Williamson Index, β -convergence, and σ -convergence. The conceptual framework is presented in Figure 3.

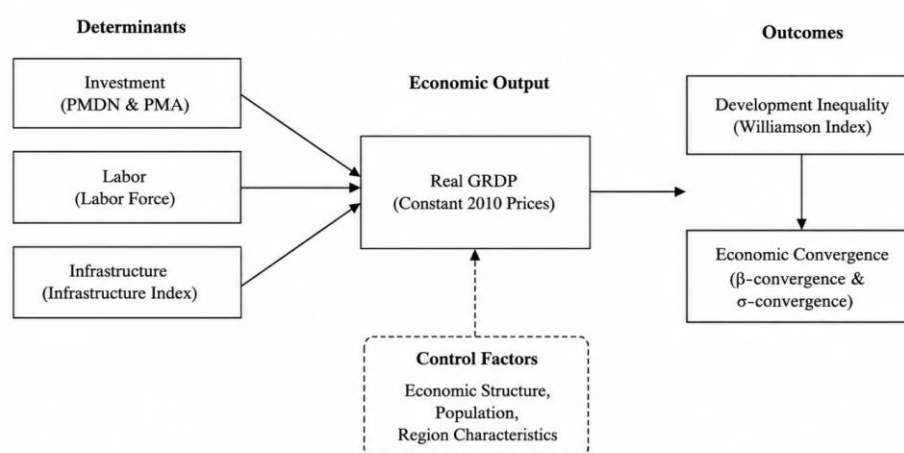


Figure 3. Conceptual Framework of the Study

Figure 3 illustrates the analytical structure of the study. The first analytical pathway examines the level of development inequality and whether interregional income disparities exhibit β -convergence and σ -convergence. The second pathway examines whether investment, labor, and infrastructure are associated with differences in regional real GRDP. These two analytical pathways are complementary: the convergence analysis identifies the extent to which regional disparities persist or narrow, while the panel regression provides empirical evidence on factors associated with differences in regional economic output.

Accordingly, this study aims to analyze the level of development inequality, examine β -convergence and σ -convergence across districts and cities in the Bodetabek region during

2018-2024, and analyze the effects of investment, labor, and infrastructure on regional real GRDP.

2. RESEARCH METHODS

This study employs a quantitative approach to examine development inequality, regional economic convergence, and differences in regional economic output in the Bodetabek region during 2018-2024. The analysis consists of four complementary components. First, the Williamson Index (IW) is used to measure interregional development inequality based on GRDP per capita at constant 2010 prices and population. Second, β -convergence is examined to determine whether regions with lower initial GRDP per capita tend to experience faster economic growth than higher-income regions. Third, σ -convergence is assessed by examining changes in the dispersion of GRDP per capita across regions over time. Fourth, panel data regression using the Fixed Effect Model (FEM) is employed to examine the effects of investment, labor, and infrastructure on regional real GRDP.

The Williamson Index is used to assess interregional inequality because it provides a measure of regional disparities by considering differences in regional per capita income and population size. The index was introduced by Williamson (1965) in his analysis of regional inequality and the process of national development and is appropriate for assessing disparities across geographically defined regions (Williamson, 1965). The β -convergence approach follows the neoclassical convergence framework developed by R. T. Barro & Sala-i-Martin (1992), which examines whether initially poorer regions tend to grow faster than initially richer regions. A negative relationship between initial income and subsequent growth is interpreted as evidence of a catching-up process (R. J. Barro, 1992). Meanwhile, σ -convergence complements β -convergence by examining whether the dispersion of regional per capita income decreases over time. The use of both approaches allows the study to distinguish between the catching-up process and the actual reduction in interregional income dispersion (R. T. Barro & Sala-i-Martin, 1992).

For the β -convergence analysis, initial income is measured by GRDP per capita in the initial year of the observation period. For the panel regression, the explanatory variables consist of realized domestic and foreign investment (PMDN/PMA), the labor force participation rate (TPAK), and the length of roads in good condition as an infrastructure indicator. These variables are used to examine differences in regional real GRDP across the eight districts and cities in Bodetabek during 2018-2024.

The study covers eight districts/cities in the Bodetabek region: Bogor City, Bogor Regency, Depok City, Tangerang City, Tangerang Regency, South Tangerang City, Bekasi City, and Bekasi Regency. The entire population was included using a saturated sampling technique. The resulting balanced panel consists of eight regions observed over seven years, yielding 56 observations.

The study uses secondary quantitative data obtained from the Central Statistics Agency (BPS), the Investment Coordinating Board (BKPM/OSS), the Regional Development Planning Agency (Bappeda), and the Ministry of Finance. Data were collected through documentation of official statistical publications and institutional reports.

Data analysis was conducted using descriptive statistics and panel data regression with EVIEWS 9. The Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) were initially considered as alternative panel specifications. Model selection was conducted using the Chow test and Hausman test. The Chow test was used to determine

whether the CEM or FEM was more appropriate, while the Hausman test was used to determine whether the FEM or REM was more appropriate. Based on the specification test results, the FEM was selected as the final estimation model.

The FEM is appropriate when unobserved, time-invariant characteristics of individual regions may be correlated with the explanatory variables. In the context of Bodetabek, districts and cities may have specific characteristics related to economic structure, spatial position, industrial concentration, and institutional conditions that are not directly captured by the observed explanatory variables. The FEM allows these region-specific characteristics to be controlled through individual effects, thereby providing a more appropriate specification for the panel data used in this study.

The Fixed Effect Model (FEM) was not retained because the model selection results did not provide sufficient evidence that region-specific fixed effects were required. Likewise, the Random Effect Model (REM) was not selected because the specification tests did not indicate that a random-effects structure provided a preferable specification to the pooled model. Thus, the CEM was retained as the model most consistent with the empirical specification results.

A dynamic panel model was not employed because the empirical specification does not include a lagged dependent variable or an explicit dynamic adjustment mechanism. The analysis focuses on estimating the relationship between investment, labor force participation, infrastructure, and regional real GRDP while controlling for unobserved time-invariant regional characteristics through the Fixed Effect Model. Therefore, a static panel specification is consistent with the objectives and structure of the present study.

The panel regression model used in this study is specified as follows:

$$GRDP_{it} = \alpha + \beta_1 INV_{it} + \beta_2 TPAK_{it} + \beta_3 INFRA_{it} + \varepsilon_{it}$$

Where $GRDP_{it}$ represents regional real GRDP at constant 2010 prices for region i in year t ; INV_{it} represents realized domestic and foreign investment (PMDN/PMA); $TPAK_{it}$ represents the labor force participation rate; $INFRA_{it}$ represents the length of roads in good condition; α_i represents the region-specific intercept in the Fixed Effect Model; β_1 , β_2 , and β_3 represent the regression coefficients; and ε_{it} represents the error term.

Model diagnostics were conducted to assess the adequacy of the selected regression model, including normality, multicollinearity, autocorrelation, and heteroscedasticity tests. The results of these diagnostic tests are reported in the Results section to provide empirical evidence regarding the adequacy of the estimated model.

Hypothesis testing employed the t-test to assess the partial effects of investment, TPAK, and infrastructure on regional real GRDP, the F-test to assess their joint significance, and the adjusted to evaluate the explanatory capacity of the regression model.

3. RESULTS AND DISCUSSION

3.1. Result

The data analysis used in this study consists of several stages to analyze the level of development inequality and economic convergence in the BODETABEK area in 2018-2024, namely as follows:

Williamson Index Analysis

The Williamson Index analysis is used to measure the level of development inequality between regions in the BODETABEK area. The Williamson Index ranges from

0 to 1, with values closer to 0 indicating low inequality, while values closer to 1 indicating high inequality.

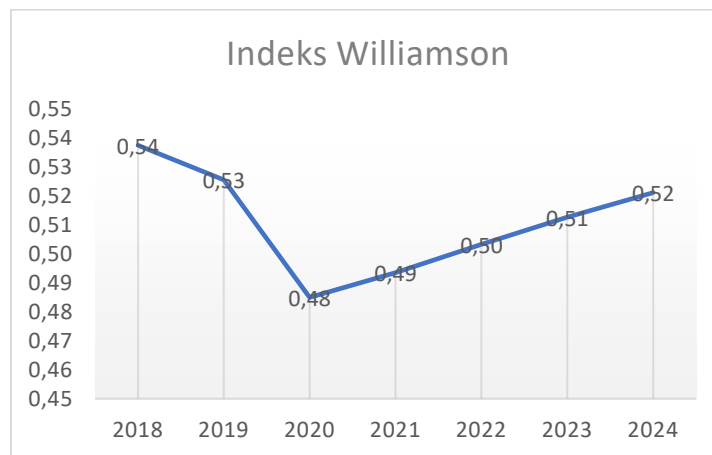


Figure 4. Williamson Index for Bodetabek Region 2018-2024

Based on Figure 4, development inequality in the Greater Jakarta (Bodetabek) region remained persistent during 2018-2024, as reflected in the fluctuation of the Williamson Index. The index decreased from 0.5373 in 2018 to 0.4849 in 2020, indicating a temporary narrowing of interregional disparities during the pandemic period. However, the index subsequently increased and reached 0.5210 in 2024. This pattern indicates that the reduction in disparity observed in 2020 was not sustained, suggesting that differences in regional economic capacity remained persistent during the post-pandemic period. The result is consistent with the broader evidence that regional inequality does not necessarily decline continuously as regional economies grow (Eva et al., 2022).

Beta Convergence Analysis (β -Convergence)

β -convergence analysis was used to test whether regions with lower initial income grew faster than regions with higher income. Based on the OLS regression results, the equation $gi = -0.003045 + 0.001192 \ln (GRDP2018)$ was obtained, with a positive coefficient of 0.001192 and a p-value of 0.1715. The positive coefficient of 0.001192 indicates that, descriptively, regions with higher initial GRDP per capita tended to experience higher subsequent growth than regions with lower initial income. However, the coefficient is not statistically significant ($p = 0.1715$), meaning that there is insufficient statistical evidence to conclude that initial income systematically determined subsequent growth across Bodetabek regions. Thus, the results do not support the existence of β -convergence during 2018-2024. Economically, this finding suggests that the expected catching-up process was not sufficiently strong to overcome differences in regional productive capacity. The result is consistent with evidence from Indonesian districts showing that convergence can be influenced by regional characteristics and spatial interactions rather than occurring automatically across regions. The R^2 value of 0.2866 indicates that initial GRDP per capita explains approximately 28.66% of the variation in regional growth, while the remaining variation is associated with other factors not included in the β -convergence specification.

Sigma Convergence Analysis (σ -Convergence)

Sigma convergence analysis was used to determine whether there was a decrease in income disparities between regions during the study period. This measurement was performed by calculating the variance or standard deviation of the logarithm of each region's per capita GRDP each year. A decrease in the variance or standard deviation over time indicates economic convergence.

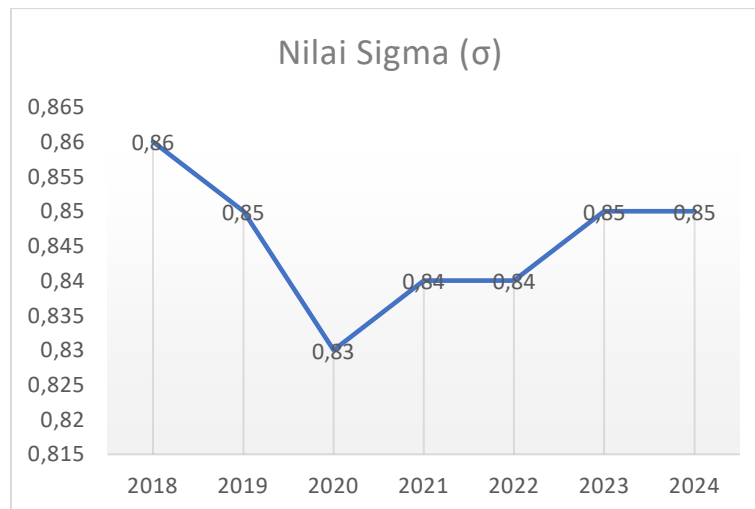


Figure 5. Sigma Convergence in the Bodetabek Region 2018-2024

Based on Figure 5, the σ -convergence measure fluctuated during 2018-2024, declining from 0.86 in 2018 to 0.83 in 2020 before increasing again to 0.85 in 2024. The decline during 2018-2020 indicates a temporary reduction in the dispersion of regional GRDP per capita, but the subsequent increase indicates that this narrowing was not sustained. Therefore, the observed pattern does not provide strong evidence of a continuous σ -convergence process. Taken together with the β -convergence result, the findings indicate that the reduction in interregional disparities in Bodetabek has not been sufficiently persistent to establish a strong convergence process during the study period. This result is consistent with international evidence showing that regional inequality and σ -convergence may follow different trajectories and that metropolitan and spatial concentration can contribute to persistent regional disparities (Eva et al., 2022).

This finding is also relevant to evidence from the Philippines, where (Pagaduan, 2023) demonstrates that regional income inequality and convergence can vary across spatial and regional contexts. The comparison suggests that economic convergence is not an automatic outcome of regional growth, as differences in regional economic structures and spatial characteristics can shape the persistence of disparities. In the Bodetabek context, the fluctuating σ -convergence pattern similarly indicates that the temporary narrowing of regional disparities was not sufficient to establish a sustained convergence process.

Panel Data Regression Analysis

Panel data regression analysis was used to examine the influence of investment, labor, and infrastructure on economic growth in the BODETABEK region. The panel data regression model was chosen because the study used combined cross-sectional (district/city) and time series data (2018-2024). Panel data regression was used to examine the effects of investment, labor force participation, and infrastructure

on regional real GRDP in Bodetabek. The panel approach combines cross-sectional observations across the eight districts/cities with annual observations from 2018-2024. The Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) were considered as alternative specifications, and the final model was determined based on the relevant panel specification tests.

Descriptive Analysis

Descriptive analysis is used to provide a general overview of the development of regional economic conditions in the BODETABEK area during the study period. The results of descriptive statistics show that during the 2018-2024 period, the average GRDP ADHK of regencies/cities in the Bodetabek area was 40,018.73 billion rupiah with a minimum value of 19,731 billion rupiah and a maximum of 89,700 billion rupiah. The investment variable has an average of Rp13.9 trillion with the highest value reaching Rp61.2 trillion and the lowest Rp618 billion. Meanwhile, the average labor force participation rate (TPAK) was 63.91 percent with a minimum value of 58.13 percent and a maximum of 67.35 percent. The infrastructure variable has an average of 943.39 km with a minimum value of 32 km and a maximum of 2,019 km. These results indicate differences in economic characteristics between regencies/cities in the Bodetabek area as reflected in variations in the value of GRDP, investment, labor, and infrastructure during the study period.

The relatively wide range of GRDP, investment, TPAK, and infrastructure values indicates substantial differences in economic scale and regional capacity across Bodetabek districts and cities, providing an empirical context for the persistent inequality identified by the Williamson Index.

Chow Test

The Chow test is used to determine the best model between the Common Effect Model (CEM) and the Fixed Effect Model (FEM). If the Cross-section F probability value is less than 0.05, then the selected model is the Fixed Effect Model. Conversely, if the probability value is greater than 0.05, then the selected model is the Common Effect Model. The Chow test results show a Cross-section F probability value of 0.0000, which is below the 0.05 significance level. Therefore, the null hypothesis that the Common Effect Model is adequate is rejected, indicating that the Fixed Effect Model (FEM) provides a more appropriate specification than the Common Effect Model. This result suggests that unobserved differences across Bodetabek districts and cities are statistically relevant and should be controlled for in the regression model.

Hausman test

The Hausman test results show a probability value of 0.0476, which is below the 0.05 significance level. Therefore, the null hypothesis that the random-effects estimator is consistent is rejected, and the Fixed Effect Model (FEM) is preferred over the Random Effect Model (REM). This result indicates that the unobserved region-specific effects are correlated with the explanatory variables, making the FEM more appropriate for estimating the relationship between investment, labor, infrastructure, and regional real GRDP in Bodetabek.

Multicollinearity Test

The multicollinearity test aims to determine whether there is a strong relationship between the independent variables in a research model. This test is conducted using a correlation matrix between the independent variables.

Table01. Results of Multicollinearity Test Between Independent Variables

	G	IN	L	INFRA
	RDP	VESTMEN	ABOR	STRUCTURE
	ADHK Y_	T X1_	X2_	X3_
GRDP	1	0.	0	-
ADHK Y	,000,00	713999	.038922	0.220025
	0			
INVES	0	1,	0	0.114
TMENT X1_	.713999	000,000	.288613	491
LABO	0	0.	1	-
R X2_	.038922	288613	,000,00	0.029441
			0	
INFRA	-	0.	-	1,000
STRUCTURE	0.22002	114491	0.02944	,000
X3_	5		1	

Based on Table 1, the correlations among the explanatory variables are relatively low. The highest correlation among investment, labor, and infrastructure is observed between investment and labor at 0.288613, while the remaining correlations are substantially lower. All pairwise correlations among the explanatory variables are below the 0.80 threshold, indicating that the model does not exhibit a serious multicollinearity problem.

Hypothesis Testing

t-test (Partial)

The t-test is used to determine the influence of each independent variable, namely investment, labor, and infrastructure on economic growth partially.

Table0 2. Results of the t-Test (Partial) Panel Data Regression

Dependent Variable: GRDP_ADHK__Y_					
Variable	Co	Std.	t-	P	
	efficient	Error	Statistic	rob.	
	-	3136	-		0
C	14284.53	9.33	0.455366	.6510	
INVESTM	3.1	1.32	2.37		0
ENT__X1_	4E-10	E-10	7975	.0217	
LABOR_X	77	488.	1.58		0
2_	2.3764	1480	2259	.1206	
INFRAST	0.5	1.88	0.31		0
RUCTURE__X3_	91877	3701	4210	.7548	

Based on Table 2, the t-test results show that the investment variable has a probability value of 0.0217, which is smaller than 0.05, indicating a positive and statistically significant effect on real GRDP in the Bodetabek area. Meanwhile, the labor

variable has a probability value of 0.1206 and the infrastructure variable has a probability value of 0.7548, both of which are greater than 0.05, indicating that neither variable has a statistically significant effect on real GRDP during the study period.

The labor force participation rate (TPAK) has a positive coefficient but is not statistically significant ($p = 0.1206$). This result indicates that differences in labor force participation alone were not sufficient to explain variations in regional real GRDP across Bodetabek during 2018-2024. Economically, the finding may reflect the limitation of TPAK as an indicator of labor input. TPAK measures the proportion of the working-age population participating in the labor market, but it does not directly capture worker productivity, educational attainment, skills, working hours, sectoral composition, or the quality of employment. This distinction is particularly relevant in a metropolitan area such as Bodetabek, where workers may live in one district but work in another, making local TPAK less directly connected to the location of economic production.

Infrastructure, measured by the length of roads in good condition, has a positive but statistically insignificant coefficient ($p = 0.7548$). This result suggests that differences in road length alone did not significantly explain differences in regional real GRDP across Bodetabek during the study period. The finding does not necessarily imply that infrastructure is economically unimportant. Rather, the road-length indicator may not fully capture the economic functionality of infrastructure. In a highly connected metropolitan region, the marginal contribution of additional road length may depend more on road quality, accessibility, congestion, connectivity with industrial and commercial centers, and integration with public transportation and logistics networks.

This interpretation is supported by international evidence showing that infrastructure can contribute to regional productivity when it improves accessibility, connectivity, and the diffusion of economic activity. The OECD emphasizes that infrastructure investment can help reduce regional productivity gaps, but its effectiveness depends on broader regional capabilities, including innovation, skills, and connectivity (OECD, 2023).

The finding also differs from studies in other Indonesian regional contexts. For example, (Hidayat et al., 2023) found significant effects of investment, energy infrastructure, and human capital on regional convergence in Sumatra, whereas the present study finds no significant effect for the road-length infrastructure indicator in Bodetabek. This difference suggests that the economic effect of infrastructure is context-dependent and may depend on the type of infrastructure and the structural characteristics of the region.

F Test (Simultaneous)

The F-test was used to determine the joint influence of investment, labor, and infrastructure on economic growth. The F-test results showed an F-statistic value of 82.52155 with a probability value of 0.0000, which is smaller than the 0.05 significance level. These results indicate that investment, labor, and infrastructure simultaneously have a significant effect on the ADHK GRDP in the Bodetabek area. The F-test results show that investment, TPAK, and infrastructure are jointly statistically significant in explaining regional real GRDP, with an F-statistic of 82.52155 and a probability value of 0.0000. This indicates that, although TPAK and infrastructure are not individually significant, the explanatory variables collectively provide statistically significant information about differences in regional real GRDP.

Coefficient of Determination (R^2)

The R-squared value of 0.948289 indicates that approximately 94.83% of the variation in regional real GRDP is explained jointly by investment, TPAK, and infrastructure within the estimated model, while the remaining 5.17% is associated with factors outside the model. The adjusted R-squared of 0.936797 remains high after accounting for the number of explanatory variables, indicating substantial explanatory capacity. However, the high R-squared should be interpreted together with the individual significance tests and diagnostic results rather than as evidence of model accuracy by itself.

Policy Implications

The empirical findings suggest several specific policy implications for reducing regional disparities and strengthening economic performance in Bodetabek. First, because realized PMDN/PMA is the only explanatory variable that shows a positive and statistically significant association with regional real GRDP, investment policy should focus not merely on increasing investment volume but on improving its spatial distribution. Local governments should prioritize investment facilitation in districts and cities with lower economic capacity by providing integrated licensing services, investment-ready industrial or business areas, and targeted incentives linked to local employment and value-added generation. This approach can help prevent further concentration of productive capital in already dominant areas such as Bekasi and Tangerang.

Second, the insignificant effect of TPAK indicates that increasing labor force participation alone may not be sufficient to raise regional output. Labor policies should therefore shift from participation-oriented targets toward productivity and job-matching measures, including vocational training aligned with manufacturing, logistics, digital services, and other sectors that dominate the metropolitan economy. Coordination of labor-market policies across Bodetabek is also important because the metropolitan labor market extends beyond administrative boundaries.

Third, the insignificant coefficient of road infrastructure indicates that simply adding road length may not generate additional economic output. Infrastructure policy should therefore prioritize connectivity, quality, congestion reduction, and integration with industrial, commercial, and public-transport networks. Investment should be directed toward infrastructure bottlenecks that constrain movement of workers and goods rather than toward increasing road length uniformly across regions.

Finally, the Williamson Index and convergence results indicate that reducing regional inequality requires policies that combine investment distribution, productivity improvement, and spatial connectivity. The absence of statistically supported β -convergence and the unstable σ -convergence pattern suggest that growth in Bodetabek cannot be assumed to produce automatic regional equalization. A coordinated metropolitan development strategy is therefore needed to ensure that economic opportunities generated by agglomeration are transmitted to less advantaged districts and cities.

3.2. Discussion

Level of Development Inequality in the BODETABEK Region in 2018-2024 Based on the Williamson Index

Based on the Williamson Index calculation results, the level of development inequality in the BODETABEK area during the 2018-2024 period tends to be in the high

category. This is indicated by the Williamson Index value being above 0.50 in most of the research years, namely 0.5373 in 2018, 0.5255 in 2019, 0.5031 in 2022, 0.5125 in 2023, and 0.5210 in 2024. Meanwhile, in 2020 and 2021, the Williamson Index value was in the moderate category, at 0.4849 and 0.4934, respectively. The temporary decline in inequality during 2020-2021 can be understood in the context of the COVID-19 pandemic, which disrupted economic activity across regions and affected areas with relatively strong economic bases. However, the subsequent increase in the index indicates that this narrowing of the gap was not sustained. This pattern suggests that the underlying differences in economic scale and productive capacity between Bodetabek regions remained after the pandemic. Regions with stronger industrial, commercial, and service bases were able to maintain greater economic capacity, while regions with relatively weaker economic structures faced greater difficulty in catching up.

The results of this study align with those of (Lania et al., 2025), which showed that development inequality between provinces in Indonesia remains high despite continued economic growth. (Mevia, 2023) study also found that development inequality in East Java persists because economic growth has not been fully accompanied by equitable development across regions. Furthermore, research by Zega et al (2022) reported that development inequality between regencies/cities in North Sumatra remained high despite the occurrence of economic convergence. These findings suggest that economic growth and convergence do not automatically eliminate regional inequality when differences in economic structure, investment concentration, and productive capacity remain. In the Bodetabek context, the concentration of economic activities in several strategically located regions provides a possible explanation for the persistence of the inequality observed in this study. Therefore, reducing regional disparities requires not only higher economic growth but also policies that broaden access to investment, productive activities, infrastructure, and employment opportunities in less-developed areas.

Beta Convergence Analysis (β -Convergence) in the BODETABEK Region 2018-2024

Based on the β -convergence estimation results, the coefficient of the initial GRDP per capita logarithm variable is 0.001192 with a probability value of 0.1715. The positive coefficient indicates that regions with higher initial income levels tended to experience higher economic growth than regions with lower initial income levels. However, the relationship is not statistically significant because the probability value is greater than 0.05. Therefore, the results do not provide sufficient statistical evidence of β -convergence in the BODETABEK region during 2018-2024. The absence of β -convergence may be related to differences in the productive structures and economic advantages of individual regions. Regions with established industrial, trade, and service activities may continue to benefit from accumulated capital, infrastructure, market access, and agglomeration advantages, allowing them to maintain relatively strong growth. In contrast, regions with lower initial income may not possess sufficient productive capacity to catch up rapidly. Thus, the expected catching-up mechanism does not appear to operate strongly across the Bodetabek regions during the study period.

The results differ from Zega et al (2022), who found absolute and conditional convergence in North Sumatra, Telaumbanua (2024) who reported beta convergence in island-based regions of Sumatra, and Zainuri et al (2022), who found absolute beta convergence in East Java. These differences can be explained by differences in regional

economic structure, spatial characteristics, and initial productive capacity. Unlike the broader provincial or island-level regions examined in those studies, Bodetabek is a highly integrated metropolitan area in which economic activity is strongly concentrated around major industrial, commercial, and service centers. Such concentration may allow already-advantaged regions to retain their growth advantages rather than automatically generating a catching-up process in lower-income regions.

The results of this study differ from those of Zega et al (2022), who found both absolute and conditional convergence in North Sumatra Province. Telaumbanua (2024) study also showed that island-based regions in Sumatra experienced both absolute and conditional beta convergence. Furthermore, Zainuri et al (2022) study found absolute beta convergence in East Java Province. These differences indicate that the economic characteristics of the BODETABEK region, which is dominated by metropolitan areas, make the process of equitable economic growth more difficult than in other regions. Therefore, the results of this study indicate that the economic development gap in the BODETABEK region remains relatively persistent, necessitating development policies capable of boosting economic growth in underdeveloped regions.

Sigma Convergence Analysis (σ -Convergence) in the BODETABEK Region 2018-2024

Based on the σ -convergence calculation, the sigma value fluctuated during the study period, decreasing from 0.86 in 2018 to 0.83 in 2020 before increasing again to 0.85 in 2024. The temporary decline indicates that the dispersion of regional GRDP per capita narrowed during the early pandemic period, but the subsequent increase shows that this reduction was not sustained. The fluctuating pattern can be explained by differences in the speed of economic recovery and the capacity of each region to benefit from renewed economic activity after the pandemic. Regions with stronger industrial, service, investment, and accessibility advantages were more capable of recovering and expanding their economic activity, while regions with weaker productive bases faced greater constraints. Consequently, the dispersion of regional income did not decline continuously, indicating that a sustained σ -convergence process had not been established in Bodetabek during 2018-2024.

The results differ from Arsyanti & Nugrahadi (2021), who found sigma convergence in Eastern Indonesia and at the national level, as well as Telaumbanua (2024), who identified sigma convergence in the Sumatran regional context. Zainuri et al (2022) also found sigma convergence in East Java after the global crisis. The different findings may reflect differences in regional economic structures and the scale of analysis. Bodetabek has a highly concentrated metropolitan economy, meaning that economic recovery and investment may benefit some regions more rapidly than others. Therefore, economic growth in the metropolitan area does not necessarily translate into an equal reduction in income dispersion across all districts and cities.

The results of this study differ from those of Arsyanti & Nugrahadi (2021), who found sigma convergence in Eastern Indonesia and at the national level. Telaumbanua (2024) study also showed sigma convergence in the island-like region of Sumatra, while Zainuri et al (2022) found that East Java Province experienced sigma convergence after the global crisis. These differences indicate that the characteristics of economic development in the Greater Jakarta (BODETABEK) region are still dominated by the concentration of economic activity in certain areas, resulting in a relatively slow process of narrowing the gap.

These findings imply that reducing regional disparities in Bodetabek requires policies that strengthen productive capacity in less-advantaged regions rather than relying solely on aggregate metropolitan growth. Investment incentives, infrastructure connectivity, and human-resource development should therefore be directed toward regions with weaker economic bases so that the benefits of metropolitan economic activity can spread more evenly across the region.

The Impact of Investment on the GRDP ADHK in the Bodetabek Area 2018-2024

Based on the results of panel data regression using the Fixed Effect Model (FEM), the investment variable has a coefficient value of 0.000000000314 with a probability value of 0.0217. This probability value is smaller than the 0.05 significance level, indicating that investment has a positive and significant effect on the ADHK GRDP in the Bodetabek area in 2018-2024. These results indicate that the higher the investment entering a region, the greater the economic activity generated.

The positive and statistically significant coefficient of investment indicates that higher realized PMDN/PMA is associated with higher regional real GRDP in Bodetabek. This relationship can be explained by the role of investment in increasing the productive capacity of regional economies through capital formation, business expansion, and the creation of economic activities. The effect is particularly relevant in Bodetabek because investment is strongly connected to industrial, manufacturing, trade, and service activities. Regions such as Bekasi and Tangerang, which have strong industrial and accessibility advantages, can attract investment that subsequently stimulates production, employment opportunities, supporting services, and local economic transactions. This mechanism may also reinforce agglomeration advantages because new investment tends to follow existing markets, infrastructure, supply chains, and labor pools. Therefore, the significant investment coefficient reflects not only the direct contribution of capital to production but also the broader economic benefits generated through metropolitan agglomeration (OECD, 2023).

The finding also corresponds with evidence from Sumatra showing that investment, infrastructure, and human capital can be relevant to regional convergence, although the magnitude and significance of these factors vary according to regional characteristics and model specification (Hidayat et al., 2023).

The finding is also consistent with Yudrianto (2023), Dita (2024), and Lailatussubha & Nazer (2025), who identified investment as an important factor in regional economic performance and inequality. The consistency of these findings can be explained by the fundamental role of capital accumulation in expanding productive capacity. However, the Bodetabek result also highlights an important spatial dimension: when investment is concentrated in already-developed areas, it can simultaneously increase aggregate GRDP while maintaining differences in economic capacity between regions. Thus, investment contributes to economic growth, but its distribution determines whether its benefits also support regional convergence.

The Role of Labor Force Participation in Regional GRDP in the Bodetabek Area, 2018-2024

Based on the results of panel data regression using the Fixed Effect Model (FEM), the labor variable has a coefficient value of 772.3764 with a probability value of 0.1206. Because the probability value is greater than 0.05, the labor force participation rate (TPAK) does not have a statistically significant effect on regional real GRDP in the Bodetabek area during 2018-2024. The absence of a significant effect does not

necessarily mean that labor is economically irrelevant. Rather, TPAK measures labor-force participation and does not directly capture labor productivity, educational attainment, skills, working hours, or the sector in which workers are employed. These limitations are particularly relevant in Bodetabek because its metropolitan labor market crosses administrative boundaries, meaning that workers may reside in one district or city while contributing to production in another. Consequently, variation in local TPAK may not correspond directly to variation in local GRDP.

A similar insignificant labor effect was reported by Mainita et al (2025), who associated the result with low-skilled labor, limited education and training, and the prevalence of low-productivity informal employment. Although the regional context differs from Bodetabek, this explanation supports the broader argument that labor participation alone does not guarantee higher regional output when it is not accompanied by improvements in productivity and skills.

This finding is in line with previous research which shows that the labor variable (X2) has a value smaller than the t-table ($0.080 < 2.179$), meaning that H_0 is accepted and H_a is rejected. This indicates that the labor force (X2) during the 2010-2023 period does not have a significant effect on economic growth (Y) in Merangin Regency. Or seen from the sig value obtained for the labor variable (X2) (β_2) whose value is greater than alpha ($0.937 > 0.05$) meaning that H_0 is accepted and H_a is rejected. This indicates that the labor force (X2) during the 2010-2023 period does not have a significant effect on economic growth (Y) in Merangin Regency. This is because the labor force in Merangin Regency is dominated by low-skilled workers, productivity also tends to be low. Lack of education, training, and access to technology hinders the ability of the workforce to significantly increase economic output. Most of the workforce may work in the informal sector whose contribution to GRDP is often unrecorded or less significant. Jobs in the informal sector generally have low productivity and do not make a large contribution to economic growth (Mainita et al., 2025).

The Influence of Infrastructure on the GRDP ADHK in the Bodetabek Area 2018-2024

Based on the results of panel data regression using the Fixed Effect Model (FEM), the infrastructure variable has a coefficient value of 0.591877 with a probability value of 0.7548. Because the probability value is greater than 0.05, infrastructure, measured by the length of roads in good condition, does not have a statistically significant effect on regional real GRDP in the Bodetabek area during 2018-2024. This finding does not necessarily indicate that infrastructure is economically unimportant. Rather, the result suggests that road length in good condition may not adequately capture the functional contribution of infrastructure to metropolitan economic activity. In a highly connected metropolitan area such as Bodetabek, economic benefits from infrastructure depend not only on the length of roads but also on accessibility, connectivity between production centers, congestion, travel time, logistics efficiency, and integration with public transportation. Therefore, additional road length may have a limited measurable effect on GRDP if existing infrastructure already provides substantial connectivity or if other bottlenecks constrain economic activity.

This finding differs from Dita (2024), Telaumbanua (2024), and Arsyanti & Nugrahadi (2021), who reported that infrastructure contributed to economic growth or convergence in other regional contexts. The difference may be explained by differences in infrastructure indicators, regional characteristics, and economic structure. In less-connected regions, additional infrastructure can generate substantial gains by opening

access to markets and reducing transportation constraints. In Bodetabek, however, where interregional connectivity is already relatively extensive, the marginal contribution of additional road length may be smaller and may depend more on infrastructure quality, congestion management, and network integration.

The finding is also consistent with studies reporting an insignificant effect of road infrastructure on economic growth, including Almismary & Wahyono, (2020) and the study discussed by Ajrina & Meraldha (2025). These similarities suggest that the effect of road infrastructure is context-dependent and cannot be inferred solely from the physical length of roads.

The Influence of Investment, Labor, and Infrastructure on the GRDP ADHK in the Bodetabek Area 2018-2024

Based on the F-test results, the F-statistic is 82.52155 with a probability value of 0.0000, indicating that investment, labor, and infrastructure are jointly significant in explaining regional real GRDP in the Bodetabek area during 2018-2024. The joint significance of the variables, despite the insignificant individual effects of TPAK and infrastructure, suggests that regional economic output is shaped by the combined operation of capital, labor, and supporting infrastructure rather than by each factor independently. In economic terms, investment may generate productive activity, while labor provides human input and infrastructure facilitates the movement of goods, workers, and services. Their combined role is therefore more relevant to regional production than the isolated effect of each variable.

4. CONCLUSION

Based on the results of the analysis of development inequality and economic convergence in the Bodetabek area for the 2018-2024 period, the following conclusions were obtained:

1. The Williamson Index calculation results indicate that the level of development inequality in the Greater Jakarta (Bodetabek) region during the 2018-2024 period tended to be high. Although inequality decreased in the 2018-2020 period, the index value increased again in subsequent years. This indicates that equitable development across regions in the Greater Jakarta (Bodetabek) region has not been optimal.
2. The results of the beta convergence analysis indicate that there was no economic convergence in the Bodetabek region during the 2018-2024 period. Regions with higher initial income levels tended to experience higher growth than regions with lower initial income levels, resulting in a tendency for economic divergence between regions.
3. The results of the sigma convergence analysis indicate that there was no strong economic convergence in the Bodetabek region during the study period. Inter-regional income disparities remain relatively high, and the process of equitable development has not been consistent.
4. Investment has a positive and significant impact on the ADHK GRDP in the Bodetabek area. Meanwhile, labor and infrastructure have no significant impact on the ADHK GRDP. Simultaneously, investment, labor, and infrastructure have a significant impact on the ADHK GRDP.

5. BIBLIOGRAPHY

- Ajrina, F. I., & Meraldha, A. R. (2025). PENGARUH INFRASTRUKTUR PENGEMBANGAN KAWASAN EKONOMI KHUSUS (KEK) PALU TERHADAP PERTUMBUHAN EKONOMI DI KOTA PALU. *Zoning: Journal of Urban and Regional Planning*, 2(1).
- Alfaris, M. R. (2024). Dalam ANALYSIS OF ISSUES AND PROBLEMS OF REGIONAL ECONOMIC DEVELOPMENT IN KUDUS DISTRICT. *WORLDVIEW (Jurnal Ekonomi Bisnis Dan Sosial Sains)*, 3(2), 119-129.
- Almismary, M. D., & Wahyono, H. (2020). PENGARUH PERKEMBANGAN INFRASTRUKTUR TERHADAP PERTUMBUHAN EKONOMI KOTA BANDA ACEH. *Jurnal Pembangunan Wilayah Dan Kota*, 16(4).
- Arsyanti, R. A., & Nugrahadi, T. (2021). ANALISIS KONVERGENSI EKONOMI PADA LEVEL KAWASAN DAN NASIONAL SERTA FAKTOR-FAKTOR YANG MEMENGARUHINYA. *Seminar Nasional Official Statistics*, 2020(1). <https://doi.org/10.34123/semnasoffstat.v2020i1.481>
- Barro, R. J. (1992). Convergence. *Journal of Political Economy*, 100(2), 223-251. <https://doi.org/10.1086/261816>
- Barro, R. T., & Sala-i-Martin, X. (1992). Regional growth and migration: A Japan-United States comparison. *Journal of The Japanese and International Economies*, 6(4). [https://doi.org/10.1016/0889-1583\(92\)90002-L](https://doi.org/10.1016/0889-1583(92)90002-L)
- Damayanti, L. (2016). Analisis dampak aglomerasi terhadap ketimpangan regional Pulau Jawa. *Jurnal Ilmiah Mahasiswa FEB*, 5(2).
- Dita, D. J. A. (2024). ANALISIS KONVERGENSI PERTUMBUHAN EKONOMI DI KAWASAN TIMUR INDONESIA [UPN Veteran Jawa Timur]. <https://repository.upnjatim.ac.id/27294/>
- Eva, M., Cehan, A., Corodescu-Roşca, E., & Bourdin, S. (2022). Spatial patterns of regional inequalities: Empirical evidence from a large panel of countries. *Applied Geography*, 140. <https://doi.org/10.1016/j.apgeog.2022.102638>
- Harsono, I., Sulistiowati, S., Apriyanto, A., & Demung, I. W. (2025). *Buku Referensi Pembangunan Ekonomi Kewilayahan*. PT. Sonpedia Publishing Indonesia.
- Hidayadi, T., & Niam, A. M. (2022). Analisis Disparitas Ekonomi Wilayah Jabodetaek Pada Masa Pandemi Covid 19. *ILTIZAM Journal of Shariah Economics Research*, 6(1), 117-130.
- Hidayat, M., Bachtar, N., Sjafrizal, & Primayesa, E. (2023). The Influence of Investment, Energy Infrastructure, and Human Capital Towards Convergence of Regional Disparities in Sumatra Island, Indonesia; Using Oil and Gas Data and Without Oil and Gas. *International Journal of Energy Economics and Policy*, 13(4). <https://doi.org/10.32479/ijeep.14117>
- Kusumastuti, S. Y., Judijanto, L., Kunawangsih, T., & Sa'dianoor, S. (2025). *Ekonomi Pembangunan Lanjutan*. PT. Sonpedia Publishing Indonesia.
- Lailatussubha, M., & Nazer, M. (2025). Analisis Faktor yang Mempengaruhi Ketimpangan Pendapatan: Studi Komparatif Kawasan Indonesia Barat, Timur, Indonesia. *Jurnal Informatika Ekonomi Bisnis*. <https://doi.org/10.37034/infeb.v7i3.1224>
- Lania, Y., Canon, S., & Payu, B. R. (2025). ANALISIS KETIMPANGAN REGIONAL ANTAR PROVINSI DI INDONESIA DAN FAKTOR-FAKTOR YANG MEMPENGARUHI. *KNOWLEDGE: Jurnal Inovasi Hasil Penelitian Dan Pengembangan*, 5(2). <https://doi.org/10.51878/knowledge.v5i2.5307>
- Mainita, M., Winarni, E., Susilawati, E., & Fajri, M. (2025). ANALISIS PENGARUH SEKTOR PERTANIAN DAN TENAGA KERJA TERHADAP PERTUMBUHAN EKONOMI KABUPATEN MERANGIN. *Journal Development*, 13(1). <https://doi.org/10.53978/jd.v13i1.586>
- Mevia, T. F. S. (2023). Analisis Pertumbuhan Ekonomi dan Ketimpangan Pembangunan Empat Koridor di Jawa Timur Tahun 2016-2021. *Jurnal Ilmu Ekonomi JIE*, 7(03). <https://doi.org/10.22219/jie.v7i03.27087>
- OECD. (2023). OECD Regional Outlook 2023 The Longstanding Geography of Inequalities. In *OECD Regional Outlook 2021*.

- Pagaduan, J. A. (2023). Spatial Income Inequality, Convergence, and Regional Development in a Lower Middle-Income Country: Satellite Evidence from the Philippines. *Developing Economies*, 61(2). <https://doi.org/10.1111/deve.12354>
- Parmadi, P., Hastuti, D., Judijanto, L., Kusumastuti, S. Y., Nopiah, R., Lutfi, M. Y., Rosyadi, A. A., Khairani, A., Putri, G. A., & Mustika, N. (2025). *Ekonomi Pembangunan 1*. PT. Sonpedia Publishing Indonesia.
- Simanjuntak, S. H., & Widodo, W. (2025). Analisis Pengaruh Perubahan Struktural Ekonomi dalam Sistem Multiregional di Indonesia. *Jurnal Ilmu Manajemen, Bisnis Dan Ekonomi (JIMBE)*, 3(1), 28-41.
- Suryadimulyo, A., & Kuncoro, M. (2008). *Analisis ketimpangan dan konvergensi produk domestik regional bruto 33 provinsi di Indonesia, 1993-2006*. Universitas Gadjah Mada.
- Telaumbanua, Y. (2024). Analisis Konvergensi Pertumbuhan Ekonomi Daerah Berciri Kepulauan Regional Sumatera. *Prosiding SENAM 2024: Seminar Nasional Ekonomi & Bisnis*, 4.
- Wibisono, Y. (2003). *Konvergensi di indonesia, beberapa temuan awal dan implikasinya*. University of Indonesia.
- Williamson, J. G. (1965). Regional Inequality and the Process of National Development: A Description of the Patterns. *Economic Development and Cultural Change*, 13(4, Part 2). <https://doi.org/10.1086/450136>
- Yudrianto, A. (2023). *KONVERGENSI PENDAPATAN ANTAR KABUPATEN/KOTA DI PROVINSI JAWA TENGAH TAHUN 2018/2022*. https://eprints.uad.ac.id/83346/9/T1_1900010194_NASKAH_PUBLIKASI__230927121707.pdf
- Zainuri, Z., Lutfhi, A., Saleh, M., Aisyah, S., & Fathorrazi, M. (2022). ANALISIS KONVERGENSI PERTUMBUHAN EKONOMI DI PROVINSI JAWA TIMUR PASCA KRISIS GLOBAL TAHUN 2008. *Ekspansi: Jurnal Ekonomi, Keuangan, Perbankan, Dan Akuntansi*, 14(2). <https://doi.org/10.35313/ekspansi.v14i2.3998>
- Zega, Y. T., Mursalin, D., & Yudhistira, I. P. (2022). Ketimpangan pembangunan dan konvergensi pendapatan antarkabupaten/kota di Provinsi Sumatera Utara. *Jurnal Ekonomi Pembangunan STIE Muhammadiyah Palopo*, 8(2), 188-207.