



Analysis of the Impact of the Base Sector and Agglomeration in the Manufacturing Industry on Economic Growth in Banten Province

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Abstract. This study aims to examine the role of the manufacturing sector in revitalizing economic growth in Banten Province. The Location Quotient (LQ) method was employed to determine the base and non-base sectors of the manufacturing industry in each region, while the Balassa Index was applied to identify the concentration of manufacturing industries (agglomeration) across districts and municipalities in the province. Banten consists of eight administrative regions, all of which were included in the analysis. Panel data regression was used to analyze the impact of base sectors and agglomeration on economic growth in Banten from 2017 to 2022. The results indicate that both base sectors and industrial agglomeration, along with the human development index and investment as control variables, have a significant positive effect on regional economic growth. In addition to regression analysis, this study also examined the development of base sectors using the LQ formula as an alternative proxy for analyzing industrial agglomeration, showing that four regions fall into base and non-base categories for the manufacturing sector. Similarly, the Balassa Index analysis revealed that four regions are classified as agglomerated and non-agglomerated in terms of manufacturing industry. These findings highlight that the manufacturing sector, supported by industrial agglomeration, human development, and investment, plays a crucial role in promoting economic growth in Banten Province.

Keywords: Agglomeration, Base Sector, Economic Growth, Manufacturing Industry, Panel Data Regression.

1 Introduction

Economic growth is an important indicator that reflects the changes and progress of a region's economy [1]. Each region within a country has different potentials, resulting in varying rates of economic growth. Regional income, derived from various economic activities across sectors, serves as an economic indicator to measure and assess economic growth at both national and regional levels [2]. The success of regional economic development is achieved when economic sectors show consistent annual growth [3]. One of the government's efforts to promote economic development is through the process of industrialization to enhance economic performance [4].

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One of the regions that plays an important role in national economic growth is Banten Province. This is due to its strategic location-being close to the Sunda Strait, which is part of the Indonesian Archipelagic Sea Lanes (ALKI), and to Jakarta, as the main route for both national and international trade [5]Therefore, this strategic position provides opportunities for the government and industry players to develop economic activities across various sectors by leveraging locational advantages to expand distribution and access to international markets.

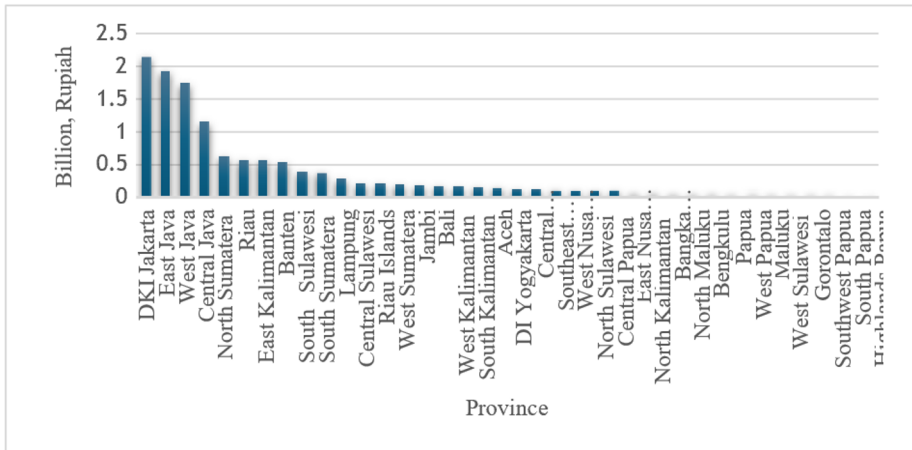


Fig. 1. GRDP at constant 2010 prices in 2024 (billion rupiah).

Source: BPS-Statistics Indonesia (2024) [6]

As shown in Fig. 1., the largest contributor to Indonesia's national GDP in 2024 was DKI Jakarta Province, with a total of Rp 2,151,041.33 billion. In contrast, the smallest contributor was Papua Pegunungan Province, with a GDP of Rp 13,798.74 billion. Meanwhile, Banten Province ranked eighth nationally, contributing a Gross Regional Domestic Product (GRDP) at Constant 2010 Prices of Rp 531,735.25 billion [7] (BPS, 2024). According to the Central Statistics Agency (Badan Pusat Statistik, 2024), Banten Province contributed Rp 507,425.74 billion to the national GRDP in 2023, which increased to Rp 570,824.01 billion in 2024 [8]. Although the GRDP value increased, the economic growth rate of Banten Province tended to fluctuate from year to year.

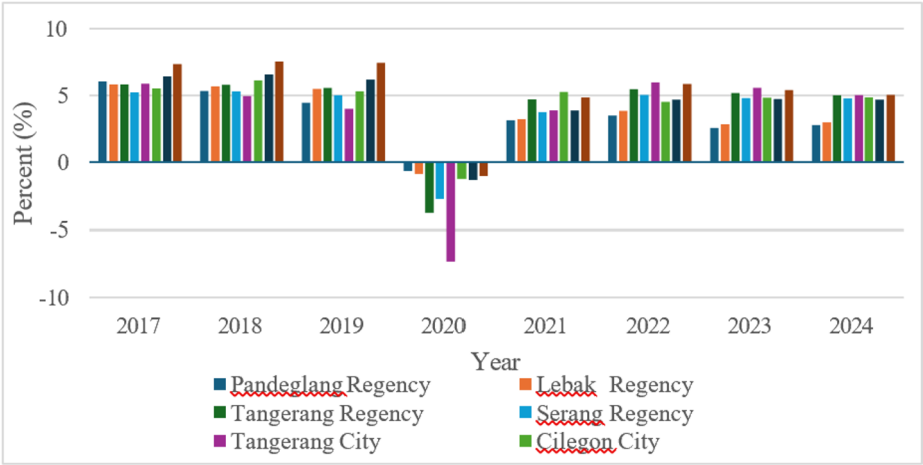


Fig. 2. Economic growth of regencies/cities in Banten Province, 2017–2024 (percent).

Source: BPS-Statistics Indonesia (2024) [9]

Fig. 2 shows that the economic growth of Banten Province fluctuated from 2017 to 2024. All regions in Banten experienced a significant decline in 2020 due to the impact of the COVID-19 pandemic, which weakened the industrial and business sectors [10]. However, from 2021 to 2024, Banten’s economic growth gradually increased in line with economic recovery, as well as fiscal, monetary, and industrial development policies implemented by the government [11].

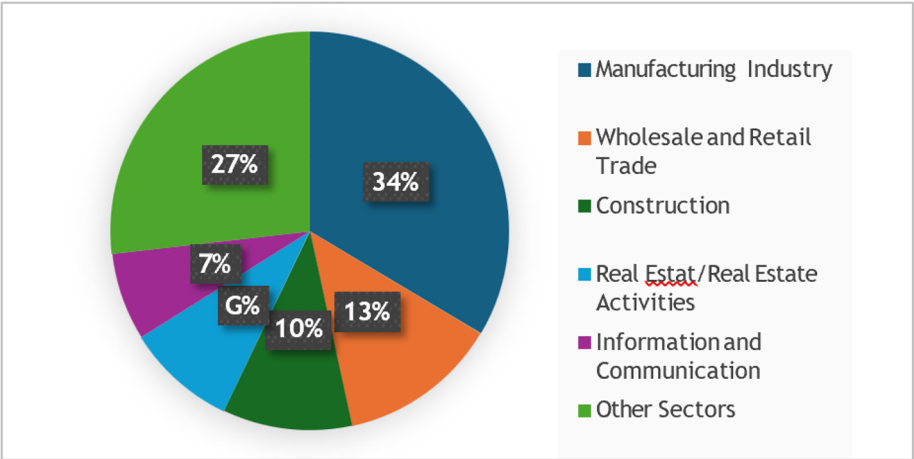


Fig. 3. GDRP contribution by industry sector in Banten Province, 2024.

Source: BPS-Statistics Indonesia (2024) [12]

Fig. 3 shows that the largest contribution to Banten Province's GRDP by business field comes from the manufacturing industry, accounting for 34%, followed by the trade sector contributing 13%, construction with 10%, real estate with 9%, information and communication with 7%, and the remaining 27% from the combined contributions of other sectors. Given the significant share of the manufacturing industry, Banten Province is recognized as one of Indonesia's major manufacturing centers, which also drives the national GRDP, particularly in Java Island [13].

The manufacturing sector plays a crucial role in economic growth by promoting investment and capital accumulation, creating economies of scale that reduce production costs, enhancing competitiveness, and stimulating innovation and technological advancement. Moreover, this sector has strong inter-sectoral linkages and produces high-value, durable goods [14].

The dominance of large-scale industries along Banten's northern coastal areas—such as Cilegon, Serang, and Tangerang—illustrates the substantial contribution of this sector to the regional economy [15]. The sectoral GRDP contribution also reflects the extent of each sector's influence on Banten's overall economic structure [16].

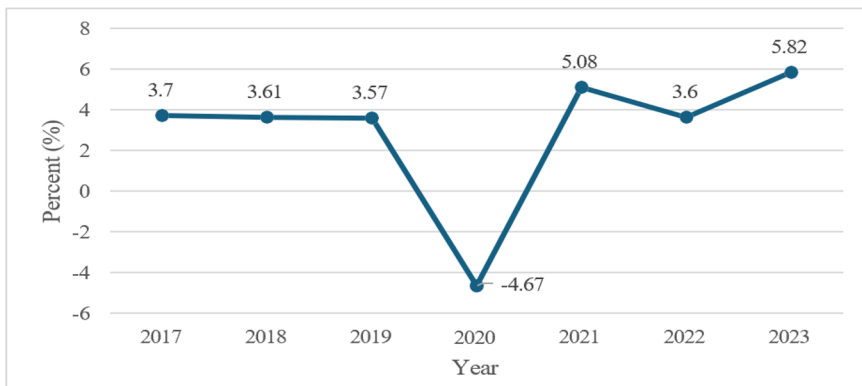


Fig. 4. Manufacturing industry economic growth in Banten Province, 2017–2023.

Source: BPS-Statistics Indonesia (2024) [17]

Based on Fig. 4, the growth rate of Banten Province's manufacturing industry experienced a sharp decline in 2020, reaching -4.67% due to the impact of the COVID-19 pandemic. The implementation of large-scale social restrictions (PSBB) reduced economic activity, decreased income, and forced industrial players to implement efficiency measures, including workforce reductions to minimize losses [10] (Satu Data Cilegon, 2023). In addition, low household consumption caused by economic uncertainty reduced demand for goods and services, which in turn led to a decrease in production [18].

Nevertheless, the manufacturing sector began to recover in 2021 with a growth rate of 5.08%, slightly slowed in 2022 at 3.60%, and rose again in 2023 to 5.82%. These fluctuations indicate the vulnerability of Banten's manufacturing structure, which still

depends heavily on external and foreign demand, lacks innovation, and has yet to optimize production capacity [19].

Although the growth of the manufacturing industry has declined, the sector remains the main pillar of Banten Province's economy. However, the BPS socio-economic analysis (2023) indicates signs of deindustrialization as the growth of the previously dominant manufacturing sector slows down [19]. This condition is marked by a decreasing contribution of manufacturing to GRDP and a reduction in employment within the sector. From 2014 to 2023, the gross value share of manufacturing has declined by an average of 0.52% per year, exacerbated by the COVID-19 pandemic, which caused a contraction of -4.67%.

During the pandemic and the subsequent recovery period, the manufacturing sector also began to be displaced by service sectors such as information and communication, health, finance, and education [20]. This shift has influenced production, demand, and employment absorption. Nevertheless, several subsectors—such as pharmaceuticals and food and beverage manufacturing—continued to grow positively in 2020. Overall, the slowdown in the manufacturing industry has had broad impacts on the sectoral and regional economic structure of Banten, which remains highly dependent on this sector.

In facing global challenges in the post-pandemic era of 2020, the manufacturing sector must undergo economic transformation to adapt, innovate, and reestablish itself as the main driver of economic growth in Banten Province. This transformation is essential to enhance productivity, create employment opportunities, attract investment, and expand exports both domestically and internationally [21]. The manufacturing sector plays a significant role in the national economy, contributing 20% to GDP, 30% to tax revenues, and 74% to national exports. Therefore, strengthening this sector is key to accelerating economic recovery [21]. Economic growth also requires the development of industries across various sectors based on regional competitive advantages [1][22]. To identify these key sectors, a basic sector analysis approach is applied using the Gross Regional Domestic Product (GRDP) indicator to determine which sectors contribute most to regional economic transformation [23]. Consequently, conducting a basic sector analysis across the eight regencies and cities of Banten Province serves as a strategic step to identify leading sectors that have the potential to grow faster, possess high competitiveness, and contribute to the export of goods and services beyond the region [3].

In addition to basic sector analysis, economic growth can also be promoted through industrial agglomeration, which refers to the concentration of enterprises within specific sectors in the same geographical area to gain the benefits of proximity—such as easier collaboration, knowledge sharing, and innovation [24]. Agglomeration emerges as economic actors seek efficiency gains to increase productivity and income [25]. Industries tend to cluster in areas with potential and comparative advantages, where geographical proximity enhances productivity, competitive wages, technological innovation, and workforce quality [26]. In Banten Province, the level of industrial agglomeration can be measured using the Balassa Index based on the number of workers in the industrial sector, which indicates the extent to which agglomeration drives regional GRDP growth [27].

In addition to analyzing industrial concentration based on leading sectors using the Balassa Index, regional economic growth in Banten Province can also be driven by

improving the quality of the workforce and investment levels. The Human Development Index (HDI) reflects the quality of human resources (HR) as well as the level of investment in a region. Successful economic development through industrialization is characterized by the creation of broad employment opportunities for the community [28]. The HDI is used to assess human development performance through three key dimensions—health, education, and a decent standard of living—that collectively influence societal welfare [29]. High-quality workforce contributes to greater productivity, innovation, and labor competitiveness across various economic sectors [30][31].

Apart from human capital, investment also plays a vital role in promoting economic growth. Investment includes both domestic investment (PMDN) and foreign direct investment (FDI), which can expand production capacity and create more job opportunities [32]. Increased investment enhances the availability of capital goods and technology, leading to higher production of goods and services and generating greater regional income [33]. Therefore, this study integrates two approaches through partial regression analysis, using control variables such as the Human Development Index (HDI) to represent labor quality and investment, in order to examine their effects on the economic growth of Banten Province, with a particular focus on the manufacturing sector, which makes a significant contribution to the regional economy.

2 Literature Review

2.1 Basic Sector and Base Theory

The Base Theory proposed by Hoover & Giarratani (1984) explains that regional economic activities can be divided into two categories: basic and non-basic activities [34]. The economic base theory is used to identify export-oriented activities, which represent a region's ability to meet demand both from within and outside the region as an indicator of regional growth. In contrast, non-basic activities serve only the local market and are assumed to be a response to local demand [34].

Economic activities are thus classified into basic and non-basic sectors. The basic sector includes the production of goods and services for export, generating income from outside the region, while the non-basic sector focuses on fulfilling local needs, which are influenced by the income of the local population [35]. Therefore, the basic sector plays a crucial role in driving regional economic growth.

One commonly used method to identify basic sectors is the Location Quotient (LQ) analysis, which compares the contribution of a particular sector to the regional GRDP with the contribution of the same sector to the provincial GRDP. According to Hoover & Giarratani (1984), the LQ method is more accurate than directly classifying industries into basic or non-basic sectors because it considers the sector's dual role in serving both export and local demand simultaneously [34].

2.2 Agglomeration Theory

In general, the concentration of economic activities is known as agglomeration, which refers to the clustering of industrial activities within a specific area to enhance efficiency and promote economic growth. Referring to the ideas of Marshall (1890), agglomeration arises from the proximity among business actors, providing advantages such as access to skilled labor, raw materials, and the diffusion of knowledge and innovation, which collectively lead to production efficiency [36][37].

Agglomeration offers external benefits in the form of reduced production and distribution costs, as well as the shared use of facilities, ultimately increasing efficiency and stimulating economic growth [38]. Industrial agglomeration can be measured using several indicators [27], including:

1. The ratio of the urban population to the total provincial population,
2. The ratio of regency/city GRDP to provincial GRDP, and
3. The ratio of industrial employment in regencies/cities to total industrial employment in the province.

These three indicators can be used to calculate the level of agglomeration. However, this study employs the Balassa Index to measure the degree of industrial sector concentration, based on the contribution of GRDP or the share of manufacturing sector employment in a given region relative to the province as a whole.

2.3 Gross Regional Domestic Product (GDRP)

Each region possesses distinct economic potential, resulting in variations in income levels and the value added generated. The Gross Regional Domestic Product (GRDP) is used to measure economic activity through the gross value added of goods and services produced within a region [7]. GRDP is classified into two types: at current prices (ADHB) and at constant prices (ADHK) [39]. Achieving equitable economic growth remains a primary objective for improving public welfare [40].

2.4 Manufacturing Industry

The manufacturing industry refers to economic activities that transform raw materials into semi-finished or finished goods through mechanical, chemical, or manual processes to increase their utility and value [41]. Manufacturing enterprises are categorized into four groups based on the number of employees: large industries (more than 100 workers), medium industries (20–99 workers), small industries (5–19 workers), and household industries (1–4 workers).

Labor plays a crucial role in the production process as a key factor—alongside capital and natural resources—in accelerating production and distribution [42]. The quality of human resources is measured using the Human Development Index (HDI), which encompasses aspects of health, education, and purchasing power [43]. The higher the quality of human resources, the greater the productivity of goods and services produced, leading to more efficient production processes and increased regional income [31].

2.5 Endogenous Growth Theory

The endogenous growth theory explains that economic growth is influenced not only by external factors such as capital and technology but also by internal factors such as human resource quality and knowledge, which enhance labor skills through experience and social interaction [44]. Economic growth is driven by capital, labor, and technological advancement [45], while the quality of human capital can be assessed through the Human Development Index (HDI), which includes education, health, and a decent standard of living [46]. The higher the quality of life and education of the workforce, the greater their impact on productivity and economic growth.

2.6 Investment

Investment refers to the allocation of capital by individuals or businesses to acquire production equipment or fixed assets with the aim of increasing the productivity of goods and services [32]. Investments are also made to replace outdated capital goods in order to maintain production efficiency [36]. Investment is generally categorized into two types: Foreign Direct Investment (FDI) and Domestic Investment (DI) [47]. According to the Harrod–Domar theory as cited in Elina (2023) [48], investment plays a vital role in promoting sustainable economic growth by increasing income and capital accumulation. As investment rises, production capacity expands, new job opportunities emerge, and the Gross Regional Domestic Product (GRDP) consequently increases [33].

3 Method

3.1 Types and sources of data

The data collection for this research was conducted through official online sources, utilizing secondary data from 2017–2022 obtained from the Banten Provincial Statistics Agency (BPS) and the BPS offices of eight regencies/cities within Banten Province. This data was used to calculate industrial agglomeration using the Balassa Index method, which requires information on the number of manufacturing industry workers in each region. For the analysis of base sectors using the Location Quotient (LQ) method, data on the manufacturing sector's Gross Regional Domestic Product (GRDP) at constant 2010 prices and the total GRDP at both provincial and regency/city levels were needed. In addition, this study also employed control variables, including the Human Development Index (HDI) and investment levels in each region of Banten Province.

3.2 Analytical method

This study employs a quantitative analysis approach, using manual calculations in Microsoft Excel to obtain industrial agglomeration values through the Balassa Index and to identify base sectors using the Location Quotient (LQ) method. Furthermore, the analysis proceeds with panel data regression using STATA software.

3.2.1 Analysis of the base sector using Location Quotient (LQ).

The Location Quotient (LQ) analysis is used to identify the leading (base) sectors of a region by comparing the performance of a specific sector within the region to that of a broader area, using value-added or GRDP variables [49]. The LQ formula [50] is as follows:

$$LQ = \frac{Si/N}{S/Ni} \quad (3.1)$$

description:

S_i = GRDP of the manufacturing sector in the regency/city N = Total GRDP of the regency/city

S = GRDP of the manufacturing sector in Banten Province N_i = Total GRDP at the provincial level (Banten)

LQ = Location Quotient value

Interpretation of the LQ value [51]:

a. $LQ > 1$: The manufacturing sector is classified as a base sector, meaning it contributes to economic growth by meeting both local and provincial demand.

b. $LQ < 1$: The manufacturing sector is non-base, indicating that it only meets local production needs.

3.2.2 Analysis of manufacturing industry agglomeration using the Balassa Index.

The Balassa Index is used to measure the degree of spatial concentration, which reflects cost efficiency resulting from industrial agglomeration [25]. This method illustrates the agglomeration conditions of a region based on the number of workers in the manufacturing sector. The Balassa Index formula is as follows [27]:

$$\text{Balassa} = \left(\frac{E_{ij}}{\sum_j E_{ij}} \right) / \left(\frac{\sum_i E_{ij}}{\sum_i \sum_j E_{ij}} \right) \quad (3.2)$$

description:

E = Employment

i = Sector

j = Regency/City

Interpretation of the Balassa Index indicates the level of manufacturing industry agglomeration:

> 4: Strong agglomeration

2–4: Moderate agglomeration

1–2: Low agglomeration

0–1: No agglomeration

However, in this study, only two categories were used:

1–2: Presence of manufacturing industry agglomeration

0–1: Absence of manufacturing industry agglomeration

This simplification was made because the focus of the study is to identify regions that either have or do not have manufacturing industry agglomeration.

3.2.3 Panel Data Regression Analysis

This study applies panel data regression with the dependent variable being the GRDP of Banten Province (Y) and the independent variables consisting of (X1) Base sector (LQ), (X2) Agglomeration (Balassa Index), and (X3) Human Development Index (HDI) as a control variable to prevent bias [52]. The analysis was conducted using STATA software for the 2017– 2022 period through three main stages:

1. Model Estimation

Selecting the most appropriate panel data model, such as Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM) to ensure valid estimation results [53].

2. Classical Assumption Test

- a. *Heteroskedasticity* Aimed at detecting non-constant error variance [54]. The Breusch– Pagan and White tests were used. If heteroskedasticity is detected, it can be corrected using the Generalized Least Squares (GLS) method with the xtglm command in STATA.
- b. *Autocorrelation* Used to detect the presence of correlation between error terms across different time periods [52]. Tests include Durbin–Watson, Breusch–Pagan–Godfrey, or Robust Standard Errors methods [54].
- c. *Multicollinearity* Aims to identify linear relationships among independent variables [52]. The Variance Inflation Factor (VIF) was used, where an average VIF > 10 indicates multicollinearity.

3. Statistical

- a. R^2 (Coefficient of Determination): Measures the ability of independent variables to explain variations in the dependent variable [54].
- b. T-test (Partial Test): Tests the individual effect of each independent variable on the dependent variable.
- c. F-test (Simultaneous Test): Assesses the joint effect of all independent variables on the dependent variable [52].

4 Result and Discussion

4.1 Analysis of the Manufacturing Sector in Banten Province

4.1.1 Analysis of the Location Quotient (LQ).

The results of the Location Quotient (LQ) analysis for the manufacturing sector in Banten Province for the period 2017– 2022 are as follows:

Table 1. Results of the 2017-2022 manufacturing industry location quotient calculation.

Regency/City	<i>Location Quotient (LQ)</i>						Average	Desc
	2017	2018	2019	2020	2021	2022		
Pandeglang	Re-0.183	0.186	0.194	0.199	0.200	0.224	0.198	Non- Base

Regency/City	<i>Location Quotient (LQ)</i>						Average	Desc
	2017	2018	2019	2020	2021	2022		
Lebak Regency	0.294	0.291	0.297	0.306	0.306	0.321	0.302	Non- Base
Tangerang Re-gency	1.108	1.097	1.090	1.048	1.037	1.051	1.072	Base
Serang Regency	1.434	1.452	1.458	1.430	1.430	1.450	1.442	Base
Tangerang City	1.049	1.048	1.056	1.096	1.091	1.043	1.064	Base
Cilegon City	1.716	1.742	1.759	1.806	1.816	1.822	1.777	Base
Serang City	0.141	0.138	0.138	0.141	0.139	0.142	0.140	Non- Base
Tangerang Selatan City	0.272	0.259	0.246	0.230	0.222	0.230	0.243	Non- Base

Based on the LQ analysis, there are four regions in Banten Province classified as manufacturing base sectors with an LQ value greater than 1, namely Tangerang Regency (1.072), Serang Regency (1.442), Tangerang City (1.064), and Cilegon City (1.777).

This advantage is supported by the presence of large industrial zones, adequate infrastructure, and high investment inflows. Meanwhile, Pandeglang Regency (0.198), Lebak Regency (0.302), Serang City (0.140), and South Tangerang City (0.243) are classified as non-base sectors, where the manufacturing sector is not yet dominant due to dependence on agriculture and services as well as limited industrial areas.

4.1.2 Analysis of Manufacturing Industry Agglomeration.

The results of calculations in this study to determine which manufacturing sectors in Banten Province are agglomerated using the Balassa Index are as follows:

Table 2. Balassa index calculation results for the manufacturing industry 2017-2022.

Regency/City	Balassa Index						Average	Desc
	2017	2018	2019	2020	2021	2022		
Pandeglang Re-gency	0.009	0.009	0.008	0.006	0.011	0.008	0.009	Not Agglomerated
Lebak Regency	0.071	0.074	0.114	0.076	0.088	0.008	0.085	Not Agglomerated
Tangerang Re-gency	1.482	1.697	1.335	1.556	1.778	1.649	1.583	Agglomerated
Serang Regency	1.344	0.876	1.481	1.018	1.424	1.370	1.252	Agglomerated
Tangerang City	1.619	1.766	1.940	1.973	1.339	1.436	1.679	Agglomerated
Cilegon City	1.370	1.384	1.008	0.975	0.930	0.900	1.095	Agglomerated

Regency/City	Balassa Index						Average	Desc	
	2017	2018	2019	2020	2021	2022			
Serang City	0.063	0.058	0.049	0.041	0.040	0.037	0.048	Not ated	Agglomer-
Tangerang Selatan City	0.449	0.300	0.234	0.231	0.235	0.273	0.287	Not ated	Agglomer-

The Balassa Index was used to identify which regions in Banten Province exhibit industrial agglomeration in the manufacturing sector. Based on the Balassa Index results from 2017–2022, only a few regions recorded values greater than 1, indicating the presence of low to moderate levels of manufacturing industry agglomeration. These regions include Tangerang Regency, Serang Regency, Tangerang City, and Cilegon City. This finding suggests that the manufacturing sector in these areas has developed into a base sector, contributing to regional economic growth.

In contrast, Pandeglang Regency, Lebak Regency, Serang City, and South Tangerang City have low Balassa Index values, indicating that the manufacturing sector is not yet dominant and remains dependent on other sectors such as agriculture and services. Factors such as limited infrastructure, restricted market access, and lower investment levels have slowed industrial development in these areas. This condition aligns with the reality that the northern region of Banten serves as the center of industrial activities and concentration of base sectors [15].

4.2 Panel Data Regression

4.2.1 Model Estimation

In panel data analysis, selecting the appropriate estimation model is crucial to avoid issues arising from the combination of time-series and cross sectional data [53]. The results of the regression analysis indicate the best-fitting model as follows:

Table 3. Results of the manufacturing industry base sector model suitability test

Estimation Model	Chi-Square Probability	Best Model
Chow Test	0.0000	Fixed EffectModel (FEM)
Hausman Test	0.000	Fixed EffectModel (FEM)

Based on table 3, the best model for analyzing the effect of the manufacturing industry base sector on economic growth in Banten Province is the Fixed Effect Model (FEM). This is indicated by the results of the Chow test (Prob. Chi-Square = 0.000) and the Hausman test (Prob. Chi-Square = 0.0007), both of which are smaller than the 5% significance level, so that FEM is selected as the estimation model used in the next stage of analysis.

Table 4. Results of the manufacturing industry agglomeration model suitability test.

Estimation Model	Chi-Square Probability	Best Model
Chow Test	0.0000	Fixed EffectModel (FEM)
Hausman Test	0.0000	Fixed EffectModel (FEM)

Based on the results of table 4, the best model for analyzing the effect of manufacturing industry agglomeration on economic growth in Banten Province is the Fixed Effect Model (FEM). This is evidenced by the results of the Chow test (Prob. Chi-Square = 0.000) and the Hausman test (Prob. Chi-Square = 0.0000), both of which are smaller than the 5% significance level, so that FEM is selected as the estimation model used in the next stage of analysis.

4.2.2 Classical Assumption Test

After obtaining the best panel regression model, the next step is to conduct a classical assumption test to ensure the model's suitability for use in the analysis. This test was conducted on both models, namely the base sector and manufacturing industry agglomeration, to ensure that the model meets the BLUE (Best Linear Unbiased Estimator) criteria. The results of the classical assumption test are as follows:

Table 5. Results of classical assumption testing in the basic manufacturing industry sector.

Multicollinearity		Prob > Chi2	
Variance Inflation Factor	Variable	VIF	1/VIF
	Ln_inv	2.12	0.4721
	LQ	1.84	0.5431
	IPM	1.22	0.8175
	Mean VIF	1.73	
Heteroskedasticity	Prob > Chi2		
Modified Wald Test	0.0000		
Autocorrelation	Prob > Chi2		
Wooldridge Test	0.1367		

The results of the classical assumption test on the manufacturing industry base sector model show that there is no multicollinearity problem (average VIF = 1.73 < 10). However, the model indicates heteroscedasticity (Chi² p-value = 0.0000 < 0.05). Meanwhile, the autocorrelation test results show that there is no autocorrelation (p-value = 0.1367 > 0.05).

Table 6. Results of classical assumption testing for manufacturing industry agglomeration

Multicollinearity		Prob > Chi2	
Variance Inflation Factor	Variable	VIF	1/VIF
	Ln_inv	1.82	0.5498
	AG	1.72	0.5805
	IPM	1.16	0.8585

	Mean VIF	1.57
Heteroskedasticity	Prob > Chi2	
Modified Wald Test	0.0000	
Autocorrelation	Prob > Chi2	
Wooldridge Test	0.2117	

The results of the classical assumption test on the manufacturing industry agglomeration model show that there is no multicollinearity (average VIF = $1.57 < 10$), but there are indications of heteroscedasticity (Chi^2 p-value = $0.0000 < 0.05$). Meanwhile, the autocorrelation test shows no autocorrelation problems (p-value = $0.2117 > 0.05$). To overcome heteroscedasticity in both models, the Feasible Generalized Least Square (FGLS) method [54] was used, so that the model was declared to have met the classical assumptions. Thus, the results of model improvement using Feasible Generalized Least Squares (FGLS) were used as the final estimate, which is presented in Table 7 and 8 below.

Table 7. Results of classical assumption test improvements in the basic manufacturing industry sector.

Variable	Coefficient	Prob
LQ	0.6600	0.000*
IPM	0.0621	0.000*
INV	0.0327	0.004*
Constan	5.2909	0.000*
Prob>F		0.0000*
R Squared		0.8293

*) Significant at the $\alpha = 1\%$ level

Table 8. Results of the improvement of the classical assumption test of manufacturing industry agglomeration.

Variable	Coefficient	Prob
AG	0.6290	0.000*
IPM	0.0495	0.000*
INV	0.0423	0.003*
Constant	6.1243	0.000*
Prob>F		0.0000*
R Squared		0.8324

*) Significant at the $\alpha = 1\%$ level

4.2.3 Statistical Test

Statistical testing was conducted using the simultaneous test ($\text{Prob} > F$), partial test (p-value), and the coefficient of determination (R^2) to evaluate the influence of independent variables on economic growth [54]. Based on the regression results after correcting for heteroskedasticity using the Feasible Generalized Least Squares (FGLS) method,

the value of $\text{Prob} > F = 0.0000 < 0.05$ indicates that the independent variables collectively have a significant effect on the Gross Regional Domestic Product (GRDP) of Banten Province.

Partially, as shown in Table 7 (LQ Model), the variables LQ (0.000), IPM (0.000), and investment (0.004) are statistically significant. Similarly, in Table 8 (Agglomeration Model), the variables AG (0.000), IPM (0.000), and investment (0.003) are also significant since their p-values < 0.05 . The R^2 value of the LQ model = 0.8293 shows that 82.93% of the variation in GRDP is explained by the variables in the model, while the R^2 of the agglomeration model = 0.8324, meaning 83.24% of GRDP variation is explained by the independent variables, with the remainder influenced by factors outside the model.

4.3 Interpretation of Panel Data Regression Results

4.3.1 Basic Sectors for Economic Growth in Banten Province

The regression results indicate that LQ has a positive and significant effect on economic growth (coefficient= 0.660; $p=0.000$), meaning that a one-unit increase in the base sector can stimulate economic growth by 66% (*ceteris paribus*). This finding implies that collaboration between base and non-base sectors plays an important role in enhancing the Gross Regional Domestic Product (GRDP). The base sector contributes through value-added activities and exports, while the non-base sector supports growth through increased local demand.

Furthermore, the Human Development Index (IPM) variable also shows a positive and significant effect (coefficient=0.062; $p=0.000$), indicating that a one-point increase in HDI can boost economic growth by 6.2% (*ceteris paribus*). A higher IPM reflects better quality of human capital, which leads to greater labor productivity and improved regional competitiveness.

Meanwhile, the investment variable has a positive coefficient of 0.032 with a p-value of 0.004, suggesting that a 1% increase in investment can raise economic growth by 0.032% (*ceteris paribus*). This finding highlights the essential role of investment in strengthening production capacity and driving economic growth in Banten Province.

In conclusion, investment plays a crucial role in transforming leading sectors into export-oriented base sectors, enhancing productivity through technology adoption from domestic and foreign investments (PMA and PMDN), and expanding export market access, which ultimately stimulates economic growth in Banten Province.

4.3.2 Industrial Manufacturing Agglomeration and Economic Growth in Banten Province.

The regression analysis also reveals that manufacturing industry agglomeration has a positive and significant effect on the economic growth of Banten Province during 2017–2022, with a coefficient of 0.629 and a probability value of 0.000. This means that a one-unit increase in the agglomeration index can raise economic growth by 62.9% (*ceteris paribus*).

In addition, the Human Development Index (IPM) also exerts a positive and significant influence (coefficient = 0.049; $p = 0.000$), indicating that improvements in human capital quality contribute to a 4.9% increase in economic growth (*ceteris paribus*). Similarly, investment shows a positive coefficient of 0.042 with a p -value of 0.003, meaning that each 1% increase in investment boosts economic growth by 0.042% (*ceteris paribus*).

Therefore, the three variables industrial agglomeration, IPM, and investment are proven to have a positive and significant effect on economic growth in Banten Province.

Conclusion

This study shows that the basic manufacturing industry sector plays an important role in driving economic growth in Banten Province. Based on Location Quotient (LQ) analysis, the areas classified as basic sectors because they are able to serve demand from outside the region are Serang Regency, Tangerang Regency, Tangerang City, and Cilegon City, while Pandeglang Regency, Lebak Regency, Serang City, and South Tangerang City are classified as non-basic sectors because they only meet local needs.

Through the Balassa Index, it was found that the areas with manufacturing industry agglomeration are Serang Regency, Tangerang Regency, Tangerang City, and Cilegon City, which show high industry concentration and increased productivity due to agglomeration benefits. Conversely, the other four areas have not experienced agglomeration because the location of industries is still scattered.

The results of panel data regression analysis show that the basic sector and manufacturing industry agglomeration have a positive and significant effect on economic growth in Banten. In addition, the Human Development Index (HDI) and investment also have a significant positive effect. An increase in HDI reflects a healthy and educated workforce, while investment drives production capacity, creates jobs, and strengthens the basic sector for exports. Thus, the combination of the basic sector, manufacturing industry agglomeration, human resource quality, and investment has proven to be the main factors in driving sustainable economic growth in Banten Province.

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