

Analysis of the Influence of Labor, Investment, and Inflation on the Growth of the Manufacturing Industry in East Java from 2008-2023

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DOI : <https://doi.org/10.61796/ijai.v2i1.31>

Sections Info

Article history:

Submitted: December 30, 2025
Final Revised: January 15, 2026
Accepted: January 30, 2026
Published: February 24, 2026

Keywords:

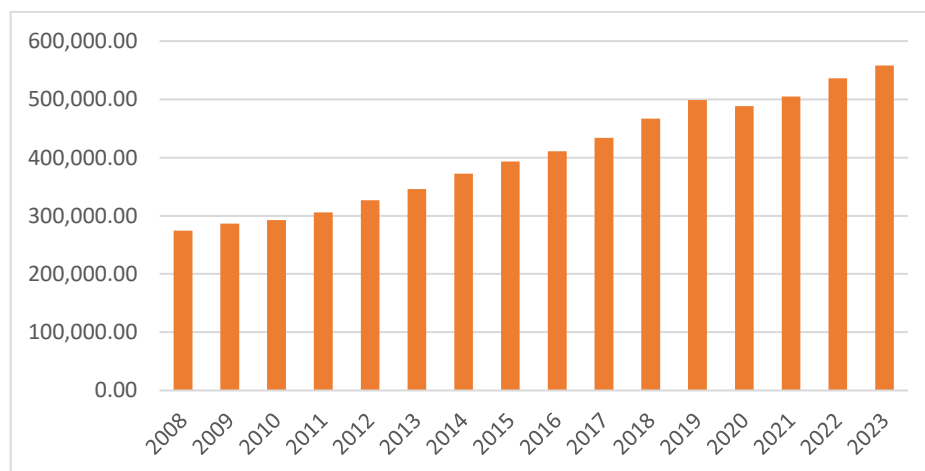
Labor
Investment
Inflation
GRDP
Manufacturing industry
East java

ABSTRACT

Objective : This study analyzes the impact of labor, investment, and inflation on the growth of the manufacturing sector in East Java Province during 2008–2023. **Method:** Using an explanatory quantitative approach with a log-linear multiple regression model and annual secondary data from the Central Statistics Agency (BPS). **Results:** The results show that labor has a positive and significant effect, while inflation has a negative and significant effect on industrial growth. Investment has a positive but statistically insignificant impact. Simultaneously, all three variables show significant influence with an Adjusted R² of 80.76%. These findings highlight the importance of industrial development policies that consider workforce quality, inflation stability, and investment effectiveness. **Novelty:** This study provides empirical evidence on the simultaneous impact of labor, investment, and inflation on manufacturing sector growth in East Java Province during 2008–2023 using a log-linear multiple regression model with long-term annual data.

INTRODUCTION

The manufacturing industry is a key sector in driving economic growth, both nationally and regionally. Its role is very strategic because it not only contributes significantly to the Regional Gross Domestic Product (PDRB) but also serves as a major employer and a driver of structural transformation towards an industry-based economy [1], [2]. In East Java Province, this sector contributes more than 30% to the total GRDP, making it the second-largest industrial center in Indonesia after West Java [3].



Sumber: BPS Jawa Timur 2008-2023

Figure 1. GDP at Constant Prices by Manufacturing Subsector Annually (Billion Rupiah).

Based on Figure 1, the GDP of the manufacturing industry sector in East Java at constant prices during the period 2008–2023 shows a fairly consistent growth trend. The value of the GDP in this sector increased from Rp274,406.12 billion in 2008 to Rp558,417.35 billion in 2023. This growth indicates a strengthening of production capacity in the long term. The growth of the manufacturing industry in East Java has not always been stable, as seen in 2020 when the GDP value decreased due to the COVID-19 pandemic, which hindered production, demonstrating the sector's sensitivity to external conditions such as health crises and global fluctuations.

This dynamic is also reflected in the fluctuations in the number of workers in the industrial sector, which increased from 2,591,185 people in 2008 to 3,473,078 people in 2023, but with inconsistencies between output growth and job opportunities. Investment in this sector also shows a positive trend, from Rp45.24 billion in 2008 to Rp74.94 billion in 2023, although with significant fluctuations. Meanwhile, inflation in East Java shows striking variations, with a peak of 9.84% in 2008 and a low of 1.69% in 2021, which could potentially hinder industrial efficiency and investment growth if left unchecked.

However, this dominance does not automatically guarantee stability or consistent growth, as the sector is highly influenced by macroeconomic dynamics such as labor, investment, and inflation [4]. The fluctuating output development also needs to be examined from the labor side as the main input, in order to see the relationship between production dynamics and changes in the number of workers, making it important to understand the relationship between industrial growth and employment conditions.

The phenomenon of the mismatch between the increase in industrial output and labor absorption remains a major issue, especially in the post-COVID-19 pandemic era. The increase in investment has not yet fully been able to drive the expansion of job opportunities, while inflation fluctuations continue to pressure production efficiency [5], [6]. For example, although the realization of Domestic Investment (PMDN) increased by 40% after the implementation of the Job Creation Law BKPM [3], the unemployment rate remained stagnant, indicating a potential mismatch between industrial needs and the quality of the available workforce [7].

Various previous studies have attempted to identify the factors influencing the growth of the manufacturing sector, but most are still limited in terms of variable coverage and time span. Islamiatus Izzah & Hendarti focused more on the relationship between labor and the human development index [8], while Mahendra & Hanifa did not include inflation as an important variable [9]. Soleman & Setyari used a short period (2015–2021), thus they were unable to fully capture the long-term economic dynamics [10]. Therefore, this research aims to fill that gap by examining the simultaneous effects of labor, investment, and inflation on the growth of the manufacturing sector in East Java Province over a long period (2008–2023). This study aims to empirically test the effects of labor, investment, and inflation on the growth of the manufacturing sector, which is a key sector in East Java. This objective is important, considering that this region is not only a center of manufacturing production but also has Strategic Economic Zones such as Gerbangkertosusila (Gresik, Bangkalan, Mojokerto, Surabaya, Sidoarjo, Lamongan) that

dominate the regional industrial structure (BPS in 2023). With an explanatory quantitative approach and 16 years of time series data, this research is expected to provide scientific and practical contributions to the formulation of regional industrial policies that are more responsive to real conditions and macroeconomic fluctuations [11], [12].

RESEARCH METHOD

This study adopts an explanatory quantitative approach to analyze the cause-and-effect relationship between independent variables (labor, investment, and inflation) and the dependent variable (GDP growth in the manufacturing sector in East Java Province). The research population includes all annual data of the manufacturing industry sector in East Java from 2008 to 2023, which is secondary data in the form of time series. The research sample was determined using purposive sampling techniques, ensuring the completeness and consistency of data over 16 years of observation.

The dependent variable in this study is the Gross Regional Domestic Product (GRDP) of the manufacturing industry sector at constant prices, measured in billion rupiah and sourced from the Central Statistics Agency (BPS). The independent variables include labor, measured as the number of workers in the manufacturing industry sector (in units of persons, from BPS); investment, measured through the realization value of Domestic Investment (PMDN) and Foreign Investment (PMA) in the industrial sector (in billion rupiah, from BPS and BKPM); and inflation, defined as the average annual percentage change in the Consumer Price Index (CPI) in East Java Province (in percent, from BPS).

The data collection process is carried out through documentation, including initial data inspection, variable grouping, formatting into digital format, and statistical processing and analysis. The data analysis technique uses multiple linear regression with a natural logarithm approach (log-linear), which aims to simplify the data scale, address potential heteroskedasticity, and allow interpretation in the form of elasticity. The regression model used is estimated using the Ordinary Least Squares (OLS) method. Before hypothesis testing, classical assumption tests are conducted, including normality (Jarque-Bera), multicollinearity (VIF and Tolerance), heteroscedasticity (Breusch-Pagan-Godfrey), and autocorrelation (Durbin-Watson) to ensure the model's validity and reliability. Hypothesis testing is conducted through partial significance tests (t-test), simultaneous significance tests (F-test), and the measurement of the coefficient of determination (R^2 and Adjusted R^2).

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 X_3 + \varepsilon$$

Where:

$\ln Y$: Natural logarithm of the Gross Regional Domestic Product GRDP of the manufacturing sector (LOGPDRB);

$\ln X_1$: Log of labor (LOGTK);

$\ln X_2$: Log of investment in the industrial sector (LOGINV);

$\ln X_3$: Inflation (LOGINF);
 β_0 : Intercept (constant);
 $\beta_1, \beta_2, \beta_3$: Regression coefficients;
 ε : Error term (residual).

RESULTS AND DISCUSSION

Results

Descriptive Statistics

Table 1. Descriptive Statistics.

Variabel	N	Min	Max	Mean	Median	Std. Dev.
LOGPDRB	16	12.5224	13.2329	12.8877	12.9040	0.2394
LOGTK	16	14.7538	15.0606	14.9416	14.9604	0.0882
LOGINV	16	10.7198	11.2244	11.0291	11.0872	0.1519
LOGINF	16	0.5242	2.2862	1.4346	1.5491	0.4848

Source: data processed with e-views 12

The results of the descriptive statistics show that the industrial sector GDP variable (LOGPDRB) has an average value of 12.8877 with a standard deviation of 0.2394, indicating relatively stable growth. The number of workers (LOGTK) shows an average of 14.9416 with a standard deviation of 0.0882, reflecting a relatively constant workforce. Investment (LOGINV) has an average of 11.0291 with a standard deviation of 0.1519, indicating controlled fluctuations. Meanwhile, inflation (LOGINF) has an average of 1.4346 with a standard deviation of 0.4848, indicating quite high variability.

Time Series Data Regression

Based on the results of multiple linear regression estimation using the Ordinary Least Squares (OLS) method conducted on time series data for the period 2008-2023, the following empirical model equation was obtained.

Table 2. Results of Multiple Linear Regression Analysis.

Ordinary Least Squares (OLS) Model

Variabel	Koefisien	Std. Error	t-Statistic
C	-14.5499	5.8224	-2.4989
LOGTK	1.8061	0.4427	4.0796
LOGINV	0.0643	0.2327	0.2762
LOGINF	-0.1797	0.0749	-2.4006
Adj R-Squared		0.759485	
F-Statistik		16.78871	
Sig(F-Statistik)		0.000136	

Source: data processed with e-views 12

Based on the results of the multiple linear regression estimation, the empirical model obtained is:

$$LOGPDRB = -145499 + 1.8061 \cdot LOGTK + 0.0643 \cdot LOGINV - 0.1797 \cdot LOGINF$$

The obtained regression model shows a significant relationship between the independent and dependent variables. The regression equation shows that labor has the highest positive coefficient (1.8061), followed by investment (0.0643), while inflation shows a negative impact (-0.1797). The constant value of -145499 indicates other variables outside the model that also influence the GDP of the industrial sector.

Classic Assumption Test

Normality Test

Table 3. Normality Test Results.

Jarque-Bera

Statistik	Value
Prob. Jarque-Bera	0.6948

Source: data processed with e-views 12

The test results show a probability value of 0.6948 (> 0.05), indicating that the residuals are normally distributed. This indicates that the residuals are normally distributed, thus fulfilling the normality assumption.

Multikolinearitas Test

Table 4. Multicollinearity Results.

Variance Inflation Factor (VIF)

Variabel	R ²	VIF
LOGTK	0.397	1.66
LOGINV	0.264	1.36
LOGINF	0.302	1.43

Source: data processed with e-views 12

The multicollinearity test conducted using the Variance Inflation Factor (VIF) shows that the VIF values for the LOGTK variable is 1.66, LOGINV is 1.36, and LOGINF is 1.43. All these values are below the threshold of 10, indicating no significant multicollinearity among the independent variables in the model.

Heteroskedastisitas Test

Table 6. Heteroskedastisitas Results.

Breusch Pagan Godfrey

Statistik	Nilai
Prob. Chi-Square	0.9423

Source: data processed with e-views 12

The results of the heteroscedasticity test conducted using the Breusch Pagan Godfrey method show a Chi-Square probability of 0.9423, which is also greater than 0.05. This means there is no heteroscedasticity problem in the model, so the residual variance can be considered constant.

Autokorelasi Test

Table 6. Autokorelasi Results

Durbin Watson

Statistik	Nilai
Prob. Chi-Square	0.9423

Source: data processed with e-views 12

The autocorrelation test using Durbin-Watson yielded a value of 1.887, which is close to 2. This indicates that the model is free from autocorrelation, meaning there is no relationship between residuals in different periods. Thus, all the classical assumptions tested have been met, providing greater confidence in the results of the regression analysis conducted.

Hipotesis Test

The results of the hypothesis test show that the independent variables in the regression model have different effects on the growth of the manufacturing sector's GDP. Partial testing using the t-test reveals that the labor variable (LOGTK) has a t-statistic of 4.0796 with a probability of 0.0015. This probability value is far below the significance level of 0.05, indicating that labor has a positive and significant impact on the GDP of the industrial sector. This suggests that an increase in the number of workers will significantly contribute to the growth of industrial output.

On the other hand, the investment variable (LOGINV) shows a t-statistic of 0.2762 with a probability of 0.7871. This probability value is much greater than 0.05, which means that investment does not have a significant effect on the industrial sector's GDP. These findings indicate that although investment has a positive coefficient, its impact on industrial growth has not yet been significantly observed during this research period.

Meanwhile, the inflation variable (LOGINF) has a t-statistic of -2.4006 with a probability of 0.0335. This probability value is less than 0.05, indicating that inflation has a negative and significant impact on the GDP of the industrial sector. This means that each increase in inflation can reduce the growth of the industrial sector, reflecting the impact of inflation on production costs and the purchasing power of the community.

Overall, the F-test results show that the three independent variables of labor, investment, and inflation simultaneously have a significant effect on the GDP of the industrial sector. The obtained F-statistic value is 16.7887 with a probability of 0.000136, indicating that this regression model can significantly explain the variation in the GDP of the industrial sector as a whole. Thus, the results of this hypothesis test provide a clear picture of the influence of each variable on the growth of the manufacturing industry sector in East Java Province.

Discussion

This discussion integrates empirical findings with theoretical foundations and previous research to explain the influence of labor, investment, and inflation on the growth of GDP in the manufacturing sector in East Java Province.

The Influence of Labor on the GDP of the Manufacturing Sector

The analysis results show that labor has a positive and significant impact on the GDP of the manufacturing sector. A positive regression coefficient of 1.8061 indicates that every 1% increase in the number of workers in the industrial sector will increase the GRDP of the industrial sector in East Java by 1.81%. This finding empirically supports the hypothesis that labor significantly influences industrial output growth. Theoretically, these results are consistent with the classical growth theories of Adam Smith and David Ricardo, which emphasize the role of labor in creating added value through specialization and production efficiency. The Solow–Swan model also identifies labor as one of the main factors in production. In the context of East Java's manufacturing industry, which is dominated by labor-intensive sectors, the availability of labor becomes an important foundation in supporting output. These findings are also supported by the research of Mahendra & Hanifa and Widodo & Woyanti, which show that the growth of the industrial sector is greatly influenced by the availability of skilled and productive labor [4], [9].

The Influence of Investment on the GDP of the Manufacturing Industry Sector

The investment variable (LOGINV) was found to have no significant effect on the GDP of the manufacturing sector, despite having a positive coefficient. This insignificance can be explained from several perspectives. In the neoclassical growth theory, investment is indeed a source of capital accumulation for the expansion of production capacity, but this theory also acknowledges the existence of diminishing returns if not accompanied by technological advancement. In East Java, the realization of investments is likely not yet fully productive or long-term in nature, so their impact on output has not been directly observed during the observation period. This is in line with the findings of Sari and Soleman & Setyari, which state that the effectiveness of investment highly depends on the efficiency of capital absorption, industrial structure, and policy synergy [10], [13]. Therefore, although investment is important, its impact may not always be instant or linear.

The Influence of Inflation on the GDP of the Manufacturing Sector

Inflation (LOGINF) shows a negative and significant impact on the GDP of the manufacturing sector. A negative coefficient of -0.1797 means that every 1% increase in inflation will reduce the GDP of the East Java industrial sector by approximately 0.18%. These findings are consistent with the Keynesian approach, which states that high inflation can lead to increased production input costs and reduce the purchasing power of the public, thereby weakening the output of the real sector. In the manufacturing industry, inflation can disrupt operational costs, hinder the purchase of raw materials, and create price uncertainty, all of which negatively impact production performance. These results are supported by the research of Amri and Hidayati, which show that the

rise in inflation directly impacts the decline in productivity and efficiency in the industrial sector, especially in conditions of economic instability [5], [14], [15].

The Simultaneous Influence of Labor, Investment, and Inflation on the Industrial Sector's GDP

Simultaneously, labor, investment, and inflation have been proven to significantly influence the GDP of the manufacturing industrial sector in East Java Province. This is evidenced by the high F-statistic value and very low probability. These findings confirm that the main objective of the research has been achieved, namely proving the collective influence of these macroeconomic factors on the dynamics of the manufacturing sector. This simultaneous influence reflects that macroeconomic stability and the availability of production factors are interconnected in driving industrial output. The coefficient of determination (R^2) value of 0.8076 indicates that this regression model is capable of explaining most of the variation in the GDP of the manufacturing sector. This is consistent with various previous studies that emphasize the importance of the simultaneous role of macroeconomic factors on industrial growth, as shown by Mahendra & Hanifa and Sari [9], [13]. Thus, the resulting regression model is valid and can be used as a basis for consideration in the formulation of regional economic policies to support sustainable manufacturing growth in East Java.

CONCLUSION

Fundamental Finding : The multiple regression results demonstrate that labor and inflation partially exert significant effects on manufacturing sector growth in East Java Province, where a 1% increase in labor raises industrial GDP by 1.81% while a 1% increase in inflation reduces it by 0.18%, investment shows a positive but statistically insignificant coefficient, and collectively labor, investment, and inflation significantly influence industrial GDP with an R^2 of 80.76% indicating strong explanatory power. **Implication :** These results imply that sustainable industrial development in East Java requires integrated policies that strengthen labor quality and productivity, maintain inflation stability to prevent rising production costs and declining purchasing power, and improve the effectiveness of investment to maximize its contribution to manufacturing growth. **Limitation :** The model explains 80.76% of the variation in industrial GDP, indicating that 19.24% of the variation remains influenced by other factors not included in the regression framework during the observed research period. **Future Research :** Subsequent studies should incorporate additional macroeconomic and structural variables, extend the observation period, and apply alternative econometric approaches to capture the remaining unexplained variation and provide a more comprehensive understanding of manufacturing sector growth dynamics.

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