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Gross Value Added of Manufacturing Industry: Determinants and Impact on Economic Growth and Employment Absorption in Java and Bali

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Abstract: The gross value added of the manufacturing industry is a key indicator for measuring the sector's contribution to Gross Domestic Product (GDP) and economic growth, as well as its ability to create jobs. This study aims to analyze the factors influencing the value added of the manufacturing industry and their impact on economic growth and employment in Java and Bali. These factors include investment, labor productivity, and inflation. This study uses a panel data regression method with annual data from 2017 to 2023 in seven provinces in Java and Bali. The results of the study indicate that partially investment has a significant effect on gross value added, labor productivity has a significant effect on gross value added, and inflation has a significant effect on gross value added. Simultaneously, investment, labor productivity, and inflation have a significant effect on gross value added. Gross value added has a significant effect on economic growth, and economic growth has a significant effect on employment absorption.

Keyword: gross value added, investment, labor productivity, inflation, economic growth, employment absorption

INTRODUCTION

The development of economic sectors relies not only on information about their contribution to the economy but also on the interrelationships between each sector. This interrelationship is demonstrated by the level of a sector's ability to drive the economy. In other words, it reflects how a sector impacts the activity of other economic sectors. A sector's contribution to the economy, along with the interrelationships between sectors, reflects the economic integration of a region. Strong, comprehensive, and sustainable economic integration between sectors is key to economic development.

The manufacturing sector plays a vital role in national economic development. Its contribution is significant, particularly in generating GDP and increasing added value. Furthermore, this sector is capable of creating extensive employment opportunities, indirectly driving increased prosperity and poverty alleviation. Furthermore, the manufacturing industry

serves as a driving force for other economic sectors, such as trade, transportation, tourism, and related sectors.

The economies of Java and Bali will show strong growth in 2024, with Java contributing 57.02% to national GDP and Bali recording annual growth of 5.48%, exceeding the national average. The industrial sector in Java is still dominated by manufacturing and processing industries, which contribute significantly to the national economy, while Bali continues to rely on the tourism sector, which drives related industries such as crafts and food and beverages.

Literature Review

Derkacz, A. J. (2020). Autonomous Expenditure Multipliers and Gross Value Added. The analysis is primarily based on the principle of aggregate demand and the main assumptions of the economic model. Verifies the proposed method for calculating autonomous expenditure multipliers and the relationship between autonomous expenditure and gross value added in aempirical study. To examine the growth rate of value added relative to GDP in the short run, using the mechanisms of fiscal multipliers, investment, and exports.

Batrancea, L. M., Balcı, M. A., Akgüller, Ö., & Gaban, L. (2022). What Drives Economic Growth across European Countries? A Multimodal Approach. This research analysis examines the factors that determine economic growth as measured by gross domestic product, gross value added, household final consumption expenditure, and gross fixed capital formation across a sample of 36 European countries during the period Q3 2018-Q3 2021. The study was conducted using panel data analysis with the first difference generalized method of moments (GMM) approach and cross-sectional fixed effects. Empirical results estimated with four econometric models show a strong significant impact of the independent variables exports, imports, foreign direct investment inflows, foreign direct investment outflows, social contributions, and wages on the economic growth proxy.

Effendy, N. (2019). The impact of investment in the upstream oil and gas mining sector on gross value added, employment, and import content in Indonesia. The impact of investment in the upstream oil and gas mining sector on gross value added (business surplus, wages, depreciation, and indirect taxes), employment, and imports. The results of the study indicate that investment in the upstream oil and gas mining sector has a positive impact on gross value added and its components (business surplus, wages and salaries, depreciation, indirect taxes), employment, and import content.

Habanabakize, T., & Mncayi, P. (2022). Modeling the effects of gross value added, foreign direct investment, labor productivity, and producer price index on manufacturing employment. A study to investigate the effects of gross value added, foreign direct investment, labor productivity, and producer price index on employment in the manufacturing sector. The study findings indicate that gross value added and producer price index stimulate employment growth, while labor productivity growth and foreign direct investment hinder employment growth in the manufacturing sector. The implications of this study suggest that, during the era of the fourth industrial revolution and developing technology, high productivity and foreign direct investment can actually reduce labor demand rather than create jobs in the manufacturing sector.

Adriyendi, Putra, O. E., & Defit, S. (2022). Data Analytics Model for Manufacturing Industry. Conducting data analysis using a descriptive model (K Means Clustering/KMC) for productivity, a diagnostic model (Naïve Bayes Classifier/NBC) for investment, a predictive model (Linear Regression/LR) for product trend lines, and a prescriptive model (Monte Carlo Simulation/MCS) for input cost estimation. The results of the study concluded that high productivity will open up new investment opportunities supported by a linear trend in gross output value and added value with low input costs.

Bezić, H., & Radić, M. N. (2017). Tourism foreign direct investment led tourism gross value added: A co-integration and causality analysis of Croatian tourism. The results of the FDI impact analysis in any sector depend on the level of development of a country and the laws and regulations in that country.

Șerban, A. C., Pelinescu, E., & Dospinescu, A. S. (2022). Beta Convergence Analysis of Gross Value Added in The High-Technology Manufacturing Industries. This study examines recent developments in the high-tech manufacturing sector in EU28 countries, focusing on the β convergence of gross value added in the Manufacturing of computer, electronic, and optical products, and the Manufacturing of basic pharmaceutical products and pharmaceutical preparations using panel data analysis. The results show a higher convergence for the Manufacturing of computer, electronic, and optical products at 16.4% compared to 2.2% for the Manufacturing of basic pharmaceutical products and pharmaceutical preparations, which is consistent with the presence of fewer barriers and higher exposure to competition in the case of the analyzed sectors.

Ong, T. S., Adedeji, B. S., Cheah, K. K., Tan, C. L., Teh, B. H., & Masoud, J. (2021). The Nexus of Economic Growth and Environmental Performance in Malaysia. This study investigates the relationship between economic growth and the Environmental Performance Index. The findings indicate that Gross Domestic Product growth has a significant and negativeimpact on the Environmental Performance Index. Population growth also shows a negative impact on environmental performance. However, there is a positive relationship between Foreign Direct Investment, agricultural value added, exports of goods and services, and environmental performance. The study results reveal that the low environmental performance index in Malaysia is caused by growth in the manufacturing sector.

Singh (2021). The linkage between carbon emissions, foreign direct investment, economic growth, and gross value added. The study investigates the interrelationship between carbon emissions, foreign direct investment (FDI), economic growth, and gross value added (GVA) in agriculture, services, manufacturing, and resource-rich industries, including the construction sector. The results show that the causality between the variables, carbon emissions, economic growth, FDI, and the four GVA sectors varies by region. This study shows that CO2 emissions have a bidirectional causality with GVA output in all four industrial sectors.

Cili & Alkhaliq (2022). Economic Growth and Inflation: Evidence from Indonesia. Research shows that inflation, investment, and population, where all three variables have the same (positive) relationship with economic growth. The effect of investment on economic growth is more significant than inflation on economic growth. The positive relationship between inflation and economic relations indicates that inflation can increase economic growth. This can be maintained if the government, represented by Bank Indonesia, can always maintain inflation at a low/mild level. The inflation targeting policy needs to be maintained by referring to the inflation targeting of previous years.

METHOD

Data

Researchers used secondary data published by the Regional Statistics Agency (BPS). Panel data is a combination of time series and cross-sectional data (Hodijah et al., 2022). There are two advantages to using panel data models over individual time series or cross-sectional data. First, by combining time series and cross-sectional data in panel data, the number of observations increases. Using panel data has the advantage of viewing explanatory variables from two dimensions, both individually and over time. Panel data can control for individual heterogeneity, allowing estimates to explicitly incorporate individual heterogeneity (Agusalim et al., 2019).

This research data covers provinces in Java and Bali for the period 2017–2023. Java and Bali are considered to be the centers of the national economy due to the availability of adequate infrastructure to boost the economy (Faradisa & Afifah, 2020). This observation involves panel data decomposition to produce a single equation output. The time series data in this study spans a seven-year period, from 2017–2023. This study uses gross value added as the dependent variable. Investment, labor productivity, and inflation as the independent variables. Economic growth and labor absorption as the impact variables. Variable descriptions in the form of symbols, measurements, and data sources are described in the following variable operationalization table.

Table 1. Operationalization of Variables

Variable Name	Symbol	Measurement	Data Source
Gross Value Added	GVA	Production Value (Output) – Intermediate Costs (Raw Material Costs) (billion rupiah)	Central Bureau of Statistics
Investation	INV	The unit used is Gross Fixed Capital Formation (PMTB) (billion rupiah)	Central Bureau of Statistics
Labor Productivity	LP	Production Value (Output) / Number of Workers. (billion rupiah)	Central Bureau of Statistics
Inflation	INF	The unit used is the Consumer Price Index (CPI) Inflation = [(CPI – CPI-1)/CPI-1] x 100%	Central Bureau of Statistics
Economic Growth	EG	GRDP (Gross Regional Domestic Product) at constant prices (billions of rupiah)	Central Bureau of Statistics
Employment Absorption	EA	The unit used is the number of workers working	Central Bureau of Statistics

Data Analysis Techniques

This method is used to determine the influence of the variables being studied using a panel data estimation process that can estimate individual characteristics by considering the cross-temporal dynamics of each variable in the study. This means that the analysis of the estimation results will be more comprehensive and address issues closer to reality. In general, the panel data model can be written as (Agusalim et al., 2019)

Model 1:

$LnGVAit = \alpha + \beta 1LnINVit + \beta 2LnLPit + \beta 3INFit + \varepsilon it$ …… (Equation 1)

Model 2:

$EGit = \alpha + \beta 1LnGVAit + \varepsilon it$ ……...… (Equation 2)

Model 3:

$LnEAit = \alpha + \beta 1EGit + \varepsilon it$ ……..…… (Equation 3)

Where:

GVA = Gross Value Added
INV = Investation
LP = Labor Productivity
INF = Inflation
EG = Economic Growth
EA = Employment Absorption

α = Constant
βn = Parameter (slope coefficient)
ε = Error term
i = Cross-section dimension
t = Times-series Dimention

The methods used to estimate interpretation criteria are the Pooled Least Squares (PLS), Fixed Effects Model (FEM), and Random Effects Model (REM) (Gujarati, 2015). PLS, also known as the general effects model, is a simple regression technique that combines cross-sectional data and time series (combined data). This combination of data is treated as a single observation unit used to estimate the model using the ordinary least squares (OLS) model.

Coefficient of Determination

This coefficient is used to measure the accuracy of the regression function in assessing the influence of the independent variable on the dependent variable. R2 is a quantity commonly used to measure consistency (goodness of fit), namely how well the regression line is able to explain the phenomena that occur (Kaontole et al., 2019).

RESULT AND DISCUSSION

Determining the analysis technique using panel data regression. There are three types of tests that will be conducted. The first test uses the Chow Test. The Chow Test is conducted to determine the best method used between PLS and FEM. The decision to use FEM occurs when the Chow test results show a Cross-Section F-prob value of less than 0.05. Next, the second test uses the Hausman test to determine whether FEM or REM is more appropriate in panel data regression. The decision to use FEM or REM can be seen from the Chi-Square probability value. If the probability value is less than 0.05, the correct choice is FEM, and if the probability level is greater than 0.05, REM is more appropriate.

Modeling Test Model 1

This modeling test explains the results of statistical tests to determine the best regression model. The panel data regression statistics are used to assess the contribution of investment, labor productivity, and inflation to gross value added in the provinces of Java and Bali from 2017 to 2023.

Table 2: Chow Test Result

Effects Test	Statistic	d.f.	Prob.
Cross-section F	334.742648	(6,39)	0.0000
Cross-section Chi-square	194.078790	6	0.0000

Based on table 2, the Chow test shows that the Cross-section Chi-square Prob. is 0.0000, which is less than 0.05. The test results prove that the best model to use is the Fixed Effect Model. Next, a Hausman test will be conducted to determine the best model between the fixed effect model and the random effect model.

Table 3: Hausman Test Result

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	8.316713	3	0.0399

Based on Table 3, the Hausman test yields a random cross-section probability of 0.0399, which is less than 0.05. It can be concluded that the best model after the Hausman test is the fixed effects model. Furthermore, the data were processed and interpreted using the fixed effects model.

Panel Data Regression Model 1

The appropriate model for this study uses the fixed effects model (FEM) approach. The results of the panel data regression using FEM are as follows

Table 4: Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.706916	4.038212	-0.422691	0.6748
LnINV	0.589013	0.234764	2.508956	0.0164
LnLP	0.484027	0.165560	2.923575	0.0057
INF	-0.605483	0.316794	-1.911283	0.0433
R-squared	0.896141			
Adjusted R-squared	0.895251			
F-statistic	1118.644			
Prob(F-statistic)	0.000000			

Based on table 4, the panel data regression results show that investment, labor productivity, and inflation have a significant influence on gross value added. Therefore, the regression equation is as follows.

GVA = -1.706916 + 0.589013INV + 0.484027LP - 0.605483INF + εit

The multiple linear regression equation above yields a constant value of -1.706916, meaning that if investment, labor productivity, and inflation are all zero, the gross value added is -1.706916. The investment regression is positive, meaning that an increase in investment can increase gross value added. The labor productivity regression is positive, meaning an increase in productivity can increase gross value added. This contrasts with inflation, which has a negative coefficient. This means that an increase in inflation can decrease gross value added.

Simultaneous F Test

The calculation results obtained in table 4 are a significance value of 0.00000 < 0.05, which means it has a significant effect, indicating that the investment, labor productivity and inflation variables simultaneously have a significant effect on gross value added in the provinces of Java and Bali.

Determinant Coefficient

The coefficient of determination (R2) is a test conducted to determine the percentage of overall variation in the independent variables in this model. This is demonstrated by looking at the Adjusted R-squared coefficient of determination in the regression test. Based on the regression results, the Adjudted R-squared value was 0.895251, or 89.52%. This means that 89.52% of the independent variables explain the dependent variable, with the remainder being explained by other variables outside the model.

Modeling Test Model 2

Table 5: Chow Test Result

Redundant Fixed Effects Tests Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.

Cross-section F	685.166940	(6,41)	0.0000
Cross-section Chi-square	226.270914	6	0.0000

Based on table 5, the Chow test shows that the Cross-section Chi-square Prob. is 0.0000, which is less than 0.05. The test results prove that the best model to use is the fixed effect model. Next, a Hausman test will be conducted to determine the best model between the fixed effect model and the random effect model.

Table 6: Hausman Test Result

Correlated Random Effects - Hausman Test Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	3.003593	1	0.0831

Based on Table 6, the Hausman test yields a random cross-section probability of 0.0831, which is greater than 0.05. It can be concluded that the best model after the Hausman test is the random effects model. Next, a Lagrange Multiplier test will be conducted to determine the best model between the random effect model and the command effect model.

Table 7: Lagrange Multiplier Test Result Lagrange Multiplier Tests for Random Effects

Test Hypothesis	Cross-section	Time	Both
Breusch-Pagan	142.2329	3.730045	145.9629
	(0.0000)	(0.0534)	(0.0000)

Based on table 7, the Lagrange Multiplier test yields a Breusch-Pagan probability of 0.0000, which is less than 0.05. It can be concluded that the best model after the Lagrange Multiplier test is the random effects model. Furthermore, the data were processed and interpreted using the random effects model.

Panel Data Regression Model 2

The appropriate model for this study uses the random effects model (REM) approach. The results of the panel data regression using REM are as follows:

Table 8: Random Effect Model Dependent Variable: EG

Method: Panel EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.500450	0.692398	13.72108	0.0000
LnGVA	0.321340	0.054640	5.881063	0.0000
R-squared	0.413766			
Adjusted R-squared	0.401293			
F-statistic	33.17276			
Prob(F-statistic)	0.000001			

Based on table 8, the panel data regression results indicate that gross value added has a significant influence on economic growth. Therefore, the regression equation is as follows.

$EG = 9.500450 + 0.321340GVA + \varepsilon it$

The intercept coefficient is +9.500450, representing the estimated average value of the economic growth (EG) variable when the gross value added (GVA) variable is zero. This can be interpreted as the basic or autonomous level of EG that exists without any contribution from GVA. Gross value added (GVA) is +0.321340. This positive coefficient indicates that there is a unidirectional relationship between GVA and the EG variable, for every one unit increase in GVA, the EG variable is estimated to increase by 0.321340 units, assuming other factors remain constant (ceteris paribus). Growth in gross value added (GVA) does indeed drive economic growth (EG). However, its effect is sub-proportional (less than 1). A 1 unit increase in GVA only results in a 0.32 unit increase in EG.

Determinant Coefficient

Based on the regression results, the R-squared value is 0.413766, or 41.37%. This means that 41.37% of the independent variable explains the dependent variable, while the remainder is explained by other variables outside the model.

Modeling Test Model 3

Table 9: Chow Test Result
Redundant Fixed Effects Tests Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2044.103752	(6,41)	0.0000
Cross-section Chi-square	279.507735	6	0.0000

Based on table 9, the Chow test shows that the Cross-section Chi-square Prob. is 0.0000, which is less than 0.05. The test results prove that the best model to use is the fixed effect model. Next, a Hausman test will be conducted to determine the best model between the fixed effect model and the random effect model.

Table 10: Hausman Test Result
Correlated Random Effects - Hausman Test Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1.189057	1	0.2755

Based on Table 6, the Hausman test yields a random cross-section probability of 0.2755, which is greater than 0.05. It can be concluded that the best model after the Hausman test is the random effects model. Next, a Lagrange Multiplier test will be conducted to determine the best model between the random effect model and the command effect model.

Table 11: Lagrange Multiplier Test Result Lagrange Multiplier Tests for Random Effects
Test Hypothesis Cross-section

		Time	Both
Breusch-Pagan	145.6713	3.968563	149.6398
(0.0000)		(0.0464)	(0.0000)

Based on table 7, the Lagrange Multiplier test yields a Breusch-Pagan probability of 0.0000, which is less than 0.05. It can be concluded that the best model after the Lagrange Multiplier test is the random effects model. Furthermore, the data were processed and interpreted using the random effects model.

Panel Data Regression Model 3

The appropriate model for this study uses the random effects model (REM) approach. The results of the panel data regression using REM are as follows:

Table 12: Random Effect Model Dependent Variable: EA
Method: Panel EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.539046	2.074528	-3.152065	0.0028
EG	1.256212	0.129914	9.669593	0.0000
R-squared	0.664589			
Adjusted R-squared	0.657452			
F-statistic	93.12643			
Prob(F-statistic)	0.000000			

Based on table 12, the panel data regression results indicate that economic growth has a significant impact on labor absorption. Therefore, the regression equation is as follows:

EA = -6.539046 + 1.256212EG + εit

The multiple linear regression equation above yields a constant value of -6.539046, meaning that if economic growth is zero, then labor absorption is -6.539046. The economic growth regression is positive, meaning that increased economic growth can increase employment absorption.

Determinant Coefficient

Based on the regression results, the R-squared value is 0.664589, or 66.45%. This means that 66.45% of the independent variable explains the dependent variable, while the remainder is explained by other variables outside the model.

CONCLUSION

This study concludes that gross value added is influenced by a combination of factors driving investment and labor productivity, and factors inhibiting inflation. Investment and labor productivity are significant drivers of gross value added. Capital and labor efficiency are key to output growth. Meanwhile, inflation acts as a strong inhibitor of gross value added. The substantial negative impact of inflation indicates that price volatility effectively erodes the growth potential generated by investment and productivity.

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