Priviet Social Sciences Journal
E-ISSN 2798-866X
P-ISSN 2798-6314
https://doi.org/10.55942/pssj.v5i8.541

Volume 5
Issue 8
August Edition 2025

Analyzing the impact of inflation, exports and unemployment on economic growth in indonesia: A fixed effects least squares dummy variable panel regression approach

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Received 16 July 2025
Revised 25 August 2025
Accepted 29 August 2025

ABSTRACT

This study explores the impact of inflation, exports, and unemployment on economic growth in Indonesia from 2019 to 2023 using a Fixed Effects Model Least Squares Dummy Variable (FEM LSDV) panel regression approach. The analysis incorporates both province-specific and time-specific effects to provide a comprehensive understanding of the dynamic relationships between these variables and their collective influence on Indonesia's economic growth. The results indicate that exports have a significant positive effect on economic growth, consistent with existing literature highlighting the importance of exports in driving economic performance. In contrast, inflation and unemployment were not found to have statistically significant impacts, possibly due to the model's focus on regional and temporal variations. The study furthermore reveals significant regional disparities in economic growth, with provinces like DKI Jakarta, Banten, and Kalimantan Timur showing negative growth, while others, such as Sulawesi Selatan and Gorontalo, experienced above-average growth. The FEM LSDV model demonstrates strong explanatory power, with an R-squared value of 0.9162, indicating that it effectively captures the variability in economic growth across regions and over time. The findings suggest that promoting export-driven growth and addressing regional imbalances are key strategies for fostering sustainable economic development in Indonesia.

Keywords: inflation, exports, unemployment, economic growth, Fixed Effects Model.

1. INTRODUCTION

Economic growth refers to the sustained increase in the output of goods and services within a nation, typically measured by the Gross Domestic Product (GDP) at the national level or Gross Regional Domestic Product (GRDP) at the regional level. It is an indicator of a country's economic health and development, reflecting how efficiently resources are utilized across various sectors of the economy. A consistent rise in economic growth signifies a dynamic and expanding economy (Suhari et al., 2023). Understanding the determinants of economic growth is crucial, as these factors directly influence employment, wages, and the standard of living. This study will focus on how inflation, exports, and unemployment contribute to economic growth, particularly in the context of Indonesia (Rohadin et al., 2025). Inflation, often seen as an adverse phenomenon, influences the economic landscape in complex ways. While moderate inflation signals growing demand, excessive inflation can erode purchasing power and destabilize the economy. Milton Friedman's assertion that "inflation is always a monetary phenomenon" highlights how unchecked growth in money supply leads to rising inflation, which may harm economic stability (Suharti et al., 2021). The relationship between inflation and growth is nuanced, with lower inflation often associated with stable economic growth, while higher inflation can slow down development (Chu et al., 2019). Thus, controlling inflation through sound monetary policies is critical for sustaining economic growth.

Exports are another vital driver of economic growth. An increase in exports results in higher income, contributing directly to economic expansion (Kalaitzi & Chamberlain, 2020). Exports not only enhance production levels but also bring in foreign exchange, which is crucial for financing imports, investments, and even stabilizing the currency. In this context, the relationship between exports and economic growth is bidirectional; exports contribute to growth, and economic growth creates the capacity for increased exports (Louhenapessy & Rijoly, 2022). Unemployment negatively affects economic growth, as high levels of unemployment reduce household income and consumption, dampening overall demand (Tope et al., 2025). However, the effect of unemployment varies across different economic contexts. Studies show that while developed economies often experience more significant negative impacts from unemployment on economic growth, developing economies may display less pronounced effects due to their labor market dynamics (Siahaan et al., 2023).

This study employs panel data regression with Fixed Effects and Least Squares Dummy Variable (LSDV) models to analyze the dynamic relationships between inflation, exports, unemployment, and their collective influence on Indonesia's economic growth (A'yun, 2018). By examining these variables, the study provides a comprehensive view of the key drivers of economic growth.

2. METHOD

2.1 Data

This study adopts a quantitative research method with a descriptive approach, aiming to analyze economic growth in Indonesia over the period from 2019 to 2023. The research will use data collected from the Statistics Indonesia (Badan Pusat Statistik, BPS) offices across several provinces. The choice of five years allows for a comprehensive analysis of trends in key economic variables such as inflation, investment, exports, money supply, unemployment, and National Health Insurance, and their influence on economic growth. The study employs a systematic and measurable approach, following the positivist philosophy, to test hypotheses regarding the impact of these factors on economic performance. The population for this study consists of data on economic growth from all 34 provinces of Indonesia, while the sample includes data from the same provinces during the 2019-2023 period. The key variables analyzed include economic growth (Y), inflation (X1), exports (X2), and unemployment rate (X3). The use of this extensive data set enables a detailed examination of the dynamics between these variables and their collective effect on economic growth across the nation. Data from BPS ensures that the analysis is grounded in reliable and authoritative sources.

2.2 Research Method

This study employs panel data regression with Fixed Effects and Least Squares Dummy Variable (LSDV) models to analyze the dynamic relationships between inflation, exports, unemployment, and their collective influence on Indonesia's economic growth. The panel data approach allows for the examination of data across both time and multiple regions, which is particularly beneficial for understanding the variations and trends within the dataset (Harismahyanti, 2023). The Fixed Effects model is used to account for the unobserved heterogeneity that may exist across different entities (in this case, regions or periods). By focusing on the variation within each entity, the Fixed Effects model controls for time-invariant characteristics that could influence the dependent variable, economic growth. This method helps to isolate the effect of the variables of interest (inflation, exports, and unemployment) on economic growth, ensuring that individual characteristics, such as geographical or historical differences, do not confound the results.

The Least Squares Dummy Variable (LSDV) model is an extension of the Fixed Effects approach, in which dummy variables are included for each entity (region or time) (Ahmad & Raupong, 2023). These dummy variables account for the individual heterogeneity in the intercepts across entities, further refining the analysis and improving the model's precision (Nurdin et al., 2024). The LSDV model is particularly useful in capturing the unique effects of each entity, providing more detailed insights into the influence of inflation, exports, and unemployment on economic growth in Indonesia. The analysis is performed using R-Studio software, which provides a comprehensive environment for statistical modeling and data analysis. The panel data regression models are estimated using the plm package in R, which is designed for linear models with panel data. Specifically, the plm function is used to fit the Fixed Effects and LSDV models. This analysis removes the potential outlier of the data before modelling the LSDV to ensure the quality of the results (Harismahyanti et al., 2022). The regression process includes diagnostic checks for model validity, such as testing for multicollinearity, heteroscedasticity, and autocorrelation, to ensure the robustness of the results.

3. RESULT AND DISCUSSION

3.1 Descriptive Analysis of Economic Growth Variables

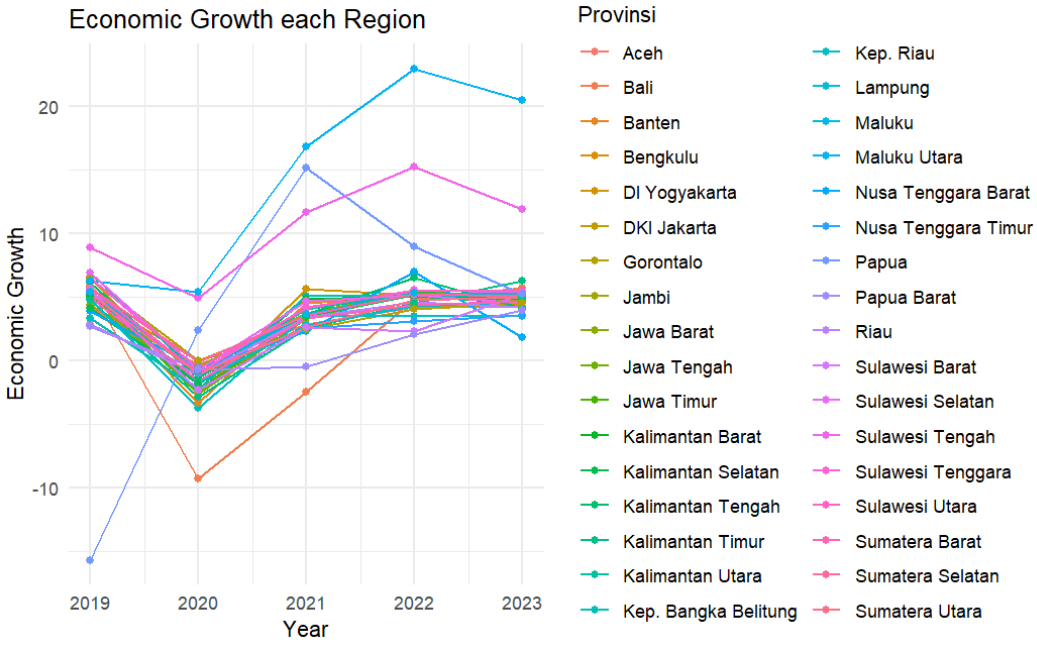

Figure 1. Economic Growth in Indonesia

Source: Processed from secondary data (2025)

The scatter plot of Economic Growth by Province from 2019 to 2023 visually illustrates the economic performance across different provinces in Indonesia during this period. Each province is represented by a unique color, with the years displayed on the X-axis and economic growth on the Y-axis. The plot shows significant variations in economic growth among provinces, with some exhibiting consistent positive growth over the years, while others, especially in 2020, experience a sharp decline, likely due to the effects of the COVID-19 pandemic. Recovery trends from 2021 to 2023 are also evident, as most provinces show a return to positive economic growth, though certain regions, such as Jakarta and Bali, exhibit more fluctuation compared to others. This visualization helps highlight the regional disparities in economic performance. Provinces like DI Yogyakarta, DKI Jakarta, and Bali show greater variation, especially in 2020, which could be attributed to their reliance on sectors like tourism that were significantly affected by the pandemic. In contrast, provinces such as Kalimantan and Sumatra, which rely heavily on natural resources, display more stability and a quicker recovery. The differences in growth trends across these regions provide valuable insights for policymakers and researchers, offering a clearer understanding of the regional factors that influenced Indonesia's overall economic trajectory during and after the pandemic.

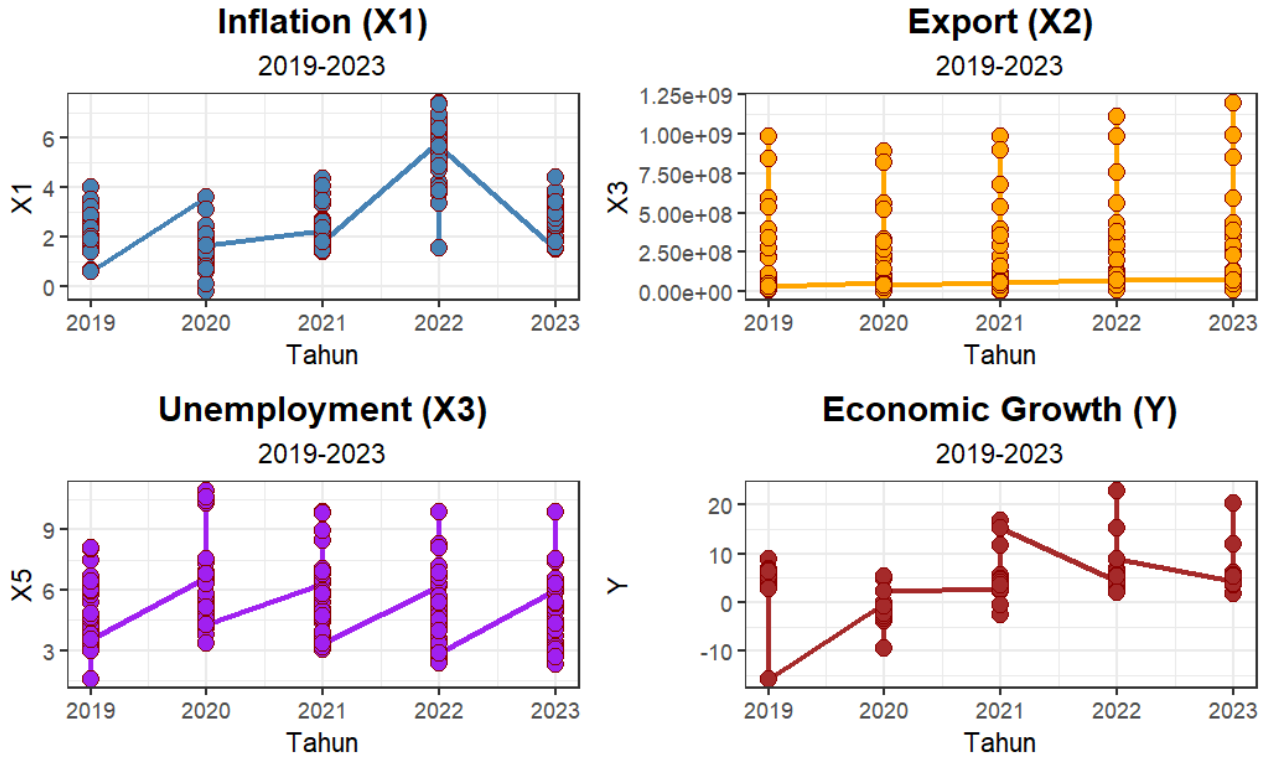

Figure 2. Variables of the Data

Source: Processed from secondary data (2025)

Figure 2 provides the data from 2019 to 2023, including key economic indicators that are critical for analyzing economic performance during this period. Inflation (X1) exhibits considerable fluctuations over the years, with significant spikes in 2020 and 2022. These fluctuations suggest periods of inflationary pressures, which are important for understanding price stability and purchasing power within the economy. Exports (X2) show a marked increase between 2020 and 2021, followed by a stabilization in later years. This suggests that export activity experienced a strong growth phase, potentially influenced by shifts in global demand or supply-side factors, before returning to a more stable trend. Unemployment Rate (X3) reflects the proportion of the working-age population actively engaged in the labor market. The data indicate a gradual rise in this rate, with a peak in 2022, which could be associated with labor market dynamics or broader economic recovery trends.

3.2 Check of Multicollinearity and Outliers

This section presents the procedures for checking outliers and multicollinearity within the dataset. Initially, outlier detection was performed, leading to the exclusion of certain provinces from the analysis. The provinces identified as outliers included Bali, Maluku Utara, Papua, and Sulawesi Utara, which exhibited extreme economic growth patterns that could potentially distort the results. These provinces were removed to enhance the robustness and accuracy of the model. Subsequently, a multicollinearity check was conducted using the Variance Inflation Factor (VIF) to assess the degree of correlation between the independent variables. Multicollinearity can inflate standard errors and lead to unreliable estimates in regression models. Generally, a VIF value greater than 10 indicates a high level of multicollinearity, which is not the case here. The calculated VIF values for the variables in the model were as follows:

Table 1. The VIF values

Variable	VIF Value
X1 (Inflation)	1.065234
X2 (Exports)	1.478354
X3 (Unemployment)	1.524663

Source: Processed from secondary data (2025)

3.3 Data Panel Regression

Before this analysis, several panel regression models were considered: CEM (Common Effects Model), FEM (Fixed Effects Model), and REM (Random Effects Model). The CEM serves as a simple baseline, assuming that individual effects are not accounted for, and thus may fail to capture heterogeneity across units. The FEM, on the other hand, accounts for individual differences by allowing for varying intercepts across different entities, which is crucial for capturing the unobserved heterogeneity in the data. The REM assumes that the individual effects are random and uncorrelated with the independent variables. The results of the F-statistic indicate that the regression model is statistically significant, with F = 3.1584, df1 = 29, df2 = 117, and a p-value of 6.237e-06. This low p-value suggests that at least one of the independent variables (X1, X2, or X3) significantly explains the variation in the dependent variable Y, and the alternative hypothesis of instability is rejected, confirming the model's stability. Additionally, the Hausman Test results (chisq = 34.151, df = 3, p-value = 1.841e-07) strongly support the use of the Fixed Effects Model (FEM) over the Random Effects Model (REM). The very small p-value indicates that one of the models is inconsistent, and FEM is the preferred choice for this analysis as it provides more reliable and consistent estimates.

After comparing the models, the Fixed Effects Model (FEM) was found to be the most suitable for this data. The Hausman test result, as mentioned above, supports the selection of the FEM over the REM. Consequently, the analysis was continued using the Fixed Effects Model (FEM) with LSDV (Least Squares Dummy Variable) estimation, which is commonly used to estimate the fixed effects in panel data regression. This model provides a more accurate and consistent estimate of the relationships between the variables, as it accounts for individual-specific heterogeneity in the data, making it the best choice for further analysis.

Table 2. The Comparison Model of FEM Analysis

Model	RMSE	AIC	R Square
FEM	0.4396735	187.16467	0.5244497
FEM LSDV Province and Time	0.2083182	31.07499	0.9161654
FEM LSDV Province	0.4396735	247.16467	0.6265525
FEM LSDV Time	0.3757993	150.07157	0.7271770

Source: Processed from secondary data (2025)

The comparison of the four models, which are FEM, FEM LSDV all (based on Province and Time), FEM LSDV Province, and FEM LSDV Time, reveals important insights into their performance based on three evaluation metrics: RMSE (Root Mean Square Error), AIC (Akaike Information Criterion), and R-squared. The FEM LSDV all (based on Province and Time) model performs the best in terms of RMSE, exhibiting the lowest value, which indicates that it produces the smallest prediction error and therefore demonstrates superior predictive accuracy. It also has the lowest AIC, suggesting that it is the most efficient model in terms of balancing model complexity and goodness-of-fit. In contrast, the FEM model shows the highest RMSE and AIC, indicating that it is less accurate and less efficient compared to the other models.

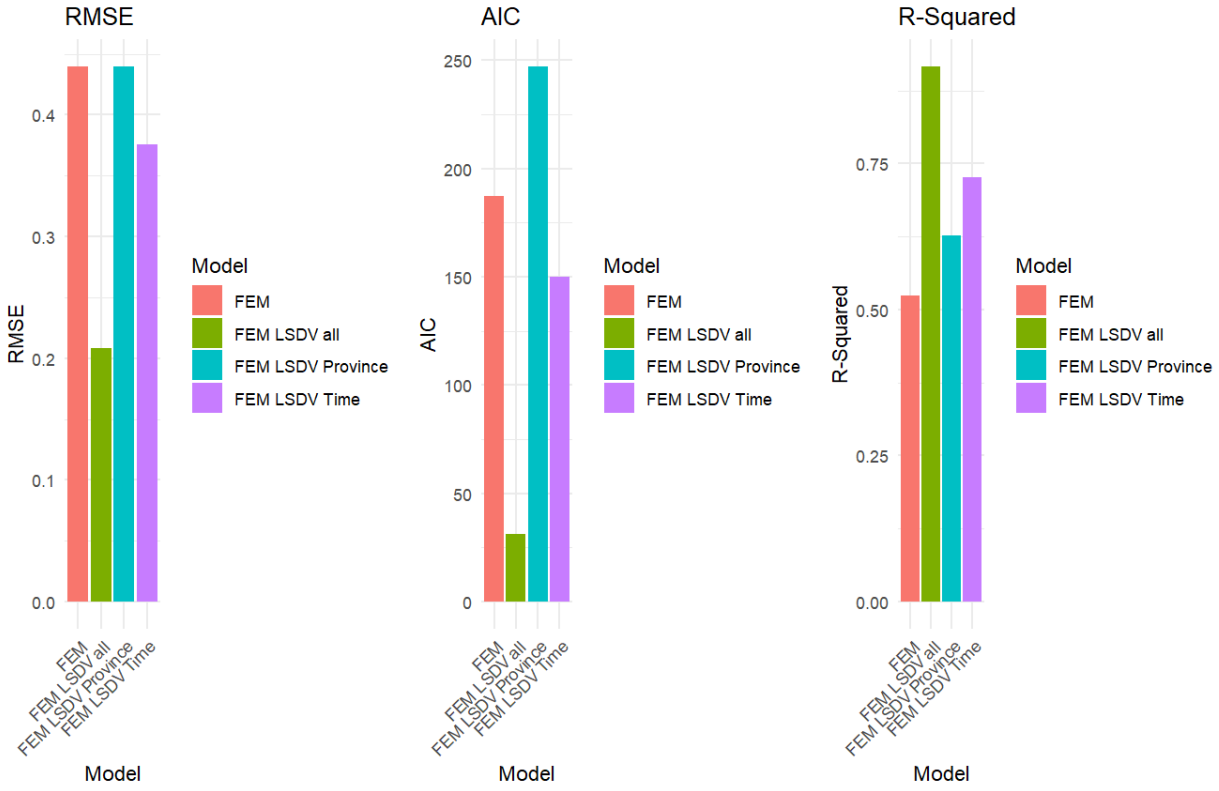

Figure 3. Model Accuracy

Source: Processed from secondary data (2025)

When considering R-squared, the FEM LSDV all (based on Province and Time) model stands out with the highest value, meaning it explains the largest proportion of the variance in the data. This suggests that the FEM LSDV model provides the best explanation of the data's variability, although its predictive accuracy is not as strong as the FEM LSDV Time model. Given that the FEM LSDV model offers the highest R-squared and is capable of accounting for both province-specific and time-specific effects, it is chosen for further analysis. This model provides a comprehensive understanding of the factors driving economic growth, as it incorporates both the regional (province) variations and the temporal dynamics (time). By doing so, it offers a more holistic view of how these factors interact over time, making it ideal for policy making and more nuanced economic analyses.

3.4 FEM LSDV (based on Province and Time) Regression Model

The FEM LSDV (Fixed Effects Model Least Squares Dummy Variable), which incorporates both province-specific and time-specific effects, was chosen for further analysis. This model provides a comprehensive framework for understanding how economic growth is influenced by regional differences

and temporal changes. By accounting for both the unique characteristics of each province and the broader temporal dynamics, the FEM LSDV (based on Province and Time) regression model allows us to assess the impact of various factors on economic growth more holistically. Table 3 presents the detailed results of the FEM LSDV (based on Province and Time) model, which focuses on the interactions between provincial characteristics and year-specific factors. This model enables a deeper understanding of the regional economic disparities and the temporal shifts that influence the growth patterns across Indonesia's provinces over the study period. By analyzing these results, we can identify key factors driving economic performance at both the provincial and national levels.

Table 3. The Comparison Model of FEM Analysis

Variable	Estimate	Std. Error	t-value	p-value	Significance
Intercept	0.568779	0.166818	3.410	0.000903	***
Inflation (X1)	-0.007495	0.036718	-0.204	0.838621	
Exports (X2)	0.792523	0.257952	3.072	0.002662	**
Unemployment (X3)	0.089120	0.088507	1.007	0.316119	
(Significant Provinces):					
Banten	-1.407280	0.490380	-2.870	0.004904	**
Bengkulu	0.753815	0.283754	2.657	0.009036	**
DI Yogyakarta	0.451931	0.199978	2.260	0.025744	*
DKI Jakarta	-1.750433	0.611868	-2.861	0.005035	**
Gorontalo	0.941815	0.328185	2.870	0.004904	**
Jawa Barat	-1.680176	0.582423	-2.885	0.004692	**
Jawa Tengah	-1.344976	0.489360	-2.748	0.006973	**
Kalimantan Barat	0.580871	0.212105	2.739	0.007171	**
Kalimantan Tengah	0.385464	0.187229	2.059	0.041814	*
Kalimantan Timur	-1.593056	0.539123	-2.955	0.003807	**
Kep. Bangka Belitung	0.471866	0.207283	2.276	0.024704	*
Kep. Riau	-1.535219	0.454077	-3.381	0.000993	***
Sulawesi Selatan	0.556905	0.182889	3.045	0.002895	**
Sulawesi Tengah	1.135582	0.330096	3.440	0.000815	***
Sulawesi Tenggara	0.543894	0.214965	2.530	0.012778	*
Sumatera Utara	-1.004173	0.381653	-2.631	0.009698	**
(Significant Years):					
2020	-1.640906	0.088226	-18.599	< 2e-16	***
2021	-0.460953	0.073810	-6.245	7.66e-09	***
2023	-0.213117	0.074551	-2.859	0.005067	**
Residual Standard Error		0.24			
Multiple R-squared		0.9162			
Adjusted R-squared		0.8895			
F-statistic	34.3			< 2.2e-16	***

The results of the regression analysis show that several factors significantly influence economic growth across provinces in Indonesia. The Intercept term is statistically significant with an estimate of 0.568779 (p-value = 0.000903), suggesting that when all independent variables are zero, the baseline economic growth is positive. Among the independent variables, Exports (X2) are significant with a positive coefficient of 0.792523 (p-value = 0.002662), indicating that higher export values are associated with higher economic growth. However, Inflation (X1) and Unemployment (X3) are not statistically significant (p-values of 0.838621 and 0.316119, respectively), suggesting that these variables do not have a strong impact on economic growth in this model.

When considering the fixed effects by province, several provinces exhibit statistically significant coefficients, indicating that provincial-level factors also play an important role in shaping economic growth. For example, Banten, DKI Jakarta, and Kalimantan Timur have negative and significant coefficients, suggesting that these provinces faced challenges that impacted their economic growth relative to the baseline. Conversely, provinces like Bengkulu, Gorontalo, and Sulawesi Selatan show positive and

significant coefficients, implying that these regions experienced above-average growth. Similarly, the year factors reveal that 2020 and 2021 had significant negative impacts on economic growth, likely reflecting the adverse effects of the COVID-19 pandemic, while 2023 shows a significant negative effect compared to the baseline year. The Multiple R-squared of 0.9162 indicates that the model explains a high proportion of the variation in economic growth, and the F-statistic of 34.3 with a p-value of < 2.2e-16 further confirms the overall significance of the model.

3.5 The Assumptions Model

The FEM LSDV (Fixed Effects Model Least Squares Dummy Variable) model, which incorporates both province-specific and time-specific effects, is widely used to analyze panel data where the objective is to understand the influence of both individual heterogeneity across entities (provinces) and temporal changes on economic outcomes. One of the key assumptions of the FEM LSDV model is that there is no autocorrelation in the residuals. This assumption ensures that the errors of the model are independent of each other. The Durbin-Watson test result (DW = 2.4797, p-value = 0.7076) suggests that there is no significant autocorrelation in the residuals, as the p-value is greater than the standard significance threshold of 0.05. This indicates that the assumption of independence of residuals holds in this model, confirming the appropriateness of the regression model for the analysis. Previous studies, such as Greene (2012), emphasize the importance of satisfying this assumption to ensure unbiased and consistent estimates in panel data regression models.

Another crucial assumption of the FEM LSDV model is that the residuals should be normally distributed, as this is essential for conducting hypothesis tests and obtaining reliable standard errors for the coefficients. The Anderson-Darling normality test (A = 0.704, p-value = 0.06479) indicates that the residuals are approximately normally distributed, as the p-value is just above the typical significance threshold of 0.05. This suggests that the normality assumption is reasonably satisfied, though slight deviations from normality may exist. Ensuring that the residuals are normally distributed is vital because, as noted by Wooldridge (Jeffrey M Wooldridge, 2018), any severe deviations from normality could lead to inefficient estimates and biased statistical inferences. These diagnostic tests confirm that the assumptions underlying the FEM LSDV (based on Province and Time) model are well supported, making it a robust choice for analyzing regional economic disparities in Indonesia.

3.6 Discussions

The results of the regression analysis conducted for Indonesia's economic growth from 2019 to 2023 highlight significant insights into the role of exports in regional economic performance. Exports (X2) were found to be a significant factor influencing economic growth, with a positive coefficient of 0.792523 (p-value = 0.002662). This finding is consistent with the work of Amri et al. (2024), who observed that Indonesia's fishery exports contributed substantially to the national economy and that export values had a direct impact on economic growth. Similarly, Wizsa et al. (2022) examined the impact of post-COVID-19 export values and found that exports are a critical driver of recovery in Indonesia's economic performance following the pandemic's impact. Thus, the results support existing literature that emphasizes the importance of exports as a key component of economic growth, especially in export-oriented economies like Indonesia. In contrast, inflation (X1) and unemployment (X3) did not show significant results in this study, which differs from findings in other studies where these variables have been shown to affect economic growth.

For example, Wizsa et al. (2022) found that fluctuations in export values were closely related to inflation rates, which in turn affected economic growth patterns in Indonesia. The lack of significance in the current study could be attributed to the model's reliance on fixed effects, which may account for the regional disparities that mask the broader impact of inflation and unemployment on economic growth. Additionally, the regional fixed effects highlight the importance of considering local factors in economic analyses, as provinces like DKI Jakarta and Banten experienced challenges that suppressed their growth,

while others like Sulawesi Selatan showed above-average growth. The COVID-19 pandemic significantly impacted economic growth in 2020 and 2021, corroborating Nursafira et al. (2025), who found that the global economic slowdown had a profound impact on Indonesia's export performance, leading to a decrease in total export values during these years.

The year-specific effects indicate that the economic downturn in 2020 and 2021 due to the pandemic had a substantial negative impact on growth, while a partial recovery was observed in 2023. This aligns with Wizsa et al. (2022), who forecasted slow recovery in export values in post-COVID-19 Indonesia, while Nursafira et al. (2025) highlighted how Indonesia's response to global trade challenges influenced economic growth outcomes during these years. With a high R-squared value (0.9162) and F-statistic (34.3), the model demonstrates that the combination of exports, provincial fixed effects, and yearly adjustments explains a significant portion of the variance in Indonesia's economic growth.

4. Conclusion

This study investigated the impact of inflation, exports, and unemployment on economic growth in Indonesia from 2019 to 2023 using the Fixed Effects Model Least Squares Dummy Variable (FEM LSDV) approach, accounting for both province-specific and time-specific effects. The results indicate that exports have a significant positive impact on economic growth, aligning with previous research that highlights exports as a key driver of economic performance, particularly in export-dependent economies like Indonesia. However, inflation and unemployment were not found to have significant effects in this analysis, possibly due to the model's focus on regional and temporal variations, which may have obscured the broader economic impacts these factors typically have. Additionally, the study revealed substantial regional disparities in economic growth, with provinces such as DKI Jakarta, Banten, and Kalimantan Timur experiencing negative growth, likely due to their reliance on sectors most affected by the COVID-19 pandemic. In contrast, regions like Sulawesi Selatan and Gorontalo showed resilience and above-average growth. The FEM LSDV model effectively captured these complex dynamics, explaining a large portion of the variance in economic growth (R-squared = 0.9162). The findings underscore the importance of promoting export-driven growth and addressing regional imbalances to foster more sustainable and balanced economic development across Indonesia, especially in the aftermath of the pandemic.

Ethical Approval
This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Informed Consent Statement
Not applicable.

Authors' Contributions
Andi Harismahyanti A. conceptualized the study, designed the research methodology, and conducted the data analysis using the fixed effects least squares dummy variable panel regression model. She also led the manuscript writing and revisions. Nur'eni contributed to the data collection, statistical validation, and interpretation of results. She also provided critical revisions and assisted in refining the discussion and conclusion sections.

Disclosure Statement
The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

Data Availability Statement
Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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