

Analysis Of Factors Affecting The Open Unemployment Rate In Sumatera And Java Islands 2015-2024

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Abstract

This study aims to analyze the effects of education (average years of schooling), Information and Communication Technology (ICT) skills, Provincial Minimum Wage (UMP), and economic growth on the open unemployment rate (TPT) in Sumatera and Java Islands during the 2015–2024 period. The analytical method used is panel data regression with the Fixed Effect Model (FEM) approach. The results indicate that education and economic growth have a negative and significant effect on the unemployment rate, implying that improvements in these variables help reduce unemployment. Conversely, ICT has a positive and significant impact, suggesting potential job displacement due to labor force unpreparedness in facing digital transformation. Similarly, the UMP variable also has a positive effect, showing that wage increases without corresponding labor productivity may lead to higher unemployment. This study recommends policy strategies that enhance education quality, ICT-based workforce training, and inclusive economic development to effectively reduce unemployment rates.

Keywords: Open Unemployment, Education, ICT, Provincial Minimum Wage, Economic Growth



INTRODUCTION

Unemployment is a multidimensional problem that is not only related to economics but also reflects the quality of human resources, policy effectiveness, and regional disparities. (Mirislavovna, 2020) states that structural unemployment occurs when the skills of the workforce do not match market needs. Although the government has implemented various policies, the mismatch between labor supply and demand remains an obstacle.

Unemployment also impacts social stability. Salimah & Wahyudi, (2025) explain that loss of income due to unemployment can encourage individuals to consider criminal acts as more profitable than legal income. The Open Unemployment Rate (TPT) in Indonesia shows fluctuations reflecting responses to national and global economic dynamics.

TPT in 2015 was 6.18%, then decreased to 5.23% in 2019, reflecting economic recovery after the global crisis. However, the COVID-19 pandemic caused a surge in TPT in 2020 to 7.07%, the highest in the last decade. Economic recovery starting in 2021 showed a gradual decrease in TPT, reaching 4.91% in 2024.

According to Firdaus, (2013), Indonesia ranks poorly in terms of inter-regional inequality, especially between developed and developing regions. Provinces with adequate infrastructure find it easier to attract investment and create jobs, while areas with limited access to transportation, technology, and education struggle to develop their economic potential, leading to persistently high unemployment.

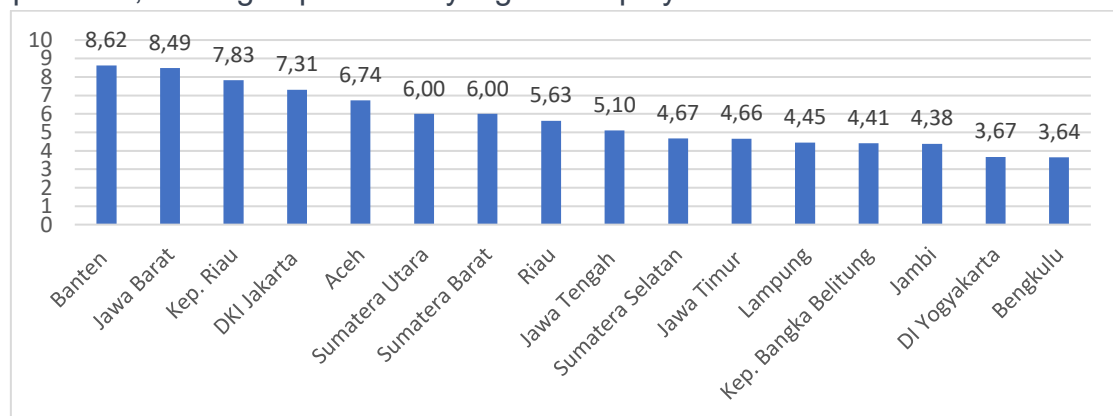


Figure 1 Open Unemployment Rate in Sumatera and Java Proviences, August 2015-2024

Source: Central Statistics Agency (2025) Processed



Inter-regional Open Unemployment disparities are also evident, Urban provinces such as Banten 8,62%, West Java 8,49% and Riau Islands 7,83% recorded high Open Unemployment due to migration and labor market imbalances. Conversely, areas relying on informal and agricultural sectors like Bengkulu, Yogyakarta, and Bangka Belitung have lower Open Unemployment, although the quality of jobs there is not yet stable

Education plays a crucial role in improving the quality of the workforce. Low education levels limit access to decent jobs and increase the risk of unemployment, especially among youth (Prawira, 2018). (Darmawan et al., 2022) emphasize that education is a key factor in economic development.

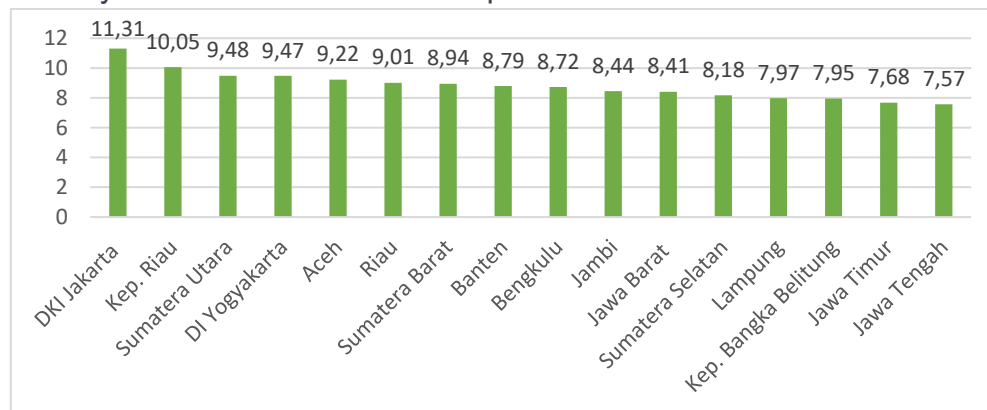


Figure 2 Average Years Of Schooling in Sumatera and Java Islands 2015-2024

Source: Central Statistics Agency (2024) Processed

Shows the disparity in average years of schooling between regions, with DKI Jakarta having the highest 11,13 years and Lampung the lowest 8,12 years, due to differences in Infrastructure, teacher quality and digital access (Suncaka, 2023). However, high formal education does not necessarily reduce unemployment, as many graduates lack skills relevant to industry needs. Therefore, strengthening vocational education and synergy between education and the world of work is necessary (Khairunnisa et al., 2021)

Advances in Informations and Communication Technology (ICT) have transformed the labor the market in Indonesia, where automation replaces many human roles, this lower the labor forces participation rate and increases the risk of unemployment for workers without digital skills Antasa & Suparta, (2024)

According to (Ngafifi, 2014), technological development as a result of scientific progress indeed increases efficiency but also creates new challenges in employment. Lack of digital skills and access to information are major obstacles to labor absorption (Nur'aini Silva et al., 2023) Therefore, increasing digital literacy is key to maintaining workforce competitiveness in the digital era.

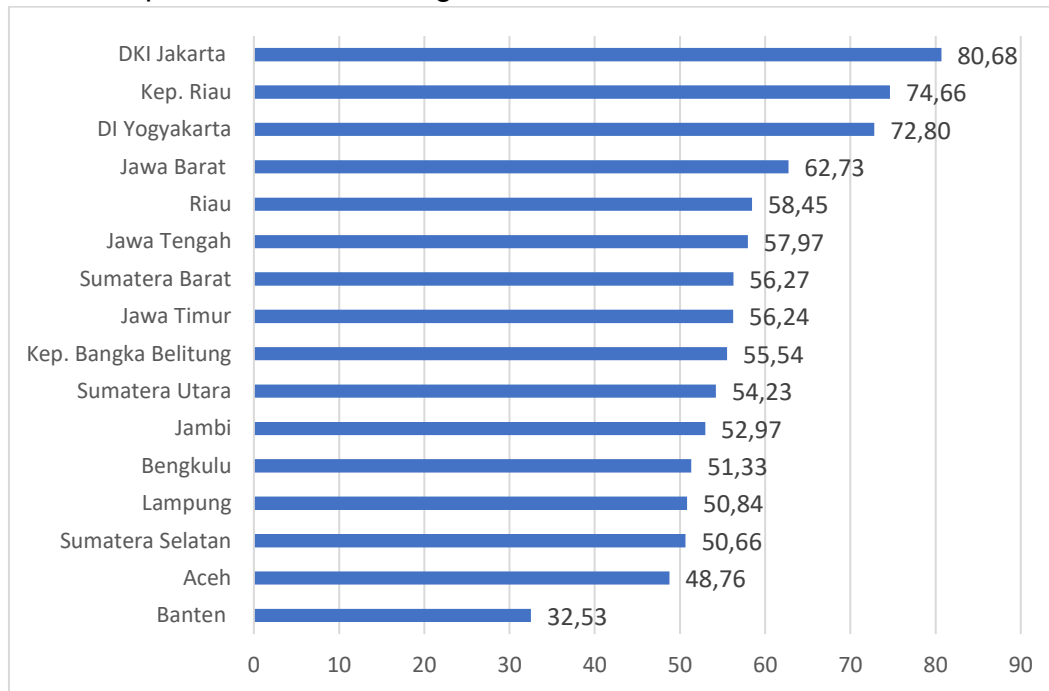


Figure 3 Proportion of youth and Adults Aged 15-59 with ICT Skills in Sumatera and Java Islands 2015-2024

Source: Central Statistics Agency (2024) Processed

Data shows that ICT utilization is not evenly distributed across provinces. DKI Jakarta recorded the highest proportion 80,68% while other provinces like Aceh and Banten lagged. This disparity indicates a digital divide that impacts job opportunities, social mobility, and the distribution of economic development across regions.

Digital transformation and Provincial Minimum Wage (UMP) policies also influence unemployment dynamics. Technological changes can increase short-term unemployment due to shifts in work patterns and new competency demands, while the inability of the workforce to adapt widens the social gap (Putri & Ash Shidique, 2023) On the other hand,

UMP increases, while improving welfare, risk hindering recruitment if not balanced with productivity, especially in the informal sector and small businesses (Aisyah et al., 2020)

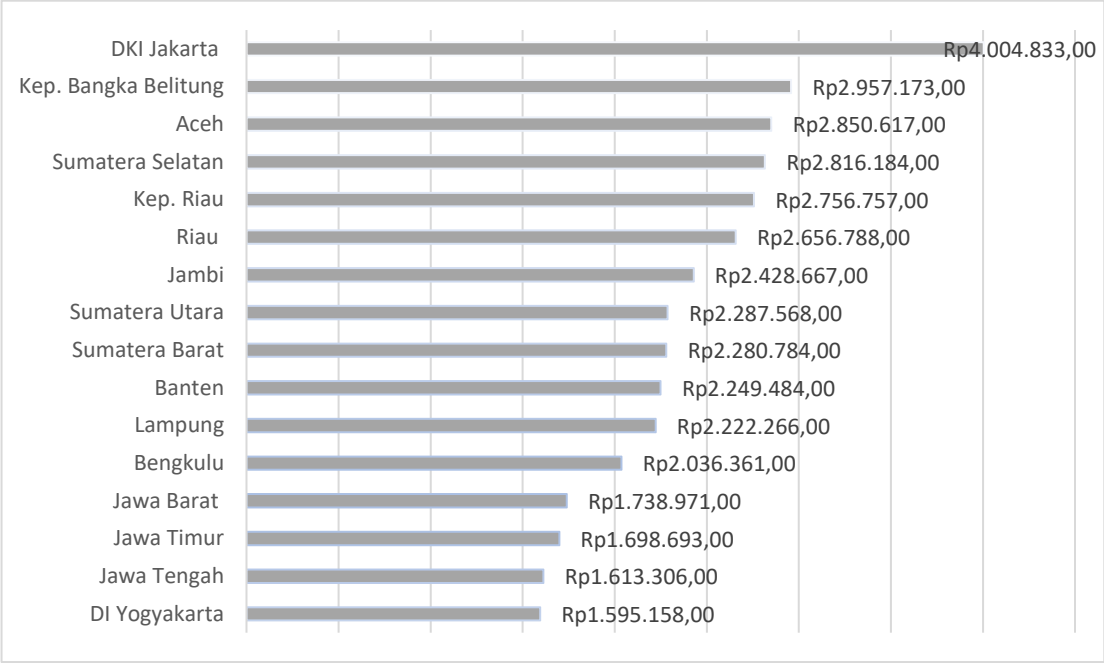


Figure 4 Provincial Minimum Wage in Sumatera and Java Islands 2015-2024
Source: Central Statistics Agency (2024) Processed

Provincial minimum wage data shows significant disparities between provinces. DKI Jakarta sets the highest Rp.4.004.833, while provinces like Yogyakarta and Central Java set much lower Provincial Minimum Wage, This inequality encourages labor migration to areas with higher wage, increasing competition and creating inter-regional unemployment risk (Sahara & Iryani, 2023)

Economic growth is another relevant macroeconomic variable affecting unemployment fluctuations. When the economy grows positively, there is an increase in labor demand and new job creation. Conversely, slowing growth will reduce employment opportunities and encourage an increase in unemployment. (Suhendra Indra & Wicaksono. 2016)



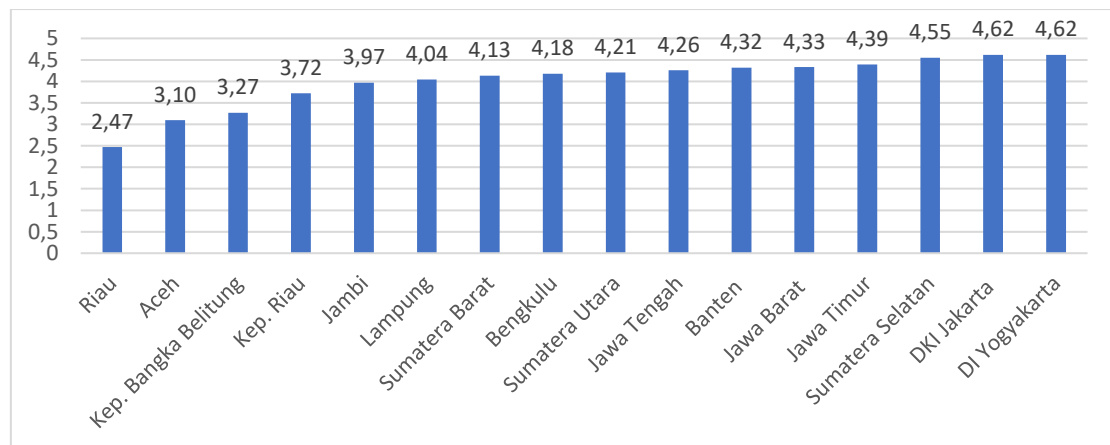


Figure 5 Economic Growth Rate Province in Sumatera and Java Islands 2015-2024

Source: Central Statistics Agency (2024) Processed

Differences in economic growth rates between provinces affect labor absorption capacity. Provinces with high growth, such as DKI Jakarta and East Java, recorded 4,65% and were able to create more jobs, while areas with slow growth like Riau and Jambi faced limitations. Kristina et al., (2022) emphasize that unemployment reduces productivity and hinders the optimization of national economic potential.

Based on these results, this study aims to analyze the influence of ICT skills, UMP policy, and economic growth on the open unemployment rate in Sumatra and Java Islands during the 2015-2024 period. The focus on this region was chosen because both have a large contribution to the national labor structure but also show striking spatial disparities. This analysis is expected to provide an empirical basis for formulating more inclusive and equitable employment and economic development policies.

METHODOLOGY

This study uses multiple linear regression with panel data, analyzed through three estimation approaches: Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Before the analysis, several classical assumption tests were applied, such as normality, multicollinearity, heteroscedasticity, and autocorrelation tests, to determine the most appropriate estimation model. The Chow test was used to compare CEM and FEM, and the Hausman test was used to compare FEM with REM. After the best model was obtained, hypothesis testing was performed using the t-test.

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(parsial), F-test (Simultaneous), and coefficient of determinations (R^2) analysis to see how much the independent variable influence the dependent variable.

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

$$TPT = \alpha + \beta_1 RLS_{it} + \beta_2 TIK_{it} + \beta_3 UMP_{it} + \beta_4 PPE_{it} + \epsilon_{it}$$

RESULT AND DISCUSSION

Table 1. Descriptive Statistics Analysis

Variabel	Obs	Mean	Std. Dev	Min	Max
TPT	160	5.723625	1.83089	2.6	10.95
RLS	160	8.811625	0.9512619	7.03	11.49
TIK	160	59.19225	21.26651	16.27	95.83
UMP	160	2387101	744623.5	910000	5067381
PE	160	101.9957	64.06214	-54.872	286.1912

Source: Output STATA 17

Based on the descriptive statistical analysis, the five main variables in this study include the Open Unemployment Rate (TPT), Education (average years of schooling), Information and Communication Technology (ICT), Provincial Minimum Wage (UMP), and Gross Regional Domestic Product (GRDP) which has been transformed into cubic form because it did not pass the normality test. During the period 2015-2024:

1. Open Unemployment: The average TPT of 5.72% indicates that about 5-6% of the workforce was unemployed during 2015-2024. The standard deviation of 1.83% reflects inter-provincial inequality, with a minimum value of 2.6% Bangka Belitung in 2016 and a maximum of 10.95% DKI Jakarta in 2020.
2. Education (Average years of schooling): The average years of schooling of 8.81 years indicates education equivalent to junior high school, with a relatively small spread standard deviation of 0.95. Values range from 7.03 years Central Java to 11.49 years DKI Jakarta in 2024.
3. ICT Skills: The average ICT skill level of 59.19 reflects a moderate but uneven level of technology utilization. High disparity is seen from the standard deviation of 21.26, with the lowest value of 16.27 Lampung in 2015 and the highest of 95.83 Riau Islands in 2024.



4. Provincial Minimum Wage: The average UMP recorded was Rp 2,387,101 with a standard deviation of Rp 744,623.5, indicating differences in living costs and economic conditions. The lowest value was Rp 910,000 Central Java in 2015 and the highest was Rp 5,067,381 DKI Jakarta in 2024.
5. Economic Growth (Cubic Transformed): The average economic growth (cubic) was 101.99 with a standard deviation of 64.06, showing high variation between regions. The minimum value of -54.87 Riau Islands in 2020 and the maximum of 286.19 DI Yogyakarta in 2019 indicate contractions and uneven economic growth.

Table 2. Normality test

Variabel	Skewness	Kurtosis
TPT	0.761917642	0.05297216
Pendidikan	0.70140503	0.390042394
TIK	-0.228948456	-1.126166683
UMP	0.851801262	1.31879942
PE	-0.2145408	-0.225336192

Source: *Output STATA 17 dan Ms.Excel*

The normality test in this study was conducted using the Skewness-Kurtosis method, where a variable is said normally distributed if the Skewness value is within the range of -2 to +2, and kurtosis value is within the range of -3 to +3. Based on the values in table 2, it can be explained that the Economic Growth variable is not normally distributed. Therefore, the Economic Growth variable had to transformed into a cubic form (PE³) using STATA software and the result then met Skewnees-Kurtosis Value to be declared normally distributed

Table 3. Multikolinieritas test

Variabel	VIF
UMP	1.99
Pendidikan	1.91
TIK	1.64
PEP	1.09
Mean VIF	1.66

Sourcer: *Output Stata 17*



The multicollinearity test was performed using the VIF method, where a value below 10 indicates the absence of multicollinearity. All independent variables (UMP, Education, ICT, and PE) have VIFs between 1.09 and 1.99, with an average of 1.66. These results indicate that the model is free from multicollinearity.

Tabel 4. Heteroskedastisitas test

Chi2	Prob > Chi2
2.77	0.0959>0,05

Sumber: Stata 17

Based on the results in Table 4, the Breusch-Pagan Cook-Weisberg test for heteroscedasticity shows a chi-square (χ^2) statistic of 2.77 with a p-value of 0.0959. The zero hypothesis (H_0) in this test states that the model has constant residual variance (homoscedasticity), while the alternative hypothesis (H_1) states that there is non-constant residual variance (heteroscedasticity). Since the $\text{Prob} > \chi^2 = 0,0959$ is greater than the common significance level, ($\alpha = 0,05$), the zero hypothesis cannot be rejected. Thus, it can be concluded that there is no heteroscedasticity problem in the regression model used, and the variance of the error term is constant or stable. Autocorrelation testing is not mandatory for short-time dimension panel data with many cross-section units, unless there are theoretical indications or problematic residual patterns. According to Baltagi (2005), this test is more relevant for time series data or long-time dimension panels, while Fixed/Random Effect models emphasize heteroscedasticity and cross-sectional dependence

Model selection test This study performed model selection by choosing the most appropriate or best model among three models: CEM, FEM, and REM, through the Chow Test, Hausman Test, and LM Test.

The Chow test is performed to determine whether the CEM or FEM model is more appropriate. If the cross-section F probability is > 0.05 , CEM is used, whereas if it is < 0.05 , FEM is used. The results of the Chow test are as follows:

Table 5. Chow test

Prob > F	0.0000
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Source: STATA 17



Table 5 shows that the Prob. Cross Section F value is $0.0000 < (\alpha) 0.05$, thus the FEM model is the appropriate model.

The Hausman test is performed to choose between the Random Effect Model (REM) and the Fixed Effect Model (FEM).

Table 6. Uji Hausman

Prob>chi2	0.0107
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Source: *Output STATA 17*

Table 6 shows that the probability value is $0.0107 < (\alpha) 0.05$ thus the FEM model is the appropriate model to use in this study.

Fixed Effect Model panel data regression estimation

Table 7. Ordinary Least Square (OLS)

Variabel	Koefisien	Std Error	t-Statistic	Prob.
C	24,2988	6,321933	3,84	0,000
Pendidikan	-2,017189	0,8042425	-2,51	0,013
TIK	0,0303036	0,0131	2,31	0,022
UMP	-6,50e-07	3,14e-07	-2,07	0,040
PE	- 0,0102262	0,0010657	-9,60	0,000

Sumber: *Output Stata 17*

This column shows the estimated coefficients for each variable. The coefficient indicates the expected change in the dependent variable Open Unemployment for a one-unit increase in the independent variable, holding all other variables constant:

1. C (Constant): The constant term is 24.2988, suggesting that if all independent variables are zero, the TPT would be approximately 24.30%.
2. Education: The coefficient of -2.0172 indicates that for each additional year of schooling, the Open Unemployment decreases by approximately 2.02%, suggesting that higher education levels are associated with lower unemployment rates.
3. ICT: The coefficient of 0.0303 implies that a one-point increase in the ICT index is

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associated with a 0.03% increase in TPT, indicating that higher ICT skills may lead to increased unemployment, possibly due to job displacement.

4. UMP: The coefficient of $-6.50e-07$ indicates that for every increase of Rp 1,000,000 in the Provincial Minimum Wage, the TPT decreases by approximately 0.65%, suggesting that higher wages can reduce unemployment.
5. PE: The coefficient of -0.0102 indicates that a one-unit increase in economic growth (in cubic form) is associated with a decrease in TPT by 0.0102%, reflecting the negative relationship between economic growth and unemployment.

Tabel 11. t-Statistic Test

Variabel	T-hitung	T-tabel	Prob.	Kesimpulan
Pendidikan	-2,51	1.65474	0.013	Menolak H_0
TIK	2,31	1.65474	0.022	Menolak H_0
UMP	-2,07	1.65474	0.040	Menolak H_0
PE	-9,60	1.65474	0.000	Menolak H_0

Sumber: *Output Stata 17*

Table 11 presents the results of the t-statistic test for the independent variables affecting the Open Unemployment Rate. Using a significance level of 95% $\alpha = 0,05$ and degrees of freedom (df) calculated as 155, the t-table value is 1.65474. The t-calculated values for Education (-2.51), ICT (2.31), UMP (-2.07), and Economic Growth (-9.60) all exceed the t-table value, with corresponding p-values of 0.013, 0.022, 0.040, and 0.000, respectively, all less than 0.05. Therefore, the zero hypothesis H_0 is rejected for all variables, indicating that education has a negative and significant effect on Unemployment, ICT has a positive and significant effect, UMP has a negative and significant effect, and Economic Growth also has a negative and significant effect on the Open Unemployment Rate.

F-Statistic test and Coefficient of Determination test

Tabel 12. F-statistic and Coefficient of Determination

Fhitung	Ftabel	Prob.	R-square
26,38	1,98	0.0000	0,4298

Sumber: *Output Stata 17*



In Table 12, the F-test results in this study show that the F-calculated value of 26.38 is greater than the F-table value of 1.98 with a probability of $0.0000 < 0.05$, meaning that H_0 is rejected and H_a is accepted. Thus, it can be concluded that all independent variables collectively influence the dependent variable or the Open Unemployment Rate.

In this study, the Coefficient of Determination (R-squared) value of 0.4298 indicates that the linear regression model can explain 42.98% of the variation in the dependent variable (TPT) through the independent variables (Education, ICT, UMP, PE). The remaining 57.02% is explained by other factors or random errors.

According to Hair et al., (2019) an R-square value below 50% indicates limited predictive ability of the model. However, in the context of social, economic, and behavioral research, a low R-Square value can still be acceptable if the independent variables are statistically significant and supported by strong theory.

DISCUSSION

Influence of education on the Open Unemployment Rate in Sumatera and Java Islands 2015-2024

Education is the process of improving human quality enough character building, attitudes, behavior, and knowledge. The government continues to strive to improve the quality of human resources, including through the construction of easily accessible educational facilities, free basic education programs, and other supporting programs (Emalia et al., 2024). These efforts are in line with the findings in this study, which show that education plays a significant role in reducing the Open Unemployment Rate (TPT).

The Fixed Effect Model (FEM) estimation results show an education coefficient of -2.017 with a significance level of 0.013, meaning that every one-year increase in the average years of schooling can reduce TPT by 2.02%. This is consistent with Human Capital Theory Becker, (1964) which states that education is an investment in increasing workforce productivity and competitiveness.

However, its effectiveness is highly influenced by the alignment between educational curricula and industry needs. The phenomenon of educated unemployment, according to Khairunnisa et al., (2021) remains a challenge in various regions, including DKI Jakarta and West Java, where high education levels are not always followed by a decrease in unemployment due to skills mismatch. Therefore, strengthening vocational education, link-and-match programs, and soft skills development are important so that



educational outputs can contribute optimally to reducing unemployment and sustainable economic growth.

Overall, this analysis confirms that education is a strategic instrument in reducing TPT. In the long run, investment in education will not only increase workforce productivity but also strengthen the foundation for inclusive and sustainable economic development.

Influence of Information and Communication on the Open Unemployment Rate in Sumatera and Java Islands 2015-2024

The development of Information and Communication Technology (ICT) has become a major catalyst in socio-economic transformation, driving the digitalization of production and service sectors. In this study, the ICT variable is measured using the ICT development index for each province.

The Fixed Effect Model (FEM) estimation results show that the ICT variable has a coefficient of 0.0303 and is significant at the 5% level ($p = 0.022$). This means that a one-point increase in the ICT index is associated with an increase in the Open Unemployment Rate (TPT) by 0.03%, assuming other variables remain constant.

This finding indicates that the acceleration of digitalization has not been fully balanced by workforce readiness, especially in regions like Sumatra and Java. Automation has the potential to replace manual jobs, while limited digital skills cause many workers to be unable to compete in the digital economy. This is consistent with the Theory of Technology and the Labor Market (Levy & Murnane, 2003) which emphasizes that routine jobs are more easily replaced by technology than jobs requiring high skills. This shows that the acceleration of digitalization has not been fully balanced by workforce readiness. Automation replaces routine jobs, while the digital skills possessed by the majority of the workforce are still basic and do not meet industry needs. The lack of reskilling and upskilling programs also widens the skills gap and increases the risk of unemployment (Padmaja & Mukul, 2021)



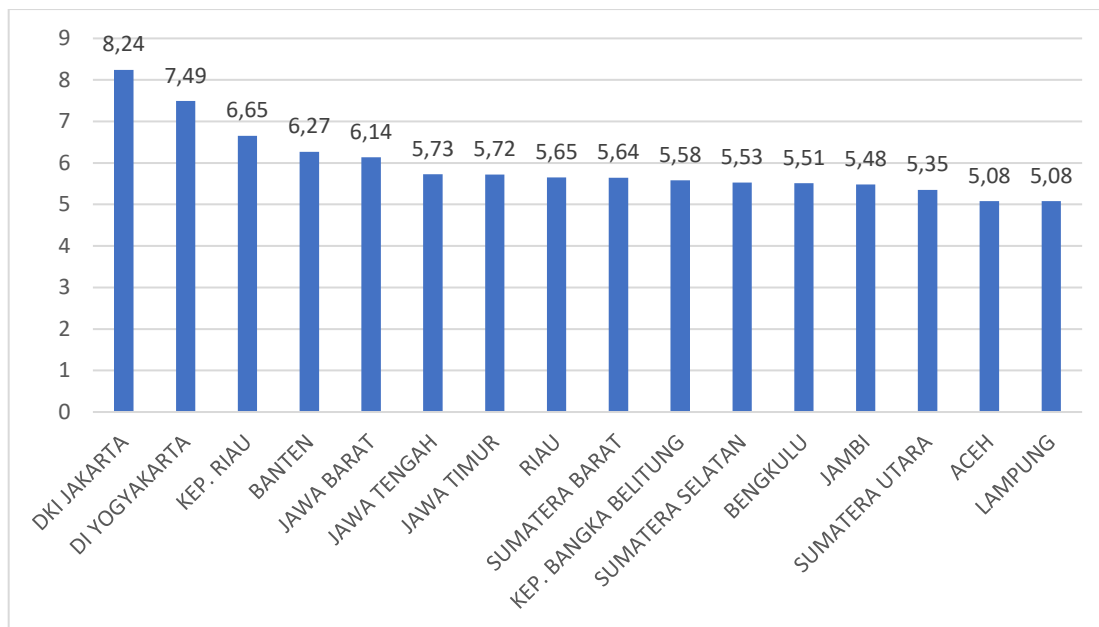


**Figure 5 ICT Infrastructure Access in Sumatera and Java Islands
2015-2024**

Source: Central Statistics Agency (2024) Processed

Analysis of average ICT Infrastructure access in Sumatera and Java during 2015-2024 shows that provinces with high access, such as DKI Jakarta and Yogyakarta, tend to have lower Unemployment rates compared to areas with limited access such as Aceh and Lampung. This emphasizes the importance of ICT infrastructure in supporting job creation and improving workforce competence. In regions with low infrastructure and digital literacy, ICT adoption actually has the potential to widen socio-economic disparities and increase unemployment, especially in traditional sectors. Uneven ICT penetration across provinces, as shown by (Yunita, 2021), exacerbates inequalities in the labor market. Adequate infrastructure can accelerate the loss of traditional jobs. The acceleration of digital transformation not accompanied by adequate reskilling and upskilling programs. In addition, the dominance of the informal sector in various regions hinders the integration of the workforce into the digital economy. This inequality is further increased by socio-economic factors, where only individuals with digital competencies can access job opportunities and improve income distribution (Ratih et al., 2023)

Influence Of Provincial Minimum Wage On The Open Unemployment Rate In Sumatera And Java Islands 2015-2024

The Provincial Minimum Wage (UMP) is a labor policy instrument to protect workers and ensure a decent standard of living, with its determination considering macroeconomic indicators such as inflation and economic growth. The estimation results using the Fixed Effect Model show that UMP has a negative significant effect on the Open Unemployment Rate (TPT), with a coefficient of $-6.50e-07$ ($p = 0.040$). This means that an increase in UMP, although having a small impact, correlates with a decrease in TPT.

This finding is consistent with the study by (Nuzulili, 2022), which states that an increase in UMP encourages job seekers to be more active and encourages businesses to retain their workforce. However, on the other hand, an increase in UMP can put pressure on small and medium-sized enterprises, triggering workforce reductions, especially in Sumatra, which is dominated by the informal sector. In Java, the preference for skilled labor can displace less skilled workers and new graduates.

The rapid growth of the workforce also puts additional pressure, especially in regions with high UMP, which reduces incentives for new job creation. This is consistent with the Theory of Labor Market Equilibrium (Marshall, 1890), that moderate UMP adjustments can reduce unemployment without causing mass layoffs. Therefore, synergy between central and regional governments in setting UMP and effective monitoring are needed to maintain a balance between labor protection and business sustainability.

Influence Of Economic Growth On The Open Unemployment Rate In Sumatera And Java Islands 2015-2024

Gross Regional Domestic Product (GRDP) reflects the level of economic activity in a region and is an important indicator in assessing welfare and job creation capacity. In this study, the Economic Growth variable was cubically transformed to meet normality assumptions. The Fixed Effect Model estimation results show that Economic Growth has a negative significant effect on the Open Unemployment Rate (TPT), with a coefficient of -0.0102 ($p < 0.01$). This finding is consistent with (Okun, 1962), which states a negative relationship between economic growth and unemployment.

In Sumatra and Java, economic growth during 2015-2024 generally had an impact on reducing TPT, especially in provinces with diversified economic sectors such as DKI Jakarta, East Java, and Riau. However, inter-regional and inter-sectoral disparities remain a challenge, especially in areas that depend on the primary sector and have not undergone economic diversification (Parluhutan et al., 2022). Non-inclusive economic

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growth risks creating a phenomenon of jobless growth, where an increase in output is not accompanied by job creation. Therefore, development strategies must focus on labor-intensive sectors, expanding access to financing, and integrating local labor into the production chain to ensure that economic growth has a direct impact on reducing unemployment.

CONCLUSION

The research results show that the variables of education (average years of schooling), ICT, UMP, and GRDP, both partially and simultaneously, have a significant effect on the Open Unemployment Rate (TPT) in 16 provinces in Sumatra and Java during the period 2015-2024. Education has a negative effect on TPT, supporting Human Capital Theory, although skills mismatch challenges remain. ICT has a positive effect on TPT, reflecting the initial impact of digitalization and the limitations of workforce reskilling. UMP has a negative effect on TPT, where a moderate increase in UMP can reduce unemployment if balanced with productivity. Economic growth also has a negative effect on TPT, consistent with Okun's Law, although sectoral disparities and the phenomenon of jobless growth remain challenges.

Simultaneously, the four variables significantly influence TPT (F-calculated = 26.38; $p < 0.05$), indicating that unemployment is multidimensional. Therefore, unemployment alleviation strategies need to be designed comprehensively with a focus on improving education quality, equitable access to technology, adaptive wage policies, and inclusive economic growth.

I.

SUGGESTIONS

Based on the research findings, it is suggested that central and regional governments strengthen investment in the education sector, especially in areas with high unemployment, through improving access, teacher quality, and curriculum alignment with labor market needs. In addition, digital transformation needs to be balanced with increased digital literacy and ICT skills through training, incubation programs, and creative economy empowerment, to reduce skills mismatch that exacerbates unemployment.

II. The determination of the Provincial Minimum Wage (UMP) also needs to be data-driven and consider the balance between worker protection and business competitiveness, accompanied by assistance to MSMEs so that they can optimally absorb labor. Furthermore, regional development strategies need to be directed towards

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labor-intensive sectors such as manufacturing, tourism, and the creative economy, by creating a healthy and inclusive investment climate so that economic growth can make a real contribution to expanding employment opportunities and reducing the open unemployment rate.

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