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Analysis of the Influence of Education, Economic Growth, Technological Development, and Wages on Unemployment on Java Island

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ABSTRACT
The main and fundamental problem in Indonesia's labor force is the high unemployment rate. This is because the growth of new labor is significantly greater than the growth of available jobs each year. Labor growth that is greater than the number of available jobs results in an increase in unemployment. This study aims to measure the direction and magnitude of the influence of Education, Economic Growth, Technological Development, and Provincial Minimum Wage on the Open Unemployment Rate in Java Island for the period 2012-2021. This type of research data is secondary data in the form of panel data with the object of research on the Open Unemployment Rate in Java Island in 2012-2021, data obtained from the Central Statistics Agency (BPS). The analysis method used in this research is panel data regression analysis with the Random Effect Model (REM) selected model. The results showed that Economic Growth and Provincial Minimum Wage had a negative and significant effect on the Open Unemployment Rate, while Education and Technological Development had no effect on the Open Unemployment Rate. It is expected that the government should maintain the factors that influence economic growth and wages, as well as improve the education system and communication technology infrastructure. This research can be a reference for related parties in solving the problem of high unemployment in Java
Keywords: Unemployment, economic growth, education, technology, wages

INTRODUCTION

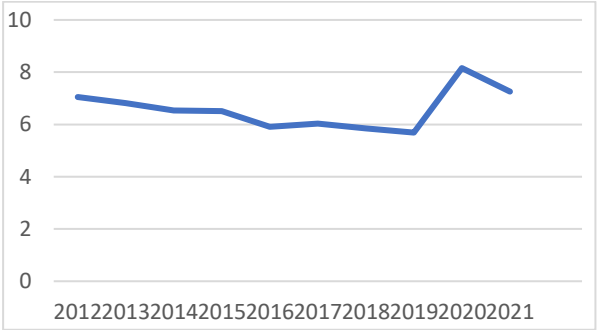
In a country or region, it is a deliberate, planned, and continuous transformation from a bad existence to a better life. The economic development of a country is one of the methods of reducing unemployment, inequality, and poverty (Noviatamara et al., 2019). There are many factors that support the progress of economic development efforts so that economic development goals can be achieved.

Labour as a human resource is one of the most essential factors in economic development efforts. By having a sufficiently large workforce, a nation can utilize human resources as the potential for economic development. Indonesia is a developing country with a considerable number of inhabitants, and a large number of people in concentrated areas will cause social problems. (Prakoso, 2020). Employment issues continue to be a source of significant social problems in developing countries including Indonesia.

High unemployment is one of the most fundamental and important employment problems in Indonesia. This is because the growth of new labor is significantly greater than the growth of available jobs each year. The greater growth of the labor force compared to the number of available jobs results in an increase in unemployment. Unemployment is one of the most significant short-term problems that every country faces. Therefore, every country and nation must face the problem of unemployment, especially the natural unemployment rate. (Rianda, 2020).

Okun's Law theory explains that unemployment can have an influence on the movement of a country's economic growth, there is a negative relationship between unemployment and the national economic growth rate. with a mass increase in the number of unemployed will bring a significant burden to the country (Basmar & Sugeng, 2020). This is due to a decrease in government revenue, as national income is measured by the percentage of the total number of Indonesians who have income divided by the total population of Indonesians. If the amount of income is smaller, the country's average national income will be smaller because the population has not been proportional to the amount of income.

According to Corolina & Panjawa (2020), one of the many indicators that can be used to assess unemployment is the Open Unemployment Rate (TPT). The total TPT value gives an indication of how much of the working-age population is unemployed. According to BPS (2016), open unemployment consists of people who do not have a job, are looking for work, preparing for business and people who are not looking for work because they feel it is impossible to get a job, and those who already have a job but have not started working. Presented in Graph 1 is the condition of the Open Unemployment Rate (TPT) in Java Island in 2012-2022.



Graph 1. Java Island Open Unemployment Rate 2011-2022 (%) Source : Badan Pusat Statistik, processed.

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Based on Graph 1, it can be seen that the Open Unemployment Rate (TPT) of Java Island during 2011-2022 fluctuated. From 2011 to 2019, the open unemployment rate in Java Island decreased, but in 2019-2020 the open unemployment rate in Java Island increased significantly. The increase was caused by the impact of the Covid-19 pandemic. The indirect impact of Covid-19 has weakened opportunities for daily income and resulted in massive dismissal of workers reaching 1,943,916 individuals consisting of 114,340 companies (Mas'udi and Winanti, 2020). Then, in 2021-2022 the Open Unemployment Rate (TPT) of Java Island decreased after the National Economic Recovery (PEN) program.

LITERATURE REVIEW

According to Rustan (2019: 89) unemployment is a term for people who do not have a job, looking for work, working less than two days a week, or people trying to get a decent job. According to Indonesia's Central Bureau of Statistics (BPS), unemployment consists of people who do not have a job, are looking for work, preparing for business, and those who are not looking for work because they feel it is impossible to get a job, as well as those who already have a job but have not started working.

The sum of the unemployment rate and the labor force indicates how much of society should be included in the development process. It can be defined that the unemployment and labor rates are part of the population that is capable of driving the economic process (Muslim, 2014). The high number of productive population must be followed by an increase in the quality of qualified Human Resources (HR). with the aim that people get the right job opportunities according to the needs of the world of work (Maryati et al., 2021).

A high unemployment rate in an area can be caused by the low quality of education and health around the area (Sukirno, 2016). These two factors are indicators of economic development that must be improved by the government as a public policy maker. If the level of education is high, then the labor force in the region will also have high productivity, so they will find it easier to get a job according to the skills they have. Meanwhile, the quality of health facilities allows the population to work in a healthy condition so that they can perform their tasks well (Todaro & Smith, 2014).

The relationship between economic growth and unemployment can be explained by Okun's law, which examines the relationship between the unemployment rate and the GDP level of a country or region. Okun's law theory explains that when there is an increase in GDP in a region, employment in the region will also increase, which will affect the decrease in unemployment (Hartanto & Masjkuri, 2017).

Technological development has an impact where in addition to reducing unemployment, technology can also increase unemployment if it is not accompanied by skills and qualified human resources (Ferdinan, 2013). The digitalization of the economy and industry is strongly influenced by the development of fields related to information and communication technology (ICT). Industrial digitization, which includes transaction processes and business system settings, is the process of transforming physical ideas into virtual ideas that aspire to increase productivity, reduce the use of humans, provide more output, and cover entire regions. Technological innovation should be cautioned as it can lead to widespread unemployment (Thompson, 2020).

In A.W. Phillips' theory, any increase in the wage rate will be followed by a decrease in labor required, which means it will contribute to an increase in unemployment. Conversely, when the wage rate falls, it will be followed by an increase in employment. So it can be said that the amount of labor absorbed has a correlation with the level of wages. Salaries have an effect on the number of employees. In this case, if wages remain excessive then production costs will increase. As a result, companies operate efficiently by reducing labor and resulting in an increase in unemployment (Hartanto & Masjkuri, 2017).

Based on the above background, this study will observe the effect of education, economic growth, technological development, and wages on unemployment in Java from 2012 to 2021.

METHOD

The research data used is panel data, which is a combination of time series and cross section. The time series data is from 2012-2021, while the cross section data used is the province in Java Island. Data obtained from the Central Bureau of Statistics (BPS), data used Average Years of Schooling (EDUC), Economic Growth (PEK), Technology and Information Development Index (TIK), and Regional / Provincial Minimum Wage (UMP).

Model Development

The analytical tool used in this study is panel data regression analysis with the following econometric model:

$$TPTit = \beta 0 + \beta 1\ \text{EDUC}it + \beta 2\ PDRBit + \beta 3\ TIKit + \beta 4\ UMPit + \varepsilon it$$

Where :

TPT	= Open Unemployment Rate (%).
EDUC	= Average Years of Schooling (years).
PEK	= Gross Regional Domestic Product Growth (%).
TIK	= Information and Technology Development Index (scale 1-10).
UMP	= Regional/Provincial Minimum Wage (rupiah).
ε	= Eror term
β_0	= Constanta
β_1…β_4	= Independent variable regression coefficient
i	= Java Island
t	= Year to t

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Central Bureau of Statistics (BPS), the data used are Average Years of Schooling (EDUC), Gross Regional Domestic Product (GRDP) Growth, Information and Technology Development Index (ICT), and Regional/Provincial Minimum Wage (UMP).

The estimation stage of panel data regression analysis will include estimation of econometric model parameters with the Pooled Least Square (PLS), Fixed Effect Model (FEM), and Random Effect Model (REM) approaches; selection of the best estimated model with the Chow test and Hausman test and if necessary the Lagrange Multiplier test; model goodness test on the selected estimated model; and testing the validity of the effect of independent variables on the selected estimated model.

Method

Approaches to Panel Data Regression

Utomo (2013) says that there are three approaches that can be used in analyzing panel data regression methods, which are"

- Common Effect Model (CEM)

The Common Effect Model (CEM) is the simplest panel data approach in model parameters. This approach combines cross section and time series data as one unit without seeing differences between time and individuals, so the method used is the Ordinary Least Square (OLS) method. With the following model:

$$L\_Y_{it} = \beta_0 + \beta_1 L\_X1_{it} + \beta_2 L\_X2_{it} + \beta_3 L\_X3_{it} + e_{it}$$

description:

β	= intercept
$\beta 1$-$\beta 3$	= slope
i	= cross section
t	= time series

- Fixed Effect Model (FEM)

Fixed Effect Model (FEM) is an approach that has intercepts in regression that are differentiated between individuals, because each individual is considered to have its own characteristics. can be distinguished by using dummy variables, so this method is known as the Least Square Dummy Variable (LSDV) model. With the following model:

$$L\_Y_{it} = \beta_0 + \beta_1 L\_X1_{it} + \beta_2 L\_X2_{it} + \beta_3 L\_X3_{it} + \mu_{it}$$

Where:

$\beta 0$	= intercept
$\beta 1$-$\beta 3$	= slope
i	= cross section
t	= time series

Subscript i is added to the intercept, because there are differences in intercepts for each individual. The model is known as the Fixed Effect Method. Although it has different intercepts between individuals, each individual has an intercept that is not different between times, which is called time invariant. It is assumed that if the model has different intercepts between individuals and between times, then differential dummy variables are used. The equation in this method is:

$$Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \beta_1 X1_{it} + \beta_2 X2_{it} + \mu_{it}$$

description:

$D2D3$ = dummy variable

- Random Effect Model (REM)

Random Effect Model (REM) is an approach that estimates panel data where disturbance variables can be interconnected between time and between individuals accommodated through errors. In this approach there is a correlation between disturbance variables, so the method used is the Generalized Least Square (GLS) method. In explaining the Random Effect Model method, consider the following equation for the Fixed Effect Model again:

$$Y_{it} = \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + \mu_{it}$$

Different from the Fixed Effect Model method, in the Random Effect Model method, β_0i is considered as a random variable with the average value of β_1 (without subscript i), then the intercept value of each individual is:

$$Y_{it} = \beta_0 + e_i \text{ with i = 1,2..., n}$$

where ei is an error term with a mean of zero and a variance of $\sigma 2\varepsilon$ (constant), then equation (4) is substituted into equation (5), resulting in the following model:

$$Y_{it} = \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + e_{it} + \mu_{it}$$
$$= \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + e_{it} + w_{it}$$

where,

$w_{it} = e_{it} + \mu_{it}$

The wit component consists of two components, namely the error of each cross section and the error of the combined time series and cross section data. Based on these conditions, the Random Effect Model is also called the Error Componen Model (ECMI).

Model Selection

According to (Sugiyono, 2017) to choose the most appropriate model in processing panel data, there are several tests that can be done, they are:

- Chow test

The assumption that each cross-section unit has the same behavior tends to be unrealistic considering the possibility of each cross-section unit having different behavior is the basis of the Chow Test. The Chow test is to determine which of the two models, namely the commont effect or fixed effect method, should be used in panel data modeling.

In summary, the decision-making criteria are as follows:

1) H0 is rejected if the F-count> F-table F(α, k-1, n-k) or the probability value> α (0.05) then the CEM model is better than FEM.

2) H0 is accepted if the F-count < F-table F(α, k-1, n-k)

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probability value < α (0.05) then the FEM model is better than the CEM.

- Lagrange Multiplier Test

The Lagrange Multiplier (LM) test is a test conducted to determine the better model between the Common Effect Model (CEM) and the Random Effect Model (REM) (Utomo, 2013).

In summary, the decision-making criteria are as follows:
1) H0 is rejected if the LM-count value < the critical value of X2 (df; α) or the Breusch Pagan Probability value > α (0.05) and the selected model is
2) H0 is accepted if the LM-count value> X2 (df;α) critical value or the Breusch Pagan Probability value < α (0.05) and the selected model is the CEM REM model.

- Hausman Test

The Hausman test is a test conducted to determine which model is better between the Fixed Effect Model (FEM) and the Random Effect Model (REM) (Utomo, 2013). Based on the Wald criterion, the value of the Hausman test statistic will follow the chi-square distribution as follows:

In summary, the decision-making criteria are as follows:
H0 is rejected if the calculated chi-square value < chi-square critical value or the Cross Section Probability value > α (0.05) and the selected model is the REM model.

H0 is accepted if the chi-square value < chi-square critical value or the Cross Section Probability value < α (0.05) and the selected model is the FEM model.

- Statistical Test

Descriptive statistic Analysis is the use of statistics to analyze data by writing down or displaying data that has already been collected as-is without making assumptions that are universal or generalizable (Sugiyono, 2017:206). According to Ghozali (2017), descriptive statistics provides an indication for any data that includes the mean, standard deviation, maximum, and minimum values.

- F-Test

The F test is intended to test the regression model for the effect of all independent stimulant variables on the dependent variable. The hypothesis in the F test is as follows:

$H0$: $\beta 1 = \beta 2 = \ldots = \beta n = 0$; independent variable has no effect.
HA: $\beta 1 \neq \beta 2 \neq \ldots \neq \beta n \neq 0$; independent variable has an effect.

Indicators in decision making are as follows:
1) If the significant value> α (0.05) then H0 is accepted and HA is rejected. This states that together the independent variables have no significant effect on the dependent variable.
2) If the significant value < α (0.05) then H0 is rejected and HA is accepted. This states that together the independent variables have a significant effect on the dependent variable.

- Coeficient of Determination (R-Square)

According to Ghozali (2018) the coefficient of determination (R2) essentially measures how far the model's ability to explain variations in the dependent variable. The coefficient of determination is between zero and one. A small R2 value means that the ability of the dependent variables is very limited. A value close to one means that the independent variables provide almost all the information needed to predict variations in the dependent variable. A model is said to be poor if the R2 value is close to zero.

- T-Test

The t statistical test is used to test whether the independent variable partially has a significant effect on the dependent variable (Ghozali, 2018). The test uses a significance level of 0.05 (α = 5%) or a researcher's confidence level of 95%. With the following criteria:

Hypothesis formulation:

$H0$: $\beta i = 0$; the i-th independent variable has no significant effect.
HA: $\beta i \neq 0$; the i-th independent variable has a significant effect.
Indicators in decision making are as follows:
1) If the probability value < α (0.05) then H0 is rejected and HA is accepted. This states that the independent variable has a significant effect on the dependent variable
2) If the probability value > α (0.05) then H0 is accepted and HA is rejected. This states that the independent variable has no significant effect on the dependent variable.

RESULT AND DISCUSSION

The estimation results of the econometric model in advance with the Pooled Least Square (PLS), Fixed Effect Model (FEM) and Random Effect Model (REM) approaches along with the model selection test results are summarized in Table 2.

Table 2. Model Selection Test Estimation Results of Panel Data Regression Econometric Model-Cross section

Variable	Regression Coefficients		
	PLS	FEM	REM
C	-2.3737	37.1752	33.8532
EDUC	1.0785	1.7047	1.1390
PEK	-0.1776	-0.2616	-0.2662
TIK	-0.7596	0.1724	0.1953
logUMP	0.3499	-3.1395	-2.5782
R2	0.1327	0.9458	0.5524
Adjusted. R2	0.0697	0.9360	0.5198
Statistik F	2.1045	96.9492	16.9690
Prob. Statistik F	0.0926	0.0000	0.0000
Test of Model Selection			
Chow			
Cross- Section F(5, 50) = 150.0170; Prob. F(5, 50) = 0.0000			
Hausman			
Cross-Section random $\chi 2$ (4) = 5.4494; Prob. $\chi 2$ (α) = 0.2442			

source: BPS, processed.

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Table 2 shows that the Chow Test Fixed Effect Model (FEM) was chosen as the best estimated model, as seen from the probability or empirical significance of the F statistic which is worth 0.0000 (< 0.01). While in the Hausman Test Random Effect Model (REM) was chosen as the best estimated model, seen from the probability or empirical significance of the statistic $\chi 2$ which is worth 0.2442 (> 0.05). Thus it can be concluded that the Random Effects Model (REM) model was chosen as the best estimated model. The complete estimation results of the Random Effects Model (REM) model are presented in Table 3.

Table 3. Estimastion Model of Random Effect Model (REM)

$\widehat{EMP}_{it} = 33.8532 + 1.1390\ EDUC_{it} - 0.2662\ PEK_{it} + 0.1953\ TIK_{it} - 2.5782 \log UMP$

(0.1103) (0.0000)* (0.2054) (0.0009)*

R2 = 0.5524; DW = 1.4520; F = 16.969; Prob. F = 0.0000

Notes: *Significant at α = 0.01; **Significant at α = 0.05; *** Significant at α = 0.10; Numbers in parentheses are probability t-statistic values.

Table 4
Regional Effects and Constants

Number	District/City	Regional Effect	Constant
1	DKI JAKARTA	-0,0098	33,8434
2	JAWA BARAT	2,3046	36,1578
3	JAWA TEGAH	-0,4729	33,3803
4	DI YOGYAKARTA	-4,4392	29,4140
5	JAWA TIMUR	-0,3708	33,4824
6	BANTEN	2,9881	36,8413

Source: BPS, processed.

From Table 3, it can be seen that the REM estimated model exists with the probability or empirical significance of the F statistic worth 0.0000 (< 0.01), with a coefficient of determination (R2) of 0.5524; which indicates that the REM estimated model has moderate predictive power. Separately from the four variables in the econometric model, it turns out that only two variables, namely the economic growth variable (PEK) and the provincial minimum wage (logUMP) have an influence on economic growth with a probability or empirical significance of t statistics of 0.0000 (< 0.01); and 0.0009 (< 0.01).

The Economic Growth variable has a regression coefficient of -0.2662, with a linear-linear relationship pattern. This means that if economic growth increases by 1%, the open unemployment rate will decrease by 0.2662%. Conversely, if economic growth decreases by 1%, the open unemployment rate will increase by 0.2662%.

The Provincial Minimum Wage variable has a regression coefficient of -2.5782, with a linear-logarithm (lin-log) relationship pattern. This means that if the Provincial Minimum Wage increases by 1%, the Unemployment Rate will decrease by 0.0258%. Conversely, if Economic Growth decreases by 1%, the Open Unemployment Rate will increase by 0.0258%.

Table 4 shows that the region with the highest constant value is Banten Province, which is 36.8413. This means that Banten Province tends to have a higher Open Unemployment Rate compared to other provinces in Java Island due to the influence of the variables Education, Economic Growth, Technology and Communication Development Index, and Wages. After Banten Province, the two provinces with the largest constants are West Java Province and DKI Jakarta Province.

The lowest constant value is owned by Yogyakarta Province, which is 29.4140. This means that related to the influence of the variables of Education, Economic Growth, Technology and Communication Development Index, and Wages in DIY Yogyakarta Province tends to have a lower Open Unemployment Rate (TPT) compared to other provinces in Java Island. After Yogyakarta Province, the two provinces with the lowest constant are Central Java Province and East Java Province.

CONCLUSION AND RECOMMENDATION

The Open Unemployment Rate (TPT) in various provinces in Java Island in 2012-2021 was negatively affected by Economic Growth (PEK) and Provincial Minimum Wage. Meanwhile, Education (EDUC) and Information Communication Technology (ICT) have no effect on the Open Unemployment Rate in Java.

Economic growth has a negative effect on the open unemployment rate in Java Island, this shows that the effect of economic growth is in accordance with the theory, namely economic growth over time is effective in reducing unemployment.

The provincial minimum wage is found to have a negative effect on the open unemployment rate in Java Island, this shows that the effect of wages is in accordance with the theory, namely an increase in the level of wages will be followed by a decrease in the required labor force. Education has no effect on the open unemployment rate, meaning that higher education has no effect on unemployment and vice versa. Higher education does not guarantee an increase in skills or productivity of Human Resources (HR).

The ability of a qualified workforce is not assessed in terms of high education, but the ability and experience possessed so that productivity can be achieved. In order to be absorbed by the labor market, the government must improve the quality of education and skills of the community so that more people have a high level of education and have competent abilities.

The technology and communication development index has no effect on the open unemployment rate. The absence of the influence of technology and communication on the unemployment rate in Java Island can occur because of the limited availability of access and community facilities in the use of ICT, which is commonly referred to as digital poverty. Therefore, it is difficult to influence the open unemployment rate in Java.

The government is expected to continue to sustain economic growth and manage the factors that influence economic growth so that the open unemployment rate continues to decline. The wage conditions in conclusion show that the macro economy has not yet reached full employment so that the increase in wages that drives up the amount of labor supply can still be absorbed adequately. This phenomenon shows that the government from time to time can still raise the Provincial Minimum Wage to maintain and even increase the real wages received by workers.

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The government is expected to continue the employment program (PRAKERJA), because this program can help improve the skills and productivity of the workforce in the form of direct training cost assistance to participants and post-training incentives with a variety of skilling, reskilling, and upskilling training.The government can increase the development of technology and communication infrastructure evenly in Java, and the government also needs to improve the soft skills and hard skills of the community, so that the ability to use technology can increase and not be displaced by the development of communication technology. Researchers hope that further research can take a more specific sample and can add new variables so that new findings can be obtained.

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