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Unemployment Rates in Vocational Education in Indonesia Using Economic and Statistical Analysis

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Abstract Unemployment is a significant issue in many countries, including Indonesia. This study aims to assess the impact of independent variables on the dependent variable. The dependent variable is the unemployment rate in vocational higher education (Y), and the independent variables are the employment opportunities in vocational higher education (X1), government policy in the establishment of the Directorate General of Vocational Education (X2), and area differences between Java and outside Java (X3). Multiple linear regression with the Ordinary Least Squares method is used in the analysis. The findings indicate that the three independent variables have a statistically significant effect on the dependent variable. Variable X1 significantly affects the unemployment rate in vocational higher education in Indonesia, while variables X2 and X3 have a significant adverse effect. According to the findings of this study, there needs to be more labor in vocational higher education in Indonesia. The novelty of this research is to demonstrate the effect of establishing the Directorate General of Vocational Education in 2020, which is then updated based on the work procedure organization in 2021 to reduce the unemployment rate in Indonesian vocational higher education.

Keywords Independent variable, Dependent variable, Ordinary least square, Significant, Over supply

AMS 2010 subject classifications 62P20

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1. Introduction

Unemployment is a significant issue in every country that must be addressed immediately. According to [1] vocational education can help to reduce the unemployment rate. [1] used a regression model for statistical estimation. Furthermore, using quantitative analysis, [2] discovered that lifelong vocational education affects the dependent variable, classified as social attitude, action, achievement, and satisfaction. A study [3] using linear regression shows that workers' knowledge, interaction with others, and personal grooming are essential in preparing for the Industrial Revolution 4.0. Indonesia faces challenges and opportunities to increase capacity and maximize its population's economic contribution. Vocational education connects the educational environment with the world of work and accelerates graduate employment. Because of its low absorption, vocational education still needs to improve its quality. According to research [4], using logistic regression, teachers and the government must devise an appropriate strategy to make vocational education appealing to the general public.

Figure 1 depicts the Open Unemployment Rate by Level of Education. Compared to the national unemployment rate, those with vocational education, either from Senior High School or Diploma I, II, or III, have a higher

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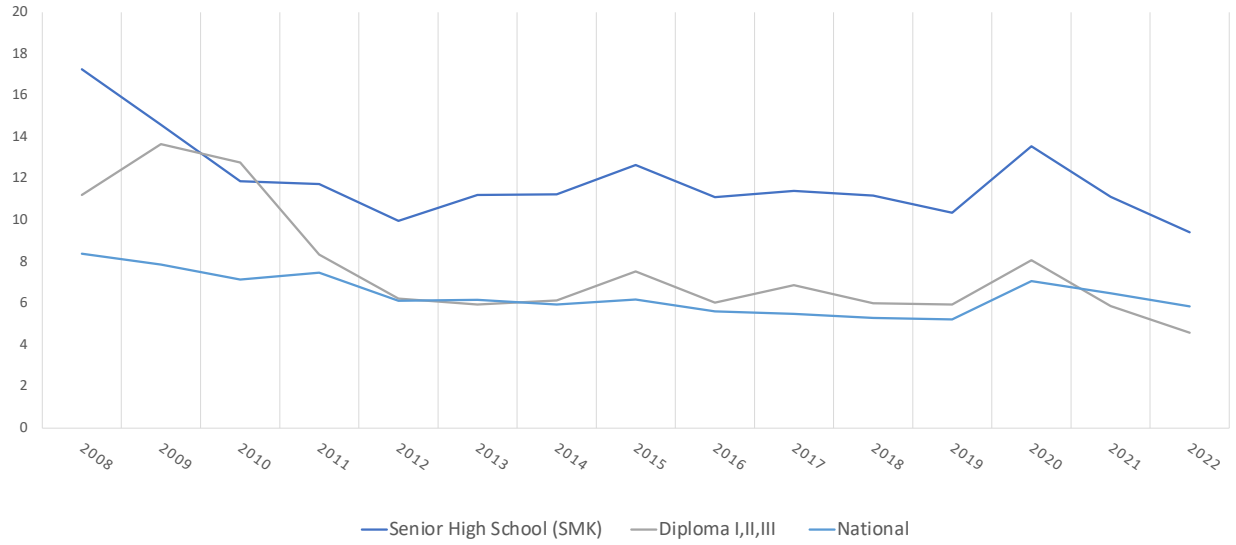

Figure 1. Open Unemployment by Educational Attainment (Percent)

unemployment rate. Unemployment occurs when someone does not have work or is attempting to find it. One of the causes of Indonesia's high unemployment rate is a mismatch between labor market needs and labor supply.

Research conducted by [5] using correlation and regression analysis discovered that empathy, self-motivation, autonomy, understanding one's own and others' emotions, managing one's emotions, influencing the emotional state of others (manipulation), and other factors influence individual subjective well-being.

The nation's competitiveness is expected to improve due to vocational education. Improving the quality and relevance of the Link and Match program in vocational education is critical. However, in practice, it has many constraints and is challenging to implement, resulting in a skill mismatch and a negative impact on the high unemployment rate. The Indonesian government has issued a policy concerning revitalizing vocational education and vocational training through presidential regulation No. 68 of 2022. Vocational education's current structure and development need to pay more attention to the ability to solve problems using critical, logical, and creative thinking skills. To improve life and career skills, vocational education programs must be developed.

Unemployed people are those who are looking for work. They may have resigned or been fired for a variety of reasons. Unemployment is a labor issue in many countries. Because this is such a severe issue, every society's economic development strategy always aims to reduce unemployment. The Open Unemployment Rate is the ratio of unemployed people to the total labor force.

Using regression models, researchers [6] estimated the availability of middle-level skilled labor in India, which can help the government and industry plan vocational education. [7], using regression analysis, suggested the importance of increasing learners' role awareness and the need for a job orientation strategy for learners in high school. Training institutions and businesses must collaborate closely and interact in the job market.

Several studies have been conducted, such as research [8], claiming that a lack of employment affects employment opportunities. According to the findings, the number of labor force variables significantly positively impacted educated unemployment. A study conducted by [9] on 26 provinces in Indonesia yielded different results, concluding that the labor force negatively affects the unemployment rate.

To address the issue of mismatches among workers graduating from higher education, collaboration between the government and higher education institutions is required. The government must provide job-fair facilities with various job opportunities and fair requirements for all groups. This is done so that new employees can learn about various job openings and adjust to the background they studied in higher education.

In addition, the government must continue to improve the link and match policy, particularly at the vocational higher education level. Later, the link and match policy can help improve the relevance of work needs to the world

of education. According to [10], government spending harms the reduction of unemployment in African countries. On the other hand, research [11] in developed countries indicates that government policies such as unemployment benefits will increase unemployment.

In Java-Bali, the residence factor has a different impact on educated unemployment [12]. Educated unemployment for college graduates is lower in Java-Bali than elsewhere. According to [13], compared to other regions of Indonesia, Sumatra, Java, and Bali positively impact the unemployment rate. Due to an imbalance in labor supply and demand, many workers who have graduated from higher education decide to look for work or work regardless of the field background they studied while in higher education.

Vocational education must still be integrated with the industrial world, with less linked and matched learning content [14]. Because the government has not yet imposed strict regulations on the link-and-match program, the industrial world is not included as an independent variable or a factor in this study. Despite its presence as a slogan, the concept of link and match has yet to be implemented comprehensively and integrated.

This study aims to examine the impact of employment opportunities, government policies, and areas in and outside of Java on the unemployment rate of vocational higher education. The government will likely use the findings of this study to make policy decisions aimed at lowering unemployment rates in Indonesian higher vocational education. Proposed hypothesis: H1: Employment opportunities in vocational higher education significantly affect unemployment. H2: Government policy in establishing the Directorate General of Vocational Education significantly affects the unemployment rate in vocational higher education. H3: The Java region significantly affects the unemployment rate in vocational higher education.

Motivation and Main Contributions

Research on unemployment in the context of vocational higher education is a very relevant and important topic. This concerns the extent to which the vocational education system is effective in preparing its graduates to enter the job market. This research focuses on the factors that influence the unemployment rate in vocational higher education which includes external aspects such as job opportunity conditions, government policies, and regional conditions in Indonesia which are very large. Regional factors are divided into Java Island and Outside Java which influence the unemployment rate among vocational higher education graduates which has never been done quantitatively by another research. This research has the potential to make a significant contribution to the understanding and improvement of the education system as well as efforts to reduce unemployment rates. By contributing to these aspects, research on unemployment in vocational higher education can provide valuable insights and help create positive changes in the education system and employment opportunities for graduates through entrepreneurship.

2. Data and Methods

This study uses data from Statistics Indonesia's National Labor Force Survey (Sakernas), released in August 2019 and August 2022. The collected data were subjected to province-specific analysis. The Statistical Program for Social Science (SPSS) software was used to process the data. The sample was collected from all provinces of Indonesia (Table 1). Given that Indonesia has 34 provinces, this study utilized data from both 2019 and 2022, resulting in a total sample size of 68 data points. A regression equation can also be constructed as follows:

$\gamma_i = \beta_0 + \beta_1 X_i + \beta_2 D_{1_i} + \beta_3 D_{2_i} + \varepsilon_i ...(1)$

γ_i= number of unemployed in vocational higher education

X_i= Number of people working in vocational education

D_{1_i}= Policy, 1 in 2022 and 0 in 2019

D_{2_i}= Area, 1 for the province variable on Java Island and 0 for other provinces

$_i$= Province in Indonesia

To obtain the elasticity of employment to unemployment, according to [15], the variables Yi and Xi need to be transformed so that both variables will produce regression coefficients, which are also the magnitude of elasticity.

$Log\gamma_i = \beta_0 + \beta_1 log X_i + \beta_2 D_{1_i} + \beta_3 D_{2_i} + \varepsilon_i ...(2)$

Many researchers have used the Ordinary Least Square method in regression analysis, such as [16], [17], [18], and [19], to determine the effect of independent variables on the dependent variable. If the classical assumptions are met, the Ordinary Least Squares method will produce the best estimate compared to other methods.

If the following classical assumptions are met, the use of multiple linear regression analysis will yield valid parameter estimation values:

1. Normality Test The normality test determines whether or not the dependent variable and independent variable in the regression model have a normal distribution and whether the residual value has a normal distribution. A good regression model should have a residual value that is normal or near normal. The Kolmogorov Smirnov test was used in this study, with the criteria that if the significant Kolmogorov Smirnov is less than 0.05, the data is not standard. However, the data is standard if the Kolmogorov-Smirnov significance is more significant than 0.05.
2. Multicollinearity Test The multicollinearity test determines whether or not there is a relationship between the independent variables in the regression model. There should be no correlation between the independent variables in a good regression model. The Variance Inflation Factor (VIF) and tolerance value can be used to detect multicollinearity in regression. There is no multicollinearity if VIF is less than ten and tolerance is more significant than 0.1. However, multicollinearity exists if VIF is more significant than ten and tolerance is greater than 0.1.
3. Heteroscedasticity Test The heteroscedasticity test determines whether there is an inequality of variance in the residuals of one observation compared to another in the regression model. If the residuals of one observation and another are fixed, this is called homoscedasticity; if they differ, it is called heteroscedasticity. The test plot of processed data can be used to determine the presence or absence of heteroscedasticity. If the plot spreads above and below the 0 axis without forming a specific pattern with the same variance, there is no heteroscedasticity.
4. Autocorrelation Analysis The autocorrelation test is used to determine whether or not there is a strong correlation between residuals. Because data from one period can influence data from another, autocorrelation is standard. The Run test can be used to determine whether or not autocorrelation exists. The data does not exhibit autocorrelation if the significance value is more significant than 0.05.

2.1. Ordinary Least Square

The Ordinary Least Square method in regression analysis minimizes the sum of squared errors by estimating a regression line. The Ordinary Least Square (OLS) method is a type of econometric method, and the result is a population regression function that will be used for data estimation. To produce an estimate using the OLS method, four basic assumptions are required that are BLUE. BLUE itself stands for best, linear, unbiased, and estimator. Here are some explanations of these basic assumptions.

Best: the best regression model results with minimal error.

Linear: the model in regression is in accordance with OLS rules.

Unbiased: The expected value matches the correct value.

Estimator: The regression model formed has a variance with the smallest value.

2.2. Descriptive Data

According to the data in Table 1, there were 217,331 unemployed vocational higher education people in 2019, with around 50.23% of them on the island of Java, that is, in DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, and Banten. Three million four hundred nine thousand six hundred seventy-one people in vocational higher education are employed, with Java Island accounting for 54.26%. In 2022, there will be 159,490 unemployed people in vocational higher education, with Java accounting for 51.09% of the total. In 2022, 3,312,508 vocational higher education graduates were working, with Java accounting for 54.63%. The high percentage of unemployed and employed people in Java is because Java controls most of Indonesia's economy despite accounting for less than 20% of the total area of Indonesia. Java controls 58.61% of Indonesia's total economy.

Table 1. Number of Vocational College Graduates Who Are Working and Who Unemployed in 2019 and 2022 (People)

Province	2019		2022	
—-	Unemployment	Working	Unemployment	Working
Aceh	7.874	97.863	3.603	80.258
Sumatera Utara	14.155	186.168	10.709	176.459
Sumatera Barat	5.785	92.135	5.454	84.975
Riau	7.495	97.958	5.758	83.126
Jambi	1.656	45.917	1.372	36.881
Sumatera Selatan	10.122	107.236	8.657	94.263
Bengkulu	1.300	24.822	480	22.474
Lampung	6.715	94.662	2.177	76.375
Kep. Bangka Belitung	970	23.176	274	20.468
Kep. Riau	1.991	46.246	1.609	44.285
DKI Jakarta	13.524	237.484	9.363	264.422
Jawa Barat	48.708	601.649	34.903	605.984
Jawa Tengah	14.667	385.356	11.799	388.149
DI Yogyakarta	3.718	92.283	814	95.117
Jawa Timur	14.420	372.893	19.388	317.034
Banten	14.123	160.280	5.218	138.955
Bali	4.889	116.444	6.019	148.007
Nusa Tenggara Barat	3.327	46.637	3.134	52.731
Nusa Tenggara Timur	6.399	62.248	4.424	68.619
Kalimantan Barat	2.978	48.919	2.418	67.421
Kalimantan Tengah	1.902	31.830	997	28.472
Kalimantan Selatan	2.980	49.206	1.572	46.050
Kalimantan Timur	4.447	58.641	3.094	56.923
Kalimantan Utara	394	12.519	203	13.347
Sulawesi Utara	727	27.621	1.141	29.280
Sulawesi Tengah	2.227	37.204	996	30.607
Sulawesi Selatan	7.478	105.136	3.354	103.067
Sulawesi Tenggara	2.174	35.173	1.611	36.044
Gorontalo	206	10.976	472	11.519
Sulawesi Barat	1.192	12.476	613	14.918
Maluku	2.581	26.539	4.454	24.969
Maluku Utara	1.675	14.237	766	15.902
Papua Barat	1.496	16.982	955	15.072
Papua	3.037	30.215	1.689	20.335
Total	217.331	3.409.671	159.490	3.312.508

Source: Central Bureau of Statistics

The Minister of Education and Culture established the Directorate General of Vocational Education in 2020 as part of Regulation 9 2020 concerning organization and work procedures. Furthermore, the regulation was updated again in 2021 with Number 28 of 2021 concerning the Ministry of Education, Culture, Research, and Technology's work procedures. According to the data in Table 1, there has been a 26.61% decrease in the unemployment rate between 2019 and 2022, with Java experiencing a 25.35% decrease. On the other hand, total employment decreased by 2.84% between 2019 and 2022, while Java Island decreased by 2.18%.

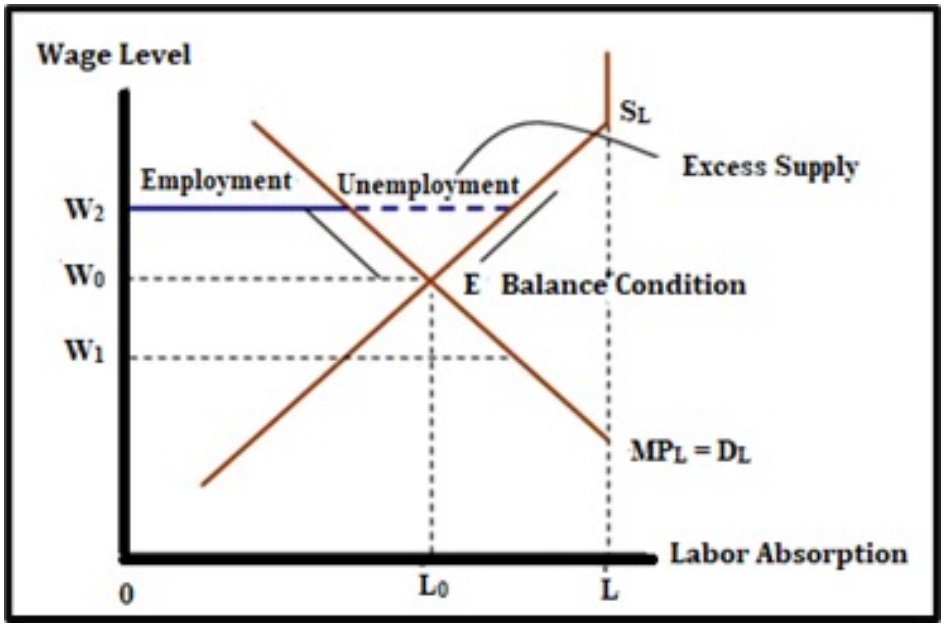

Figure 2. Demand and Supply of Labor at Certain Wage Level

2.3. Labor Demand and Supply

The Labor Force is defined as the economically active population aged 15 and up, including the working and unemployed populations. Working is a way to make money. Unemployment is defined as a person who is not working and is looking for work, is starting a new business, believes it is impossible to find work (hopeless), or has been accepted for work but has yet to begin working. The Labor Force Participation Rate is the proportion of the total labor force in the working-age population (15 and up). The Open Unemployment Rate is the percentage of the unemployed labor force.

Labor issues are highly complex. Good working conditions, high output quality, decent wages, and the quality of human resources are all issues that come up in labor discussions. In Indonesia, there are still several structural and sectoral imbalances in the labor market.

Figure 2 depicts a labor market model based on labor demand and supply. Labor market equilibrium can be determined using labor demand and supply (Balance Condition) by intersecting supply and demand curves [20]. Adam Smith's famous theory gave rise to the concepts of supply-demand and equilibrium. According to neoclassical theory, most markets can quickly reach an equilibrium with no excess supply or demand. However, there may be long-term unemployment in the labor market. Wage disparities exist in the labor market as well.

Demand (MPL=DL) is the relationship between the wage rate and the number of workers willing to be hired by employers. The labor supply is the amount of labor that labor owners can provide over a specific period at each possible wage. According to classical theory, workers are free to choose whether or not to work. Figure 2 depicts the equilibrium condition of demand and supply at a given wage level (point E).

Wage disparities reflect differences in tastes or preferences for various types of work. This is commonly referred to as the wage equality theory. A person may be willing to sacrifice his dislike for a job to earn a higher salary or vice versa. Demand and supply are important factors in determining the appropriate wage for job seekers and employers in the labor market.

When wages rise from W0 to W2, there is an increase in labor supply and a decrease in labor demand, resulting in excess supply and unemployment. Unemployment will impact the community's waste of resources, low productivity, and low per capita income, which will have social consequences such as increased social unrest and crime, a burden on the family, and low self-esteem.

2.4. Increasing Labor Demand, Reducing Unemployment

Unemployment is something that no one wants. As a result, they try to avoid being unemployed by looking for work to earn money to meet their needs. On the other hand, the desire to work is used to achieve non-economic goals such as gaining value, dignity, or self-actualization. The composition of entrepreneurs in the structure of society is one of the benchmarks for a nation's progress. The more entrepreneurs there are, the more advanced and established the country will be. Instilling an entrepreneurial spirit in the community can help reduce unemployment. By engaging in entrepreneurial activities, jobs are expected to be created, thereby improving people's welfare.

According to [21], entrepreneurship education can stimulate business intentions among vocational education graduates. Entrepreneurship education is critical for vocational education graduates who want to start their businesses. The involvement of vocational higher education graduates will have a significant impact on reducing unemployment. Participation of vocational higher education graduates in entrepreneurship can directly create new jobs for the community while improving their quality of life and economic status. Entrepreneurship education programs are critical to reducing unemployment and creating jobs for graduates of vocational higher education. An excellent vocational higher education system will boost competitiveness and promote entrepreneurship [22]. There are several reasons why creating entrepreneurs in a country is related to welfare, including (1) being a solution for oneself because entrepreneurs are not unemployed and even create employment opportunities for others; (2) being a solution for the community because entrepreneurs can transform resources into products needed by the community through their creativity; and (3) being a solution for the state, namely that the state to finance development programs. Youth unemployment can be alleviated through youth entrepreneurship programs, and the potential for youth entrepreneurship is sufficient to warrant development. Increasing potential and entrepreneurial spirit can be accomplished in various ways, including vocational education [23]. Because of Indonesia's current unemployment problem, youth are not fully participating in development. Employment as an entrepreneur can benefit society by providing real financial rewards. Entrepreneurs in various business fields will benefit the country by increasing employment opportunities and providing consumers with a wide range of goods and services at home and abroad.

3. Results and Discussion

3.1. Testing Multiple Linear Regression Assumptions

1. Normality Test.
   Data normality testing is used to determine whether the data used is normally distributed or not. In this study, the normality test used the Kolmogorof-Smirnov test. For this test the real level α=0.05. The statistical hypothesis tested is stated as follows:
   H0: The sample is normally distributed
   H1: The sample is not normally distributed

   The test criterion is to reject H0 if the significance is less than α=0.05 and accept H0 if it is significant α>0.05. Based on the results of calculations using SPSS software, the normality test results were obtained as in Table 2.

   In Table 2, the values can be seenAsymp. Sig. (2-tailed) is 0.200 and the Test Statistics value is 0.072 which is greater than 0.05 so it can be concluded that the data is normally distributed.

2. Multicollinearity Test.
   The multicollinearity test is carried out to determine whether there are independent variables that are correlated with each other or not. To test the existence of multicollinearity, it can be seen through the Variance Inflation Factor (VIF) value and tolerance value for each independent variable. If the tolerance value is above 0.10 and the VIF is less than 10, it is said that there are no symptoms of multicollinearity.

Table 2. One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		68
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.20381963
Most Extreme Differences	Absolute	.072
	Positive	.060
	Negative	-.072
Test Statistic		.072
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

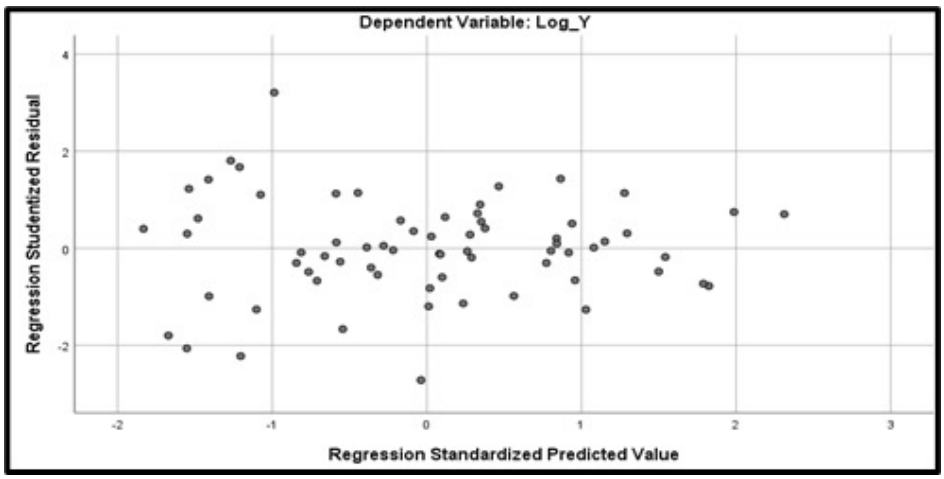

Figure 3. Heteroscedasticity Test Result

Based on the test results, it was found that the value of collinearity statistics tolerance was > 0.10 and the VIF value was < 10. Based on the results in Table 4, it was found that the Tolerance value of each independent variable was above 0.1 and the VIF value was less than 10. Thus, it can be concluded that there are no symptoms of multicollinearity.

3. Heteroscedasticity Test.
The heteroscedasticity test is carried out to detect the presence of unequal variances in the residuals of the regression model in one observation. The heteroscedasticity test in this study used a plot diagram. Based on the plot results, the plot spreads above and below the 0 axis and does not form a particular pattern so that the variance is the same and there is no heteroscedasticity (Figure 3).

4. Autocorrelation Test.
Based on the results of the Autocorrelation Test with the Run Test, a 2-tailed significance value of 0.625 was obtained. Because the Run Test value is more than 0.05, it can be concluded that the data does not experience autocorrelation.

Table 3. F Test Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.935	3	4.978	114.475	.000[b]
	Residual	2.783	64	.043		
	Total	17.719	67			

a. Dependent Variable: LogY
b. Predictors: (Constant), Area, Policy, LogX1

Table 4. Coefficient of Determination Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.918a	.843	.836	.20854

a. Predictors: (Constant), Area, Policy, Log X1
b. Dependent Variable: LogY

Table 5. Regression Analysis Results

		Unstandardized Coefficients		Standardized Coeff.	t	Sig.	Collinearity Statistics	
Model		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-2.076	.371		-5.592	.000		
	Log X1	1.188	.080	1.017	14.895	.000	.527	1.899
	Policy	-.157	.051	-.154	-3.105	.003	.999	1.001
	Area	-.242	.091	-.181	-2.650	.010	.527	1.898

Dependent Variable: LogY

3.2. Interpretation of Regression Models

Multiple linear regression was used in this study's statistical analysis. This analysis determines the impact of the independent variables, namely the number of working vocational higher education participants, government policies, and work areas, on the vocational higher education unemployment rate. The magnitude of the independent variables' simultaneous and partial influence on the dependent variable is shown below.

According to the F-test calculation result, the value of the F count is 114.475, with a significance value of 0.000 < 0.05. This demonstrates that the independent variables (Log X1, Policy, and Area) work together to explain the effect of the independent variables on the dependent variable (Log Y).

The coefficient of determination analysis calculates the percentage of variation in the model's independent variables that can explain the variation in the dependent variable. The results of the determination analysis are shown in Table 4 as a summary model output from the multiple regression analysis results.

Based on the output results in Table 3, the correlation between the independent and dependent variables is 0.836, as shown in Adjusted Square. This indicates that the contribution of the Log X1, Policy, and Area variables to Log Y is 84.30%, while the remaining 15.70% is influenced by other variables not used in this study.

1. **Hypothesis Test: Job opportunities in vocational higher education have a significant effect on unemployment**
   According to the findings in Table 5, Log X1 (employment opportunity variable) has a positive and statistically significant effect on the unemployment rate of vocational higher education graduates. The Log X1 coefficient is 1.19, implying that every 1 percent increase in employment opportunity raises the unemployment rate by 1.19 percentage points. Because the sign is positive, this implies an oversupply of

labor in Indonesian vocational higher education [24]. The government, educational institutions, and society continue to pay attention to employment issues. The government considers the employment issue a national development problem because employment is crucial to development.

Human resources development aims to 1. maximize human resources utilization, 2. create equal employment opportunities and supply human resources by national development, 3. protect human resources in achieving their welfare, and 4. improve the welfare of human resources and their families.

Employment policies include efforts to encourage the growth and expansion of employment opportunities in each region and the development of the number and quality of available labor forces to utilize the development potential in their respective regions fully. Creating job opportunities is the prudent course of action when the labor supply exceeds the demand. Employment opportunities refer to the willingness of manufacturing firms to hire the labor required in the manufacturing process.

Vocational higher education must develop programs to help students develop entrepreneurial skills [25]. Entrepreneurs can be a driving force for change, innovation, and a country's progress. An entrepreneur is someone who starts a business that involves risk and uncertainty in order to make a profit. The availability of employment is related to entrepreneurship. Entrepreneurship allows people to increase their economic activity, necessitating labor and expanding employment opportunities. Increased employment opportunities will reduce the number of unemployed labor force members while increasing national income.

2. **Hypothesis Testing: Government policy in the form of establishing the Directorate General of Vocational Education significantly affects the unemployment rate in vocational higher education**.

   Policy variables harm unemployment; government policy can reduce unemployment by 0.16%. The strategy of the Directorate General of Vocational Education, which provides competency certification through systematic and objective competency tests that refer to work competency standards, the Job Skills Program, and the Entrepreneurial Skills Program, has influenced this increase.

   In 2021, 41.37% of vocational higher education graduates will be employed or self-employed, rising to 42.10% in 2022 [26]. According to [26], vocational education aims to develop essential human qualities such as thinking, emotional intelligence, and physical power to develop and master science, technology, arts, and sports.

   There are several reasons why vocational higher education policies are ineffective in lowering the unemployment rate. The following obstacles have been encountered: 1. There is a budget block, which causes delays in program implementation; 2. The implementation of study programs outside the main campus needs to be improved by adequate facilities and infrastructure, including the completeness of the learning building; 3. The establishment of new study programs is hampered by the availability of lecturers by the needs, and the accreditation process must be proposed again for upgrading at the higher education level.

   The Directorate of Vocational Education continues to improve access to vocational higher education for economically disadvantaged communities, to encourage the improvement of the quality of vocational higher education graduates who are competitive, and to improve the quality of vocational lecturer education in order to improve the quality of teaching and mentoring to students, as well as research and community service. Efforts are still being made to improve the competitiveness and quality of vocational higher education. However, Indonesia's higher education system is vast and complex, with quality that needs to be improved.

   By 2022, the private sector will control 95.97% of Indonesia's vocational colleges. There are 48% of these colleges that are not accredited, 32% that are C accredited, and only 2% that are A accredited. There are still many universities in Indonesia that could be of better quality. In general, small universities predominate in Indonesian universities. As a result, governance could be more optimal, affecting educational quality achievement.

3. **Hypothesis Test: The Java region significantly affects the unemployment rate in vocational higher education.**

   Java Island, as an area variable, harms unemployment, with the ability to reduce the unemployment rate by 0.42%. This is due to the concentration of 51.62%t of polytechnic higher education in Java. This situation demonstrates that there is still an imbalance in the distribution of human resources, economic development, and infrastructure development across regions. However, industrial and infrastructure development that

promotes employment remains concentrated in Java. Because Java Island contributes more than half of Indonesia's GDP, Java Island is the backbone of Indonesia's main economic activities. DKI Jakarta Province, both the center of government and the center of the economy, contributes the most GDP value. West Java Province, which contributes the second highest GDP to Java Island, is increasing its GDP value yearly and has nearly surpassed DKI Jakarta Province. The manufacturing, trade, and creative industries make up most of West Java Province's contribution.

The manufacturing sector (30%), trade (16%), construction (10%), and agriculture (8%) are the main sectors supporting the economy of Java Island. Though their share is less than 10%, other sectors are growing faster than the four main sectors. This demonstrates that as the purchasing power of the people of Java Island grows, so does the demand for tertiary goods and services, such as transportation and services. On the other hand, the agricultural sector, particularly food crops, must be preserved due to its critical role in meeting the needs of Java Island's population. According to [27], Java Island plays an essential role in urban development as the center of investment accumulation, the economy, and the government. It is located in Jakarta's Special Capital Region. From 2019 to 2021, Java will continue to account for 55% of the national economy. Java has the highest consumption of household expenditures, and its population has a higher education level (average years of schooling) than the population outside of Java.

4. Conclusion

Based on the research hypothesis and data processing on vocational higher education, it can be concluded that the contribution of three variables, Job Opportunity, Policy, and Area to Unemployment, reaches 84.30%. In contrast, the remaining 15.70% is influenced by other variables not used in this study. The employment opportunity variable has a positive and significant effect on the unemployment rate of vocational higher education graduates with a coefficient of 1.19, which means that every 1 percent increase in employment opportunity will increase the unemployment rate by 1.19 percent. The positive sign implies that there has been an oversupply of labor in vocational higher education in Indonesia. To reduce the unemployment rate in vocational higher education, it is necessary to increase demand by developing entrepreneurial competencies in vocational higher education. The Policy variable in the form of the establishment of the Directorate General of Vocational Education hurts unemployment, meaning that government policy can reduce unemployment by 0.16 percent. The Area variable (Province in Java Island) negatively affects the unemployment rate of vocational education. This shows that there is still inequality in the distribution of human resources.

Wage disparities reflect differences in tastes or preferences for various types of work. This is commonly referred to as the wage equality theory. A person may be willing to sacrifice his dislike for a job to earn a higher salary or vice versa. Demand and supply are important factors in determining the appropriate wage for job seekers and employers in the labor market. When wages rise from W0 to W2, there is an increase in labor supply and a decrease in labor demand, resulting in excess supply and unemployment. Unemployment will impact the community's waste of resources, low productivity, and low per capita income, which will have social consequences such as increased social unrest and crime, a burden on the family, and low self-esteem.

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REFERENCES

1. T. Blinova, S. Bylina , and V. Rusanovskiy, *Vocational education in the system of determinants of reducing youth unemployment: interregional comparisons*, Procedia - Social and Behavioral Sciences 214, pp. 526 – 534, 2015.
2. J. Y. J. Kim, E. Kim, and D. H. Lim, *A meta-analysis of the effects of lifelong vocational education in South Korea*, European Journal of Training and Development, 2023, DOI 10.1108/EJTD-02-2023-0026.
3. D. P. Dewata, D. Liu, and T. Mao, *Using linear regression model to analyze the role of internship program in supporting work readiness*, The 4th International Annual Meeting On Stem Education, Vol. 2685, Issue 1, 2023.
4. C. M. Hong, C. K. Ch'nga, and T. R. N. Roslan, *Logistic regression in predicting students' decision to enroll in technical and vocational education and training (TVET)*, e-Proceedings of The 3rd Young Researchers' Quantitative Symposium, 2021.
5. E. I. Biktemirova, E. I. Shagiakhmetova , and O.A. Guryanova, *Regression model of students subjective well-being learning at technical universities* E3S Web of Conferences, 2023.
6. P. Khanale, and A. Vaingankar, *Estimating availability of middle-level skilled manpower* The Turkish Online Journal of Educational Technology – TOJET, vol. 5 Issue 2, Article 4, 2006.
7. T. H. Thanh, and N. T. T. Nga, *Research regression function of vocational education training quality of transport sector in Vietnam*, International Journal of Civil Engineering and Technology, Vol. 8, Issue 11, pp. 943-958, 2017.
8. F. S. N. Ramadhani, *Pengaruh kondisi demografi, ketenagakerjaan,dan ekonomi terhadap pengangguran terdidik di Indonesia*, Universitas Brawijaya, Malang, 2021.
9. E. K. Oktafianto, N. A. Achsani, and T. Irawan, *The determinant of regional unemployment in Indonesia: The spatial durbin models*, Signifikan: Jurnal Ilmu Ekonomi Volume 8 (2), pp. 179 – 194, 2019.
10. O. D. Akinyele, O. M. Oloba, and G. Mah, *Drivers of unemployment intensity in sub-Saharan Africa: do government intervention and natural resources matter?*, Review of Economics and Political Science, Vol. 8 No. 3, pp. 166-185, 2023.
11. M. Choudhry, E. Marelli, and M. Signorelli, *Youth and total unemployment rate: the impact of policies and institutions*, Rivista Internazionale di Scienze Sociali, pp. 1 – 18, 2013.
12. D. S. Pratomo, *The phenomenon of educated unemployment in Indonesia [Fenomena pengangguran terdidik di Indonesia]*, Sustainable Competitive Advantage-7, UNSOED, Purwokerto, 2017.
13. A. Sumanto , M. H. I. Abbas, F. Rahmawati, and S. Merlinda *Do technological developments reduce unemployment in Indonesia?* Advances in Economics, Business and Management Research, Vol. 124, pp. 345 – 350, 2019.
14. Suharno , N. A. Pambudi, B. Harjanto, *Vocational education in Indonesia: History, development, opportunities, and challenges.* Children and Youth Services Review, 115, pp. 1 – 8, 2020.
15. Soekartawi, *Economic theory of production,An analysis of the Cobb-Douglas function [Teori ekonomi produksi , analisis fungsi cobb-douglas]*, PT Raja Grafindo Persada, Jakarta, 1994.
16. Z. Erdinç, and G. Suhail, *using ordinary least squares to measure the impact of the factors affecting underground economy: a comparison between Pakistan and turkey*, Journal of Business & Economic Policy, Vol. 4, No. 3, pp. 61 – 68, 2017.
17. M. S. Peprah, and I. O. Mensah, *Performance evaluation of the ordinary least square (OLS) and total least square (TLS) in adjusting field data: an empirical study on a DGPS data*, South African Journal of Geomatics, Vol. 6. No. 1, pp. 73 – 89, 2017.
18. S. L. Baier, and J. H. Bergstrand, *Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation*, Journal of International Economics 77, pp. 77–85, 2009.
19. G. Khalaf, *Improving the ordinary least squares estimator by ridge regression*, Open Access Library Journal, Vol. 9, pp. 1 – 8, 2022.
20. A. Stirati, *Interpretations of the classics: the theory of wages*, Working Paper, No. 116, pp. 1 – 14, 2010.
21. R. A. Saibon, A. Kamis, Z. Zainol, *Entrepreneurship education: unemployment issues, people's well being and entrepreneurial intentions among the graduates in Malaysia*, International Journal of Psychosocial Rehabilitation, Vol. 23, No.4, pp. 953 – 965, 2019.
22. E. E. Inyiagu, *Challenges facing technical and vocational education in Nigeria*, Journal of Educational Policy and Entrepreneurial Research, Vol.1, No.1, pp. 40 – 45, 2014.
23. Asian Development Bank, *Indonesia: Vocational education strengthening project*, 2020.
24. O. Ohagwu, P. K. Nwanesi, Z. Hassan, *Skill acquisition (TVET) and entrepreneurship*, International Journal of Academic Research in Business and Social Sciences, Vol. 1 3, No. 8, pp. 1858 – 1878, 2023.
25. Directorate General of Vocational Education, *Report on the Performance of the Directorate General of Vocational Education [Direktorat Jenderal Pendidikan Vokasi, Laporan Kinerja]*, 2022.
26. Y. Octifany, *The history of urbanization in Java island: path to contemporary urbanization*, Tata Loka, Vol. 22, No. 4, pp. 474 – 485, 2020.
27. N. A. Susanto, Misdawita, D. Nuryadin, D. Hartono, I. B. P. C. P. Surayuda, N. K. Saputri, S. Azzahrah, *Education and Energy Consumption: A Provincial Analysis in Indonesia*, Economics Development Analysis Journal, Vol. 12, No.4, pp. 458 – 471, 2023.