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RESEARCH ARTICLE OPEN ACCESS

PANEL DATA REGRESSION ANALYSIS OF THE DETERMINANTS OF EDUCATED UNEMPLOYMENT IN EAST JAVA

Haniatul Mudawamah[1], Muhtadin Amri[2]

[1,2] IAIN Ponorogo, East Java, Indonesian
Corresponding Author: haniatulmudawamah01@gmail.com

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Abstract: The primary goal of this research is to determine the relationship between the educated unemployment rate in East Java Province and several variables, including the minimum wage from 2018 to 2022, the labor force, and the human development index. This study included 190 secondary data samples in total, all of which came from the Central Bureau of Statistics' official website. For this investigation, the fixed effects panel data model (FEM) works well. This research demonstrates that: (1) the labor force and the educated unemployment rate do not correlate, or only partially correlate; (2) the educated unemployment rate is negatively impacted by the human development index; (3) there is a significant correlation between the educated unemployment rate and the minimum wage; and (4) in East Java, the minimum wage, the human development index, the labor force, and educated unemployment have a substantial correlation.
Keywords: Educated Unemployment, Labor Force, Human Development Index, Minimum Wage.

Abstrak: Tujuan utama dari penelitian ini adalah untuk mengetahui hubungan antara tingkat pengangguran terdidik di Provinsi Jawa Timur dengan beberapa variabel, termasuk upah minimum dari tahun 2018 hingga 2022, angkatan kerja, dan indeks pembangunan manusia. Penelitian ini menggunakan 190 sampel data sekunder, yang semuanya berasal dari situs resmi Badan Pusat Statistik. Untuk investigasi ini, model data panel efek tetap (*fixed effects model*/FEM) bekerja dengan baik. Penelitian ini menunjukkan bahwa: (1) angkatan kerja dan tingkat pengangguran terdidik tidak berkorelasi, atau hanya berkorelasi secara parsial; (2) tingkat pengangguran terdidik dipengaruhi secara negatif oleh indeks pembangunan manusia; (3) terdapat korelasi yang signifikan antara tingkat pengangguran terdidik dengan upah minimum; dan (4) di Jawa Timur, upah minimum, indeks pembangunan manusia, angkatan kerja, dan pengangguran terdidik memiliki korelasi yang cukup besar.
Kata Kunci: Pengangguran Terdidik, Angkatan Kerja, Indeks Pembangunan Manusia, Upah Minimum.

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INTRODUCTION

Unemployment is a challenge faced in the economy on an ongoing basis, especially for developing countries. Unemployment occurs when there is a mismatch between the demand and availability of labor. One of the characteristics of unemployment in Indonesia, there is a high unemployment rate among highly educated individuals known as educated unemployment (Pratomo, 2017). Educated unemployment refers to people who have completed their education and expect to find a job, but have not been successful in doing so. The primary reason of educated unemployment is the mismatch between job availability and plans for educational progress. In emerging nations, the majority of educational institutions generate more job seekers than employers. Conversely, educated unemployed people typically look for formal work that pay well, come with nice perks, and provide high positions.

According to The Central Bureau of Statistics, educated unemployment is defined as the ratio of job searchers with an education level equivalent to or above to the total labor force in that category. Meanwhile, according to Mankiw (Mankiw, 2003), educated unemployment refers to individuals who have an educational background equivalent to high school and above and are currently not working or actively looking for work. A measure of educated unemployment, the labor force participation rate is the proportion of individuals in the labor force relative to the total population of working age. Some factors that cause an increase in educated unemployment are: a mismatch between the characteristics of graduates and employment opportunities, preferences for jobs that are safe from risk, limitations in the acceptance of labor in the formal sector, and ineffective labor market functions (Siswanto et al., 2021).

A Central Bureau of Statistics (BPS) research states that young people with high school/vocational school, DI/II/III, and higher education levels make up the majority of educated unemployed people in Indonesia, particularly in East Java Province. Over the past five years, East Java has experienced the phenomenon that the open unemployment problem in East Java is dominated by those who have been educated, especially high school/vocational school/diploma/graduate graduates. The high level of educated unemployment in East Java indicates the need for special attention and action in overcoming the gap between the number of high school/vocational school/diploma/graduate graduates and the demand for labor in the

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labor market. Based on data on educated unemployment available at the Central Bureau of Statistics, it shows that East Java Province ranks second in the number of educated unemployed for five consecutive years compared to other provinces in Indonesia. The number of educated jobless individuals in East Java from 2018 to 2022 is shown below. This figure is dependent on a variety of factors, including the labor force, the human development index, and the minimum wage:

Table 1. Average Level of Labor Force, Human Development Index, Minimum Wage, and Educated Unemployment in East Java 2018-2022

Year	Number of Educated Unemployed (People)	Total Labor Force (People)	Human Development Index (Percent)	Minimum Wage (Rupiah)
2018	14,115.82	570,457.13	72.84	2,076,345.55
2019	15,102.29	575,866.00	73.57	2,300,716.02
2020	21,519.50	596,328.47	73.76	2,496,511.73
2021	19,341.16	597,288.68	74.12	2,533,820.47
2022	15,705.95	612,527.61	74.87	2,554,466.90

Source: Central Bureau of Statistics, data processed by the author in 2023

The population over 15 years old who are of working age, either working or temporarily stopped working, or who are not working, are defined by the Central Bureau of Statistics as the labor force. A person is considered unemployed if he or she has the desire and readiness to work and has made an effort to find a job within the last four weeks (Kurniawan & Budhi, 2015). The Labor Force is known by first knowing the Labor Force Participation Rate. Malthus' population theory explains the relationship between the labor force and educated unemployment. According to Malthus, rapid population growth would affect the work force and provide an issue with excessive labor absorption, which could ultimately result in higher unemployment (Arifianto & Setiyono, 2013). According to Keynes and Malthus (in Setiono et al., 2023), if the level of the labor force increases, the unemployment rate tends to increase as well. However, data from BPS in Table 1 shows that the decline in the labor force goes hand in hand with an increase in educated unemployment. This shows a mismatch between theory and the actual situation on the ground.

The human development index may be used to gauge the caliber of human resources in a certain area. The Central Bureau of Statistics defines the human development index as a metric that assesses the attainment of human development grounded on the principles of a decent living, which in turn might impact an individual's productivity level. According to the

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Central Bureau of Statistics (in Sembiring & Rohimah, 2019), the human development index is derived from three primary factors: lifespan and good health, knowledge, and reasonable living standards According to Keynes' theory (in Wardani et al., 2022), employment opportunities may be impacted by an increase in people's purchasing power, which is a sign of a good standard of living based on the human development index. Firms usually cut production when there is a shortage of broad aggregate demand because they cannot absorb excess labor. This results in an imbalance between supply and demand for labor, which often increases unemployment. According to the new growth theory (in Subri, 2017), if the value of the Human Development Index increases, the number of unemployed will decrease. Conversely, as indicated by data in Table 1 from the BPS, there is a positive correlation between the rise in the Human Development Index and the number of educated unemployed people. This demonstrates how the actual situation differs from the notion that is currently held.

Economic theory defines wages as the amount of money paid to employees in return for mental and physical labor rendered. Meanwhile, Afzalur Rahman defines minimum wage as the amount that employers or other industry players agree to pay employees at their workplace (Rahman, 1995). According to Mankiw (2003), the level of educated unemployment in a region is also affected by the level of wages. It is expected that the problems that arise between employers and workers can be resolved through the establishment of government policies on wages, such as city or district minimum wages. People's income and purchasing power will increase if wages increase. Mankiw also emphasizes that two factors that can cause unemployment are wage rigidity and the inability of wages to adjust to the level of labor supply and demand, which can have an impact on the unemployment rate. Setting a lower minimum wage can encourage firms to hire more workers, which in turn can reduce the unemployment rate. In essence, if the minimum wage is lowered, the unemployment rate will also decrease. Meanwhile, from BPS data, when the minimum wage increases, the educated unemployment rate actually decreases. Meanwhile, from BPS data in Table 1, when the minimum wage increases, the level of educated unemployment actually decreases. This clearly shows that the situation on the ground does not match the theory. Further research needs to be done to identify the cause, and this indicates that the setting of minimum wages by the government has an impact on educated unemployment in East Java Province.

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Based on the data that has been presented, there are discrepancies between theory and facts that are interesting to investigate further. In addition, there are differences between the results of previous studies and the theories proposed by several researchers. Research by Siregar et al. (2023) concluded that the labor force significantly and positively affects unemployment. Meanwhile, according to research from Risandi (2022), who obtained the result that the number of labor force has a negative and significant effect on educated unemployment. Meanwhile, according to research from Himo et al. (2022), the labor force variable has no effect on unemployment.

Human Development Index (HDI) has a good and considerable impact on educated unemployment, according to Rizky's (2022) research. In contrast, Himo et al. (2022) discovered a negative and noteworthy relationship between educated unemployment and the HDI. Khotimah (2023), on the other hand, came to the conclusion that the HDI had no appreciable impact on unemployment. According to Sapitri's (2018) research, the minimum wage significantly and positively affects the unemployment rate among educated workers. In addition, Risandi (Risandi, 2022) conducted another study which showed that educated unemployment was significantly negatively affected by the minimum wage. Meanwhile, a study conducted by Soekapdjo and Oktavia (Soekapdjo & Oktavia, 2021) showed that the level of educated unemployment is not affected by the minimum wage.

The research gap of this study is the discrepancy between empirical data from the Central Bureau of Statistics (BPS) and existing economic theories, such as Keynes and Malthus theories. This mismatch sparked interest in conducting further research. In addition, there are inconsistencies in the results of previous studies, where the findings are still varied and inconsistent. This research specifically highlights the discrepancy between classical economic theories, such as Keynes and Malthus, and empirical data related to educated unemployment in East Java. While many previous studies tend to support the existing theories. This research aims to explore and reveal the differences between theory and reality in the field, especially in the context of educated unemployment in East Java.

Considering that East Java has had consistently high rates of educated unemployment for the previous five years, this research is extremely urgent. That's why the goal of this research is to pinpoint the variables that affect educated unemployment in the area. The results of this study should offer more targeted and practical ways to lower the rate of unemployment among

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educated workers. This research has significant practical benefits as well as important implications that can affect policy, the economy and society in East Java. In particular, this research can contribute to efforts to formulate more appropriate policies in addressing educated unemployment in East Java. Based on this, the researcher is interested in proposing a research title "Panel Data Regression Analysis of the Determinants of Educated Unemployment in East Java".

METHOD

This study takes a quantitative approach and relies on secondary data, which has already been gathered and published by others. Panel data is used in the research, which consists of cross-sectional and time series data. The study's focus is on the people of East Java Province, and the data came from the official website of the Central Bureau of Statistics. While the sample is 190 data, which has been limited by sampling several variables, including labor force data, Human Development Index, minimum wage, and educated unemployment covering the time span from 2018 to 2022. The sample selection process used is purposive, which means sampling from data sources with certain considerations (Sugiyono, 2017).

The approach or means of data collection used in this study is library research. Regression analysis using panel data is used in this study. Research can investigate the link between certain factors across time and between individual units by utilizing panel data. Panel data processing and analysis are done using the e-views 10 program. The data analysis technique entails many steps, including the estimation of a regression model to understand the connection between the variables under inquiry and the classical assumption test to verify the model's fit. Additionally, statistical tests were performed, such as the coefficient of determination (R2) test, which evaluates how well the model accounts for fluctuations in the observed data. Furthermore, the significance of each independent variable is tested separately using a partial test (t-test), but the significance of the model as a whole is assessed using a simultaneous test (F-test). This process, which is common in regression analysis, is essential to guaranteeing the reliability and validity of results obtained from panel data analysis.

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RESULTS AND DISCUSSION

Regression Model Estimation

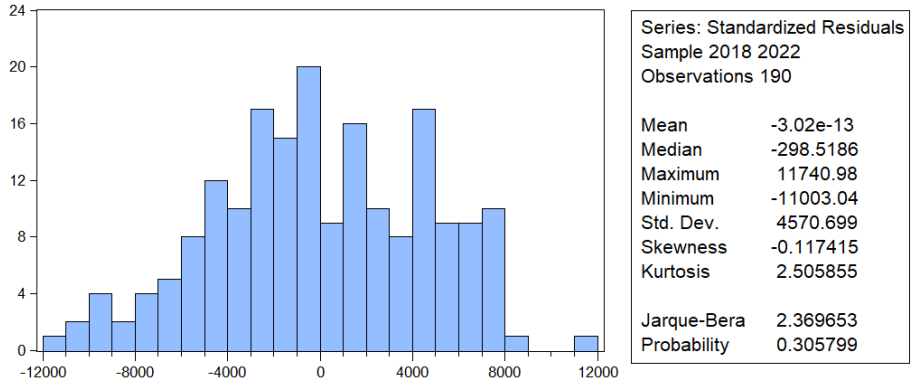
Table 2. Chow and Hausman Test Results

Chow Test Results			
Effects Test	***Statistic***	***d.f.***	***Prob.***
Cross-section F	7.949799	(37.149)	0.0000
Cross-section Chi-square	207.089586	37	0.0000
Hausman Test Results			
Test Summary	***Chi-Sq. Statistic***	***Chi-Sq. d.f.***	***Prob.***
Cross-section random	35.281996	3	0.0000

Source: Data processing results using Eviews 10

Selecting between the Random Effect Model (REM) and Fixed Effect Model (FEM) for panel data estimation begins with the Chow test. In this case, the significance level of α = 5% (0.0000 < 0.05) is exceeded by the Chi-Square probability value of 0.0000, leading to the rejection of the null hypothesis (H0). This suggests that the FEM is more useful. Next, the Hausman test is run to verify that the FEM is the best model to use when analyzing panel data. Table 2 data indicates that the cross-section Chi-Square probability is 0.0000, which is less than α = 5% (0.0000 < 0.05). The Hausman test's rejection of the null hypothesis supports the finding that the FEM is the best suitable model. Thus, the model selection process is complete with FEM as the optimal choice. However, if REM is selected, then the next step is to carry out the Lagrange Multiplier (LM) Test to validate the choice.

Classical Assumption Test



Source: Data processing results using Eviews 10

Figure 1. Normality Test Results

Table 3. Classical Assumption Test Results

Autocorrelation Test			
F-statistic	0.341849	*Prob. F(2,183)*	0.7109
*Obs*R-squared*	0.703485	*Prob. Chi-Square(2)*	0.7035

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Multicollinearity Test			
	X_1	**X_2**	**X_3**
X_1	1.000000	-0.087821	0.482014
X_2	-0.087821	1.000000	0.431728
X_3	0.482014	0.431728	1.000000
Heteroscedasticity Test			
F-statistic	0.565346	Prob. F (9,179)	0.8242
*Obs*R-squared*	5.223873	*Prob. Chi-Square* (9)	0.8144

Source: Data processing results using Eviews 10

The purpose of the normality test is determine if the independent and dependent variable data distributions in the regression model exhibit a normal pattern. The Jarque-Bera probability value in Figure 1 is 0.305799 > 0.05, according to the findings of the normality test. The assumption of normalcy is satisfied as this suggests that the data have a normal distribution. To determine whether there is autocorrelation or a chain link between the disturbances in the regression function, autocorrelation testing is helpful. According to Table 4's autocorrelation test findings, there is a 0.703485 > 0.05 chance of the Chi Square (Obs*R-Squared). This suggests that the observed data does not have an autocorrelation issue. Consequently, it may be said that the presumption that autocorrelation is absent has been satisfied.

Multicollinearity testing is used to evaluate the linear relationship between the independent variables in the regression. Every variable has a coefficient less than 0.09, according to Table 5's test findings. It is therefore possible to conclude that the model does not have a multicollinearity issue. The heteroscedasticity test determines the non-uniformity of the variable variance. From Table 6, the results show a probability value > 0.05. This suggests that the data does not exhibit heteroscedasticity.

Statistical Test

Table 4. Partial Test Results (t Test)

Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
C	320,365.6	69,677.17	4.597856	0.0000
X_1	0.009059	0.023160	0.391125	0.6963
X_2	-5,131.599	1,079.512	-4.753627	0.0000
X_3	0.025788	0.003969	6.497725	0.0000

Source: Data processing results using Eviews 10

Based on the results of the research model estimation, the regression equation obtained is:

$$\boldsymbol{Y = 320,365.6 + 0.009059X_1 - 5,131.599X_2 + 0.025788X_3 + e}$$

According on the test findings for the variables, the following conclusion may be drawn:

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1) With a probability value of 0.06963 and a t-statistic value of 0.391125, the labor force variable surpasses the significance threshold of $\alpha = 0.05$. A direct association between the two variables is not supported by statistical data, since this shows that the labor force variable has no statistically significant influence on the degree of educated unemployment in East Java.
2) In contrast, the Human Development Index (HDI) variable is much below the $\alpha = 0.05$ cutoff, with a t-statistic of -4.753627 and a probability value of 0.0000. This demonstrates that there is a strong inverse link in East Java between the HDI and educated unemployment. The negative coefficient of -5,131.599 shows that every 1% increase in HDI has the potential to decrease the number of educated unemployment by 5,131.59 people, assuming other variables remain constant. This finding underlines the important role of HDI in reducing educated unemployment in the region.

The Minimum Wage variable has a probability value of 0.0000 and a t-statistic of 6.497725, both smaller than the 0.05 significance level, indicating a significant positive correlation between minimum wage and educated unemployment in East Java. The positive coefficient of 0.025788 reflects a unidirectional relationship, where each increase of Rp. 100,000.00 in the minimum wage is expected to increase the number of educated unemployment by 2,578.8 people, assuming other variables remain constant.

Table 5. Simultaneous Test and Coefficient of Determination Results

Simultaneous Test Results (F Test)	
F-statistic	43.58585
Prob(F-statistic)	0.000000
Coefficient of Determination (R^2)	
R-squared	0.921265
Adjusted R-squared	0.900129

Source: Data processing results using Eviews 10

The F-statistic value of 43.5858 and a probability (F-statistic) less than 0.05 indicate that the variables Labor Force (X1), Human Development Index (X2), and Minimum Wage (X3) have a significant simultaneous impact on the unemployment rate of education graduates (Y) in the province of East Java, according to the results of the simultaneous test. Table 5's coefficient of determination (R^2) is 0.921265, which equals 92.1%. This suggests that the labor force, human development index, and minimum wage factors account for 92.1% of the

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variation in highly educated labor absorption. Meanwhile, the impact of other variables not considered in this study is 100% - 92.1% = 7.9%.

DISCUSSION

Effect of Labor Force on Educated Unemployment

According to the study, which employed the Fixed Effect Model and panel data regression, the labor force variable had a positive coefficient of 0.009059. The alpha significance level of 0.05 is exceeded by the probability value of 0.06963. Accepting H_0, we may conclude that the labor force variable has no substantial or statistical influence on educated unemployment in East Java. This contradicts the theory proposed by Malthus, which states that rapid growth of the labor force will result in an increase in educated unemployment. The study's findings are consistent with earlier research by Siregar (Siregar et al., 2023), which discovered a statistically significant positive correlation between the total labor force variable and unemployment among educated individuals.

This study demonstrates that the number of educated jobless people in East Java remains unchanged despite changes in the labor force's size. The primary reason might be a mismatch in skills, or between the workforce's knowledge and the demands of the job market. According to the International Labour Organization (2017), skills mismatches can lead to suboptimal use of labour, negatively impacting productivity, competitiveness and economic growth. Although the number of the labor force with a high school education and above is already quite large in East Java, the skills gap arises due to the lack of skills development in accordance with labor market demand. This indicates that formal education is available, but there is a lack of skills that match the needs of certain industries or sectors in East Java. In addition to the government's role, the workforce also needs to be proactive in developing their skills. Companies now require a more flexible, competent and talented workforce to adapt to environmental changes (León et al., 2018).

Effect of Human Development Index on Educated Unemployment

Based on the Fixed Effect Model method, panel data regression analysis yielded a coefficient of -5,131.59 for the Human Development Index. Thus, for every 1% improvement in the Human Development Index, there will be a corresponding 5,131.59 fewer jobless educated individuals. Based on a probability value of 0.0000, which is less than the significance level of 0.05, the study's results show a statistically significant negative correlation between

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East Java's educated unemployment rate and the Human Development Index. Consequently, it is decided to reject the null hypothesis (H0). The negative coefficient demonstrates an inverse relationship: as the Human Development Index improves, educated unemployment decreases, whereas a reduction in the index increases educated unemployment.

The study's findings are consistent with Keynes' theory, which holds that when the Human Development Index rises, aggregate demand rises as well, lowering the proportion of educated workers without jobs. The findings of this study are similar with previous research by Soekapdjo and Oktavia (2021), who discovered that educated unemployment is negatively influenced by the Human Development Index variable. Thus, a high Human Development Index will influence how easily workers may find job. Dynamic environmental changes require organizations to continue to innovate, not only in the aspect of business profits, but also in employee development (Novianti & Yogatama, 2019). Organizations must ensure employees have competencies that continue to grow. Facilitating the professional growth and job happiness of employees is one approach of addressing this difficulty (Barnett & Bradley, 2007).

Effect of Minimum Wage on Educated Unemployment

Using panel data regression and the Fixed Effect Model, this study found that the minimum wage variable had a positive coefficient of 0.025788. This suggests that raising the minimum wage is associated with greater educated unemployment in East Java. Specifically, for every Rp 100,000.00 rise in the minimum wage, the number of educated jobless people is predicted to fall by 2,578.8. With a probability value of 0.0000, which is significantly below the 0.05 level of significance, this finding demonstrates the minimum wage's strong beneficial influence on educated unemployment. The positive association indicates that as the minimum wage rises, educated unemployment rises, and vice versa. This study confirms Mankiw's hypothesis, which argues that decreasing the minimum wage may result in increased hiring by employers. This result supports the theory put forward by Mankiw, which states that a decrease in the minimum wage can motivate companies to hire more workers, thus reducing the level of educated unemployment.

The results of this study are consistent with Sapitri's (Sapitri, 2018) earlier research, which examined minimum wages from an Islamic viewpoint and discovered that minimum wages had a favorable and substantial affect on educated unemployment. When the minimum wage increases, usually the workforce will compete to find jobs in companies that increase

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wages. However, companies often respond by reducing labor demand, which causes some workers to be unemployed. According to (Katidjan P. S. et al., 2017), research shows that salary has a positive impact on employee performance, a finding supported by various other studies. Research conducted by Eko Pristiwanto also states that compensation is proven to improve employee performance. The wages received by employees in return for their work are able to increase work results, both in terms of quantity and quality (Pristiwanto & Firdaus, 2023).

The Effect of Labor Force, Human Development Index, and Minimum Wage on Educated Unemployment

Based on panel data regression analysis using the Fixed Effect Model, the F-Statistic value of 43.58585 with a probability of 0.0000 is below the significance threshold of 0.05 (α). The data suggests a statistically significant correlation between the degree of educated unemployment in East Java and the variables of labor force participation, minimum pay, and human development index. This study also shows that these variables are able to explain 92.1% of the variation in educated unemployment, based on the R-squared value of 0.921265, while 7.9% of the variation is influenced by other factors not covered in this study. This finding is in line with the research of Husain et al. (2023), who also found that the variables of labor force, quality of human resources, and minimum wage have a significant effect on educated unemployment.

CONCLUSION

The research data analysis leads to the following conclusions: First, for the years 2018–2022, educated unemployment in East Java is not significantly impacted by the labor force variable. This demonstrates that, maybe as a result of an imbalance between labor skills and market demands, a decline in the work force is insufficient to lower the rate of educated unemployment. Second, the human development index has a negative and considerable effect on educated unemployment in East Java from 2018 to 2022. This suggests that raising the Human Development Index will lower the amount of educated jobless people in East Java. According to estimates, for every 1% improvement in the Human Development Index, the number of educated unemployment will decrease by 5,131.59 people. Third, the minimum wage in East Java had a positive and significant impact on educated unemployment between 2018 and 2022. Therefore, increasing the minimum wage could be a factor in East Java's rise in the unemployment rate for educated workers. It is projected that for every 100,000 IDR rise

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in the minimum wage, there will be 2,578.8 more educated jobless individuals. Fourth, the labor force, minimum wage, and human development index factors all have an impact on educated unemployment in East Java from 2018 to 2022, either concurrently or jointly. This suggests that the degree of educated unemployment in East Java is significantly influenced by these three variables.

Given these findings, the government must develop effective regulations on labor force size, human resource quality, and minimum pay. The expansion of the work force must be supported by increases in the quality of education and training so that graduates meet the industry's requirements. A balanced minimum wage policy is also important to prevent barriers to recruitment and avoid worker dissatisfaction. Regular evaluation of policies is necessary to address educated unemployment. In addition, cooperation with Lembaga Amal Zakat Infak dan Sadakah (LAZIS) can encourage economic development through business capital grants and investment in the real sector, which can help create new jobs and reduce educated unemployment in East Java.

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