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Analysis of the Influence of Education Level, Health Level, and Wage Level on Labor Force Participation (Labor Force Participation Rate) On the island of Madura

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Abstract

Economic development is an important part of national development with the main goal of achieving optimal growth. This study aims to analyze the influence of Average School Length (RLS), Life Expectancy (UHH), and Regency/City Minimum Wage (UMK) on the Labor Force Participation Rate (LABOR FORCE PARTICIPATION RATE) on Madura Island, which covers four districts in East Java during the period 2010–2024. This study uses secondary data obtained from the Central Statistics Agency (CSA), with a panel data regression analysis method. The results showed that the RLS variable had a positive but insignificant effect on LABOR FORCE PARTICIPATION RATE, indicating that education was not fully able to encourage work participation, possibly due to limited formal employment and skills mismatches. The UHH variable had a positive and significant effect, reflecting that improved health supports long-term work participation. Meanwhile, MSEs show a negative and significant influence on LABOR FORCE PARTICIPATION RATE, which can be caused by wage pressures in the informal sector. These findings imply that improving health quality is more effective in encouraging labor force participation than education and minimum wage policies in the region.

Keywords: Labor Force Participation Rate, Average School Length, Life Expectancy, Minimum Wage, Panel Data Regression, Madura Island.

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INTRODUCTION

Development is closely related to population conditions. Understanding the behavior and mobility of the population is important for formulating the right policies (Kamaroellah,2024).The quantity and quality of the components of economic development have an important role in growth, as has happened in China since the reforms. Factors such as capital formation and demographic dividends drive rapid growth, supported by a strong economic system and have an impact on people's well-being and increased national strength (Hutajulu et al., 2024) .

Increasing labor force participation can drive prosperity through GDP and employment growth. Although labor market integration is able to increase efficiency and growth, it also poses a risk to stability. Therefore, policies are indispensable to build a resilient and sustainable labor market (Huang, 2020) . Optimal labor absorption can reduce unemployment and encourage economic growth by involving more people in productive activities. For example, in Germany, Italy, and France, labor absorption patterns had a major effect on the unemployment rate during 1970–2000 (Beverly et al., 2024) . Optimal labor absorption is important to reduce unemployment by providing jobs according to workers' skills. For example, in Germany, Italy, and France between 1970 and 2000, changes in labor absorption affected the unemployment rate. High labor absorption also supports economic growth by involving more people in productive activities. (Borjas, 2013)

Developing countries such as Indonesia face employment problems due to large populations, this will have an impact on increasing unemployment due to a decrease in income. Development aims to improve the quality of life through equal distribution of income and labor productivity. For this reason, the government must focus on economic growth by ensuring effective labor absorption, reducing unemployment, and expanding employment opportunities to improve living standards and income (Budiasih & Asmara, 2024) .

Employment is one of the main factors in production and is a focus of the macroeconomy, especially in Indonesia with a very large population of 220 million. Despite having a quality workforce and great economic potential, challenges will still arise if production capacity and labor quality are not able to meet basic needs. Low productivity and poor resource management can exacerbate employment problems despite large (Pratiwi & Wijaya, 2024) populations. The government pays close attention to complex and sensitive labor issues, as these problems can have an impact on security and society. Key issues include limited expansion of employment opportunities, child labor, high

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unemployment, low productivity, and inadequate labor competencies, all of which are part of the complexity of the labor problem (Muhaimin et al., 2022) .

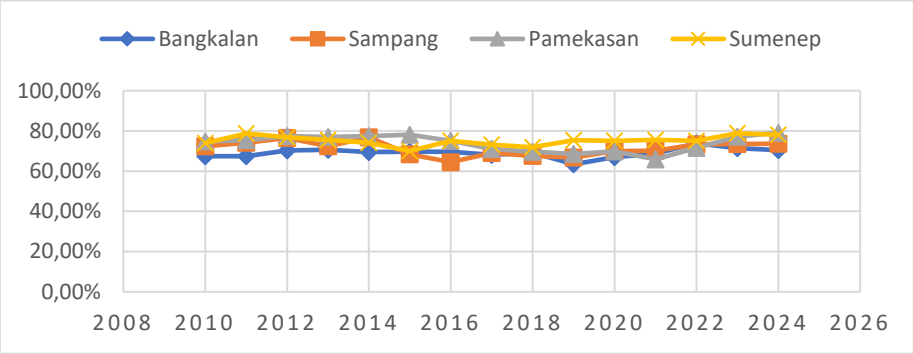
Every Indonesian citizen has the right to a decent job and life, but there are still many people who face problems with jobs and decent livelihoods. Employment problems such as poverty, limited employment opportunities, and unemployment have not been solved with a capital-based economic approach. This issue involves low wages, employment status, income, and low competence and productivity, which are overall challenges to the labor economy. Indonesia's economic competitiveness has also been hampered due to the low quality of human resources and work ability. The problems of lack of job opportunities, unemployment, and poverty have not been solved with capital-based development strategies. The condition of the labor surplus makes economic growth indirectly reduce unemployment and poverty significantly (Situmorang, 2010) . The Labor Force Participation Rate (LABOR FORCE PARTICIPATION RATE) shows the percentage of people who are working or actively looking for work, which also reflects the labor market and economic conditions of a region. On Madura Island, the performance of the economic sector is closely related to employment. The number of workers reflects the sector's ability to absorb labor, while unemployment shows limited absorption. Although it is expected that jobs are according to education and skills, often higher education graduates have difficulty being absorbed in the available sectors (Muhaimin, Setiyono, et al., 2024).

Population issues, including distribution, quality of human resources, and population, are important challenges in development. Madura Island has a population of 4.16 million people in 2024 which is divided into four districts: Sumenep with the largest population of 1.14 million, Bangkalan with 1.10 million, Sampang with 992 thousand, and Pamekasan with the lowest population of 862 thousand. Pamekasan Regency has the highest population density, especially in Pamekasan District. Around 10.33% of Pamekasan residents live in the district capital, with 67.35% of productive age and 32.65% of non-productive age. According to CSA 2023 data, Sumenep Regency has the highest Labor Force Participation Rate (LABOR FORCE PARTICIPATION RATE) on Madura Island at 78.86%, an increase of 4.98% from 2022. The district with the second highest LABOR FORCE PARTICIPATION RATE score is Pamekasan Regency with a LABOR FORCE PARTICIPATION RATE of 77.14% (up 3.55%), then Sampang with 73.54% which is accompanied by a decrease in unemployment to 2.72%, and Bangkalan with the lowest with 71.49%. As many as 46.55% of the workforce on Madura Island work in the agricultural sector.

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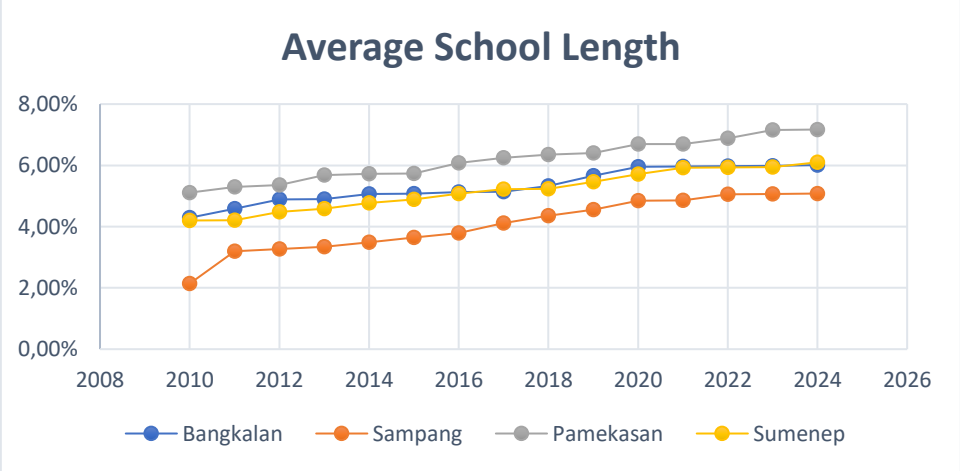
Graph 1 Labor Force Participation Rate on Madura Island 2010 – 2024



Source : CSA (data processed)

From 2010 to 2024, Labor Force Participation Rate in four districts of Madura Island experienced fluctuations. Bangkalan recorded the lowest LABOR FORCE PARTICIPATION RATE, with a peak of 73.86% in 2022 and 70.48% in 2024. Sampang also fluctuated, from 72.30% (2010) down to 66.74% (2019) and up to 73.62% (2024). Pamekasan had dropped to 65.88% (2021) but rose again to 79.13% (2024). Meanwhile, Sumenep recorded the highest labor force participation rate, reaching 78.16% in 2024. In general, formal education and higher wages play an important role in improving the productivity and quality of human resources.

Graph 2 Average School Length on Madura Island 2010 – 2024



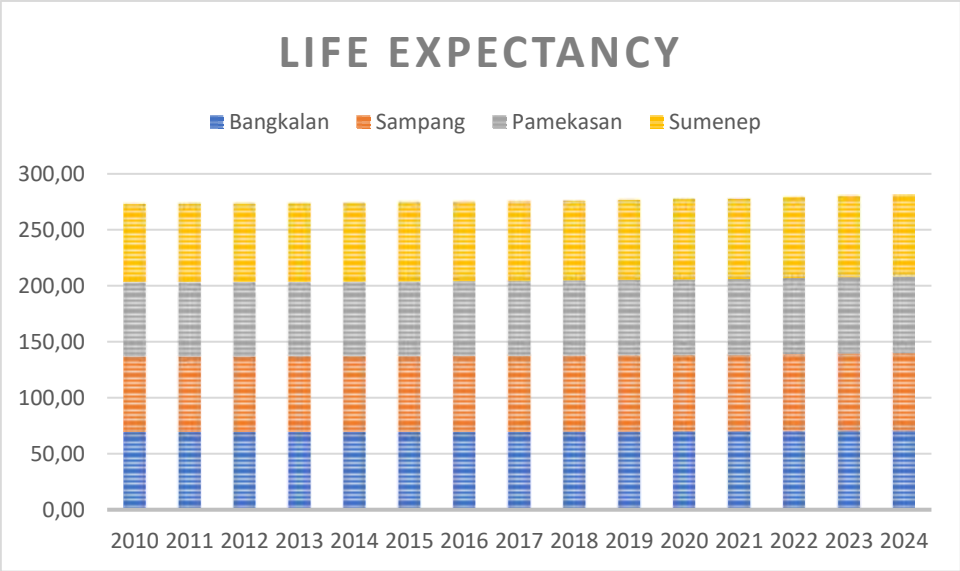
Source : CSA East Java (data processed)

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Education levels in Bangkalan, Sampang, Pamekasan, and Sumenep Regencies increased from 2010 to 2024, with the average length of school gradually increasing. However, this increase in education often leads to delays in entering the job market, especially for young people. Therefore, the development of the formal sector and economic diversification on Madura Island are needed so that education is more effective in increasing labor participation, supported by government strategies to improve the quality of education.

Figure 1 Life Expectancy on Madura Island 2010 – 2024



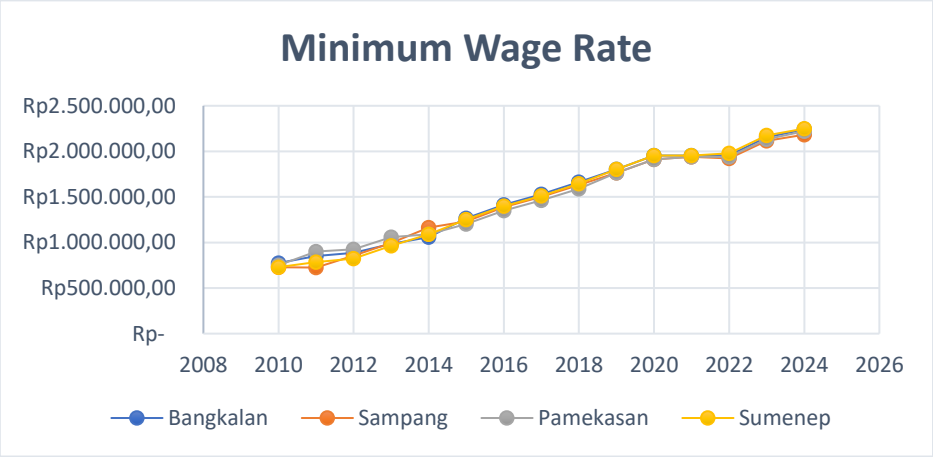
Source : CSA East Java (data processed)

The health index, especially UHH, has increased in all districts on Madura Island. In Bangkalan Regency, UHH increased from 69.46% in 2010 to 70.96% in 2024. This condition is one of the gaps discussed in the study. Sampang, Pamekasan, and Sumenep districts also experienced an increase in UHH from 2010 to 2024, although the increase is relatively small each year. In 2024, UHH in Sampang is 68.81%, Pamekasan is 68.48%, and Sumenep is the highest at 72.65%. All districts showed an increasing trend of UHH, with Sumenep having the highest UHH rate compared to others.

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Graph 3 Minimum Wage Rate in Madura Island 2010 – 2024



Source : CSA East Java (data processed)

The minimum wage in Bangkalan, Sampang, Pamekasan, and Sumenep districts continues to increase from 2010 to 2024, although it is still relatively low compared to other regions in East Java. This wage increase has a positive effect on public spending, but LABOR FORCE PARTICIPATION RATE on Madura Island remains volatile. This wage level affects people's spending, which has a positive relationship with income—the higher the income, the greater the individual's spending. (Amru & Sihaloho, 2020)

This study examines the influence of these three variables on LABOR FORCE PARTICIPATION RATE based on Becker's Human Capital theory which states that investment in education and health increases productivity and decisions to enter the job market. Mincer's theory also mentions that higher education encourages work participation due to a greater return on investment. However, lower wages in Madura than in other regions lead to labor migration, so local LABOR FORCE PARTICIPATION RATE remains volatile even though other supporting factors have increased.

Based on the above description, further analysis is needed on the influence of factors that contribute to the change in LABOR FORCE PARTICIPATION RATE on Madura Island with special emphasis on factors of education level, health level, and wage level. Thus, the purpose of this study is to determine the influence of these factors on the level of labor participation on Madura Island

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LITERATURE REVIEW

Grand Theory

Based on the theory described in the book Human Capital by Gary S. Becker, that the level of education, wages, and health significantly affect the level of participation in the labor market. Education and health not only increase the chances of earning higher wages, but also strengthen one's motivation and ability to stay active in the workforce. (Becker, 1993)

Labour Force Participation Rate (LABOR FORCE PARTICIPATION RATE)

LABOR FORCE PARTICIPATION RATE is an employment indicator used to assess the contribution of the productive age population to economic activities, both those who work and those who are looking for work. A high LABOR FORCE PARTICIPATION RATE indicates the active involvement of the working-age population in economic activities, while a low LABOR FORCE PARTICIPATION RATE indicates that the potential of the workforce has not been optimally utilized.

Education Level

The level of education reflects the highest level of education that a person has completed and is an indicator of the quality of human resources in a region. The commonly used quantitative measure is the average length of schooling, which is the average number of years of education taken by the population aged 15 years and above. People with higher education tend to have better career opportunities and contribute to the economy.

Health Level

The level of health is a reflection of the physical and mental condition of the population as shown through access to health services, nutritional quality, the environment, and the lifestyle of the community which can be illustrated through Life Expectancy (UHH). The better the level of health, the higher the quality of life of the community, which is characterized by low mortality rates, increased productivity, and the ability of individuals to carry out daily activities optimally.

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RESEARCH METHODS

Research Location

The location of this study focuses on four districts on Madura Island, East Java. This study uses a time period from 2010 to 2024. This location was chosen because the labor participation rate in the region fluctuates.

Data and data sources

The data used is the type of secondary data taken from CSA. The existing secondary data is the 2010-2024 Labor Force Participation Rate (LABOR FORCE PARTICIPATION RATE) data as a dependent variable. Meanwhile, the level of education is proxied by the Average School Length (RLS), the level of health is proxied by the Life Expectancy (UHH), and the wage level is proxied by the District Minimum Wage (UMK) during the period 2010-2024 as independent variables.

Data Analysis

Data analysis in this study was carried out using the panel data regression analysis method. There is also a form of multiple regression equation used in this study, which is as follows:

$$TPAK = \alpha + b_1 RLS_{it} + b_2 UHH_{it} + b_2 UMK_{it} + e$$

Where:

Y	: Dependent Variable (LDR)
α	:Constant
RLS	: Average School Length
UHH	: Life Expectancy
UMK	: Regency/City Minimum Wage
b_1	: RLS Regression Coefficient
b_2	: UHH Regression Coefficient
b_3	: MSE Regression Coefficient
e	: Error (Disruptive Variable)
t	:Time
i	:Company

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RESULTS

Regression Equation Results

Panel data regression analysis was used to describe the direction of the relationship as well as the intensity of the influence of each independent variable on LABOR FORCE PARTICIPATION RATE. In addition, this model also measures differences between districts through a special constant (*cross section effect*), which represents the fixed characteristics of each region such as Bangkalan, Sampang, Pamekasan, and Sumenep.

Table 1 Regression Equation Results

Regency	Regression Equation Results
Bangkalan	$TPAK = -2{,}81 + 1{,}79RLS_{Bangkalan} + 5{,}07UHH_{Bangkalan} - 9{,}43UMK_{Bangkalan} + e$
Sampang	$TPAK = -2{,}66 + 1{,}79RLS_{Sampang} + 5{,}07UHH_{Sampang} - 9{,}43UMK_{Sampang} + e$
São Paulo	$TPAK = -2{,}64 + 1{,}79RLS_{Pamekasan} + 5{,}07UHH_{Pamekasan} - 9{,}43UMK_{Pamekasan} + e$
São Paulo	$TPAK = -2{,}79 + 1{,}79RLS_{Sumenep} + 5{,}07UHH_{Sumenep} - 9{,}43UMK_{Sumenep} + e$

Source: Eviews *Version* 12 processed data

The value of the regression constant in each district varies, but does not represent a realistic LABOR FORCE PARTICIPATION RATE value because it is only a theoretical cut-off point when all independent variables are zero. The RLS coefficient in all districts of 1.79 shows that an additional one year of average school time increases LABOR FORCE PARTICIPATION RATE by 1.79 percentage points. The UHH coefficient of 5.07 means that a one-year increase in life expectancy increases LABOR FORCE PARTICIPATION RATE by 5.07 points. Meanwhile, MSEs have a very small negative coefficient (-0.0000000943), meaning that every increase of one rupiah in the minimum wage has the potential to reduce LABOR FORCE PARTICIPATION RATE by a very small amount, assuming other variables remain the same.

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Model Specification Test Results

Chow Test Results

The Chow *test* was conducted to find out between *a Fixed Effect* model or a better Common Effect model.

Table 2 Chow Test Results

Effects Test	*Statistics*	*D.F.*	*Prob.*
Cross-section F	15.090547	(3,53)	0.0000
Cross-section Chi-square	37.046614	3	0.0000

Source: Eviews *Version* 12 processed data

Based on table 2, the probability values of 0.0000 < 0.05 indicate that H_0 is rejected and H_1 is accepted, so the Fixed Effect model is feasible.

Hausman Test Results

The Hausman test aims to determine whether *the Fixed Effect* model is more appropriate than the Random *Effect model*.

Table 3 Hausman Test Results

Test Summary	*Chi-Sq. Statistics*	*Chi-Sq. D.F.*	*Prob.*
Cross-section random	45.271640	3	0.0000

Source: Eviews *Version* 12 processed data

Based on table 3, the test results show a probability value of less than the significance level of 0.05, it can be concluded that H_0 rejected and H_1 accepted. That is, the model *Fixed Effect* more precisely used than the model *Random Effect.* This shows that there is a significant difference between the estimators *Fixed Effect* and *Random Effect*, so individual effects cannot be assumed to be random.

Lagrange Multiplier *Test*

The LM test was carried out to recognize whether the *Random Effect* model is better than the *Common Effect model.*

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Table 4 LM Test Results

	Cross-section	***Test Hypothesis Time***	***Both***
Breusch-Pagan	37.40952 (0.0000)	0.746516 (0.3876)	38.15604 (0.0000)

Source: Eviews *Version* 12 processed data

Referring to table 4, the *cross-section probability values* and *both* are smaller than the significance level of 0.05, so the *Random Effect* model is considered the most appropriate compared to *the Common Effect* model. Meanwhile, the probability value for time exceeds 0.05, which suggests that the effect of time is not significant in the model. Therefore, the *Random Effect model* that takes into account variations between *cross-sections* is a more appropriate choice.

Table 5 Results of Panel Data Regression Model Selection

Test	**Result**	**Decision**
Chow Test	Prob < 0.05	*Fixed Effect Model*
Hausman Test	Prob < 0.05	*Fixed Effect Model*
LM Test	Prob < 0.05	*Random Effect*

Source: Eviews *Version* 12 processed data

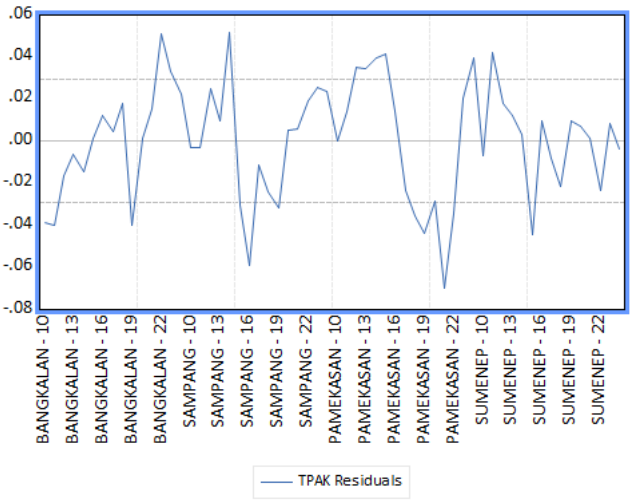
Thus, it can be concluded that the best model is the *Fixed Effect Model*. *The Fixed Effect Model* was chosen because it is able to capture the specific characteristics of each individual that are not observed but remain constant over time, thus providing a more precise and relevant estimate of the characteristics of the panel data used.

Classic Assumption Test

The heteroscedasticity test with the *Glejser Test* was carried out using the residual absolute value (ABS(RESID)) as the dependent variable and the original independent variable as the predictor (RLS, UHH, and UMK). The goal is to find out whether independent variables significantly affect the residual value of the model, which is an indication of the existence of non-constant error variance (heteroscedasticity).

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Graph 4 Heteroscedasticity Test

Table 6 Heteroscedasticity Test Results

Variable	*Prob.*
C	0.6459
RLS	0.6753
UHH	0.6909
MSEs	0.5334

Source: Eviews *Version* 12 processed data

Based on table 6, the probability value (p-value) of each variable is as follows, RLS 0.6753, UHH 0.6909, and UMK 0.5334. Since all variables had a p-value > 0.05, it can be concluded that the model did not experience symptoms of heteroscedasticity.

Based on the residual graph displayed, it can be seen that the residual values are randomly scattered and are in a relatively small range, which is between -0.08 to 0.06. No systematic patterns or symptoms of conspicuous deviations were found. Therefore, it can be concluded that the regression model does not experience symptoms of heteroscedasticity and has fulfilled the assumption of homoscedasticity.

Multicollinearity Test

Multicollinearity is tested to ascertain whether there is an excessive linear correlation between the independent variables in the model.

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Table 7 Multicollinearity Test Results

	RLS	UHH	MSEs
RLS	1.000000	0.181307	0.652129
UHH	0.181307	1.000000	0.379369
MSEs	0.652129	0.379369	1.000000

Source: Eviews *Version* 12 processed data

Based on the results of the correlation test between variables using Eviews 12, all correlation values between independent variables were below the threshold value of 0.85, which is an indicator of the absence of multicollinearity.

Hypothesis Testing

T Test

In this study, the t-test was used to assess the significance of the influence of each independent variable on the LABOR FORCE PARTICIPATION RATE dependent variable partially. The method used is Pooled Least Squares, which combines time *series* and cross-section data without distinguishing the characteristics of each observation unit.

Table 8 T Test Results

Variable	*Coefficient*	*t-Statistic*
C	-2.729688	-2.828772
RLS?	1.796140	0.872968
UHH?	5.074222	3.564440
MSEs?	-9.44E-08	-2.701775

Source: Eviews *Version* 12 processed data

Based on the results of the t-test on the Pooled Least Squares model with a t-table value of 2.006 at a significance level of 5%, it is known that the Average School Length (RLS) variable has a t-calculation value of 0.873 which is lower than the t-table so that it has a positive but not statistically significant effect on LABOR FORCE PARTICIPATION RATE; the variable Life Expectancy (UHH) with a t-calculated value of 3.564 greater than the t-table showed a positive and statistically significant influence on LABOR FORCE PARTICIPATION RATE; while the Regency Minimum Wage (UMK) variable has a t-calculated value of -2.702 with an absolute value greater than the t-table, so it has a

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significant but negative effect on LABOR FORCE PARTICIPATION RATE; thus, only UHH and MSEs have a significant effect on LABOR FORCE PARTICIPATION RATE, while RLS has no significant effect in this model.

F Test

This regression model is estimated using a cross-section fixed effects approach by adding dummy variables for each district to capture the differences in fixed characteristics between regions that cannot be observed directly, so that the constant influence of each district can be controlled and the estimation of the coefficient of the free variables becomes more accurate.

Table 9 F Test Results

R-squared	0.494936
Adjusted R-squared	0.437759
S.E. of regression	0.029400
Sum squared resid	0.045811
Log likelihood	130.1907
F-statistic	8.656192
Prob(F-statistic)	0.000001

Source: Eviews *Version* 12 processed data

Based on the estimated results, an F-calculation value of 8.656 was obtained compared to F-table 2.29 at a significance level of 5%, where because F-calculation > F-table and p-value of 0.000001, the overall model was statistically significant at the level of 1%, indicating that independent variables simultaneously contributed to explaining the change in labor force participation rate (LABOR FORCE PARTICIPATION RATE). Overall, these results confirm that the regression model with a cross-section-based fixed effect approach is able to capture differences between regions and is feasible to be used to explain LABOR FORCE PARTICIPATION RATE variation during the study period.

Determinant Test (R2)

This test is important to assess the predictive power of the model and its statistical feasibility, although it still needs to be combined with the F-test to see simultaneous significance.

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Table 10 Determinant Test Results

R-squared	0.494936
Adjusted R-squared	0.437759
S.E. of regression	0.029400
Sum squared resid	0.045811
Log likelihood	130.1907
F-statistic	8.656192
Prob(F-statistic)	0.000001

Source: Eviews *Version* 12 processed data

The results of the determination test showed an R-Squared value of 0.494936 which indicated that around 49.49% of LABOR FORCE PARTICIPATION RATE variation could be explained by independent variables in the model, namely RLS, UHH, UMK, and district fixed effects, while the Adjusted R-Squared of 0.437759 showed that the model was still able to explain 43.77% of the data variation, reflecting a fairly good explainer power, supported by a small S.E. value of regression (0.029400) and a low residual sum squared (0.045811) that shows the model's predictions are relatively accurate.

DISCUSSION

Analysis of the Influence of Average School Length on the Participation Rate of the Labor Force on Madura Island

The results of the panel regression analysis using the Pooled Least Squares method showed that the average length of school (RLS) had a positive coefficient of 1.796 but was not statistically significant (p = 0.3866), so although in theory education can increase LABOR FORCE PARTICIPATION RATE, this is not proven to be significant on Madura Island. This insignificance can be attributed to the dominance of the informal sector, delays in entering work by educated individuals, and mismatches between education and the needs of local industries. These results are consistent with the findings of Pratiwi & Wijaya (2024) in Semarang City, but different from the research of Solicha et al. (2024) in Central Java. The regression model has an R-squared value of 49.49%, indicating that almost half of the LABOR FORCE PARTICIPATION RATE variation can be explained by RLS, UHH, and MSEs. The F-statistic test shows the model as a whole is significant.

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Analysis of the Influence of Life Expectancy on the Participation Rate of the Labor Force on Madura Island

The results of the panel regression showed that the variable Life Expectancy (UHH) had a positive coefficient of 5.074 and was significant at the level of 1% (p = 0.0008), indicating that UHH had a positive and significant effect on LABOR FORCE PARTICIPATION RATE on Madura Island in 2010–2024. These findings support the Human Capital theory, in which individuals who are healthier and have a longer life expectancy tend to be more active and productive in the job market. The increase in UHH reflects the success of health development in Madura, as seen in Sumenep and Bangkalan. These results are consistent with studies in Central Java and East Java, but in contrast to the study in Sampang, which showed that the influence of HDI on LABOR FORCE PARTICIPATION RATE was not significant. The overall regression model was significant (F = 8.656; p = 0.000001) and was able to explain 49.49% of LABOR FORCE PARTICIPATION RATE variation through RLS, UHH, and MSEs.

Analysis of the Influence of Minimum Wage of School Regencies/Cities on the Participation Rate of the Labor Force on Madura Island

The results of the panel regression using the Pooled Least Squares method showed that the Regency Minimum Wage (UMK) variable had a significant negative effect on LABOR FORCE PARTICIPATION RATE on Madura Island (p = 0.0092). This means that the increase in MSEs tends to reduce the participation of the labor force in this area. This can be explained by the dominance of the informal sector which is not directly affected by MSEs, the effect of reducing recruitment due to increased labor costs, and the migration of young workers to other regions with more competitive wages. These findings are in line with several studies that also show the negative or insignificant influence of MSEs on LABOR FORCE PARTICIPATION RATE in several regions, but in contrast to the results of studies in Banten which found a positive influence of MSEs, indicating that the impact of MSEs on work participation is contextual and depends on the economic conditions of each region.

CONCLUSION

This study examines the effect of Average School Length (RLS), Life Expectancy (UHH), and Regency/City Minimum Wage (UMK) on the Labor Force Participation Rate (LABOR FORCE PARTICIPATION RATE) on Madura Island (2010–2024). The results showed that RLS had a positive effect but not significantly, indicating that education was

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not optimal in encouraging work participation due to formal field limitations and skill mismatch. UHH has a positive and significant effect, reflecting health that supports long-term work participation. On the other hand, MSEs have a negative and significant effect, because wage increases in the informal sector are restrictive.

SUGGESTION

Based on the findings of the study, it is recommended to strengthen the linkage between education and the world of work through training and curriculum that meet the needs of the industry, improve access and quality of health services, especially in rural areas, and evaluate minimum wage policies by paying attention to the absorption of the local business sector and supporting business actors. In addition, the development of the industrial and formal sectors in Madura is essential to open up more job opportunities and reduce dependence on the informal sector. Further research also needs to be carried out by adding new variables and qualitative approaches so that the understanding of labor participation in Madura is more comprehensive.

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