Analysis The Impact of Health, Education and Labor Force Participation Rate (LFPR) on Labor Productivity in 10 Productive Districts or Cities in East Java (2019-2023)

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Sections Info	ABSTRACT
	Objective: This study aims to analyze the influence of health, education, and the labor force participation rate (LFPR) on labor productivity in the ten most productive regencies/cities in East Java during the 2019–2023 period. *Method:* Employing a log-log panel data regression approach using the Fixed Effect Model (FEM), the study investigates the effects of Life Expectancy (LE), Average Length of Schooling (ALS), and LFPR on labor productivity, which is measured by the ratio of Gross Domestic Product (GDP) to the working population. *Results:* The findings reveal that LE and ALS exert a positive and statistically significant impact on productivity, reinforcing Becker and Grossman's Human Capital theory. In contrast, LFPR demonstrates a negative and significant effect, suggesting that increased labor participation has not been matched by improvements in worker quality. *Novelty:* The study contributes to the empirical literature by emphasizing that LFPR is not merely a control variable but a crucial independent determinant of labor productivity. This insight underscores the importance of parallel investments in health and education to ensure that rising labor force participation translates into sustainable productivity gains.

INTRODUCTION

Worker productivity is a strategic indicator in assessing the efficiency of economic development in a region. High productivity directly contributes to economic growth and the well-being of society. However, according to OECD Statistics (2024), global trends indicate a slowdown in productivity during 2022–2023 due to structural pressures such as inflation, the energy crisis, and supply chain disruptions. This condition makes productivity a key issue on the agenda of both global and national economic policies.

In Indonesia, East Java contributed 14.91% to the national GDP in 2023 [1], making it a province with a strategic economic role. Unfortunately, there are still productivity disparities between districts/cities that can hinder the region's economic growth evenly. Therefore, understanding the determinants of productivity in productive regions becomes important both theoretically and in terms of policy. In the framework of human resource development, there are three main variables that influence productivity: health, education, and the Labor Force Participation Rate (LFPR). Human Capital Theory (Becker, 1993; Schultz, 1961) asserts that investment in education and health is the main capital in enhancing the productive capacity of individuals. In practice, the three not only correlate but also have a strong causal relationship with labor productivity.Data shows that AHH in East Java increased from 71.18 years (2019) to 72.11 years (2023) (Central

Bureau of Statistics, 2023), while RLS increased from 8.17 years to 8.69 years in the same period [2]. However, regional disparities remain high. Likewise, the TPAK reaching 72.56% in 2023 may not necessarily have a positive impact on productivity if it is not accompanied by an improvement in the quality of the workforce. The contradictory phenomenon between TPAK and productivity, as seen in Surabaya and Gresik, indicates that the quantity of labor participation does not guarantee work efficiency. This underscores the importance of an analytical approach that not only considers the quantity of the workforce but also its quality. To illustrate the dynamics of productivity, the following graph presents the productivity trends of the workforce in the 10 most productive regencies or cities in East Java during the period 2019–2023:

Source: BPS East Java Data (processed by the author)

Figure 1. Trends in Labor Productivity in 10 Productive Districts or Cities of East Java (2019-2023).

The graph above shows the spatial disparity in productivity. Kediri City consistently holds the highest position despite experiencing a downward trend post-2019, while Surabaya City shows progressive recovery post-pandemic. On the other hand, Bojonegoro has experienced a sharp decline every year. This disparity emphasizes that productivity is not only determined by the number of workers or the size of GDP, but also by structural factors that affect the quality of the workforce [4].

The period 2019–2023 was chosen because it reflects complex socio-economic dynamics, including the pre-pandemic period, the crisis period, and the structural recovery period. The COVID-19 pandemic (2020) pressured the employment sector, but by 2023, the unemployment rate decreased to 4.82% and the number of employed people increased significantly. The government's policy response, such as strengthening human resource competencies and digital transformation, has become part of the national strategy in driving productivity recovery [8]. Several previous studies have not yet integrated the AHH, RLS, and TPAK variables within a spatial-temporal framework simultaneously. Such an approach is crucial because it can identify variations between regions and over time. As stated by Elhorst (2014), the spatial-temporal panel model is

very appropriate for explaining regional dynamics more accurately and relevantly for formulating region-based policies.

Therefore, this study aims to analyze the influence of health (AHH), education (RLS), and TPAK on labor productivity in the 10 most productive regencies or cities in East Java during 2019–2023. This research is expected to enrich the labor literature based on panel data and make a tangible contribution to more inclusive and contextual human resource development policies.

Literature review

Human capital theory

Human capital theory explains that economic growth is not only determined by the accumulation of physical capital but also heavily relies on the quality of productive human resources [9]. emphasized that education and health are forms of long-term investment that directly impact an individual's work capacity [11] then expanded this concept by including job training, experience, and lifestyle habits as part of human capital. The quality of education enhances cognitive abilities and technical skills, while good health conditions enable the workforce to work consistently and efficiently. In this context, education and health not only enhance the income potential of individuals but also increase the overall economic competitiveness of a region. The relevance of this theory in research lies in measuring the quality of human resources through the indicators of Life Expectancy (LE) and Average Length of Schooling (ALS). Meanwhile, the Labor Force Participation Rate (LFPR) is positioned as a manifestation of the actualization of that human capital accumulation, where individuals utilize their productive capacity in the labor market.

Labor productivity

Labor productivity is a key indicator in measuring the efficiency of labor use in producing goods and services. According to the International Labour Organization (ILO, 2016), productivity is defined as the ratio between total economic output (usually GDP) and the number of workers [16] states that the standard of living in a country is greatly determined by the ability of its workforce to produce output. In the context of regional economic development, increasing labor productivity becomes a strategic indicator for measuring the success of human resource development. On the other hand, microeconomic approaches such as [7] labour–leisure trade-off theory explain how individuals respond to economic incentives, such as wages, in deciding the allocation of time for work. This theory reinforces that the quality and incentives for labor significantly affect the output produced.

Health and productivity

From the perspective of health economics, optimal physical and mental conditions are an absolute prerequisite for a productive workforce [12] stated that individuals treat their health as capital, which can be invested in through care, a healthy lifestyle, and access to healthcare services [14] assert that an increase in life expectancy is positively correlated with an increase in human capital investment and long-term economic growth.

In this study, Life Expectancy (LE) is used as a representative proxy to measure the contribution of health to labor productivity. The higher the LE of a region, the greater the likelihood of creating a productive and sustainable workforce.

Education and Productivity Education plays a central role in shaping a workforce that is adaptive, competent, and efficiency-oriented. [5] stated that education not only enhances basic skills but also shapes an innovative mindset and the ability to adapt to technological changes. Research by [13] shows that the quality of education significantly affects labor productivity, especially in the context of a modern knowledge-based economy. In this study, Average Years of Schooling (AYS) is used as an aggregate indicator of the education level of the working-age population, as it reflects the duration of exposure to the formal education system and the opportunities for skill accumulation.

Labor force participation rate (LFPR)

LFPR is an important indicator in measuring the extent to which the productive age population is actively involved in economic activities. Although not explicitly included in the classical human capital theory, labor participation represents the direct utilization of the accumulation of human capital. [10] show that the decision to work is greatly influenced by income incentives, which in turn are determined by education, experience, and health. Therefore, the TPAK in this study is not only viewed as employment statistics but also as a signal of the effectiveness of utilizing the productive human resources of a region. The increase in the TPAK that is not accompanied by the quality of the workforce has the potential to create an economic burden, rather than productivity

RESEARCH METHOD

This study uses a quantitative approach with spatial-temporal log-log panel data regression techniques. The main objective of this method is to analyze the impact of human capital indicators—namely health (Life Expectancy or LE), education (Average Length of Schooling or ALS), and labor force participation (LFP)—on labor productivity in the 10 most productive regencies or cities in East Java Province during the period 2019–2023. The sample selection was conducted purposively based on the 10 regions with the highest GDP per capita to working population ratio in East Java, reflecting the most superior labor productivity. The data used are secondary time-series and cross-section (panel data) obtained from the Central Statistics Agency (BPS) and the National Labor Force Survey (Sakernas) for the period 2019–2023.

The panel regression model was chosen because it can simultaneously capture the dimensions of spatial variation between regions and temporal variation over time [14]. Natural logarithm transformation is performed to obtain elasticity interpretation, reduce heteroskedasticity, and stabilize data variance [8]. The selection of panel model specifications is carried out through:

1. Chow Test to compare the Pooled Least Square (PLS) model with the Fixed Effect Model (FEM).

2. Hausman Test to determine whether the best model is FEM or Random.

RESULTS AND DISCUSSION

Overview of the research object

This research focuses on the 10 most productive districts or cities in East Java Province during the period 2019–2023. The selection of regions was conducted purposively based on the highest labor productivity values, measured using the ratio of Gross Regional Domestic Product (GRDP) at constant prices to the number of working-age population. The regions include Surabaya, Sidoarjo, Gresik, Pasuruan, Malang, Kediri, Jember, Mojokerto, Probolinggo, and Banyuwangi — areas that consistently record significant contributions to East Java's GDP and high levels of economic participation.

The data used is of a spatial-temporal panel type (cross-section × time-series) covering 50 observations (10 regions × 5 years). The data sources were obtained from the Central Bureau of Statistics (BPS), the National Labor Force Survey (Sakernas), the Ministry of Education and Culture, and the Ministry of Health of the Republic of Indonesia. Labor productivity as the dependent variable is measured in millions of rupiah per worker. Three independent variables are used as determinants of productivity: (1) Life Expectancy (AHH) as a proxy for health; (2) Average Length of Schooling (RLS) as an indicator of education; and (3) Labor Force Participation Rate (TPAK) in percent as a measure of labor engagement.

Panel data regression estimation results

Table 1. Panel regression estimation results (fixed effect, log-log)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.51606	0.636798	29.07684	0.0000
AHH	0.237404	0.110352	2.151331	0.0380
RLS	0.214504	0.091617	2.341304	0.0247
TPAK	-0.272722	0.101723	-2.681021	0.0109

Regression equation results:

$$\ln Y_{it} = 18.516 + 0.237\ln\text{AHH}_{it} + 0.215\ln\text{RLS}_{it} - 0.273\ln\text{TPAK}_{it} + \quad \varepsilon_i$$

The estimation results in the table above indicate that the log-log panel regression model in this study shows that health (AHH) and education (RLS) have a positive and significant effect on labor productivity, with elasticities of 0.237% and 0.215% respectively for each 1% increase. These findings affirm that improvements in the quality of health and education can enhance work capacity and efficiency. Conversely, TPAK has a significant negative effect of –0.273%, indicating that high labor participation without an accompanying increase in quality actually reduces productivity. Overall, this model emphasizes the importance of investment in the health and education sectors, as well as the need to align the quantity and quality of the workforce to enhance productivity in the productive regions of East Java.

Hypothesis test results

Partial t-test

The t-test results show that the three independent variables have a significant effect on labor productivity. AHH (β = 0.2374; p = 0.0380) and RLS (β = 0.2145; p = 0.0247) have a positive and significant effect, while TPAK (β = –0.2727; p = 0.0109) has a negative significant effect. This indicates that improvements in health and education drive productivity, while an increase in TPAK without an improvement in quality actually decreases it.

F-Test (Simultaneous)

The F-statistic value of 598.2582 with a p-value of 0.0000 indicates that the three independent variables simultaneously have a significant effect on labor productivity. This strengthens the validity of the regression model and supports the Human Capital framework, which emphasizes the importance of investment in health, education, and optimal management of work participation.

Coefficient of determination (R²)

The regression model shows an R² value of 0.9949 and an adjusted R² of 0.9932. This means that 99.49% of the variation in labor productivity can be explained by the variables AHH, RLS, and TPAK. The high value indicates that the model has a very strong and relevant explanatory power in the context of productivity development in the productive regions of East Java.

The influence of health on labor productivity

Health, measured through the Life Expectancy Index (AHH), has been proven to have a positive and significant impact on labor productivity. Based on the regression estimation results, the AHH coefficient is 0.2374 with a significance level of p = 0.0380. This means that a 1% increase in Life Expectancy can boost labor productivity by 0.237%. This finding is consistent with the Human Capital Theory [5], which emphasizes that healthy individuals have a more optimal work capacity, lower absenteeism risk, and higher work resilience. In the context of productive regions in East Java, improving public health standards becomes a strategic element to strengthen the contribution of the workforce to economic growth.

The influence of education on labor productivity

Education, represented by the Average Length of Schooling (ALS), also has a positive and significant impact on productivity. The RLS coefficient is recorded at 0.2145 with a p-value of 0.0247. This indicates that an increase in the average length of schooling by 1% will increase productivity by 0.215%. Education plays a crucial role in shaping technical skills, cognitive capacity, and the adaptability of the workforce to market and technological dynamics. These findings reinforce the strategic role of education in the development of superior human resources, particularly in regions with high productivity potential such as districts or cities in East Java.

The influence of the labor force participation rate on labor productivity

Unlike the previous two variables, the Labor Force Participation Rate (LFPR) shows a negative and significant impact on labor productivity. The regression results recorded a TPAK coefficient of –0.2727 with a p-value of 0.0109. This means that a 1% increase in TPAK has the potential to decrease productivity by 0.273%. This phenomenon indicates that an increase in labor force participation does not always coincide with an improvement in the quality of the workforce. Without training or skill enhancement, the expansion of the workforce can actually increase the proportion of informal or less productive workers. In the framework of Human Capital, the quality of the workforce is more influential than its quantity. Therefore, the increase in labor force participation must be accompanied by training programs, vocational education, and alignment with labor market needs.

CONCLUSION

Fundamental Finding : This study concludes that labor productivity in the most productive regencies/cities in East Java during 2019–2023 is significantly influenced by human capital indicators, where increases in life expectancy (AHH) and average length of schooling (RLS) enhance productivity, while a rise in the labor force participation rate (TPAK) has the opposite effect. The results, derived from a log-log panel regression using the Fixed Effect Model (FEM), show that although greater participation in the workforce is occurring, it is not matched by improvements in labor quality, thereby reducing overall productivity. **Implication** : These findings underscore the urgency of adopting a more integrated human capital development strategy that aligns health and education improvements with labor market readiness. Local governments and policymakers should not only encourage labor participation but also ensure that such increases are supported by capacity building, vocational training, and adequate public services to achieve sustainable productivity growth. **Limitation** : However, the study is constrained by its reliance on secondary data from aggregate regional statistics, which may not capture intra-regional disparities, informal employment contributions, or qualitative factors influencing labor quality and productivity. **Future Research** : It is recommended that subsequent studies utilize micro-level or firm-level data, incorporate qualitative indicators such as job quality and worker motivation, and explore sector-specific analyses to inform more precise and actionable policy recommendations.

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