

-RESEARCH ARTICLE-

THE IMPACT OF WAGE RATE, EDUCATION, AND HEALTH STATUS ON WORKERS' PRODUCTIVITY IN INDONESIA

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—Abstract—

The productivity of workers is a key indicator of the economic development potential in a specific area. This aspect necessitates a thorough examination of current scholarly works and the valuable input of policymakers. Therefore, this study seeks to examine and assess the various factors that impact the productivity of workers in Indonesia, including wage rates, unemployment, education, and health status. The study utilised secondary data obtained from the World Bank Indicators (WDI) for the period of 1991

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to 2023. The study employed the dynamic autoregressive distributed lag (DARDL) approach to examine the relationships between variables. This study discovered that wage rate, unemployment, and education positively impact workers' productivity, while health status negatively affects it. Local governments should regularly adjust the minimum wage level to account for inflation in order to preserve the real wage level and ensure the purchasing power of workers remains intact. The government should ensure that workers have access to health insurance in order to maintain their health. The government should regularly release updates on the unemployment rate to enable individuals to adequately prepare for their entry into the labour market.

Keywords: Workers' productivity, wage rate, education level, health status

JEL Code: J30, J24, J38

INTRODUCTION

Workers' productivity is an indicator of a region's economic development. Productivity is a useful measure of human capital, which assesses the quality of human resources and the capital required for an investment to generate a higher return on investment. Productivity is defined as the ability to produce output using input components in the production process. Wages are compensation for the labour exerted by workers and serve as a potential incentive for employment (Alam et al., 2020). According to Putra (2019), higher wages are associated with increased labour productivity. Pajrin et al. (2022) study shows no significant correlation between wage levels and labour productivity. Establishing a connection between wage levels and productivity can be difficult when productivity is measured at the microlevel, specifically in terms of labour. The wage level used is a macro variable. Conducting productivity measurement at the macro level may lead to a misconception of productivity when it is linked to unemployment (Coviello et al., 2022).

In general, productivity is typically quantified as the ratio of GDP value to labour input. This measurement suggests a negative relationship between high unemployment and workers' productivity at an aggregate level. According to Eeckhout and Sepahsalari (2024), higher unemployment levels are associated with lower labour input usage, resulting in increased productivity while output remains constant. Moreover, the elevated unemployment rate and the relaxation of labour market regulations create incentives for workers to exert greater effort in order to mitigate the risk of being terminated. Conversely, workers' productivity may decrease when the ease of finding new employment after being dismissed is high (Awada et al., 2021). Meanwhile, according to Assaad and El-Adaway (2021), increased productivity is attributed to labor utilization. Conversely, an increase in labor utilization leads to a decline in the unemployment rate. The relationship between the unemployment rate and worker productivity is currently a subject of ongoing debate and requires further investigation.

The relationship between the unemployment rate and worker productivity is positive and significant. The study conducted by [Mehmood et al. \(2022\)](#) found no significant impact of the unemployment rate on worker productivity.

The provinces of West Kalimantan and East Kalimantan exhibit the lowest and highest productivity levels, respectively, on the island of Kalimantan, Indonesia. The productivity of workers in The Province of West Kalimantan is below the national average, while The Province of East Kalimantan exceeds the average. According to [Utari et al. \(2021\)](#), labor productivity in the Province of West Kalimantan is IDR 54,470,315 and in the Province of East Kalimantan it is IDR 287,152,403. The national average labor productivity is IDR 82,559,957. Between 2015 and 2019, both provinces experienced a consistent increase in productivity value. Human capital is the outcome of the amalgamation of skills, energy, training, education, initiatives, health, experiences, and habits. The measurement of human capital can encompass health and education ([Baharin et al., 2020](#)). The high value of human capital has a significant impact on labour productivity. The level of education in the provinces of West Kalimantan and South Kalimantan, as measured by the mean years of schooling, is lower than the national average of 8.34 years in Indonesia. In 2019, the mean years of schooling in the Province of West Kalimantan was 7.31 years, while in the Province of East Kalimantan it was 8.20 years. This study examines the variations in labour productivity, average years of schooling, population health status, wage levels, and unemployment rates in the provinces of West Kalimantan and East Kalimantan.

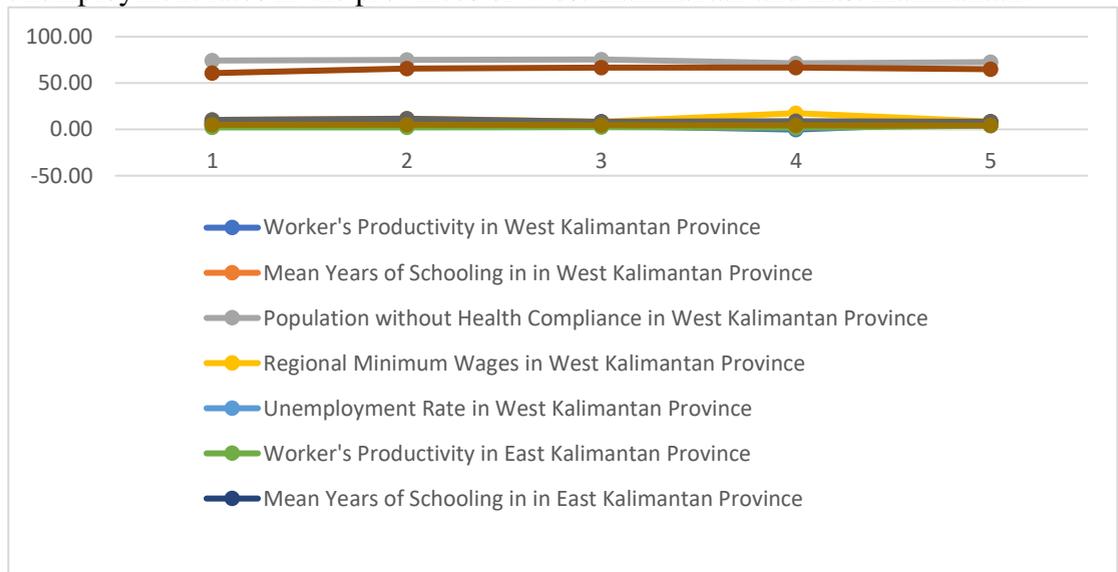


Figure 1: Worker's Productivity

Source: Central Bureau of Statistic, 2022

Productive individuals are closely linked to good physical health. The World Health Organisation defines health as the state of being free from disease or disability and

having optimal physical, mental, and social well-being. Poor health conditions can significantly reduce productivity as it renders the labour unable to work, resulting in zero productivity. The productivity of workers can be significantly affected by poor health (Prasetyo et al., 2021). Galanti et al. (2021) conducted a study on the two variables and obtained consistent findings. However, Nor et al. (2023) observed no significant relationship between health level and worker productivity. The relationship between wage level, education level, health level, unemployment rate, and workers' productivity in Indonesia is worth investigating. Multiple studies have investigated the correlation between health levels and labor productivity, using life expectancy as a measure of health. This proxy may not be suitable for measuring labour productivity. Older workers are at a disadvantage in the labour market compared to younger workers, who are still at their productive age. An individual who reaches retirement age is typically no longer productive and may become dependent on the next generation. A more suitable approach would be to use the average number of individuals with health complaints as a proxy for the health variable when using it as a regressor for productivity. Health complaints suggest a disruption in an individual's health condition. This will likely affect worker productivity at the individual level. If a worker is unable to work due to a health problem, they will not receive a wage because they are not actively contributing to the production of goods and services. This is based on the assumption that workers receive their wages daily.

This study examines the relationship between the unemployment rate and worker productivity at both the macro and micro levels. The findings suggest that there is an ambiguous relationship between these two variables. The literature review reveals an ambiguous relationship between the wage rate and worker productivity. Thus, it makes a valuable contribution to the existing body of literature. This study examines the relationship between the unemployment rate, health status, mean years of schooling, wage rate, and worker productivity. The paper is divided into the following sections: The second section examines the relationship between unemployment rate, wage rate, health status, education level, and worker productivity by reviewing prior research. The authors provide a brief overview of the methodologies and procedures used in the third section. They extract the results of the analysis. The discussion section provides explanations and support for the results from relevant studies. The study concludes by presenting its findings and discussing its limitations.

LITERATURE REVIEW

Conceptually, productivity is the ratio between the capital input and the output produced in the production process of specific goods. When measuring productivity, labour and capital are commonly considered as input factors. However, this study specifically examines the productivity of workers and argues that the most suitable indicator is the number of employed labourers (Salimova et al., 2022). Technology plays a crucial role

in enhancing productivity in the present era. Technological mastery is unevenly distributed across regions, resulting in unequal productivity. Technology proficiency in different regions of Indonesia is unevenly distributed. Several provinces are classified as lagging in terms of technology mastery (Latief et al., 2023). This further reduces the significance of technology for worker productivity in these two provinces. Investment in enhancing human resource quality closely links with education and training (Davidescu et al., 2020). Formal education and training can help improve the quality of human resources in terms of knowledge and skills, leading to increased productivity. Higher levels of formal education are associated with increased productivity. Furthermore, higher levels of formal education in a specific region are associated with increased aggregate productivity. The mean years of schooling is a commonly used indicator for measuring the education variable (Aji, 2022).

The mean year of schooling is a measure, expressed in years, that represents the cumulative time individuals in a specific area devote to formal education (Laut et al., 2023). The mean year of schooling is commonly employed as an indicator of the level of formal education in a given region. Residents who have completed elementary school are included in the count for a period of six years. The score component of the mean years of schooling does not take into account the learning journey or whether students failed in class. Those who graduated from junior high school completed nine years, while those who finished high school completed 12 years. Workers can enhance their work productivity by meeting their needs, such as having access to nutritious food, quality education, and training (Barışık & Budak, 2020). Good health conditions are essential for high worker productivity. An indicator of health is the number of sick days within a specific time frame, such as one month. The healthy population refers to the percentage of individuals who did not report any health complaints in the past week, as compared to the total population, as stated by the Central Bureau of Statistics. Workers with fewer sick days tend to have higher productivity due to increased time spent working. A healthy society fosters high social well-being through the promotion of physical and psychological health among its members (Shindell et al., 2021).

The wage level is crucial for enhancing workers' productivity in an institution or business unit. Higher wages often serve as a motivating factor for workers, leading to increased productivity and effort. Cafferty et al. (1990) proposed the Efficiency Wage Theory, which suggests that higher wages can contribute to workers' well-being by enabling them to meet their needs. Abonazel and Shalaby (2021) conducted a study to examine the impact of education level and wages on worker productivity in Belgium. The findings indicate that education level has a greater influence on productivity than wage level. The standard Microeconomic Theory proposes a direct correlation between short-term wage growth and productivity growth, with wage levels adapting to changes in productivity. This model is commonly employed in wage-setting regulations to ensure that wage growth does not surpass productivity growth, thereby ensuring full

employment. There is a negative correlation between wages and productivity. The company's wages are directly linked to labour productivity. Higher productivity attracts companies to hire more labour and increase wages (Ozturk et al., 2020). The Neoclassical model introduced the concept of efficiency wages. This model challenges the assumption that wages and worker productivity have a one-way relationship in a perfectly competitive market. This model suggests that companies may pay labour wages above market wages in order to enhance labour productivity. Herman (2020) discovered a bidirectional correlation between wages and productivity. Higher pay can enhance workforce efficiency in several ways, including attracting high-quality applicants during the selection process, reducing labour turnover, improving labour discipline, and boosting labour morale.

According to economic theory, unemployment is attributed to aggregate demand rather than workers' productivity (Salimova et al., 2022). There is no relationship between unemployment and workers' productivity. Generally, higher levels of unemployment lead to increased labour productivity in the economy, as measured by the ratio of absorbed labour to productivity. Feng et al. (2024) argue that the relationship between unemployment and productivity is intricate. The research findings indicate no correlation between unemployment and productivity in the United Kingdom. A similar result was also reported in a study conducted by (Olubusoye et al., 2023) in Nigeria. Bertani et al. (2020) identified a significant negative correlation between unemployment and labour productivity.

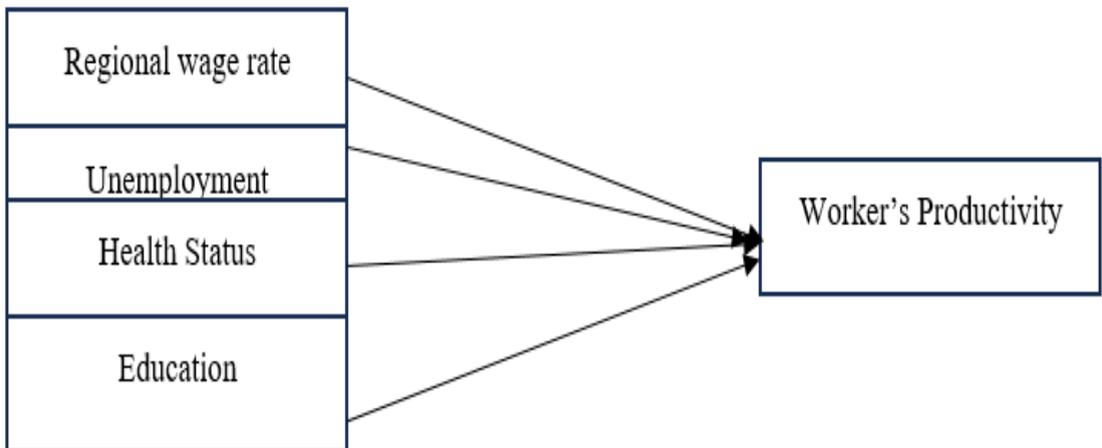


Figure 2: Theoretical Framework

This study employed a theoretical framework to examine the impact of health, education, the regional minimum wage rate, and unemployment on worker productivity in Indonesia. The proxy used for education is the mean years of schooling, while the proxy for health is the percentage of the population without any health complaints in the past month. This study examines the potential use of different productivity measures

at the macro and micro levels. Specifically, unemployment is selected as one of the regressors for labour productivity.

RESEARCH METHODOLOGY

Productivity of workers is a key indicator of economic development that requires regular attention. This study aims to analyse the factors affecting workers' productivity in Indonesia, including wage rate, unemployment, education, and health status. The study utilised secondary data obtained from the World Development Indicators (WDI) for the period of 1991 to 2023. The equation presented below was developed in the study:

$$WRP_t = \alpha_0 + \beta_1 WR_t + \beta_2 UEMP_t + \beta_3 EL_{it} + \beta_4 HS_t + e_t \quad (1)$$

Where.

WRP = Workers' Productivity

t = Time Period

WR = Wage Rate

UEMP = Unemployment

EL = Education Level

HS = Health Status

The study examines the relationship between workers' productivity and total production as a percentage of the workforce. The study used four predictors: wage rate (measured as wage and salaried workers, total (% of total employment)), unemployment (measured as unemployment with basic education, total (%)), education level (measured as educational attainment, at least bachelor's or equivalent, population 25+, total (%)), and health status (measured as current health expenditure (% of GDP)). [Table 1](#) provides the variables and their corresponding measurements.

Table 1: Variables with Measurements

S#	Variables	Measurement	Sources
01	Workers' Productivity	Total production (% of workforce)	WDI
02	Wage Rate	Wage and salaried workers, total (% of total employment)	WDI
03	Unemployment	Unemployment with basic education (% of total labor force with basic education)	WDI
04	Education Level	Educational attainment, at least bachelor's or equivalent, population 25+, total (%)	WDI
05	Health Status	Current health expenditure (% of GDP)	WDI

This study utilises descriptive statistics to analyse variables such as standard deviation, mean, and minimum and maximum values. The study examines the correlation using a

correlation matrix. Furthermore, the unit root is assessed using the ADF and PP tests. The equation is mentioned below:

$$d(Y_t) = \alpha_0 + \beta t + \gamma Y_{t-1} + d(Y_t(-1)) + \varepsilon_t \quad (2)$$

Moreover, the study also examines the co-integration with the help of (Westerlund & Edgerton, 2008) approach. The equations are mentioned below:

$$LM_\varphi(i) = T\hat{\varphi}_i (\hat{r}_i/\hat{\sigma}_i) \quad (3)$$

$$LM_\tau(i) = \hat{\varphi}_i/SE(\hat{\varphi}_i) \quad (4)$$

The researchers employed the ARDL approach due to the requirement of the ARDL model that certain variables must be stationary at the level and others in first difference (Nazir, Nazir, Hashmi, & Ali, 2018). The ARDL model accounts for the impact of heteroscedasticity and autocorrelation on the results (Zaidi & Saidi, 2018). The equation is mentioned below:

$$\Delta WRP_t = \alpha_0 + \sum \delta_1 \Delta WRP_{t-1} + \sum \delta_2 \Delta WR_{t-1} + \sum \delta_3 \Delta UEMP_{t-1} + \sum \delta_4 \Delta EL_{t-1} + \sum \delta_5 \Delta HS_{t-1} + \varphi_1 WRP_{t-1} + \varphi_2 WR_{t-1} + \varphi_3 UEMP_{t-1} + \varphi_4 EL_{t-1} + \varphi_5 HS_{t-1} + \varepsilon_t \quad (5)$$

Finally, the study employed the DARDL approach to examine the relationships between variables including wage rate, unemployment, education, health status, and workers' productivity. Jordan and Philips (2018) introduced the approach. Furthermore, this approach addresses all the shortcomings present in the ARDL model. The equation is given below:

$$\Delta WRP_t = \alpha_0 + \sum \delta_1 \Delta WRP_{t-1} + \sum \delta_2 \Delta WR_t + \sum \delta_3 \Delta WR_{t-1} + \sum \delta_4 \Delta UEMP_t + \sum \delta_5 \Delta UEMP_{t-1} + \sum \delta_6 \Delta EL_t + \sum \delta_7 \Delta EL_{t-1} + \sum \delta_8 \Delta HS_t + \sum \delta_9 \Delta HS_{t-1} + \varepsilon_t \quad (6)$$

Study Results

This study utilises descriptive statistics to analyse variables such as standard deviation, mean, and minimum and maximum values. The study revealed that the mean value of WRP was 15.108, WR was 40.051, and UEMP was 3.715. The results showed that EL had a mean value of 8.344 and HS had a mean value of 2.492. [Table 2](#) lists the values.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WRP	33	15.108	5.499	3.804	27.778
WR	33	40.051	5.974	32.835	48.996
UEMP	33	3.715	1.307	1.862	6.466
EL	33	8.344	0.974	7.735	11.09
HS	33	2.492	0.532	1.844	3.414

This study also analyses the correlation using a correlation matrix. The results showed that WR, UEMP, and EL have a positive correlation with WRP, while HS has a negative

correlation with WRP in Indonesia. [Table 3](#) provides the correlations.

Table 3: Matrix of Correlations

Variables	WRP	WR	UEMp	EL	HS
WRP	1.000				
WR	0.085	1.000			
UEMP	0.614	-0.393	1.000		
EL	0.041	0.651	-0.506	1.000	
HS	-0.200	0.916	-0.210	0.686	1.000

Furthermore, the unit root is assessed using the ADF and PP tests. The findings indicate that the variables WRP, WR, EL, and HS are stationary at the level, while UEMP is stationary at the first difference. The figures are presented in [Table 4](#).

Table 4: Unit Root Test

Series	ADF		PP	
	Level	First difference	Level	First difference
WRP	-2.876***	-----	-2.091***	-----
WR	-3.092***	-----	-3.321***	-----
UEMP	-----	-5.897***	-----	-4.554***
EL	-2.098***	-----	-2.987***	-----
HS	-2.776***	-----	-3.091***	-----

In addition, the study also investigates co-integration using the approach proposed by Westerlund and Edgerton (2008). The results showed that the t-values were greater than 1.96, indicating statistical significance, and the p-values were less than 0.05, suggesting a significant effect. The data indicates the presence of co-integration. The figures are presented in [Table 5](#).

Table 5: Co-integration Test

Model	No Shift		Mean Shift		Regime Shift	
	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value
LM_{τ}	-4.392	0.000	-5.392	0.000	-4.982	0.000
LM_{ϕ}	-4.928	0.000	-5.093	0.000	-5.009	0.000

The productivity of workers is a key indicator of the economic development potential of a specific region. This aspect necessitates considering current literature and policymakers' input. This study aims to analyse the factors that affect workers' productivity in Indonesia, including wage rate, unemployment, education, and health status. The study employed the DARDL approach to examine the relationships between variables including wage rate, unemployment, education, health status, and workers' productivity. This study found that wage rate, unemployment, and education have

significant positive effects on workers' productivity. On the other hand, the study revealed a significant negative impact of health status on workers' productivity. Table 6 presents the associations.

Table 6: Dynamic ARDL model

Variable	Coefficient	t-Statistic	Prob.
ECT	-0.092***	-3.902	0.000
WR_{t-1}	2.019***	4.875	0.000
WR	0.986**	2.002	0.043
$UEMP_{t-1}$	1.921**	2.007	0.041
UEMP	0.976***	4.363	0.000
EL_{t-1}	2.112***	5.463	0.000
EL	0.453***	3.901	0.001
HS_{t-1}	-1.911**	2.009	0.039
HS	-2.191**	2.111	0.034
Cons	1.894***	4.887	0.000

R square = 60.348

Stimulation = 5000

DISCUSSIONS

Productivity of workers is a key indicator of the economic development capacity in a given region. This aspect necessitates the examination of current literature and the input of policymakers. This study aims to analyse the factors affecting workers' productivity in Indonesia, including wage rate, unemployment, education, and health status. The education variable positively affects workers' productivity in Indonesia. Increased engagement in formal education leads to higher productivity. Formal education imparts knowledge and skills to individuals. The study's results align with Deming (2022) research findings. The findings align with the statement made by (Sodirjonov, 2020). The variable of health, measured as current health expenditure (% of GDP), has a negative impact on workers' productivity. A higher number of sick days will lead to a decrease in workers' productivity. The productivity, quantity, and quality of goods and services produced by workers are positively correlated with their level of labour health, indicating that higher levels of labour health result in lower rates of sickness. The findings of this study are relevant to the research conducted by (Sultana et al., 2022).

Wages are a motivating factor for workers. There is a positive correlation between wages and workers' productivity. The study discovered a significant positive correlation between wage levels and workers' productivity. The study's findings align with the Concept of Wage Efficiency and are relevant to the research conducted by (Ciminelli et al., 2021). Wages motivate workers and have a direct and indirect relationship with productivity. Increasing wages can help workers meet their basic needs, including access to nutritious food. Improving workers' nutritional needs can enhance their health and productivity. The macro-level measure of productivity, which considers absorbed

labour as a divisor, appears to depict a positive relationship between unemployment and productivity. The study's findings confirm the described relationship, as a significant positive correlation between unemployment and productivity was observed. At the micro level, a positive relationship can be observed between higher unemployment and the potential replacement of workers with low productivity by competitors in the labour market. There is a high likelihood of them being dismissed. This phenomenon will incentivize workers to be more productive. This statement aligns with the research conducted by (Mubarak & Nugroho, 2020).

CONCLUSION AND SUGGESTIONS

In Indonesia, the data analysis of the relationship between education level, health level, wage level, and unemployment rate to productivity yields the following conclusions: The Common Effect model was determined to be the best model for this study based on the estimation results. There is a strong positive correlation between education and worker productivity. Workers can enhance their knowledge and skills through formal education. Individuals' knowledge and skills will improve more the longer they engage in the formal education process. As a result, it is expected to enhance their productivity. The level of health, as measured by current health expenditure as a percentage of GDP, has a significant negative impact on worker productivity. Due to their inability to work while sick, we expect the workers' productivity to be zero. There is a positive correlation between the average number of sick days and workers' productivity.

There is a strong positive correlation between wage levels and productivity. Higher wages can incentivize workers to enhance their productivity as wages serve as a motivating factor for individuals to exert greater effort. Higher wages can have an indirect impact on productivity by enabling workers to afford health pre-commitments. The unemployment rate positively impacts workers' productivity. High unemployment rates pose a threat to low-productivity workers. There is a high likelihood of dismissal as companies can easily find replacements from the surplus labour market. Future research may benefit from examining productivity variables at the micro level. The variables of health, education, and wages have a direct impact on productivity at the micro level. This type of research necessitates primary data obtained directly from workers.

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