

## HEALTH EXPENDITURES AND EDUCATION EXPENDITURES RELATED TO LABOR PRODUCTIVITY IN INDONESIA? A TIME SERIES ANALYSIS SPANNING 2001–2019

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### Abstract

This study examined government health and education spending and its impact on Indonesian labor productivity from 2001 to 2019. The problem was relevant since Indonesia's labor productivity rose before 2019, while health and education spending fluctuated. Labor productivity rose from 4.38 in 2001 to 11.84 in 2019, while government health expenditure rose from 3.96% to 8.67% of general government expenditure. Government education spending rose from 11.59% of general government spending in 2001 to 17.35% in 2019 but fluctuated thereafter. These patterns raised the question of whether Indonesian labor productivity was improved by public spending on education and health. This study used secondary data from 2001 to 2019 for quantitative time-series analysis. Descriptive analysis, Augmented Dickey-Fuller and Phillips-Perron unit root tests, Johansen and cointegration test, and regression analysis were used. Results revealed that health spending boosted labor productivity in the short and long term. Education expenditure had little short-term effect but a favorable and large long-term benefit. These findings suggested that health investment boosted labor productivity faster than education spending. Thus, Indonesian policy should increase health and education spending and improve the quality and effectiveness of these expenditures to boost human capital and labor productivity.

Keywords: Health expenditures, education expenditures, labor productivity, time series analysis.

### Abstrak

*Studi ini mengkaji dampak belanja kesehatan dan pendidikan pada produktivitas tenaga kerja Indonesia dari tahun 2001 hingga 2019. Studi ini signifikan karena produktivitas tenaga kerja Indonesia meningkat sebelum tahun 2019, sementara belanja untuk kesehatan dan pendidikan berfluktuasi. Produktivitas tenaga kerja meningkat dari 4,38 pada tahun 2001 menjadi 11,84 pada tahun 2019, sementara belanja pemerintah untuk kesehatan meningkat dari 3,96% menjadi 8,67% dari belanja pemerintah umum. Belanja pemerintah untuk pendidikan meningkat dari 11,59% dari belanja pemerintah umum pada tahun 2001 menjadi 17,35% pada tahun 2019 tetapi berfluktuasi setelahnya. Kondisi ini menimbulkan pertanyaan apakah produktivitas tenaga kerja Indonesia meningkat akibat belanja pendidikan dan kesehatan. Studi ini menggunakan data sekunder dari tahun 2001 hingga 2019 untuk analisis deret waktu. Analisis deskriptif, uji akar unit Augmented Dickey-Fuller dan Phillips-Perron, uji Johansen dan kointegrasi, serta analisis regresi digunakan untuk menjawab tujuan penelitian. Hasil penelitian menunjukkan bahwa belanja kesehatan meningkatkan produktivitas tenaga kerja dalam jangka pendek dan panjang. Belanja pendidikan memiliki sedikit pengaruh jangka pendek tetapi memberikan manfaat jangka panjang. Temuan ini menunjukkan bahwa investasi kesehatan meningkatkan produktivitas tenaga kerja lebih cepat daripada belanja pendidikan. Oleh karena itu, kebijakan peningkatan belanja kesehatan dan pendidikan perlu disertai kualitas dan efektivitas belanja untuk meningkatkan produktivitas tenaga kerja.*

*Kata Kunci: Belanja kesehatan, belanja pendidikan, produktivitas tenaga kerja, analisis deret waktu.*

## Introduction

The Indonesian context provides an important empirical background for examining the relationship between public spending on health, education, and labor productivity. Before the 2019 data cut-off used in this study, Indonesia experienced an upward trend in labor productivity, from 4.38 in 2001 to 11.84 in 2019. During the same period, government health expenditure increased from 3.96% of general government expenditure in 2001 to 8.67% in 2019, while government education expenditure increased from 11.59% in 2001 to 17.35% in 2019, peaking at 21.21% in 2016. These figures indicate that Indonesia increased its fiscal commitment to human capital sectors before 2019, although the allocation pattern was not always stable across years. The data are consistent with the indicators used in this study, namely labor productivity, government health expenditure, and government education expenditure for the period 2001–2019. The education expenditure indicator is also available in the World Bank's data on government education expenditure as a percentage of total government expenditure, sourced from the UNESCO Institute for Statistics. The health expenditure indicator is traceable through World Bank health expenditure data sourced from the WHO Global Health Expenditure Database, including the indicator of domestic general government health expenditure as a percentage of general government expenditure.

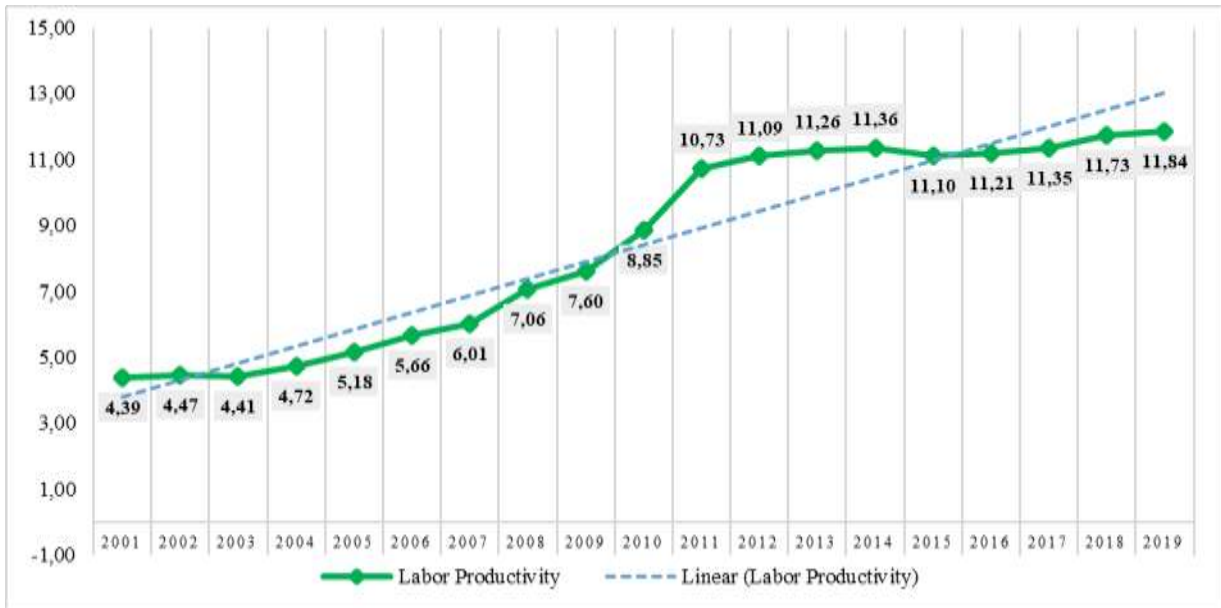
Labor productivity, defined as the number of goods and services produced by employees in a particular period, is critical to economic growth (Akoum, 2016; Gaies, 2022; Magableh et al., 2022; Li et al., 2023). Acquiring health, knowledge, and skills leads to a more productive workforce. Several factors influence workforce productivity, including physical and mental health (Yusri, 2022). Workers with robust physical and mental health are more likely to participate actively in various physical activities (Chansarn, 2013; Viju & Wullianallur, 2020). On the other hand, suboptimal health conditions might hinder mobility and task completion, thereby negatively influencing productivity (Prasetyo et al., 2019). Thus, worker health influences economic output because a healthier workforce is more productive, which leads to better economic outcomes (Gaies, 2022; Moyo et al., 2024). As a result, a country must prioritize the most critical issues affecting worker productivity (Zhao & Xu, 2022).

Beyond health, Moyo et al. (2024) contend that education is crucial because it increases worker productivity. Quality workers have experience and talents, which affect the workforce's productivity. Education provides skills and knowledge; a more innovative workforce is more productive (Ngutsav & Akaakohol, 2018). As a result, education equips people with the information and skills needed to create commodities and services. Education enables a country to develop a workforce with high levels of knowledge, thereby increasing productivity (Ali et al., 2022).

Public spending choices in these two sectors are crucial since health and education affect worker productivity (Al-Zyoud et al., 2021). Several scientific conversations have focused on how investments in health and education affect worker productivity. Allocating public financing to the health and education sectors will determine the size of expenditure on these services (Phiri & Mbaleki, 2022). Health and education services influence workforce welfare, which improves productivity. From this perspective, health and education serve as markers of progress in human resource development. Human resources are created via health and education services. These productive people resources drive up national income levels (Chansarn, 2013; Ezoji et al., 2019; Baharin et al., 2020). Given the debate over the relationship between government funding for health and education and its potential positive impact on labor productivity, it is critical to conduct a comprehensive study to investigate the effects of government spending in these domains on labor productivity, with a focus on the Indonesian context (Li et al., 2023; Moyo et al., 2024).

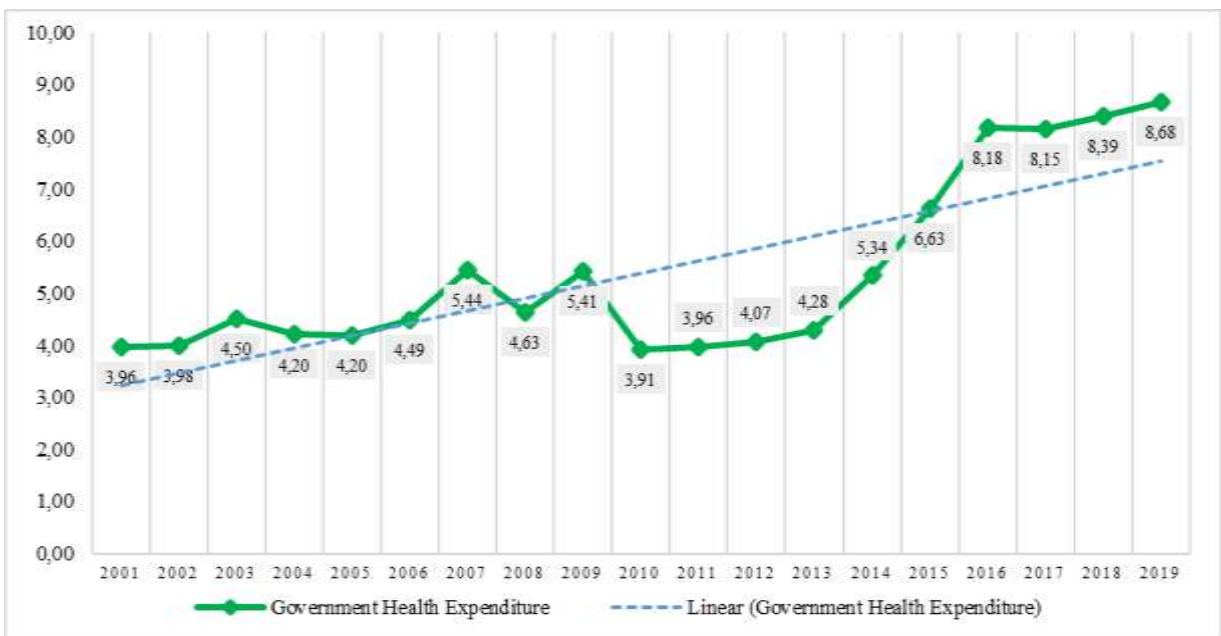
Figure 1 shows the trajectory of labor productivity in Indonesia from 2001 to 2019, with oscillations and an overall upward trend. The peak value of labor productivity over the previous 19 years was achieved in 2019, at 11.84% of production per working hour. In comparison, the lowest point was in 2001, when output per hour worked was only 4.38%. Labor productivity in Indonesia increased steadily throughout the years, particularly between 2003 and 2014. Productivity peaked in 2014 at 11.36% of production per hour worked, up from 4.41% in 2003.

Despite a 11.10% drop in 2015, Indonesia's productivity improved again in 2019 to 11.84%. The most significant gain in labor productivity during these 19 years was observed in 2011, with a 1.21% increase over the previous year. If this figure is taken as an average, Indonesian labor productivity was 8.42% of total production per working hour. This chart demonstrates Indonesia's attempts to boost labor productivity during the last two decades, albeit with annual variations. This growth indicates economic and technological advancements that have increased productivity in several areas.



**Figure 1.** Indonesian labor productivity 2001–2019 (% of output per working hour)

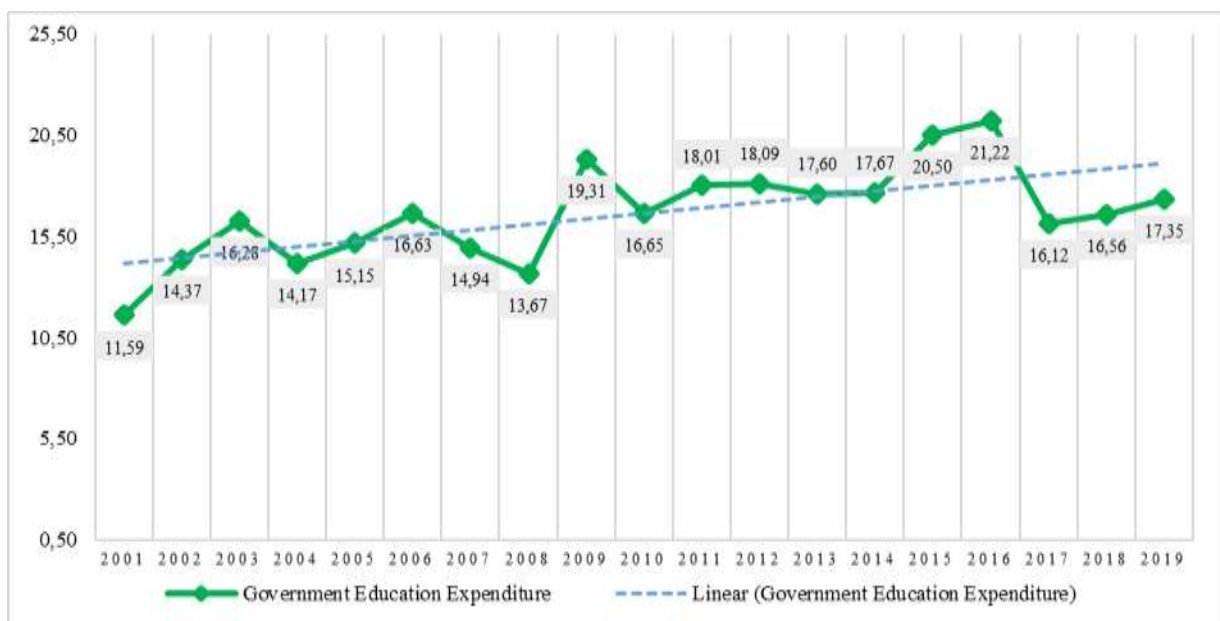
Figure 2 exhibits the fluctuating pattern of Indonesian government health spending from 2001 to 2019. The proportion of government spending allocated to the health sector, namely Government Health Expenditure, reached its highest level in the last 19 years in 2019, accounting for 8.67% of overall government spending. The lowest peak was reached in 2010, accounting for only 3.91% of overall government spending. The proportion of Indonesian government health spending increased steadily in the following years, particularly between 2010 and 2016. In 2010, the share was 3.91% of total government spending; in 2011, it increased to 3.96%; in 2016, it reached 8.18%. Despite a decline in 2017 to 8.15%, the proportion of Indonesian Government Health Expenditures grew again in 2019 to 8.68%. The most considerable growth in Government Health Expenditure was achieved in 2014, with a 1.25% increase over the previous year. If this statistic is averaged, the proportion of Indonesian Government Health Expenditures throughout this period reached 5.39% of total Indonesian government expenditure. This pattern shows efforts over the last two decades in Indonesia to boost government budget allocations for the health sector, albeit with annual variations. This growth reflects the country's rising emphasis on health care and public welfare.



**Figure 2.** Indonesian government health expenditure 2001–2019 (% of general government expenditures)

Figure 3 depicts fluctuations in Indonesian government education expenditures from 2001 to 2019. In 2016, the proportion of government expenditure allocated to the education sector, known as Government Education Expenditure, reached its highest point in 19 years, accounting for 21.21% of total government expenditure. Conversely, the lowest point was in 2001, when only 11.59% of total government expenditure was recorded. Between 2001 and 2019, the Indonesian government's investment in education climbed considerably. In 2001, the percentage was only 11.59% of total government expenditure, but it rose to 17.35% in 2019, reflecting a 5.76% increase.

The most significant percentage increase in Indonesian Government Education Expenditure over the preceding 19 years was reported in 2009, with a 1.41% increase over the previous year. Over the last 19 years, the proportion of Indonesian Government Education Expenditures reached 16.62% of overall Indonesian government expenditure. This trend, albeit with annual changes, illustrates the Indonesian government's dedication to expanding educational access and quality over the last two decades. These efforts demonstrate an understanding of the value of education in social and economic development and community empowerment.



**Figure 3.** Indonesian government education expenditure 2001–2019 (% of general government expenditure)

### Theoretical Study and Hypothesis

Scholars increasingly acknowledge the role of human resources in determining productivity and economic growth (Mehrara, 2011; Chansarn, 2013; Viju & Wullianallur, 2020; Chang et al., 2022). Human resources directly and indirectly affect a country's productivity (Prasetyo et al., 2019). The health of human resources directly impacts individual skill and knowledge development. The state of one's health has a considerable impact on one's intellectual growth potential (Al-Zyoud et al., 2021). Conversely, poor HR health can hinder an individual's ability to achieve his or her full potential and contribute to social and economic growth (Alam et al., 2018; Zhao & Xu, 2022).

Health care quality for human resources can significantly impact a country's economic growth and development (Akoum, 2016; Linhartova, 2021; Allanson & Cookson, 2022). Low productivity is directly linked to poor health; high health (care) expenses can impede societal and economic development (Chang et al., 2022). Boosting national productivity, per capita income, and social welfare requires countries to invest heavily in people's health (Yang, 2020; Allanson & Cookson, 2022). To get the most out of their human resources, countries should invest in health care, disease prevention, and the promotion of healthier lifestyles (Mehrara, 2011; Linhartova, 2021).

In their study, Chang et al. (2022) argued that one's state of health is a sort of human capital. According to the results, spending money on healthcare positively affects the economy, leading to higher wages and a better standard of living (Knight, 2022). Nonetheless, health's importance extends beyond its effect on GDP growth, as it creates human and physical capital. Human resource investment should include health care, as Allanson

(2017) and Alhassan et al. (2020) state. Increasing national health services spending can boost economic output, individual well-being, and public prosperity (Mehrara, 2011).

Life expectancy increases while morbidity and infant mortality rates decrease, mainly due to healthcare expenditures (Chang et al., 2022; Alhassan et al., 2020). As a result, health is a vital human resource. As one of the most critical factors in achieving sustainable economic growth and improving the equitable quality of life, public health conditions must be accompanied by adequate investment in the health sector (Maciulyte-Sniukiene & Matuzeviciute, 2018; Li et al., 2023).

Phiri and Mbaleki's (2022) analysis found a favorable link between healthcare expenditures and labor productivity across agricultural and non-agricultural sectors. According to this study's findings, there is a positive association between health spending and improvements in people's cognitive abilities. However, it is critical to recognize that this link might adversely affect areas with inadequate infrastructure. However, Allen et al. (2014) found that the relationship between changes in agricultural input utilization and agricultural sector productivity is influenced, to some extent, by farming households' health. A variety of government healthcare spending categories affect health status. This discovery reveals a complicated relationship between healthcare spending and agricultural productivity.

Ye and Zhang's (2018) research is relevant to government health-care spending, which affects labor productivity. This study demonstrates how increasing spending on health services can improve community services. As a result, life expectancy, social well-being, and societal security can increase. Employees in better health are more productive and able to work longer hours. These findings suggest that increasing funding for the health sector can help improve public health and increase labor productivity (Chansarn, 2013; Rahman et al., 2018; Alhassan et al., 2020; Zhao & Xu, 2022).

Given the rapid pace of economic expansion, society has a discernible tendency toward greater emphasis on quality of life. As a result of this shift in cultural values, demand for health care has increased (Wahab & Kefeli, 2017; Duggan et al., 2019). The study shows a positive relationship between a country's per capita income and healthcare expenditure allocation. This discovery emphasizes the link between accelerated economic growth and increased healthcare spending. The allocation of more financial resources to healthcare infrastructure indicates a concerted effort by nations to maintain their populations' well-being in tandem with favorable economic progress, as evidenced by the positive correlation between improved labor health conditions and increased productivity (Rahman et al., 2018; Baharin et al., 2020; Li et al., 2023; Moyo et al., 2024).

Gaies (2022) stated that workplaces prioritizing employee health and safety lead to greater output and sustained technical progress. According to Knight (2022), having more time to complete chores and achieve goals correlates with workers living longer and better lives. This viewpoint is consistent with endogenous growth theory, which suggests that spending on health can be used to prevent disease and its associated costs, according to Phiri and Mbaleki (2022). Improved health and new technology can amplify the positive impact of health on economic growth (Baharin et al., 2020). According to Duggan et al. (2019), individual health insurance has dramatically enhanced worker output. Employees benefit from health insurance because it provides access to medical care, illness prevention, financial stress reduction, and emotional well-being support, increasing productivity. As a result, it boosts employee morale and motivation, resulting in increased output and remarkable business success (Rahman et al., 2018; Viju & Wullianallur, 2020). Based on the evidence presented on the relationship between public health expenditures and worker output, the first hypothesis goes as follows:

*H<sub>1</sub>*: Health expenditure has a favorable impact on labor productivity.

In economic theory, factors of production such as capital and labor are crucial to economic growth. According to Yusri (2022), increasing workforce productivity depends on their knowledge and training level. Access to and the quality of education affect worker productivity. Workers with a high level of education and competence will contribute to economic growth by sustaining productivity and adapting more quickly to new technology. Baharin et al. (2020). As a result, government spending and investment in education aim to develop human resources, thereby boosting labor productivity by providing skills, encouraging innovation, and increasing labor mobility (Phiri & Mbaleki, 2022). As a result, government spending and investment in higher education are increasingly important (Ali et al., 2022; Sahnoun & Abdennadher, 2022).

Wahab and Kefeli (2017) stressed the importance of education in society. They suggested that it might be used to assess a sovereign country's investment optimism regarding education spending and labor performance. Furthermore, education develops human resources, which determine the quantity of national income that can be generated through the contribution of physical capital to the economy (Ali et al., 2022). According to Ngutsav and Akaakohol (2018), allocating financial resources to education will encourage the expansion of educational

opportunities at all levels of the educational system, with a focus on improving access and quality for children from low-income families. According to recent research conducted by Al-Zyoud et al. (2021) and Baharin et al. (2020), investing in education improves overall educational quality. It allows for more effective resource allocation across multiple economic sectors. According to Guo (2018), inadequate investment in education is evident in the constrained allocation of resources, which is typical in poor countries, resulting in reduced human capital output.

Magableh et al. (2022) found a robust long-term link between schooling and worker productivity. The existence of a global consensus on the importance of education in cultivating individuals' creativity has a dramatic impact on their efficacy, occupational opportunities, and overall well-being. According to Rukumnuaykit and Pholphirul (2016), the benefits of education extend beyond the acquisition of material benefits for students and encompass a wide range of practical applications that transcend generational and national boundaries, thereby benefiting society as a whole.

The scholarly works of Arshada and Malik (2015) and Ezoji et al. (2019) emphasize the critical need for human resource development to achieve long-term production growth and increased labor productivity. Sustainable production growth will be achieved by upgrading the education sector, improving public health, and adopting cutting-edge pedagogical and training initiatives. Mačiulytė-Šniukienė and Matuzevičiūtė (2018) emphasize that maintaining a growth rate is challenging for a workforce with insufficient levels of education and health. The following hypothesis is based on convincing arguments about the complex relationship between education expenditures and labor productivity.

$H_2$ : Education expenditure has a beneficial impact on labor productivity.

### Research Methods

The methodology used in this study is quantitative. The dataset covers demographic data from 2001 to 2019, including independent factors such as government spending on healthcare and education. In the present context, it is essential to note that the variable under examination is labor productivity, the dependent variable. The current study used a purposeful random selection technique for 19 years, from 2001 to 2019. The samples were chosen to represent Indonesia's varied levels of health expenditures, education expenditures, and labor productivity. Furthermore, the selection method considers data accessibility over the duration specified above.

**Table 1**  
**Variable Definitions**

Variable	Code	Description	Units	Source
Labor Productivity	L.P	Productivity is measured as gross domestic product (GDP) per hour worked. This data is adjusted for inflation and differences in living costs between countries.	(%)	Our World in Data, <a href="https://ourworldindata.org/">https://ourworldindata.org/</a>
Government Health Expenditure	GHE	Total general government expenditure on health as a percentage of total government expenditure for all sectors.	(%)	The World Bank, <a href="https://data.worldbank.org/">https://data.worldbank.org/</a>
Government Education Expenditure	GEE	Total general government expenditure on education as a percentage of total government expenditure for all sectors.	(%)	Our World in Data, <a href="https://ourworldindata.org/">https://ourworldindata.org/</a>

### Statistical Analysis

This study employs a unit root test and a cointegration test to ensure the reliability of the regression results (Greene, 2008) and to verify that the regression's fundamental assumptions are met before any subsequent analysis (Box et al., 2015). The current study uses time series regression analysis to determine and quantify the effect of health and education spending on worker productivity. The regression equation used in this investigation is as follows.

$$LP_t = \alpha_0 + \beta_1 GHE_t + \beta_2 GEE_t + \varepsilon_t$$

In the equation above,  $LP$  is the dependent variable,  $\alpha_0$  is the constant term, and  $\beta_1$  and  $\beta_2$  are the coefficients indicating the impact of health and education spending on labor productivity, respectively.  $GHE$  and  $GEE$  represent the health and education expense variables at time  $t$ , while  $\varepsilon_t$  represents the error term. Health and education expenses were examined concurrently to determine whether they significantly affect labor

productivity in Indonesia in the short and long run. This test determines whether the regression model's overall influence on the dependent variable is statistically significant. In parallel, various tests were conducted to determine whether health and education spending significantly affected worker productivity in the short and long term. Such methods show the relative relevance of each independent variable in explaining observed disparities in labor productivity. The study uses simultaneous and partial hypothesis testing to establish a link between labor productivity in Indonesia and short and long-term health and education expenditures.

The acquired data was analyzed using a statistical software application called EViews 12. The Augmented Dickey-Fuller test and the Phillips-Perron unit root test were employed to assess cointegration in the model. Then, the study employed time-series regression analysis to examine the relationship among health expenditures, education expenditures, and labor productivity.

### Data Analysis and Discussion

Table 2 presents a detailed summary of descriptive statistics from a dataset with 19 observations. The average worker productivity is 8.42%, while the average government health expenditure is 5.39%. Education spending averages 16.52%. The average amount of government education expenditure is a noteworthy 16.52 percent. Indonesia's labor productivity peaked in 2019, reaching an impressive 11.84. In contrast, Indonesia's lowest level of labor productivity was recorded in 2001, at a mere 4.38. In the meantime, it is worth noting that the peak of Indonesia's government health expenditure was reached in 2019, totaling 8.67.

In contrast, the lowest point in expenditures in the Indonesian context was recorded in 2010, at a relatively modest 3.91. The highest level of Indonesia's government expenditure on education was in 2016, at a noteworthy 21.21. In contrast, the lowest level of educational expenditure in Indonesia was recorded in 2001, at a tiny figure of 11.59. The standard deviation, a statistical measure quantifying the dispersion of observed values around their mean, indicates that labor productivity exhibits the greatest variability among the variables analyzed. At the same time, health expenditure demonstrates the utmost stability.

**Table 2**  
**Summary Statistic of Variables**

	Labor Productivity	Government Health Expenditure	Government Education Expenditure
Mean	8.422223	5.389743	16.62592
Maximum	11.84327	8.677219	21.21980
Minimum	4.385334	3.914953	11.59389
Std. Dev.	3.016013	1.715175	2.362905
Observations	19	19	19

### Unit Root Test

Unit root testing is critical in time-series analysis for determining the integration properties of time series (Hsiao, 2007; Baltagi, 2021). This study uses the Augmented Dickey-Fuller test (ADF) method (Dickey & Fuller, 1981) and the Phillips-Perron (PP) unit root test. ADF test employs a lag length based on the Schwarz Criterion (SC), and the PP test uses Newey-West for three types of equation models: the intercept model, the trend-and-intercept model, and the model without trend and intercept (slope) (Phillips & Perron, 1988). ADF and PP tests test the null hypothesis that a series contains a unit root against the alternative that the series is trend stationary. Time series stationarity tests consider the null hypothesis that a series is trend stationary against the alternative that it contains a unit root.

**Table 3**  
**Unit Root Test Result**

Variable	Augmented Dickey-Fuller				Phillips-Perron			
	Level		First Difference		Level		First Difference	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
Labor Productivity	-1.178751	0.6579	-2.312993	0.1792	-0.753415	0.8081	-2.301099	0.1825
Government Health Expenditure	0.025998	0.9494	-3.930621	0.0092	-0.142940	0.9301	-3.965029	0.0086
Government Education Expenditure	-3.218246	0.0356	-5.434309	0.0006	-3.222258	0.0354	-8.879185	0.0000

**Table 4**  
**Unit Root Test Result at Level**

Variable	Augmented Dickey-Fuller			Phillips-Perron		
	Intercept	Trend and Intercept	Slope	Intercept	Trend and Intercept	Slope
Labor Productivity	-1.178751	-1.616830	0.868413	-0.753415	-1.362149	1.909913
Government Health Expenditure	0.025998	-1.206848	1.468523	-0.142940	-1.356934	1.356317
Government Education Expenditure	-3.218246	-3.735052	0.371661	-3.222258	-3.733293	0.777801
Critical Values	Augmented Dickey-Fuller			Phillips-Perron		
	Intercept	Trend and Intercept	Slope	Intercept	Trend and Intercept	Slope
1% Level	-3.886751	-4.616209	-2.708094	-3.857386	-4.571559	-2.699769
5% Level	-3.052169	-3.710482	-1.962813	-3.040391	-3.690814	-1.961409
10% Level	-2.666593	-3.297799	-1.606129	-2.660551	-3.286909	-1.606610

The test results presented in Tables 3 and 4 indicate that labor productivity and health expenditure are statistically significant in the ADF and PP tests, considering the intercept, trend, and slope models. These absolute values are smaller than the corresponding absolute critical value ( $\alpha$ ) specified in the Mac Kinnon table. In the context of education expenditure, the absolute values of the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) statistics obtained from the intercept, trend, and slope testing models exceed the absolute critical value ( $\alpha$ ) specified in the MacKinnon table. In addition, the probability value for the education expenditure is statistically significant at the 5% confidence level. Consequently, based on the outcomes of the zero-order unit root test, it can be inferred that labor productivity and health expenditure support the null hypothesis ( $H_0$ ). In contrast, education expenditure rejects the null hypothesis ( $H_0$ ).

To mitigate the presence of unit root issues, the investigated variables are subjected to the ADF and PP unit root tests in first differences. Assessing stationarity in level data involves using several models, including intercept-only, trend-only, and intercept-and-slope models. For this purpose, the zero-order ADF test is applied to the preceding level data. The table below presents the unit root test results at the first difference level (first order). It indicates a variation in the significant level of the probability values, ADF and PP statistics, and the critical value ( $\alpha$ ) for all variables. The results of the unit root test indicate that the absolute values of the ADF and PP statistics exceed the absolute critical values provided in the MacKinnon table.

The results imply that all variables are stationary, meaning they no longer have a unit root of order 1. In addition to the point above, the stationary condition is further supported by the statistical probability values from the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for all exchange variables, which are significant at the 5% level ( $\alpha = 0.05$ ). Upon doing the first-order augmented Dickey-Fuller (ADF) differencing test, it was seen that all variables, after undergoing the differencing procedure via the first-order ADF and Phillips-Perron (PP) tests, no longer exhibit unit roots. Consequently, the null hypothesis ( $H_0$ ) is rejected, indicating that all the data used is stationary. Therefore, assessing the stationarity of the data at a higher degree of differentiation is unnecessary.

**Table 5**  
**Unit Root Test Result at the First Level of Difference**

Variable	Augmented Dickey-Fuller			Phillips-Perron		
	Intercept	Trend and Intercept	Slope	Intercept	Trend and Intercept	Slope
(D) Labor Productivity	-4.834065	-4.807036	-5.000600	-4.933710	-5.238792	-5.117279
(D) Government Health Expenditure	-8.262325	-7.958144	-8.553160	-8.321897	-8.012142	-8.616117
(D) Government Education Expenditure	-4.925700	-4.821223	-5.046308	-13.92964	-13.16757	-14.09765
Critical Values	Augmented Dickey-Fuller			Phillips-Perron		
	Intercept	Trend and Intercept	Slope	Intercept	Trend and Intercept	Slope
1% Level	-3.920350	-4.807036	-2.717511	-3.920350	-4.667883	-2.717511
5% Level	-3.065585	-4.807036	-1.964418	-3.065585	-3.733200	-1.964418
10% Level	-2.673460	-4.807036	-1.605603	-2.673460	-3.310349	-1.605603

### Cointegration Test

The Johansen test is used to determine whether the equation is cointegrated. If the equation is cointegrated, the estimated equation exhibits long-term balance (Greene, 2008). However, before testing Johansen cointegration, the lag length must be optimized using AIC and SC, which indicate the optimal lag length (Anderson et al., 1998). As presented in Table 6, based on the AIC, the order test results for the variables used indicate a second-order vector autoregression (VAR), although the SC magnitude indicates that the ideal lag is first-order. Compared to AIC, SC is used to pick a lower-order model. The second order was chosen since the closing time is comparatively longer (19 years of observation).

**Table 6**  
**Criteria for Determining Order**

Lag	LogL	L.R	FPE	AIC	S.C	HG
0	-103.3586	NA	54.57355	12.51277	12.65981	12.52739
1	-51.57748	79.19460*	0.365323	7.479703	8.067854*	7.538167
2	-39.93960	13.69162	0.304694*	7.169365*	8.198628	7.271676*

Information:

\* Indicates the optimum number of lags based on the selection criteria

LR: Sequential modified LR test statistics (each test at 5% level)

FPE: Final prediction error HQ: Hannan-Quinn information criterion

AIC: Akaike information criterion

SC: Schwarz information criterion

The next step is to perform a cointegration test using the Johansen method (Greene, 2008) after determining the optimal latency length based on the preceding criteria table. These are the output results from EViews for the Johansen cointegration test, which assumes linear deterministic trends (intercept and trend). Following the Johansen cointegration test, if the trace statistic or the maximum eigenvalue statistic exceeds the 5% critical value, the test results indicate a cointegration relationship, indicating long-term equilibrium (Table 7).

**Table 7**  
**Johansen Cointegration Test Based on Trace Statistics**

Hypothesized No. of CE(s)	Eigenvalues	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.815689	55.68396	35.01090	0.0001
At most 1*	0.773802	28.62590	18.39771	0.0013
At most 2*	0.261233	4.844359	3.841465	0.0277

Information:

\* Indicates rejection of the hypothesis at the 5% confidence level

Trace indicates three cointegration equations at  $\alpha = 5\%$

Trend assumptions: Deterministic trend (Trend and intercept)

Series: LP, GEE, GHE

SC: Schwarz information criterion

Lag interval: 1 to 1 (in first differences)

Based on trace statistics exceeding the 5% critical value, a cointegration test at the 95% confidence level is constructed. At the 95% confidence level, the results of the Johansen cointegration test based on max-eigenvalue statistics indicate one type of cointegration equation.

**Table 8**  
**Johansen Cointegration Test Based on Max-Eigen Statistics**

Hypothesized No. of CE(s)	Eigenvalues	Max-Eigen Statistics	0.05 Critical Value	Prob.**
None *	0.815689	27.05806	24.25202	0.0207
At most 1*	0.773802	23.78154	17.14769	0.0047
At most 2*	0.261233	4.844359	3.841465	0.0277

Information:

\* Indicates rejection of the hypothesis at the 5% confidence level

Trace indicates three cointegration equations at  $\alpha = 5\%$

Trend assumption: Deterministic trend (Trend and intercept)

Series: LP, GEE, GHE

SC: Schwarz information criterion

Lag interval: 1 to 1 (in first differences)

### Short Run and Long Run Results

Overall, the study's findings suggest that the impacts of health and education expenditures on labor productivity differ between the short and long term, as shown in Table 9. These findings demonstrate that only health expenditure plays a significant role in short-term labor productivity. In contrast, in the long run, health and education expenditures positively and significantly impact labor productivity. Based on Table 9, the coefficient regressions are as follows. Coefficient of the constant = 0.525;  $\beta_1 = 0.469$  (health);  $\beta_2 = 0.038$  (education). As such, the time regression results in the short-term is written as follows:

$$LP = 0.525 + 0.469GHE + 0.038GEE.$$

Based on the long-run regression, health expenditure has a significant positive effect on labor productivity, whereas education expenditure has no significant effect. The coefficient of constant = -6.206;  $\beta_1 = 0.674$  (health);  $\beta_2 = 0.661$  (education).

Therefore, the long-run regression result is found below:

$$LP = -6.206 + 0.674GHE + 0.661GEE.$$

**Table 9**  
**Short-term and Long-term Regression Results**

Variable	Coefficient	<i>t</i> -statistics	Prob	Conclusion
Long-term:				
Constant	-6.206	-1.795	0.091	Insignificant
GHE	0.674	2.154	0.046	Significant
GEE	0.661	2.909	0.010	Significant
<i>Adj. R</i> <sup>2</sup>	0.531	-	-	
<i>F</i> -statistics	11.219	-	-	
Short-term:				
Constant	0.525	0.110	4,770	Insignificant
DGHE	0.469	2.855	0.012	Significant
DGEE	0.038	0.777	0.449	Insignificant
<i>Adj. R</i> <sup>2</sup>	0.277	-	-	
<i>F</i> -statistics	4.262	-	-	
Prob ( <i>F</i> -statistic)	0.034	-	-	

### Discussion

In the long term, the coefficient on the constant is -6,206, indicating that if government expenditure for the health and education sectors remains constant, then productivity power Work experience will decline by 6,206 units. The adjusted coefficient of determination (*Adjusted R-squared*) is 0.531, indicating that health expenditure and education expenditure explain approximately 53.1% of the variation in labor productivity. Other variables not included in this study explain the remaining 46.9%. The *F test* is used to evaluate if the independent variables simultaneously have a significant impact on the dependent variable (Sureiman & Mangera, 2020). The result demonstrates that *the F-statistic* of 11.219, suggesting that health and education expenditures jointly have a significant impact on labor productivity.

The allocation of funds towards health expenditures and education expenditures has a substantial impact on labor productivity in Indonesia over an extended period. From 2001 to 2019, *the t-statistics* were 2.154, with a corresponding *p-value* of 0.046. Additionally, the regression coefficient was 0.674. According to Prasetyo et al. (2019) and Phiri and Mbaleki (2022), the well-being of human resources personnel will significantly impact the amount of productivity attained within a nation.

Consequently, this element will influence the per capita income of the population, thereby affecting society's overall welfare. According to Ye and Zhang (2018), augmenting expenditures on healthcare services can enhance the quality of services offered to the community. Consequently, improvements in life expectancy, social well-being, and overall societal security can be observed. Typically, those with better health conditions exhibit higher work productivity and can sustain their performance for longer periods. The impact of health expenditure on labor productivity is 0.674, indicating that a one percentage point increase in health expenditure as a proportion of overall government expenditure is associated with a 0.67% rise in labor productivity.

This study's findings are consistent with those of earlier researchers who discovered that healthcare expenditures had a favorable impact on labor productivity (Al-Zyoud et al., 2021; Phiri & Mbaleki, 2022; Ali et

al., 2022). According to Ye and Zhang (2018), increased funding for the health sector can improve public health, which in turn can increase labor productivity. According to Baharin et al. (2020), improved worker health conditions increase productivity. According to Chang et al. (2022) and Sahnoun and Abdennadher (2022), health may be regarded as human capital. As a result, investment in the health sector can help boost productivity and overall well-being in the context of economic growth. Furthermore, Duggan et al. (2019) found that boosting health expenditures through health insurance has a substantial positive effect on labor productivity.

In the long run, education expenditures have a positive and significant effect on labor productivity in Indonesia, with a *t-statistic* of 2.909 (*p-value* = 0.010) and a regression coefficient of 0.661. The finding implies that each percentage point improvement in education expenditure is associated with a 0.661% gain in labor productivity over time. According to Ngutsav and Akaakohol (2018), education expenditure will improve learning chances at all levels of education, particularly for poor students. Such an improvement would also increase educational quality and optimize resource utilization across all economic sectors. Furthermore, Wahab and Kefeli (2017) argued that education generates human resources, which measures the extent to which national revenue output might develop in proportion to physical capital contribution to the economy.

Similar findings were obtained in Yusri's (2022) study, which indicated that growth in labor productivity depends on expertise and training. Educational opportunity was found to be the primary source for enhancing these abilities. According to Phiri and Mbaleki (2022) and Magableh et al. (2022), investment in education enriches human resources, thereby increasing labor productivity by providing skills, fostering innovation, and boosting labor mobility.

There were slight differences observed between the short-run regression results and the long-run regression findings. In the immediate timeframe, it is observed that solely health expenditure has a positive and statistically significant impact on labor productivity in Indonesia. The coefficient value, also known as the *adjusted R-squared*, of 0.277 indicates that variables related to health and education expenditure can account for a certain degree of variation in productive power. The work component accounted for 27.71% of the total, while the remaining 72.3% was attributed to other variables omitted from this study. The obtained *F-statistic* of 4.262 indicates that both health and education expenditures substantially affect labor productivity in Indonesia over the analyzed period.

The regression coefficient for health expenditures is 0.469, indicating a positive influence. The result suggests that a 1% decrease in education expenditure over a certain period will lead to a 0.469% increase in labor productivity. The influence of healthcare expenditure on labor productivity can vary depending on a range of factors, including the economic environment and preexisting healthcare systems. In the short term, elevated health expenditure may adversely affect labor productivity by diverting resources that could otherwise be allocated to investment in sectors more directly associated with economic productivity, such as education or infrastructure (Sahnoun & Abdennadher, 2022). The assessment of the degree to which Indonesians possess sufficient access to healthcare services is significant. Insufficient access to healthcare among a significant portion of the population has adverse consequences for labor productivity by hampering the effective management of preventable or treatable diseases. Furthermore, the current findings reinforce several studies that have already provided evidence supporting this claim. Engaging in health-conscious expenditure practices can have a favorable impact on labor productivity.

Piabuo and Tieguhong (2017) conducted a study that revealed a positive correlation between healthcare expenditure and a country's Gross Domestic Product (GDP). They observed that rising healthcare expenditure increases the country's GDP. Conversely, a decrease in healthcare expenditures is associated with a decrease in GDP. If the government ensures sufficient health services, it can lead to improved health outcomes and increased productivity among individuals, enabling them to work consistently for longer durations. Consequently, this can help enhance energy levels and job efficiency. Individuals with higher incomes tend to work longer hours, increasing their productivity and ultimately leading to higher profitability and income. An alternative explanation for the positive correlation between educational attainment and work productivity is that individuals with better health have a greater capacity to be productive in their work, leading to higher incomes (Phiri & Mbalek, 2022). This increased income can enable individuals and governments to engage in profitable investments and promote overall well-being (Ezaji et al., 2019; Sahnoun & Abdennadher, 2022; Chang et al., 2022).

During the specified time frame, the allocation of funds to education in Indonesia does not significantly affect labor productivity. Yusri (2022) posited that substandard secondary education might detrimentally affect production, as governmental investments in tertiary education translate into important skill acquisition.

Acquiring knowledge and skills through education is a strategic and enduring investment that may require a significant duration to provide tangible effects on an individual's productivity (Brunello et al., 2016; Phiri & Mbalek, 2022). According to Ziberi et al. (2022) and Li et al. (2023), if education expenditure is allocated solely to physical infrastructure or is not effectively used to enhance the quality of teaching and curriculum, the effect on labor productivity will be negligible.

Furthermore, it is worth noting that if the education system fails to equip students with the necessary skills that align with the requirements of the job market, there is a possibility that there will be limited growth in labor productivity within a short timeframe (Wahab & Kefeli, 2017; Marconi, 2018; Yusri, 2022). In addition, Marconi (2018) presents evidence supporting the idea that education plays a crucial role in enhancing individual productivity. The idea is primarily achieved by augmenting an individual's capacity to acquire knowledge through practical experience or on-the-job training. Furthermore, education has been found to generate positive externalities on productivity, particularly among individuals who have surpassed a certain age threshold (Ziberi et al., 2022).

## **Conclusions, Limitations, and Suggestions**

### *Conclusions*

The purpose of this research is to determine whether health and education expenditures in Indonesia significantly affect labor productivity. Based on the findings of this study, the following key points can be deduced. Health expenditures have a substantial impact on labor productivity, both in the short and long run. The results demonstrate the expeditious and favorable impact of healthcare expenditures in addressing pressing health issues and mitigating disease-related work absenteeism.

Furthermore, these examples illustrate the progressive accumulation of benefits resulting from investments in public health, such as improved overall well-being, reduced burden of long-term illnesses, and increased longevity. Likewise, it can be shown that the variable denoting expenditure on education does not demonstrate a statistically significant influence in the immediate term. Nevertheless, over time, it has been observed to significantly affect workforce productivity. In the near term, the observed occurrence can be attributed to the time lag required for the impact of education on productivity to become evident, making the results less noticeable in the immediate term. Over time, this phenomenon exemplifies the cumulative benefits of education in augmenting the labor force's talents and knowledge, leading to increased productivity.

Several recommendations are made to policymakers, including prudent distribution of funds, improvement of service quality, a focus on increasing expenditures and improving the quality of health and education services, and continuous monitoring and evaluation to ensure the provision of funds. The allocated funds are utilized to enhance community productivity and quality of life. In addition to health and education expenditures, it is essential to consider unemployment rates, infrastructure, and employment policies as factors affecting labor productivity. Thus, the results imply that government expenditures on education benefit society only in the long term.

### *Limitations*

This study has several limitations. The first limitation is the analysis period spanning 2001 to 2019, which excludes more recent developments, and the small sample size may reduce the statistical power of the resulting predictors. Second, the time series regression approach is limited, as it relies on the assumption of structural stability and does not explicitly account for potential structural changes, such as policy shifts in education and health. Third, the study's generalizability is limited to the Indonesian context, and the national-level analysis may obscure regional differences.

### *Suggestions*

Based on the empirical findings, policy recommendations should differentiate between short-term and long-term priorities. Since health expenditure has a positive and significant effect on labor productivity in both the short and long run, the government should prioritize the effectiveness of health spending as an immediate means to enhance productivity. This can be achieved by strengthening primary health care, expanding preventive health programs, improving occupational health services, and ensuring that public health expenditure directly addresses workers' health-related constraints, such as illness, absenteeism, and reduced working capacity. The focus should not only be on increasing the health budget but also on improving the quality of health service delivery, particularly for working-age populations.

In contrast, education expenditure significantly influences labor productivity only in the long run. Therefore, education policy should be viewed as a long-term investment in human capital rather than a short-term productivity tool. The government should enhance the quality of education spending by prioritizing teacher effectiveness, vocational training, curriculum relevance, digital skills, and aligning educational outcomes with labor market needs. This alignment is crucial because education spending will be more effective in boosting labor productivity when it produces skills that are relevant to industry demands. The finding that education expenditure is insignificant in the short run indicates that merely increasing the education budget is insufficient; the allocation must focus on programs that improve learning outcomes, practical skills, and employability.

Moreover, because long-term results show that both health and education expenditures significantly affect labor productivity, the government should integrate health and education policies into a broader human capital development strategy. Health programs should ensure that workers are physically and mentally capable of productive work, while education programs should equip them with the skills and knowledge required by the labor market. This integrated policy approach aligns with the necessity to enhance the quality and effectiveness of public spending in Indonesia, as highlighted in the Indonesia Public Expenditure Review. Therefore, the main implication of this study is that improving labor productivity requires not only increased public spending but also better-targeted, better-coordinated, and outcome-oriented expenditures in the health and education sectors.

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