The Effect of Human Capital Expenditure on Labor Productivity in Central Java Province

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Abstract. Education and health are two essential aspects in improving the quality of human capital because higher education and good health make workers more productive. This study aims to estimate the direction and magnitude of the influence of human capital spending on labor productivity in Central Java Province in 2013–2019 using panel data regression using the Fixed Effects Model (FEM) approach and applying the chain rule method. The results of this study indicate that education spending positively affects the average length of schooling (RLS), and health spending positively impacts life expectancy (AHH). Then, RLS and AHH positively affect labor productivity in Central Java Province. Thus, it is proven that this study has a chain rule. The government expected to evaluate the use of education and health expenditure budgets. So that the RLS can be high and the AHH is also high.

Keywords: Education Spending · Health Spending · RLS · AHH · Labor Productivity · Panel Data · Chain Rule

1 Introduction

Economic development is inextricably linked to the role of humans, who serve as labor, development inputs, and consumers of development outcomes. Employment is a fundamental aspect of human life because it encompasses social and economic dimensions. One of the most important goals of economic development is to provide enough jobs to keep up with the labor force growth, which is outpacing the growth of employment opportunities. The most fundamental issue in Indonesian employment is the availability of job opportunities. Unemployment will result from an imbalance between the increase in the working-age population and the availability of job opportunities (Pangastuti 2015).

According to Table 1, the working population, GRDP, and labor productivity are expected to rise between 2017 and 2020. The fall began only in 2020 due to the Covid-19 epidemic, which caused a decrease in the mobility of products and services and increased layoffs, resulting in lower economic activity.

Labor productivity is intimately tied to education and health, both of which are components of human capital. The average length of schooling (RLS) is defined as the number of years spent in formal education by inhabitants. It can assess the quality of community education in a particular area. Meanwhile, Life Expectancy (AHH) is the

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average year of life that a person will still survive after attaining a specific age, in a particular year, under a mortality condition prevalent in the community, such that AHH can be used as a health measure.

RLS in Central Java Province was 7.45 years from 2013 to 2019, implying that citizens of Central Java Province aged 25 and up studied for 7.45 years, or equivalent to elementary school graduates (SD).). People with a low level of education will find it challenging to advance in their careers (Yuliani, 2020). On the other hand, the AHH in Central Java Province is 74.56, which is already high.

Government funding for education and health is necessary to support these two areas. Expenditures on education and health care are investments because, like investments in buildings or land, they will yield future returns. Investing in education, training, and health will improve a person's health and knowledge, resulting in increased production and income. Farah and Sari (2014).

Sumber: Ministry of Finance, Directorate General of Fiscal Balance (DJPK).

According to Table 2, the Central Java Provincial government's education budget has increased yearly. The constitution requires the state to prioritize education spending at least 20% of the APBN/APBD. This decision is expected to lessen the community's burden and cost of education, which is perceived to be increasing.

The district/city authority of Central Java Province has set aside at least 20% of the APBD money for education. For example, Sidoarjo Regency contributes 43.8% of its APBD to schooling, whereas Pemalang Regency allocates 47.8% of its APBD to education. Furthermore, Salatiga City has executed this legislation by giving education 34% of APBD revenues. (Universitas Pendidikan Indonesia, 2017).

Table 1. Workforce, GDP, and Productivity in Central Java Province from **2017 to 2020**

Tahun	**Workforce**	**PDRB**	**Productivity**
	(Person)	**(Million Rupiah)**	**(Million Rupiah Per Person)**
2017	17.186.674	1.172.794.520	68,24
2018	17.413.869	1.268.261.170	72,83
2019	17.602.917	1.360.960.130	77,31
2020	17.536.935	1.347.922.690	76,86

Source: BPS Jawa Tengah

Table 2. Education and health spending in Central Java Province in 2017–2020 (Billion Rupiah)

Tahun	**Shopping for Education**	**Shopping for Health**
2017	5.203,80	2.401,34
2018	6.402,28	403,07
2019	7.115,77	1.907,32
2020	7.389,84	2.129,04

According to the preceding description, labor productivity is impacted by human capital as measured by Life Expectancy (AHH) and Average Years of Schooling (RLS), with AHH influenced by health spending and RLS influenced by education spending. This study tries to assess the direction and amount of the impact of human capital spending on labor productivity in Central Java Province, using chain rules.

2 Review of the Literature

Datta, Guhrrie, and Wrifht (2005) discovered in 2005, using the Ordinary Least Squares (OLS) approach, that the intensity of industrial capital, economic growth, and workforce performance influenced labor productivity in 132 manufacturing enterprises in the United States. In West Sumatra Province, we discovered in 2006 that worker pays positively affected worker productivity. However, working time allocation harmed labor productivity. Male workers are more productive than female workers on average. Labor productivity is unaffected by age, education level, dependents, or work experience (Akmal, 2006). Meanwhile, Hasanah and Widowati (2011) discovered that age, experience, and gender favored worker productivity in the kretek house industry sector in Segoroyoso Village, Pleret District, and Bantul Regency, whereas education level had no effect.

Ramayani (2012) discovered that education, health, government investment, and private investment all impacted labor productivity in Indonesia. Meanwhile, education, health, government investment, and private tourism all have a favorable impact on labor productivity in Indonesia. Meanwhile, Nainggolan, Purwoko, and Yuliasro (2012) discovered that the harvester's age and the number of dependents in the family substantially impact output.

Adhadika (2013) also investigated the impact of education, earnings, incentives, social security, and job experience on worker productivity in Semarang. According to the findings, education, pay, incentives, and job experience all favored worker productivity. Workers with social security have better average output than workers without protection. Meanwhile, earnings, work experience, and age tend to affect the shuttlecock industry's workforce productivity in Tegal City, whereas education does not affect the shuttlecock industry's workforce productivity (Herawati, 2013).

Mahendra (2014) discovered that wages, age, and work experience had a beneficial influence on the productivity of the tempe small industry in Semarang City. However, education did not affect the labor productivity of the tempe small industry in Semarang City. The average productivity of men is thus higher than that of women. Farah and Sari (2014) discovered that human capital, as evaluated by education and health level, had a positive and significant effect on production in Indonesian provinces between 1996 and 2010.

In 2014, descriptive research with a cross-sectional methodology discovered that respondents with the highest stress had high production levels and vice versa (Putri & Tualeka, 2014). Meanwhile, Sumarningsih (2014) found that while using overtime hours to speed up the project completion timeline or catch up with the schedule was advantageous, it would reduce productivity, resulting in a rise in labor expenses.

According to Mawarsari (2015), operational health assistance substantially impacted the quality of health services in Tasikmalaya City in 2015. This issue is corroborated

by the analysis's regression and correlation findings, which discovered that operational health assistance (BOK) has a favorable and significant effect on the quality of health services.

Furthermore, Firmansyah (2015) discovered that age, education, and pay all favor the productivity of the hair industry workforce in Purbalingga City using the Ordinary Least Squares (OLS) method. The three independent variables then each have a positive effect on labor productivity. Meanwhile, Idin (2016) discovered that the productivity of copra processing workers in Muna Regency was driven by training rather than education, health, or age.

Then, Ukkas (2017) discovered that education level, age, and job experience all favored the productivity of small industrial workers in Palopo City. Men have a greater average productivity level than women. This issue is influenced by female characteristics such as being physically weak. Women in the workplace tend to utilize sentiments or biological problems such as taking time off to give birth.

In the 2017/2018 school year, Alfiningsih (2018) discovered that education financing substantially impacted the quality of education at SMK SATRIA West Jakarta. If education funding is not used following the stages and procedures, the principal will not understand how to use education funding, thereby impacting educational quality.

Furthermore, Abidin (2021) discovered that the Covid-19 epidemic reduced agricultural labor productivity. The pandemic raises health risks, interrupts farm production and marketing, increases the burden of health spending, and decreases access to education and training, all of which can diminish labor productivity in the farm sector.

This study differs slightly from earlier studies. The critical distinction is in the analysis model, which employs a differential chain rule to evaluate the effect of human capital spending on labor productivity. Human capital spending is believed to affect labor productivity in this study indirectly. Human capital spending is believed to affect labor productivity in this study indirectly. Human spending will impact human capital performance as evaluated by the Average Length of School (RLS) and Life Expectancy (AHH). The version of human capital then has an impact on labor productivity.

3 Methods of Investigation

Education spending, health spending, education performance indicators, health performance indicators, and labor productivity are all variables in this study. Table 3 shows the data on the variables in this study.

We will use the chain rule in differential mathematics in this study. According to Chiang (1996), in differential, we can differentiate two or more functions, each with its own set of independent variables, including the following:

$$y = f(z) \tag{3.1}$$

According to Eq. (3.1), the value of y is determined by the value of z. The variable z is then a function of the variable x in the following step, which may be stated as follows:

$$z = g(x) \tag{3.2}$$

Table 3. Research variable

Variable	Data/Unit	Source
Shopping for education	Spending on the education function (million rupiahs)	DJPK Kemenkeu
Shopping for health	Spending on health-related services (million rupiahs)	DJPK Kemenkeu
Indicators of education	School Length on Average (years)	BPS
Indicators of health	Average Life Expectancy (years)	BPS
Productivity in the workplace	PDRB per employee (million rupiahs per person)	BPS

According to Eqs. (3.1) and (3.2), the effect of x on y equals the product of x on z multiplied by the impact of z on y can be represented as follows:

$$\frac{dy}{dx} = \frac{dy}{dz}\frac{dz}{dx} \tag{3.3}$$

The change in y (dy) in Eq. (3.3) is dependent on the change in z (dz), and the change in z (dz) is dependent on the change in x. (dx). The outcomes of two functions, f, and g, representing a plural function, are determined using Eqs. (3.1) through (3.3). (a part of a part). The chain rule is also known as the rule of numerous functions or the rule of a piece.

The chain rule was used by Jaya (2015) to examine the pattern of the relationship between education and health spending on district/city labor productivity in Central Java Province from 2007–2013. The study used regression to estimate the effect of education spending on the average Length of School (RLS), then the impact of health spending on life expectancy (AHH), and then the effect of RLS and AHH on worker productivity.

This study makes use of panel data, which is a hybrid of cross-section and time series data. The cross-section data in this study are from 35 districts/cities in Central Java Province, and the time series data is from 2013 to 2019 (six years because 2016 is not included), so the total number of samples in this study is 35 x 6 = 210.

$$RLS_{it} = \alpha_0 + \alpha_1 BP_{it} + e_{it} \tag{3.4}$$

$$AHH_{it} = \gamma_0 + \gamma_1 BK_{it} + \nu_{it} \tag{3.5}$$

$$Prod_{it} = \delta_0 + \delta_1 RLS_{it} + \delta_2 AHH_{it} + \mu_{it} \tag{3.6}$$

$$Prod_{it} = \beta_0 + \beta_1 BP_{it} + \beta_2 BK_{it} + \varepsilon_{it} \tag{3.7}$$

RLS: Average Length of School (years)
BP: Education spending (million rupiahs)
AHH: Average Life Expectancy (years)

BK: Spending on health care (millions of rupiah)
Prod: Productivity in the workplace (millions of rupiah per person)
α_0: Constant Eq. (3.4)
α_1: Equation's education expense coefficient (3.4)
γ_0: Constant Eq. (3.5)
γ_1: Equation's health spending coefficient (3.5)
δ_0: Constant Eq. (3.6)
δ_1: Coefficient of Average School Length (RLS) in Eq. (3.6)
δ_2: Life Expectancy Coefficient (AHH) in Eq. (3.6)
β_0: The product of Constant Eq. (3.7) and $\delta_0 + \delta_1\alpha_0 + \delta_2\gamma_0$
β_1: Equation (3.7)'s education spending coefficient, which is the outcome of $\delta_1\alpha_1$
β_2: The health-spending coefficient in Eq. (3.7), which is the consequence of $\delta_2\gamma_1$
e: Residual in Eq. (3.4)
ν: Residual in Eq. (3.5)
μ: Residual in Eq. (3.6)
ε: In Eq. (3.7), the residual is the product $\delta_1 e_{it} + \delta_2 \nu_{it} + \mu_{it}$
i: 1–35 (Central Java Province district/city cross-section statistics)
t: 1–6 (Data from 2013 through 2019, excluding 2016)

This study also used an F test or test to determine whether the independent variables affected the dependent variable to ensure the model's existence. The F test was only used in this study for Model 3 because Models 1 and 2 only contained one independent variable. The H0 in the F test is that RLS and AHH do not affect labor productivity when combined. If the likelihood F-statistic is, we will reject H0.

Then, on all models, a t-test must be performed to see whether the independent variables significantly affect the dependent variable, assuming that the other independent variables are constant. In each model, the H0 t-test results show that $1 = 0$ (education spending does not affect RLS), $1 = 0$ (health expenditure does not affect AHH), $\beta I = 0$; $I = 1$ & 2 (RLS and AHH do not involve labor productivity, respectively). Meanwhile, HA indicates that $\alpha 1 > 0$; $y1 > 0$; $\beta I > 0$; $I = 1$ & 2, implying that each independent variable positively affects the dependent variable in all models.

4 Results and Discussion

This study aims to assess the influence of education spending on the Average Length of Schooling (RLS), the effect of health spending on Life Expectancy (AHH), and the impact of RLS and AHH on labor productivity. From 2013 to 2019, I worked in Central Java Province and used a panel data analysis tool with the econometric model shown below:

$$RLS_{it} = \alpha_0 + \alpha_1 BP_{it} + e_{it} \tag{4.1}$$

$$AHH_{it} = \gamma_0 + \gamma_1 BK_{it} + \nu_{it} \tag{4.2}$$

$$Prod_{it} = \delta_0 + \delta_1 RLS_{it} + \delta_2 AHH_{it} + \mu_{it} \tag{4.3}$$

$$Prod_{it} = \beta_0 + \beta_1 BP_{it} + \beta_2 BK_{it} + \varepsilon_{it} \tag{4.4}$$

RLS: Average Length of School (years)
BP: Education spending (million rupiahs)
AHH: Average Life Expectancy (years)
BK: Spending on health care (millions of rupiah)
Prod: Productivity in the workplace (millions of rupiah per person)
α_0: Constant Eq. (4.1)
α_1 Equation's education expense coefficient (4.1)
γ_0: Constant Eq. (4.2)
γ_1: Equation's health spending coefficient (4.2)
δ_0: Constant Eq. (4.3)
δ_1: Coefficient of Average Length of School (RLS) in Eq. 4.3)
δ_2: Coefficient of Life Expectancy (AHH) in Eq. (4.3)
β_0: Equation (4.4) constant, which is the combination of $\delta_0 + \delta_1\alpha_0 + \delta_2\gamma_0$
β_1: Equation (4.4)'s education spending coefficient, which is the outcome of $\delta_1\alpha_1$
β_2: The health-spending coefficient in Eq. (4.4), which is the consequence $\delta_2\gamma_1$
e: Residual in Eq. (4.4)
v: Residual in Eq. (4.2)
μ: Residual in Eq. (4.3)
ε: In Eq. (4.4), the residual is the combination of $\delta_1 e_{it} + \delta_2 v_{it} + \mu_{it}$
i: 1–35 (Central Java Province district/city cross-section statistics)
t: 1–6 (Data from 2013 through 2019, excluding 2016)

The panel data regression model is estimated using three approaches: the Common Effects Model (CEM), the Fixed Effects Model (FEM), and the Random Effects Model (REM) (REM). Table 4 displays the estimation results of the panel data model.

After obtaining the CEM, FEM, and REM regression results, we must perform two tests to find the optimum panel data estimate model. First, the Chow test was used to assess which model was superior between CEM and FEM. Second, the Hausman test determines which is passable between REM and FEM.

The Chow test was used to assess which model was better for estimating panel data, FEM or CEM. The Chow test provides that if the F-statistical probability value is $>$ α, then H0 is accepted, indicating that we chose the CEM model to estimate the panel data. Meanwhile, if the F-statistics probability value is $<$ α, then H0 is rejected, meaning that we decided on the FEM model to evaluate the panel data. The Chow test findings in Table 4 demonstrate that the probability of cross-section F is less than for the three models, indicating that H0 is rejected. As a result, the Fixed Effect Model was chosen (FEM). The Hausman test was used to select the best model for estimating panel data among REM and FEM. The Hausman test stipulates that if the probability $2 > 0.05$, H0 is accepted, implying that REM is the best model for estimating panel data. However, if the likelihood is less than 0.05, H0 is rejected, indicating that FEM will be used to estimate the panel data. The Hausman test findings in Table 4 demonstrate that the probability $\chi 2$ is less than α for the three models. Hence H0 is rejected, indicating that the Fixed Effects Model was chosen (FEM).

The Fixed Effects Model is known to be the correct model for estimating panel data in this study based on the Chow and Hausman tests (FEM) results. Table 5 displays the results of the FEM regression.

Table 4. CEM, FEM, and REM Regression Results

Model 1: Dependent Variable RLS			
Variable	**Regression Coefficient**		
	CEM	**FEM**	**REM**
C	7,7772	7,2940	7,3008
BK	−5,53E-07	4,71E-07	2,60E-07
R^2	0,02	0,96	0,06
Prob *F*-Statistik	0,04	0,00	0,00
(1) Uji Chow *Cross-section F*(34,175) = 115,6863; Prob.F = 0,00 (2) Uji Hausman *Cross section random* $\chi^2(1)$ = 5,03662; Prob χ^2 = 0,0248			
Model 2: Dependent Variable AHH			
Variable	**Regression Coefficient**		
	CEM	**FEM**	**REM**
C	74,8984	74,4643	74,4652
B	−1,46E-06	4,48E-07	4,44E-07
R^2	0,01	0,99	0,08
Prob *F*-Statistik	0,15	0,00	0,00
(1) Uji Chow *Cross-section F*(34, 175) = 614,5258; Prob.F = 0,00 (2) Uji Hausman *Cross section random* $\chi^2(1)$ = 4,4931; Prob χ^2 = 0,0340			
Model 3: Productivity Dependent Variable			
Variable	**Regression Coefficient**		
	CEM	**FEM**	**REM**
C	−38,0581	−618,6055	−416,9936
RLS	18,5175	8,4478	10,1312
AHH	−0,6443	8,1477	5,2757
R^2	0,45	0,99	0,45
Prob *F*-Statistik	0,00	0,00	0,00
(1) Uji Chow *Cross-section F*(34, 175) = 217,8954; Prob.F = 0,00 (2) Uji Hausman *Cross section random* $\chi^2(2)$ = 6,365728; Prob χ^2 = 0,0415			

The F test is not required for Models 1 and 2 because they are basic regression models with only one independent variable. Table 5 shows the probability of F-statistics

Table 5. Results of FEM Regression

Model 1
$RLS_{it} = 7{,}2940 + 2{,}71\text{E-}07BP_{it}$ (0,000)*
$R^2 = 0{,}96$; F-stat = 144,8388; Prob. F-stat = 0,00
Model 2
$AHH_{it} = 74{,}4643 + 24{,}48\text{E-}07BK_{it}$ (0,000)*
$R^2 = 0{,}99$; F-stat = 603,1408; Prob. F-stat = 0,00
Model 3
$PRODit = -618{,}6055 + 8{,}4478RLSit + 8{,}1477AHH$it (0,000)* (0,000)*
$R^2 = 0{,}99$; F-stat = 380,4186; Prob. F-stat = 0,00

in Model 3 of 0.000 (less than 0.05), indicating that H0 is rejected and that RLS and AHH substantially affect labor productivity when combined.

Table 5 reveals that the t-statistical likelihood of 1 Model 1 is less than 0.05, implying that education spending substantially affects the Average Length of Schooling (RLS). Model 2 shows that health spending substantially affects Life Expectancy (AHH) because the t-statistic $\gamma 1$ probability is less than 0.05. Then, Model 3 demonstrates that the likelihood t-statistic $\delta 1$ is less than 0.05, implying that RLS significantly affects labor productivity. Because the likelihood of t-statistic two is less than 0.05, AHH substantially affects labor productivity.

R2 in Model 1 is 0.96, indicating that education spending accounts for 96% of the change in RLS, with the remaining 4% impacted by factors outside the regression model. Meanwhile, in Model 2, health spending changes account for 99% of changes in AHH, with the remaining 1% impacted by factors outside the regression model. Then, Model 3 yields an R2 of 0.99, indicating that RLS and AHH account for 99% of changes in labor productivity, with the remaining 1% impacted by factors outside the regression model.

The t-test was used to evaluate whether the independent variable had a significant individual or partial influence on the dependent variable. It is possible to determine whether each independent variable affects the dependent variable by comparing the t-statistical probability. The t-test H0 indicates that the independent variable does not affect the dependent variable. Table 6 summarizes the results of the FEM t-test.

Table 6 demonstrates that education expenditure has a considerably positive effect on RLS, health spending has a significantly positive impact on AHH, RLS has a very positive effect on labor productivity, and AHH has a highly positive influence on labor productivity.

The constant values for each region in Central Java Province were calculated based on the results of computing the constants for each area. The highest constant of Model 1 is recorded to be 10.26 in Surakarta City. This result implies that it is associated with the impact of education investment on RLS. Surakarta has the highest RLS from

2013 to 2019. The constant in Sukoharjo Regency is the highest in Model 2, implying that the influence of health spending on AHH is most significant in Sukoharjo Regency from 2013 to 2019. Furthermore, because the highest constant of Model 3 is in Cilacap Regency, labor productivity in Kudus Regency was the highest from 2013 to 2019. Kudus Regency has the most significant constant combined Model 1, Model 2, and Model 3 values of 148.66, indicating that it is related to the influence of education and health spending on labor productivity.

The education expenditure coefficient of 2.71E-07 indicates that a one million rupiah increase in education spending will enhance RLS by a very tiny amount, as will the effect of health spending on AHH, which is just 4.48E-06. The RLS coefficient of 8.4478 in Model 3 indicates that a one-year increase in the RLS will enhance labor productivity by 8.4478 million rupiahs per person. Meanwhile, the AHH coefficient of 8.1478 suggests that a one-year increase also increases labor productivity by 8.1478 million rupiahs per person. The combination of Models 1, 2, and 3 provides β_1 2.29E-06 and β_2 3.65E-06, respectively, implying that the influence of education and health spending on labor productivity is negligible when assessed using RLS and AHH.

The t-test results show that education spending has a positive effect on RLS in Central Java Province from 2013 to 2019, indicating that the findings of this study are consistent with the research hypothesis. Because of increased government funding for education, many schools have been able to develop and renovate facilities and infrastructure to support teaching and learning activities. Facilities and infrastructure that keep learning to enable students to gain more knowledge and enhance their abilities, including technical and non-technical ones, hence increasing the quality of education.

Table 6. Test results *t*

Model 1			
Variable	**Coefficient**	**Prob.**	**Conclusion**
BP	$\alpha_1 = 2{,}71\text{E-}07$	0,00	BP has a substantial impact on $\alpha = 0{,}05$
Model 2			
Variable	**Coefficient**	**Prob.**	**Conclusion**
BK	$\gamma_1 = 4{,}48\text{E-}06$	0,00	*BK* has a substantial impact on $\alpha = 0{,}05$
Model 3			
Variable	**Coefficient**	**Prob.**	**Conclusion**
RLS	$\delta_1 = 8{,}447837$	0,00	*RLS* has a substantial impact on $\alpha = 0{,}05$
AHH	$\delta_2 = 8{,}147765$	0,00	*AHH* has a substantial impact on $\alpha = 0{,}05$
Combined Model 1, Model 2, and Model 3			
Variable	**Coefficient**	**Conclusion**	
BP	$\beta_1 = \delta_1\alpha_1 = 2{,}29\text{E-}06$	*BP* has a substantial impact on $\alpha = 0{,}05$	
BK	$\beta_2 = \delta_2\gamma_1 = 3{,}65\text{E-}06$	*BK* has a substantial impact on $\alpha = 0{,}05$	

Alfiningsih (2018) discovered the same finding: education financing substantially affected the quality of education at SMK SATRIA West Jakarta in the 2017/2018 school year. If education funding is not used following the stages and procedures, the principal will not understand how to use education funding, thereby impacting educational quality.

Model 2 demonstrates that health spending has a favorable effect on AHH in Central Java Province from 2013 to 2019, indicating that the findings of this study are consistent with the research hypothesis. Government funding in the health sector, such as the Health Operational Assistance (BOK) program for health centers in each region, makes health facilities more contemporary and in line with the health concerns of the local community. On the other hand, BOK can distribute the number of healthcare experts to diverse locations, thereby improving healthcare quality. Mawarsari (2015) discovered that operational health assistance substantially impacts health service quality. This result is corroborated by the findings of the analysis, both regression and correlation, which found that active health assistance (BOK) has a favorable and significant effect on the quality of health services.

Then, according to Model 3, RLS and AHH have a beneficial influence on labor productivity in Central Java Province from 2013 to 2019. The length of a person's schooling generally indicates their level of education. The greater a person's education degree, the more significant their knowledge, experience, abilities, and social intelligence, allowing workers to become more productive and capable of solving more complicated challenges. On the other hand, high AHH in an area can boost worker productivity. The reason is that health workers can accomplish more work and be more productive than sick workers. Farah and Sari (2014) discovered the same conclusion, where human capital, as assessed by education and health level, had a positive and significant effect on production in Indonesian provinces from 1996 to 2010.

Thus, in this study, the chain rule in the difference is demonstrated, where education expenditure impacts RLS, health spending affects AHH, and RLS and AHH affect labor productivity in Central Java Province.

5 Closing

Economic development is inextricably linked to the role of humans, who serve as labor, development inputs, and consumers of development outcomes. Labor productivity is intimately tied to education and health, both of which are components of human capital. Using the chain rule, this study tries to assess the direction and amount of the influence of human capital spending on labor productivity in Central Java Province.

Panel data regression using the selected Fixed Effects Model was used to fulfill the study's aims (FEM). The validity of the effect results shows that education spending benefits the Average Length of School (RLS). Health spending, on the other hand, has a positive effect on Life Expectancy (AHH). Thus, RLS and AHH have a favorable mathematical influence on labor productivity in Central Java Province. As a result, a chain rule in this study has been established.

According to the study's findings, the government is expected to promote education by providing scholarships and other forms of aid to encourage labor productivity in Central Java Province so that more and more people can obtain a better education.

Scholarships for higher education levels are likely to extend the Average Length of Schooling even further (RLS).

The government is expected to provide health insurance to the population, health education from the lowest level of society, and equitable access to health facilities in all regions so that all levels of the organization can enjoy it, increasing the Life Expectancy Rate (AHH).

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