The Role of Health and Education in Agriculture Performance : Case Study Indonesia

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Abstract : This study examines the direction of the relationship between human capital and agriculture where education and health are indicators of human capital development in this study. For indicators of agricultural development, we focus on agriculture performance and employment in agriculture. This study uses vector analysis to see the direction of the relationship between education investment, health investment, employment in agriculture and agriculture performance. The data used is secondary data with an annual period from 2000 to 2019. We found that the Forecasting graphs of agricultural performance, health investment, and education investment appear to have an increasing trend but the trend of employment in agriculture continues to decline. The decline in employment in agriculture indicates the risk of a shortage of labor in the agricultural sector in Indonesia, if employment in agriculture continues to decline, it is feared that Indonesia will experience a shortage of human resources in the agricultural sector.

Keywords: Human Capital, Agriculture, Employment in Agriculture, Vector Analysis

JEL Classification : C01,E24,J24, J43

1 INTRODUCTION

Indonesia is the biggest archipelago country in the world. It lies on both sides of the equator in Southeast Asia. This country is very volcanic. Around 70 volcanoes are still active today. Earthquakes regularly rock the country. Floods caused by large fluctuations in a runoff between the rainy and dry seasons cause as much damage as forest fires. Indonesia is a multiethnic country. One tries to solve the problem of overpopulation through resettlement projects (called transmigration) on the outskirts of the country. The economic boom in Indonesia in the 90s was based on strong agriculture with rice cultivation, raw material industry for export, and tourism. The natural beauty in Indonesia is not only rich in nature. But also fertile land for agriculture. The agricultural sector of the archipelago is in dire need of technology because more and more food must be imported. But smart farming is just getting started. Indonesia continues to develop agricultural technology and develop modern agricultural resources to improve Indonesia's food security (Widarni & Drean,2021 ; Kamal et al,2018).

There is a law in Indonesia that guarantees free schooling for children between the ages of seven and 15. There is also compulsory education. But until the 1980s, the goal of comprehensive education for all was still a long way off. Too little is happening, especially in the countryside. Efforts are now being made to remedy the situation. At least that's what it says on paper. However, many children in Indonesia do not attend a school or only attend school briefly. Parents have to pay for school uniforms and books. Many cannot afford it at all. Many schools are also miles from the homes and villages where the children live (Hasan & Wodon,2015).

The concept of basic health services is also part of the government's health policy in Indonesia. Despite progress in a number of areas, the country still has significant shortcomings in providing health care for a large part of the population. The Puskesmas, which was established in the late 1960s, plays an important role in providing health services for the majority of the population, especially in rural areas where doctors usually have doctors. They are mainly used to provide medical care for pregnant women and young children, but also to implement prevention programs such as vaccination protection. In addition, so-called "Health Subcenters" exist at the city level, which is usually staffed by up to three nurses, and in many villages, there are also "Pos Desa", which, however, are only staffed by a certain level of medical staff. Time (Anita et al,2019 ; Febriana et al,2021) .

2 LITERATURE REVIEW

Agricultural companies use the factors of production to engage in agricultural activities for the production of crops, animals, and cultivation. Agricultural production results are realized by marketing the results obtained as a result of these agricultural activities (processing, preservation, storage). Those who do this work are called farmers. Living things have to struggle with many factors to maintain their survival. Among these factors, the first priority is meeting basic needs such as nutrition, shelter, and health. There is an indispensable standard of living for all living things we see around us, namely plants, animals and us humans. Even the smallest problems that may occur during the establishment of these standards can prevent healthy living. In this context, health is one of the most important elements for humans and all living things. If we are not able to lead a healthy life, the difficulties we are currently living can turn into a very difficult situation and this situation can directly affect the quality of life. For all these reasons, health is an indispensable priority of human life (Drean & Bawono,2021).

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. In this definition, physical and mental well-being are known aspects of health. All social welfare is a new concept that needs to be clarified. To explain this concept, it should be noted that health is not only a personal phenomenon but also has a social aspect. A prerequisite for a person's social well-being is a healthy social life. In a society where job and life security are uncertain, there is no opportunity to find a job, and the anxiety created by the injustice in income distribution cannot be eliminated, it is not possible for a person to be incomplete welfare. Disease or disease is a condition caused by abnormal structural and functional changes in tissues and cells. Generally, a person considers himself sick if the symptoms of the disease increase to a level that prevents him from functioning. E.g; According to doctors, if someone coughs, they are sick. If the cough does not prevent the person from working, the person does not consider himself sick. A person with hard, sticky, and painless glands in their neck may not think they have a health problem. However, this person may have lung cancer and will die within a few months (Widarni & Mora,2021 ; Freyermuth-Enciso et al,2016).

Education is a lifelong process for humans and brings about behavioral change. This behavior change is based on the individual's own experience. Behavioral change can be desirable, that is, in accordance with expectations and goals, or it can develop in an undesirable way. The operation of the educational process can be intentional, that is, programmed and programmed, or it can be arbitrary. Deliberate education is called formal education, and haphazard education is called informal education. To give a clearer example, education provided in places such as schools, private teaching institutions, and training centers is formal; While informal education is education obtained by individuals from their environment and is not planned and programmed. In other words, education is not only limited to learning at school (Mora & Afriani,2021 ; Bawono, S., & Wilantari, R. (2021). Education and health are two important factors in human capital. Human capital is the company's added value for its employees every day. This can be done through the effectiveness of teamwork, competence, motivation, and commitment. It can be said that the concept used in human capital is to invest in the skills, knowledge, and values of the company itself. In other words, this is referred to as the evolution of the concept of human resources. Human capital is needed by humans to work. Two important components in developing and maintaining human capital are education and health.

3 RESEARCH OBJECTIVE AND METHODOLOGY

This study uses vector analysis to see the direction of the relationship between education investment, health investment, employment in agriculture and agriculture performance. The data used is secondary data with an annual period from 2000 to 2019.

4 RESULTS AND DISCUSSION

The table below presents a summary of descriptive statistics of several variables used in this study during the period 2000 to 2019.

Table 1. Descriptive statistics of agricultural performance in USD value in January 2021, education (investment in education in USD value in January 2021), and employment in agriculture (total working population).

	AGRICULTURE_VALUE_ADDED	EDUCATION	EMPLOYMENT_IN_AGRICULTURE	HEALTH
Mean	8.48E+10	2.14E+10	4.31E+07	1.78E+10

Median	9.38E+10	2.10E+10	4.37E+07	1.84E+10
Maximum	1.42E+11	4.43E+10	4.62E+07	3.25E+10
Minimum	2.57E+10	3.68E+09	3.87E+07	3.15E+09
Std. Dev.	4.31E+10	1.36E+10	2.27E+06	1.07E+10

Based on Table 1 above, it appears that from the period 2000 to 2019, the average agricultural performance in Indonesia is very high at around 84.8 billion USD which can be seen from the mean value in Table 1. with a high level of volatility at 43.1 billion USD. With an average number of workers 43.1 million people with an average educational investment value of 21.4 billion USD, and Health investment 17.8 billion USD. To see a more detailed and careful relationship of influence, vector analysis is carried out, namely Vector Autoregressive. Before estimating using Vector Autoregressive, there are several conditions that must be met from several observed variables, namely Stationarity Test, and Optimum Lag Test.

Cointegration test to see if there is a long-term relationship between variables and a causality test to see a reciprocal relationship between variables. Estimation using the VAR model requires all variables to be stationary at the level, if the variable is not stationary at the level, the estimation is carried out using the VECM model on the condition that all variables formed are cointegrated with each other where the results are shown in Table 2 below:

Table 2. stationarity test

Method			Statistic	Prob.**
ADF - Fisher Chi-square			6.16E+01	0.00E+00
ADF - Choi Z-stat			-6.55E+00	0.00E+00
Series	Prob.	Lag	Max Lag	Obs
D(AGRICULTURE_VALUE_ADDED,2)	3.80E-03	0.00E+00	3.00E+00	1.70E+01
D(EDUCATION,2)	0.00E+00	0.00E+00	3.00E+00	1.70E+01
D(EMPLOYMENT_IN_AGRICULTURE,2)	2.00E-04	3.00E+00	3.00E+00	1.40E+01
D(HEALTH,2)	2.40E-03	1.00E+00	3.00E+00	1.60E+01

From the results of stationarity testing with Augmented Dickey-Fuller, it can be seen that at the 2nd level the difference is stationary and vector estimation uses Vector Autoregressive. It can be seen that the probability is less than 0.05 in each tested variable. After doing the stationarity test, a cointegration test was conducted to see the long-term integration between variables. If there is cointegration between variables, the estimation is made using the Panel Vector Error Correction Model (VECM) method, but if there is no cointegration, the estimation is made using the Vector Autoregressive method. Cointegration test results are shown in Table 3.

Table 3. Cointegration test results

Hypothesized		Trace	5.00E-02	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	8.23E-01	6.02E+01	4.79E+01	2.30E-03
At most 1	6.18E-01	2.90E+01	2.98E+01	6.10E-02
At most 2	3.92E-01	1.17E+01	1.55E+01	1.72E-01
At most 3	1.42E-01	2.75E+00	3.84E+00	9.74E-02

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From the cointegration result, the critical value is less than the Trace Statistics value and the Max-Eigen Statistics value which shows that there is have cointegration relationship in the variable equation so that the next method that can be used to determine the long-term and short-term relationship is the Vector Error Correction Model method.

Optimum lag test is used to determine the time period of the influence of a variable on other variables which will give optimal results. This is because changes in the movement of a variable are not directly responded to by changes in other variables, but there is still a certain grace period. Therefore it is important to know the lag length. The optimum lag test can be seen in Table 4.

Table 4. Optimum lag test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1.55E+03	NA	1.17E+70	1.73E+02	1.73E+02	1.73E+02
1	-1.50E+03	7.44E+01	2.40E+68	1.69E+02	1.70E+02	1.69E+02
2	-1.47E+03	27.18948*	9.68e+67*	167.5001*	169.2808*	167.7456*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

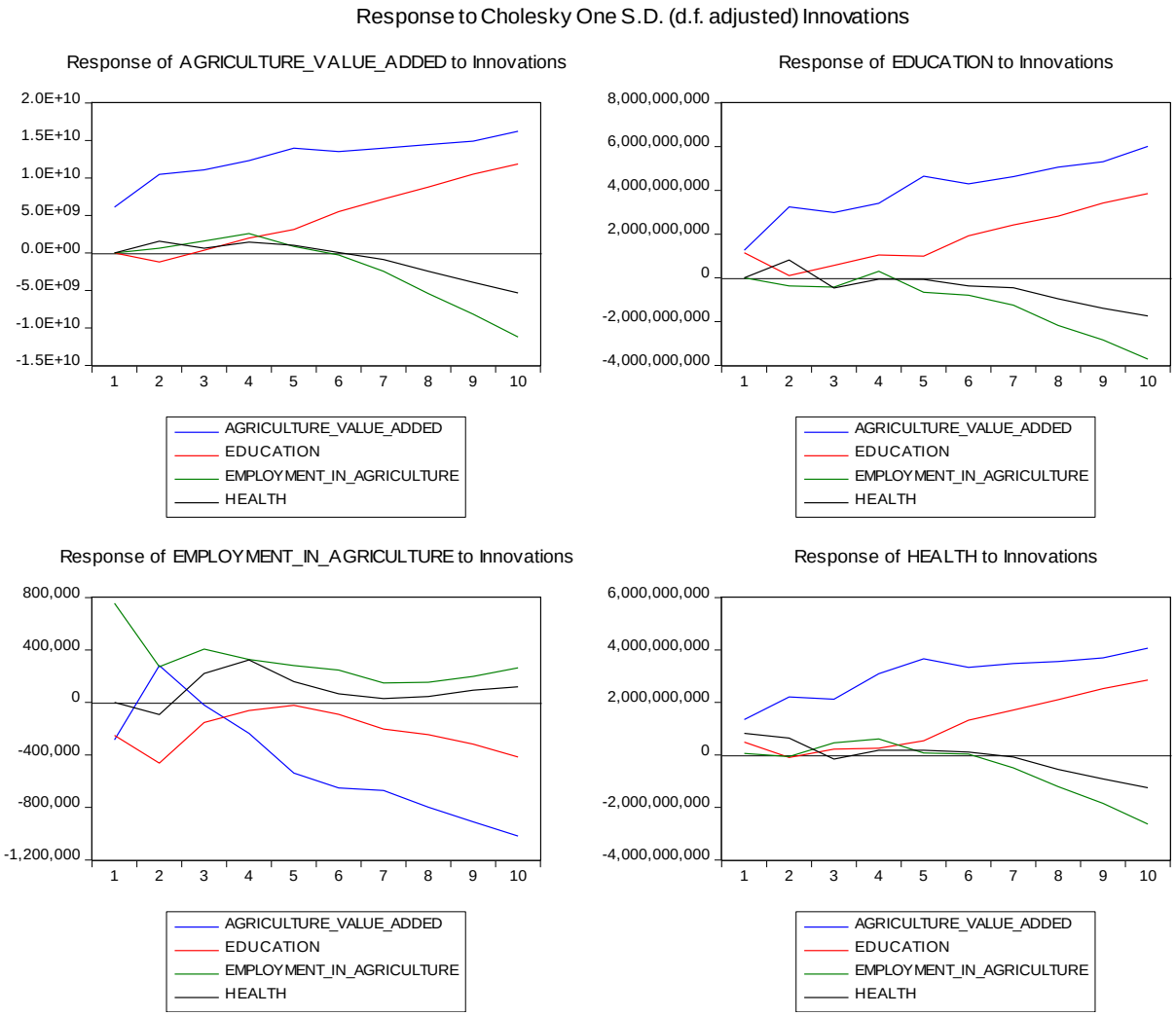
From the results of the Optimum lag test, it can be seen that the optimum lag is found in lag 2. The results of the Vector Autoregressive are shown in Table 5.

Table 5. The results of the Vector Error Correction Model estimation

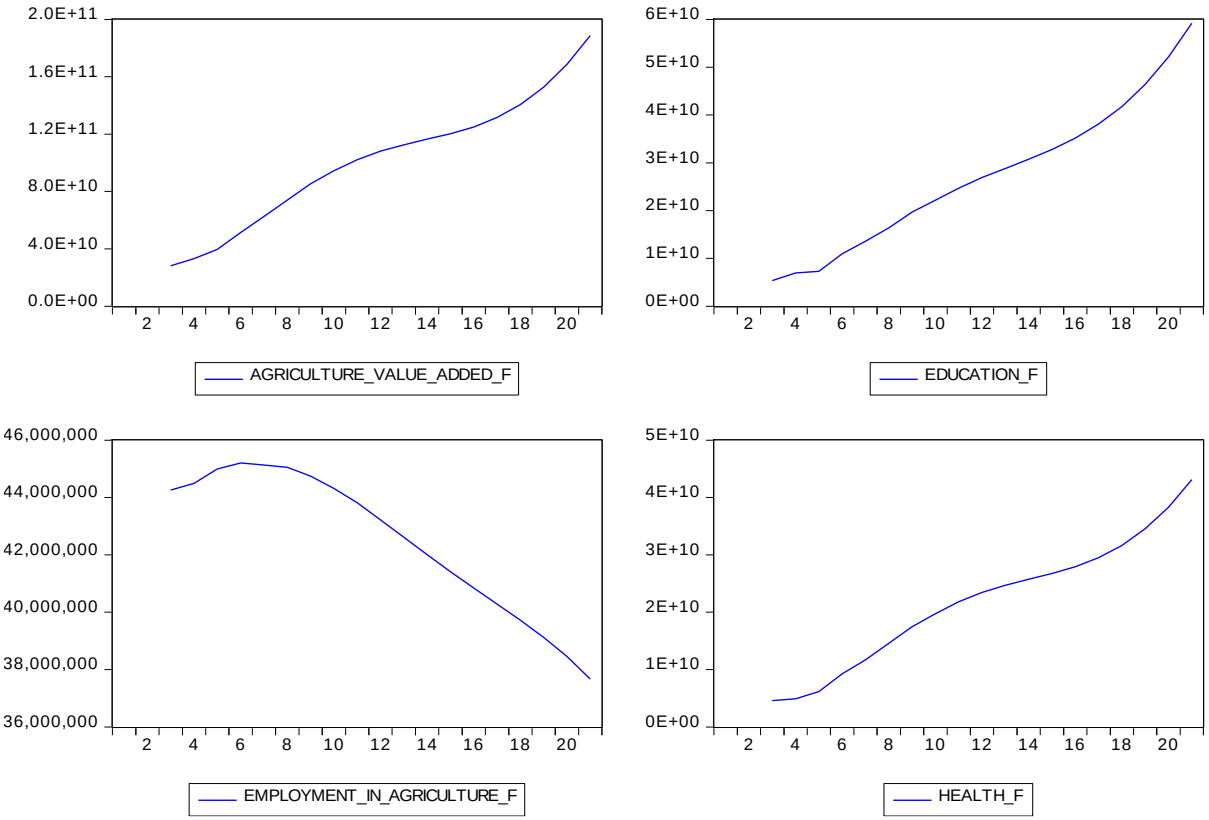
	AGRICULTURE_VALUE_ADDED	EDUCATION	EMPLOYMENT_IN_AGRICULTURE	HEALTH
AGRICULTURE_VALUE_ADDED(-1)	1.68E+00*	3.79E-01*	1.45E-04*	2.75E-01*
	-5.11E-01	-1.42E-01	-7.10E-05	-1.38E-01
	[3.29717]	[2.65873]	[2.04967]	[1.98551]
AGRICULTURE_VALUE_ADDED(-2)	-1.15E+00*	-1.98E-01*	-1.73E-04*	-1.53E-01*
	-5.80E-01	-1.62E-01	-8.00E-05	-1.57E-01
	[-1.98735]	[-1.22474]	[-2.15346]	[-0.97607]
EDUCATION(-1)	-1.70E+00	-4.47E-01*	-2.76E-04*	-4.44E-01*
	-1.22E+00	-3.40E-01	-1.70E-04	-3.30E-01
	[-1.39804]	[-1.31588]	[-1.63433]	[-1.34379]
EDUCATION(-2)	3.57E+00	1.35E+00*	4.23E-05*	9.86E-01*
	-1.51E+00	-4.20E-01	-2.10E-04	-4.08E-01
	[2.37324]	[3.21031]	[0.20301]	[2.41787]
EMPLOYMENT_IN_AGRICULTURE(-1)	6.71E+02	-5.66E+02	3.69E-01*	-1.41E+02
	-1.79E+03	-4.98E+02	-2.47E-01	-4.84E+02
	[0.37551]	[-1.13655]	[1.49233]	[-0.29239]
EMPLOYMENT_IN_AGRICULTURE(-2)	-6.03E+01	-6.73E+02	1.12E-01*	3.50E+02
	-1.88E+03	-5.25E+02	-2.61E-01	-5.10E+02
	[-0.03204]	[-1.28098]	[0.42848]	[0.68533]
HEALTH(-1)	1.88E+00	9.92E-01*	-1.12E-04*	7.79E-01*
	-1.86E+00	-5.18E-01	-2.60E-04	-5.03E-01
	[1.01484]	[1.91648]	[-0.43556]	[1.54851]
HEALTH(-2)	-2.14E+00	-1.67E+00	3.96E-04*	-8.90E-01*
	-1.74E+00	-4.84E-01	-2.40E-04	-4.70E-01
	[-1.23412]	[-3.43909]	[1.64538]	[-1.89274]
C	-1.78E+10	5.39E+10	2.41E+07	-9.77E+09
	-9.90E+10	-2.70E+10	-1.40E+07	-2.70E+10
	[-0.18082]	[1.96203]	[1.76639]	[-0.36602]
R-squared	9.88E-01	9.91E-01	9.32E-01	9.86E-01
Adj. R-squared	9.77E-01	9.82E-01	8.72E-01	9.73E-01
Sum sq. resids	3.36E+20	2.61E+19	6.44E+12	2.46E+19
S.E. equation	6.11E+09	1.70E+09	8.46E+05	1.65E+09
F-statistic	9.12E+01	1.20E+02	1.55E+01	7.71E+01
Log likelihood	-4.25E+02	-4.02E+02	-2.65E+02	-4.01E+02

Akaike AIC	4.82E+01	4.57E+01	3.04E+01	4.56E+01
Schwarz SC	4.87E+01	4.61E+01	3.09E+01	4.60E+01
Mean dependent	9.14E+10	2.34E+10	4.31E+07	1.94E+10
S.D. dependent	4.02E+10	1.29E+10	2.37E+06	1.00E+10

Based on the results of the estimated output, it can be indicated the direction of the relationship, and the significance of each variable and each period. Negatively related variables are marked (-). Significant relationships are marked with a sign (*). The value of the coefficient of determination (Adj. R-Square) shows the degree of truth of the estimate of 0.977. This means 97% accuracy of the calculation rate of the vector error correction model. Impulse Response Function (IRF) describes the response of an endogenous variable to shock that occurs in other variables in a dynamic VAR system. IRF can be used to see the effect of fluctuations or shocks from one variable on the value of another variable either now or in the future. The results of the Impulse Response Function (IRF) of the Infrastructure variable against other variables are shown by the following Impulse Response graph:



Based on the response and impulse graphs, it can be seen that each variable responds to each other since the first time period with a lag of 2. This shows that in Indonesia the three variables influence each other. To see the direction of influence can be seen in the following forecasting chart:



Based on the forecast graph, it can be seen that the growth of agricultural performance is in line with investment in education and health in Indonesia. The graph of agricultural performance, health investment, and education investment appears to have an increasing trend. However, the trend of employment in agriculture continues to decline. The decline in employment in agriculture indicates the risk of a shortage of labor in the agricultural sector in Indonesia, if employment in agriculture continues to decline, it is feared that Indonesia will experience a shortage of human resources in the agricultural sector.

5 CONCLUSION

The Forecasting graphs of agricultural performance, health investment, and education investment appear to have an increasing trend but the trend of employment in agriculture continues to decline. The decline in employment in agriculture indicates the risk of a shortage of labor in the agricultural sector in Indonesia, if employment in agriculture continues to decline, it is feared that Indonesia will experience a shortage of human resources in the agricultural sector.

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