IMPACT OF AGRICULTURE PRODUCTIVITY ON ECONOMICS GROWTH: A CASE STUDY OF ASEAN-3

Pannawadee Radinghin[a], Shania Temeña[b], and Badara Shofi Dana[c]

[a] Prince of Songkla University, Surat Thani Cumpus, 31 M.6 T.Makhamtia Amphoe Muang , Surat Tahni `8400, Thailand, E-mail : pannawadee.r@hotmail.com

[b] Department of Economics of San Carlos Downtown Campus, P. del Rosario St. Cebu City, 6000 Phillipiness, E-mail : shania.temena18@gmail.com

[c] Faculty of Economics and Business, Universitas Jember, Street Kalimantan No. 37, Kampus Tegalboto, Jember, 682121, Indonesia, E-mail :badara.dana@gmail.com

Abstract

The agricultural sector still has a large contribution to economic growth in developing countries such as ASEAN. Because the agricultural sector absorbs high labor and has a large output as a source of economic growth in developing countries. Based on the level of productivity of agriculture sector in ASEAN-3 (Indonesia, Thailand, and the Philippines), this study aims to see the contribution of agricultural sector productivity to economic growth. Variables used as a proxy for agricultural productivity are gross capital formation, agriculture value-add, employment in agriculture sector, inflation and trade openness with economic growth through real gross domestic product per capita. The use of Vector Autoregression (VAR) in this study aims to see the relationship between the agricultural sector with economic growth and the amount of agricultural productivity contribution to economic growth through impulse response function and variance decomposition. The results obtained in this study are the productivity of the agricultural sector has contributed to economic growth in ASEAN-3, where inflation and gross capital formation has the largest contribution in economic growth in Indonesia, the Philippines, and Thailand. The government policy that needs to be paid attention is about the level of price and assistance in the capital of business in the agricultural sector.

Keywords : Productivity Agriculture, Economic Growth, ASEAN-3, VAR

INTRODUCTION

The agriculture sector has a strategic position in promoting economic development in developing countries [1], [2]. Because the productivity of agriculture sector has an important role in increasing the economic growth caused by agriculture sector output become the source of economic growth [3], [2]. On the other hand, in developing countries such as in ASEAN-3 countries (Indonesia, Thailand and Philippines) agriculture sector dominates in labor absorption. This condition is caused by the majority of people working in the agricultural sector, especially people living in rural areas [4], [5]. Employment in the agricultural sector can reduce unemployment and increase per capita income. In addition, the absorption of labor can also encourage increased output that will increase economic growth. This condition is in line with the findings made by [6], [2] explains that agricultural productivity can be a factor in changes in economic growth.

In contrast to research conducted by [7] explains that the agricultural sector has no effect on economic growth. In line with the research conducted by [4], [8] were stated that the agricultural sector has a weak influence on economic growth. However, [9] explained that the agricultural sector can contribute to economic growth [1]. [1] provides confirmation that the agricultural sector can be a source in promoting economic growth.

The condition of agriculture sector in developing countries ASEAN which is the most productive country in the world in agriculture sector, this area can produce 129 million tons of rice, 40 million tons of corn, 171 million tons of sugar cane, 1.44 million tons of soybeans and 70.34 million tons cassava and can be raised again. High productivity conditions are also boosted by increased exports. This reflects the conditions in ASEAN-3 countries (Indonesia, Thailand, Philippines) which contributes greatly to economic growth through the agricultural sector. This research is supported by research done by [10], [7]. Based on this background, this study aims to see the contribution of agriculture sector seen through the absorption of labor and capital can increase economic growth in ASEAN-3 with an increase in output. The magnitude of agricultural productivity contribution to economic growth can be seen through Vector Autoregression (VAR) analysis tool using impulse response function and variance decomposition.

METHODS

The data used in this study is time series data from 1986 to 2015. In 1986 to 2015 it was used in this study to illustrate the contribution of agricultural productivity in the pre-crisis period and after the crisis that experienced a boom in the year before the crisis but decreased after a crisis. The object of research is ASEAN-3 which consists of Indonesia, Thailand, and the Philippines. In addition, the source of data as research support is obtained from the World Bank.

The specification of the research model used in this study modifies the research used by [9]

$$y_t = \alpha_0 + \alpha_1 GCF_t + \alpha_2 EM_t + \alpha_3 TOP + \alpha_4 INF_t + \alpha_5 AVA_t + \varepsilon_t \tag{1}$$

Equation (1) describes the contribution of agriculture to economic growth seen through the level of agricultural productivity. Agricultural productivity in proxy through labor and capital. The use of variable Gross capital formation and agriculture value added as a capital proxy.

Vector Autoregression (VAR) analysis tool was used in this study to assess the contribution value of agricultural productivity in promoting economic growth through Impulse Response Function (IRF) and Variance Decomposition (VD). Thus, equation (1) can be transformed into the Vector Autoregression (VAR) model.

$$y_{1t} = \alpha_{10} + \alpha_{11}y_{2t} + \alpha_{12}GCF_{3t} + \alpha_{13}EM_{4t} + \alpha_{14}TOP_{5t} + \alpha_{15}INF_{6t} + \alpha_{16}AVA_{7t} + \varepsilon_{1t} \tag{2}$$
$$GFC_{2t} = \alpha_{20} + \alpha_{21}y_{2t} + \alpha_{22}GCF_{3t} + \alpha_{23}EM_{4t} + \alpha_{24}TOP_{5t} + \alpha_{25}INF_{6t} + \alpha_{26}AVA_{7t} + \varepsilon_{2t} \tag{3}$$
$$EM_{3t} = \alpha_{30} + \alpha_{31}y_{2t} + \alpha_{32}GCF_{3t} + \alpha_{33}EM_{4t} + \alpha_{34}TOP_{5t} + \alpha_{35}INF_{6t} + \alpha_{36}AVA_{7t} + \varepsilon_{3t} \tag{4}$$
$$TOP_{4t} = \alpha_{40} + \alpha_{41}y_{2t} + \alpha_{42}GCF_{3t} + \alpha_{43}EM_{4t} + \alpha_{44}TOP_{5t} + \alpha_{45}INF_{6t} + \alpha_{46}AVA_{7t} + \varepsilon_{4t} \tag{5}$$
$$INF_{5t} = \alpha_{50} + \alpha_{51}y_{2t} + \alpha_{52}GCF_{3t} + \alpha_{53}EM_{4t} + \alpha_{54}TOP_{5t} + \alpha_{55}INF_{6t} + \alpha_{56}AVA_{7t} + \varepsilon_{5t} \tag{6}$$
$$AVA_{6t} = \alpha_{60} + \alpha_{61}y_{2t} + \alpha_{62}GCF_{3t} + \alpha_{63}EM_{4t} + \alpha_{64}TOP_{5t} + \alpha_{65}INF_{6t} + \alpha_{66}AVA_{7t} + \varepsilon_{6t} \tag{7}$$

Equations (2) through (6) are Vector Autoregression (VAR) models used in this study.

Tabel 1. Descriptive Data

Variables	Definition
y	Real Gross Domestic Product is proxy from Economic Growth
GCF	GCF = Gross Capital Formation Annual growth rate of gross capital formation based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.
EM	EM = Employment Empolyment in sector agriculture
TOP	TOP = Trade Openness
INF	INF = Inflation with proxy consumer index price
AVA	AVA = Agriculture Valuee Add Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs

FINDINGS AND ARGUMENT

The contribution of agriculture sector that is seen from agricultural productivity in encouraging economic growth in ASEAN-3 can be seen through the use of Vector Autoregression (VAR) analysis tools. Stages of testing Vector Autoregression (VAR) starts from stationary data. Stationarity test is used regularly the appropriate regression results. Thus, the stationarity test of the data used to obtain a picture of the agricultural sector relationship with economic growth appropriately. The stationarity test in this study uses Augmented Dicky Fuller (ADF) shortcuts on condition that the data can be stationary if the Augmented Dicky Fuller (ADF) probability is less than the alpha value ($\alpha = 5\%$).

Stages of data stationarity there are three stages consisting of level, first difference, and the second difference. Data is not stationary at the level, it is necessary at the next level that is the first difference. Furthermore, when the first difference level is not stationary, then the next test is done the second difference. The result of stationary data in this study shows all stationary data on the second difference for Indonesia and Thailand, while the Philippines on the first difference can be seen in Table 2.

Tebel 2 is the result of stationary data which calls for a change of stationarity level in ASEAN-3. Indonesia's level of stationarity at the second level of visible difference of the probability value of all variables is smaller than the alpha value ($\alpha = 5\%$). In line with the result of stationary level in the Thai state, the stationarity at the second level of difference with the probability value of all variables is smaller than the alpha value ($\alpha = 5\%$). Compare the results with the Philippines which in the first stage differences all the variable stationarity with a probability value that is smaller than the alpha value ($\alpha = 5\%$). The next stage after stationarity of data at each level, then forwarded by cointegration test.

Table 2. Data Stationarity

Country		Economic Growth	Gross Capital Formation	Employment	Trade Opennes	Inflation	Agriculture Value Add
Indonesia	Level	0,915	0,000*	0,901	0,027	0,001*	0,001*
	First Difference	0,006	0,000*	0,063	0,000*	0,000*	0,000*
	Second Difference	0,000*	0,012*	0,000*	0,000*	0,000*	0,001*
Thailand	Level	0,029	0,003*	0,032*	0,260	0,023*	0,000*
	First Difference	0,050*	0,000*	0,133	0,000*	0,000*	0,000*
	Second Difference	0,000*	0,000*	0,012*	0,000*	0,000*	0,000*
The Phillippines	Level	1,000	0,000*	0,786	0,538	0,711	0,000*
	First Difference	0,031*	0,000*	0,001*	0,002*	0,000*	0,000*
	Second Difference	-	-	-	-	-	-

* Significant α=5%

The cointegration Johansen test seen in Table 3 shows that long-term relationships in the agricultural sector contribute to changes in economic growth. This result is seen from the value of the critical value in the country of Indonesia is smaller than the value of trace statistics so that it implies there is a long-term relationship. The value of the critical value compared to the trace statistic value in Thailand and the Philippines also shows similar results with Indonesia.

Tabel 3. Johansen Cointegration Test

Country	Trace Statistic	Critical Value	Probability
Indonesia	411,940	95,753	0,000*
Thailand	461,196	95,755	0,000*
The Phillippines	219.370	95,654	0,000*

* Significant α=5%

The next stage is the result of the analysis in viewing the contribution of agricultural sector productivity in increasing the economic growth in ASEAN-3 through Impulse Response Function. Figure 1 is the result of impulse response function in Indonesia which shows that there is a relationship between agricultural sector productivity and economic growth. Agricultural productivity, one of which is seen from Gross Capital Formation (GFC), has contributed to boosting economic growth, where shocks from Gross Capital Formation (GFC) are responded by economic growth at the beginning of the period up to the 30th period.
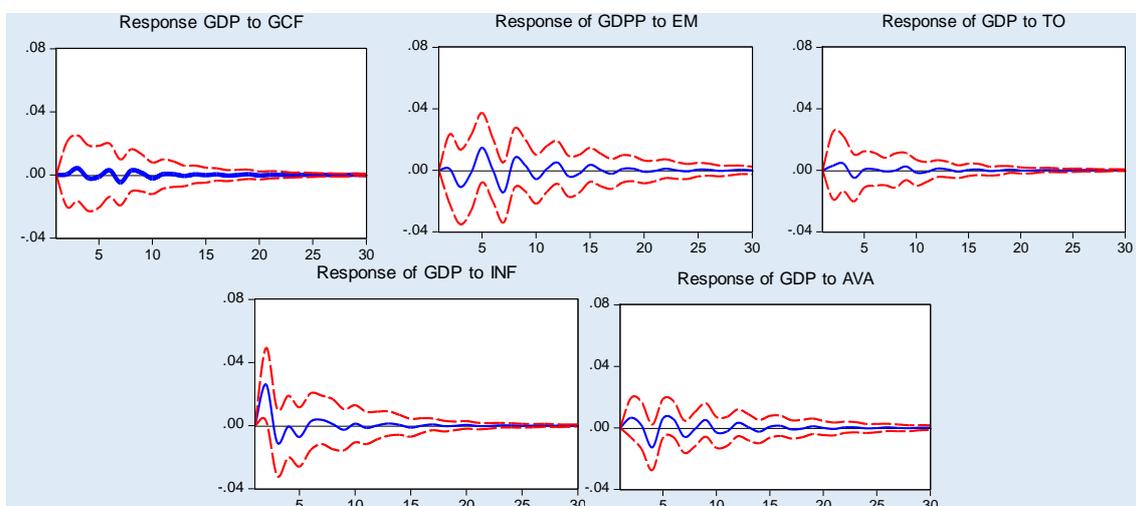

Figure 1. Impulse Respon Function in Indonesia

These results indicate that the increasing Gross Capital Formation (GFC) which is a proxy of capital can contribute to economic growth through enhanced output output. Research conducted by [9] provides the truth for the contribution of Gross Capital Formation (GFC) to economic growth. The shocks to the Agricalture Value Add (AVA) are also shown at the beginning of the period up to the 30th period. The relationship between Agricalture Value Add (AVA) with economic growth in accordance with research conducted by [11]. These results show that

the increase in Agriculture Value Add (AVA) increases the output produced so that it can contribute to economic growth. At the productivity level of agriculture sector which can be seen from the increase of labor force in agriculture sector can increase the input of agricultural sector and can contribute to economic growth. On the other hand, an increase in agricultural output could increase per capita income and contribute to economic growth. This result is in accordance with the impulse response between labor and economic growth that is visible shock from labor responded by economic growth at the beginning of the period up to the 30th period. Research conducted by [12] supports the results of the relationship between labor and economic growth. Freedom of trade in Indonesia also gives effect to the economic growth caused by the increase of trading activity. Similar results are also shown by changes in inflation will affect the productivity of the agricultural sector and then give effect to economic growth.

The result of impulse response analysis function in Thailand also shows that every variable has a relationship. The movement of Gross Capital Formation (GFC) shows in the early response of the period by economic growth up to the 30th period. This result is consistent with research conducted by [9] which explains that the capital increase seen from Gross Capital Formation (GFC) can increase output and further enhance economic growth. Similar results also occurred in Agriculture Value Add (AVA) in response at the beginning of the period by economic growth until the 30th period with this implication that the increase in Agriculture Value Add (AVA) can contribute to economic growth through increased output. This result is consistent with research conducted by [11] in looking at the relationship between Agriculture Value Add (AVA) with economic growth.
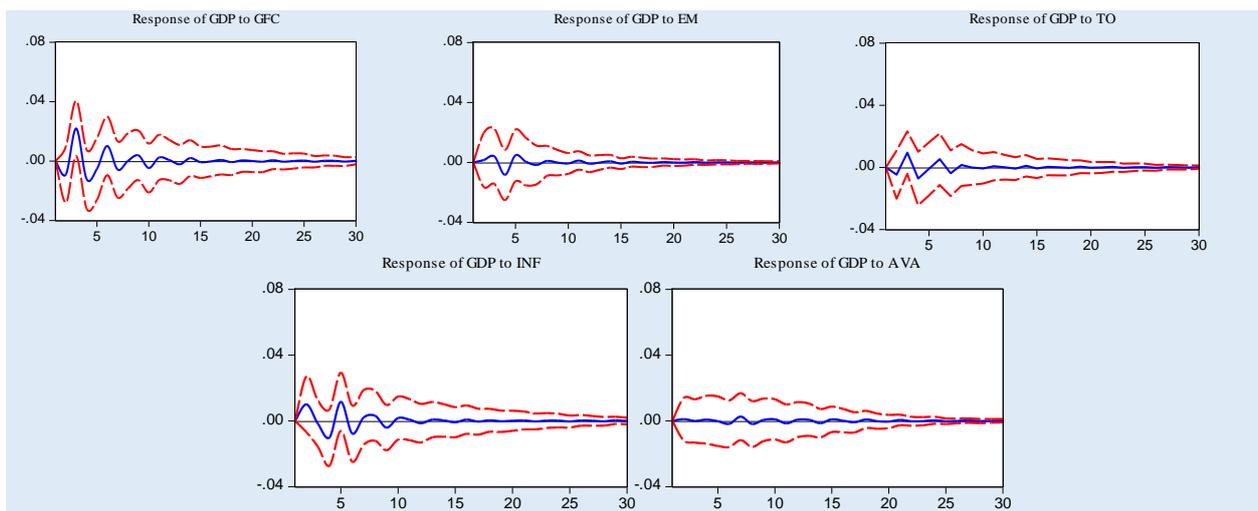

Figure 2. Impulse Respon Function in Thailand

In labor shocks also responded early in the period up to the 30th period. This result is consistent with research conducted by [12], [13] show that the agricultural sector absorbing a lot of manpower funds can provide an increase in output that can further increase economic growth. In the movement of trade openness and inflation also contributes to economic growth similar to the results found in Indonesia..
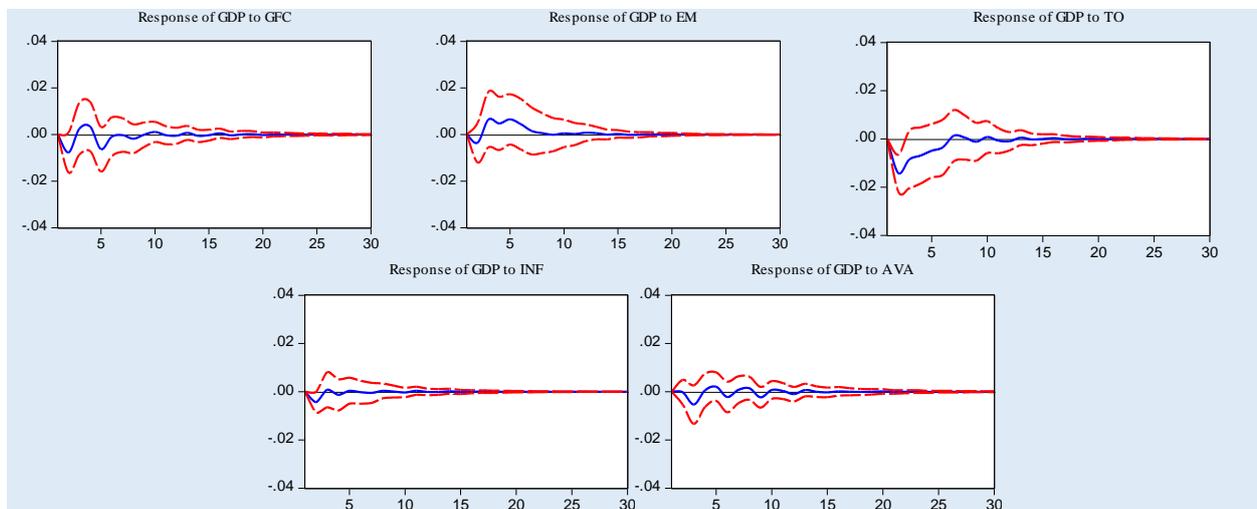

Figure 3. Impulse Respon Function in The Philippines

Impulse response function in the Philippines shows that the productivity of the agriculture sector has contributed to economic growth. Shocks on Gross Capital Formation (GFC) in early response periods by economic

growth up to the 30th period. This result is similar to that of [9] with the result that Gross Capital Formation (GFC) can increase economic growth through output in the agricultural sector due to the amount of capital. In addition, the Agriculture Value Add (AVA) also has a relationship with economic growth but its fluctuation is not the same as Gross Capital Formation (GFC) fluctuations. The initial response of the period by economic growth to the 30th period was caused by the shock of Agriculture Value Add (AVA). This condition suggests that Agriculture Value Add (AVA) contributes to economic growth.

Table 4. Variance Decompostion in Indonesia

	Variance Decomposition GDP				
Period	Gross Capital Formation	Employment	Trade Opennes	Inflation	Agriculture Value Add
1	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.003073	0.027344	0.310790	23.68380	0.336810
3	0.578872	3.753812	0.885761	25.11865	0.456456
4	0.666364	3.565804	1.545681	23.46112	0.573945
5	0.643467	9.132615	1.424363	22.92940	0.599610
6	0.865960	9.015884	1.415890	22.80740	0.798338
7	1.325671	13.17128	1.296320	20.91887	0.929347
8	1.482839	14.33133	1.268869	20.48469	0.954919
9	1.501548	14.37157	1.390277	20.37551	1.163748
10	1.589540	14.97646	1.430065	20.16524	1.192415
11	1.592440	14.95142	1.452167	20.15984	1.185247
12	1.583241	15.40162	1.465786	19.98885	1.211377
13	1.585661	15.67948	1.465607	19.94468	1.209424
14	1.584427	15.73940	1.482090	19.89341	1.214401
15	1.579394	15.96998	1.478943	19.86724	1.208309
16	1.580844	15.96273	1.483578	19.85757	1.217687
17	1.582291	16.05714	1.487995	19.83701	1.216291
18	1.581783	16.07106	1.487791	19.83346	1.224090
19	1.584514	16.08590	1.492197	19.82309	1.232373
20	1.586337	16.10428	1.491957	19.82117	1.230988
21	1.586129	16.10487	1.493020	19.81917	1.232774
22	1.585884	16.12400	1.492915	19.81461	1.233583
23	1.586032	16.12339	1.493236	19.81441	1.233627
24	1.585840	16.13382	1.493413	19.81133	1.233322
25	1.585891	16.13653	1.493381	19.81076	1.233260
26	1.585987	16.13864	1.493733	19.80960	1.233428
27	1.585923	16.14201	1.493705	19.80907	1.233470
28	1.586059	16.14181	1.493849	19.80870	1.234119
29	1.586263	16.14368	1.493912	19.80820	1.234185
30	1.586288	16.14367	1.493920	19.80823	1.234190

While the labor relations with economic growth appear to have a relationship with the response at the beginning of the period indicated by economic growth due to shocks from labor and return to normal in the period to 17. Results are different from the countries of Indonesia and Thailand, wherein shocks caused by inflation was initiated early in the period by economic growth and returned to normal in the 20th period. Similar results are also shown by trade opponents responded at the beginning of the period up to the 20th period. Conditions show that trade opponents and inflation have a low contribution to economic growth.

Further analysis in view of the magnitude of agricultural sector contributes to economic growth seen from the result of Variance Decomposition. Variance Decomposition on the Vector Autoregression analysis tool aims to see the greatest contribution of independent variables in influencing the dependent variable. In Table 4 the result of variance decomposition in Indonesia shows that inflation has the greatest contribution in influencing the productivity of agriculture sector which in turn can give influence to economic growth. The second contribution in encouraging economic growth is labor, which in this case the workforce can provide increased output in the agricultural sector. In addition, the condition of the agricultural sector in Indonesia is still a high absorbent sector of the workforce. At Gross Capital Formation (GFC) has the third contribution to increasing economic growth. Furthermore, trade openness that has contributed to economic growth after that is Agriculture Value Add

Table 5. Variance Decompostion in Thailand

	Variance Decomposition GDP				
Period	Gross Capital Formation	Employment	Trade Opennes	Inflation	Agriculture Value Add
1	100.0000	0.000000	0.000000	0.000000	0.000000
2	88.63028	4.472192	0.144325	1.195355	5.504837
3	67.84589	22.64847	0.771741	4.499597	4.194938
4	59.82172	24.37067	3.032185	5.613271	7.111681
5	56.46509	23.70921	3.535377	5.284850	10.95660
6	53.17205	25.43343	3.333352	5.807984	12.11423
7	52.48710	25.78994	3.341502	6.100042	11.95667
8	52.30247	25.63440	3.350539	6.130352	12.15729
9	51.86888	25.79374	3.316187	6.066041	12.52513
10	51.52919	26.19633	3.300533	6.028629	12.49688
11	51.37384	26.27964	3.334976	6.026424	12.47314
12	51.32029	26.26298	3.355143	6.020101	12.51550
13	51.22527	26.35279	3.348927	6.028050	12.50689
14	51.12366	26.40319	3.355513	6.044200	12.48200
15	51.08931	26.38752	3.369156	6.053585	12.48405
16	51.08287	26.37896	3.373443	6.054813	12.49352
17	51.06140	26.38251	3.372033	6.052348	12.49463
18	51.04204	26.38404	3.372169	6.053059	12.49239
19	51.03534	26.38451	3.373491	6.056921	12.49236
21	51.02945	26.38081	3.372972	6.056657	12.48998
22	51.02200	26.38434	3.373429	6.058016	12.49085
23	51.01748	26.38619	3.373934	6.059570	12.49052
24	51.01737	26.38401	3.373775	6.059162	12.49010
25	51.01363	26.38445	3.373460	6.059414	12.49243
26	51.00843	26.38730	3.373420	6.060857	12.49339
27	51.00762	26.38741	3.373479	6.061346	12.49276
28	51.00664	26.38674	3.373366	6.061117	12.49440
29	51.00347	26.38812	3.373192	6.061395	12.49614
30	51.00232	26.38907	3.373164	6.061708	12.49588

The result of variance decomposition in Thailand is different from the result of variance decomposition in Indonesia as shown in Table 5. Gross Capital Formation (GFC) has the greatest contribution to increasing the economic growth in Thailand seen from up to the 30th period contributing 51,001. While the second contribution is labor which is the same result with Indonesia. Labor has a large contribution to economic growth caused by the agriculture sector to be a deposit that has a large labor absorption, especially in rural areas. The third contribution that has a role in the change of economic growth is Agriculture Value Add (AVA) which in the period to-30 amounted to 12.495. The next contribution to economic growth is inflation with a contribution in the 30th period reaching 6.067. The last contribution to economic growth in Thailand is the trade openness, which until the 30th period reached 3.3731.

Table 6. Variance Decompostion in The Philippines

	Variance Decomposition GDP				
Period	Gross Capital Formation	Employment	Trade Opennes	Inflation	Agriculture Value Add
1	100.0000	0.000000	0.000000	0.000000	0.000000
2	51.56177	9.890219	2.049836	33.35741	3.131391
3	41.30118	8.741161	7.138095	36.46497	2.602392
4	37.14871	9.237713	9.151518	38.49909	2.547696
5	33.56141	12.19472	12.42513	36.13442	2.242575
6	33.48570	11.61952	13.70354	35.34277	2.123030
7	33.31071	11.56378	13.87286	35.34639	2.136548
8	33.17807	11.80703	13.81311	35.13024	2.134242
9	32.96476	11.73199	13.72448	35.03454	2.120701
10	32.97707	11.80145	13.69301	34.94880	2.122752
11	32.94813	11.79715	13.68699	34.96984	2.136761
12	32.90057	11.78395	13.69824	34.94457	2.130210
13	32.85099	11.81418	13.71220	34.91490	2.127948
14	32.84110	11.84216	13.70601	34.90192	2.131102
15	32.83638	11.84647	13.70981	34.89334	2.131400
16	32.82586	11.86677	13.70473	34.88911	2.130457
17	32.82275	11.87581	13.70382	34.88469	2.130468
18	32.82196	11.87593	13.70441	34.88411	2.130438
19	32.82068	11.87916	13.70398	34.88281	2.130354
20	32.81936	11.88122	13.70378	34.88141	2.130276

Variance Decomposition GDP					
Period	Gross Capital Formation	Employment	Trade Opennes	Inflation	Agriculture Value Add
21	32.81950	11.88104	13.70358	34.88104	2.130248
22	32.81935	11.88107	13.70352	34.88121	2.130274
23	32.81912	11.88105	13.70339	34.88103	2.130270
24	32.81886	11.88094	13.70328	34.88086	2.130253
25	32.81877	11.88100	13.70322	34.88087	2.130270
26	32.81875	11.88099	13.70323	34.88083	2.130291
27	32.81867	11.88103	13.70318	34.88079	2.130284
28	32.81860	11.88112	13.70316	34.88076	2.130282
29	32.81858	11.88113	13.70316	34.88075	2.130287
30	32.81858	11.88114	13.70316	34.88073	2.130288

Different results with the variance of decomposition in the Philippines seen in Table 6 shows that inflation has the greatest contribution to the source of changes in economic growth that in the 30th period reached 34,881. The second contribution is Gross Capital Formation (GFC) which in the 30th period reached 32.818. The third contribution is Trade Openness which in the 30th period reached 13.703. Furthermore, the variable of labor has the fourth contribution in driving economic growth. Caused by the agricultural sector has little role in absorbing labor. The last contribution is Agriculture Value Add (AVA) in giving influence to economic growth in the Philippines.

Based on the results of analysis by using Vector Autoregression (VAR) shows that the need for some government focus to be able to encourage the agricultural sector as a supporter of economic growth. First, the government needs to focus on capital assistance in the agricultural sector because capital aid can increase output productivity and can further increase economic growth. Second, the government needs to control the prices in the agricultural sector, because prices can have an impact on productivity. Third, the policy concerning the quality of production in the agricultural sector

CONCLUSION

The productivity of the agricultural sector has contributed to improving economic growth in ASEAN-3. The greatest contribution in improving agricultural productivity in encouraging economic growth is capital that is proxied by gross capital formation and inflation. These results illustrate that capital becomes an important thing for the agricultural sector to increase its productivity. However, price changes in agriculture sector seen from inflation also need to be observed because it has a contribution to the productivity of the agricultural sector which will subsequently affect economic growth. Recommendation of policies that need to be done by the government based on the results of this research is First, the government needs to give focus on capital assistance in the agricultural sector because capital assistance can improve output productivity and can further increase economic growth. Second, the government needs to control the prices in the agricultural sector, because prices can have an impact on productivity. Third, the policy concerning the quality of production in the agricultural sector.

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