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The Relationship Between Agricultural Value Added, Investment, and Consumption: Vector Error Correction Model Approach

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ABSTRACT

The purpose of this study was to determine the impact of the relationship between agriculture on investment and consumption in Indonesia. This study uses data from a period of 36 years, from 1985 to 2020 by vector modeling to understand causal relationships between variables. This research is based on secondary data from the world bank. We use the variables of value-added agriculture, consumption, and investment in Indonesia. We find that macroeconomic variables such as agricultural value-added, consumption to GDP, and non-financial investment have a mutually influencing relationship. Changes that occur in one variable will affect other variables. With the decline in the value-added of agriculture, the level of consumption of the total GDP in Indonesia will increase. However, an increase in consumption will also increase the value-added of agriculture, an increase in investment in the non-financial sector will increase the value-added of agriculture, and an increase in investment will increase consumption.

Keywords: Agriculture, Consumption, Indonesia, Investment, VECM.

INTRODUCTION

Various policy flows, goals, and development paradigms in different developing nations challenged the agricultural sector from the 1960s to the early 2000s, resulting in diminished, faltering, or inappropriate investment in the industry (Bjornlund, Bjornlund & van Rooyen, 2022). Despite the prevailing mindset at the time of the government's massive investment and public sector engagement in the economy, the post-Independence focus on development through industrialization drove the government in much of Africa and parts of Asia to disregard farm investment (Ahmad & Qayyum, 2008). According to Putri, Christiana, Kulsum, Widya, and Justianti (2021), Investment itself is a preparation made by someone to prepare for everything in the future, where the preparation can be done by investing (saving, managing money to be a business, or participating in insurance that is useful in the future).

The international community's tightening of belts on developing countries in the 1980s meant not only a reduction in social spending, which is a frequently mentioned aspect of the era of structural adjustment in discussions of its implications for public spending, but also a reduction in agricultural infrastructure and human resources for service provision. Disillusionment with sluggish agricultural growth in some developing nations, along with the underperformance of agricultural investment by aid organizations and governments, led to a sustained decrease and low levels of public investment in the industry in the 1990s and early decades of the next decade (Baba, Saini, Sharma, & Thakur, 2010).

Capital formation is considered one of the main factors or variables in economic development (Widarni & Bawono, 2021). According to Sulisnaningrum (2021) and Damayanti (2021), this is reasonable because capital formation is useful in the use of economic resources. With the formation of capital, it will increase national output. Furthermore, capital formation and investment together create job opportunities. Finally, capital formation can improve people's economic welfare. As a developing country, Indonesia relies on the agricultural sector as a source of income and livelihood for its people. In fact, most of the land is assigned to the agricultural sector, and the agricultural sector provides almost half the employment opportunities. So far, the agricultural sector is one sector that provides input for the industrial sector in Indonesia. Thus, economic development in Indonesia must be based on sustainable agricultural development. Investment in agriculture is critical for Indonesia to meet its economic goals. This is because the agricultural sector has become the most important sector in Indonesia's development for several reasons: it meets the food needs of the majority of Indonesia's population, it provides employment opportunities, it provides inputs to the industrial sector, and it serves as a foreign exchange reserve. A competitive agriculture sector is a precondition for the growth of the industrial and service sectors (Darsono, 2008).

According to Todaro and Smith (2011), Economic growth is a rise in a country's long-term capacity to offer products and services to society. According to Runtunuwu (2020), economic growth is defined as the development of activities in the economy that causes goods and services, as well as the prosperity of society to increase. Technical growth (technological progress), institutions, and ideology all influence capacity building. Meanwhile, capital accumulation, population expansion, and technical progress are all elements that influence a country's economic growth. One of the important factors of production is capital. The

accumulation of capital comes from investments in the economy. According to Kartikasari (2017), investment is the component of GDP that relates to today and the future. Investment is expenditure on consumer goods aimed at meeting current household needs, while investment spending is aimed at improving spending standards for the coming years. So far, residential investment, company fixed investment, and inventory investment have been the three forms of investment spending.

LITERATURE REVIEW

According to Nasir, Faizun, and Syechalad (2017), the agricultural sector in developing countries is a potential economic sector in its contribution to economic growth and the national economy. First, the expansion of the economic sector, especially in the non-agricultural sector, relies on agricultural sector products, not only for sustainable growth in the food supply but also in the supply of raw materials for the non-agricultural sector, especially the manufacturing industry. This is known as product contribution. Second, due to the strong agricultural bias in the economy at various stages of development, the population in the agricultural sector (rural sector) becomes a larger share of the domestic market for domestic industrial products. This is known as the market contribution. Third, because the agricultural sector is relatively important in generating GDP and its role in employment, the agricultural sector is a source of capital for investment in the economy. This is known as the contribution of production factors. Lastly, the agricultural sector acts as an important source of trade surplus and a source of foreign exchange by exporting agricultural products and import substitution. This is known as foreign exchange contribution.

Indonesia is an agricultural and maritime country, and the agricultural sector is one of the “main drivers” of the Indonesian economy. In terms of agricultural investment in Indonesia, there are two commitments: preventing a downward trend in domestic and foreign funding for agriculture, food security, and rural development in developing countries, and significantly increasing public assistance, as well as increasing new investment for agricultural production and productivity in developing countries and help the community’s poverty and food security (Morley, Kennedy, Pradesha, & Hadiwidjaja, 2019). In order to develop agricultural investment, each region is anticipated to be able to attract as many investors as possible who are prepared to invest their capital in the development of their individual regions, in accordance with the autonomy policy (Naqvi, 2019). Agricultural investment development services include providing data/information on the potential and investment opportunities of the agribusiness/agro-industry sector, various policies, regulations, and incentives provided by the regions to the wider community, especially potential investors both from within the country and abroad, as well as investment planning facilitation. Thus, it is expected to encourage potential investors further to invest in Indonesia's agribusiness/agro-industry sector. A very large investment opportunity in agribusiness/agro-industry is in the plantation, livestock, fishery, food industry, and forest product processing sub-sectors (Utama, 2013).

Investment, export policies, and tax incentives in the agro-industry sector have an impact on reducing sectoral, labor, and household income disparities (Malahayati, Masui, & Anggraeni, 2021). Export and investment policies in the food agro-industry sector have a greater impact on reducing income inequality than policies

in the non-food agro-industry sector (Singh, 2021). Likewise, increased investment in the agricultural sector is less able to drive growth in the food crops sub-sector, mainly because it has not been able to create industrial augmenting in the food crops sub-sector (Enahoro et al., 2019). However, an increase in investment in the agricultural sector can drive the growth of the horticultural industry quite large, as well as an increase in the rate of investment in the forestry sector which has a positive impact on increasing employment and output produced (Monckton & Mendham, 2022).

Agriculture investment by large corporations has a favorable influence on agricultural GDP and new jobs (Magdalena & Suhatman, 2020). The food context and challenges for local authorities in food policy are related to economic development. Difficulty in integrating agri-food industry in upstream (Rural) because of the choice of local authorities (negative image of agro-industry actors, especially large scale), distribution, orientation strong alternatives to local government, bias in the selection of local authorities related to the system of origin of agriculture; on the other hand, the choice of the company (parallel relocation approach has been carried out, ignorance of the system and a priori, synergies are difficult to find, especially in terms of time and scale) (Béné, 2020). However, this merger is very interesting as a search for social responsibilities and barriers, economic opportunities, and legal obligations in agricultural economic development through the agglomeration of agricultural industries in rural areas (Barth & Zalkat, 2021). In terms of methodology, it will tend to be easier to integrate companies through their projects and not upstream, i.e., in the governance structuring phase. It is also useful for hybridizing and making connections with existing ones (short circuit attached) rather than re-creating the entire logistics. Finally, many existing networks and actors can facilitate intermediation, professional networks, trade unions, and start-ups, facilitating co-development and engagement of economic actors in the agricultural industry.

The agricultural sector is one of the sectors that absorbs human labor, which is quite significant in Indonesia. Employment in areas designated for agriculture and food agriculture can still be developed considering that Indonesia's territory is quite large and fertile for developing the agricultural industry, especially on empty and remote islands. Territorial cooperation around the food agriculture sector (land and sea) has an impact on the development of a sustainable economic system in Indonesia (Saptutyningsih, Diswandi, & Jaung, 2019).

For inter-community, the prerequisite for territorial cooperation in the development of a common vision with agricultural and food agribusiness actors. Industrial cooperation thus occurs through Industrial Area programs on the one hand and by supporting players on the other. Good knowledge from agricultural actors made possible by previous cooperation on water conservation issues is very important to bring cooperatives, primary processors, secondary processing craftsmen, maritime trade, and local residents together to build environmentally-friendly agricultural and industrial areas. The main difficulty in building agglomerations in the agricultural sector, especially in rural areas, concerns a proper understanding of the different levels of progress and the different economic logic of the actors. Agroindustrialists do not follow the same logic as alternative systems. Cooperation between groups in the agriculture industry is external but also internal between agglomeration services, supporting industries, and markets (Picard & Zeng, 2005).

Agricultural agglomeration areas can develop and promote the local agricultural sector. In developing rural agglomerations, integration is needed in urban areas as markets for the food industry. So that each city can identify rural technical partners so that they are able to support the rural and urban economic climate in synergy and then carry out wider mobilization with a collective arrangement of players in the agricultural sector and local companies that are present at the national level (Zhang, Zhang, & Song, 2022).

According to Ahmad & Qayyun (2008), there was neglect of investment in the agricultural sector due to industrialization. Still, according to Baba, Saini, Sharma, and Thakur (2010), the agricultural sector actually received investment support and various other policies from the government. From here, to find out whether the agricultural sector is influenced by investment and consumption or not, we conducted this study using 36 years of data from 1985 to 2020. This data is secondary data taken from the world bank.

Economic growth is the long-term process of increasing output per capita. Economic growth has three aspects: it is an economic process, it is linked to growing output per capita, and it is linked to ideal timing (Todaro & Smith, 2011). According to Sukirno (2010), the total output or GDP in an economy is a function of existing resources such as labor, physical capital, human capital, and productivity with which the contribution is used to produce output (GDP). In the development process, especially in sectors that contribute to GDP, the agricultural sector is one of the important and dominant sectors for developing countries. Indonesia, one of the developing countries, relies on the dominant agricultural sector through the early stages of the development process to date, even though its role is now decreasing. The importance of investment in national development, especially in the agricultural sector, has long been acknowledged, and it is one of the strategic actions to promote development and support high levels of economic growth. According to Todaro and Smith (2011), from a long-term macroeconomic viewpoint, the investment will expand the capital stock, enhancing people's output capacity and accelerating the national economy's growth rate.

According to Utama (2013), Harrod and Domar have long studied the impact of investment in economic growth by developing a model based on developed country experience. They emphasize the importance of investment in the economic growth process, particularly in light of the dual nature of investment as a result of the acceleration and multiplication processes. First, it generates revenue (also known as the "demand effect"), and then it expands the economy's productive capacity by establishing a capital stock (also known as the "supply effect" of investment). As a result, real income and output will continue to rise as long as net investment continues.

A rise in investment, as well as an increase in capital goods, can benefit the economy. This is due to the fact that increasing the national stock of capital goods will boost economic activity while also increasing job prospects. Investment refers to a company's total outlay for real capital goods, both to start a new firm and to grow an existing one in order to make a profit. History shows that new discoveries in technology encourage entrepreneurs to buy new capital goods, including new factories to increase production, productivity, and efficiency. So that it can be said that technological advances can increase investment. The application of new technologies will cause the productivity of labor and capital to increase. This will

result in the growth of national income as a whole. An increase in people's income will increase people's purchasing power, which in turn will increase the demand for consumer goods. Furthermore, it will result in an increase in investment demand to provide these consumer goods. Therefore, it can be said that the increase in investment is also due to the increase in national income (Sukirno, 2010).

Agriculture is critical to civilization because it provides the food necessary for human survival. People in rural areas and those working in the food supply chain benefit from agriculture as well. There has been an increase in environmental and social costs associated with improving agricultural production to support a growing and increasingly wealthier global population. Even if agriculture as a whole has grown more productive and hunger has dropped dramatically around the world, many agriculturally dominant rural communities have socioeconomic challenges such as poverty, malnutrition, and a lack of work possibilities. Agricultural production will continue to be a difficulty in the future as society's needs grow nourishment in the form of carbs, fats, and proteins. Consistent and open assessment is vital for promoting responsibility for state commitments to sustainable agriculture and for influencing policy. While definitions of sustainable agriculture vary widely, few quantitative analyses of agricultural sustainability for the world's countries are currently available. While some academics and practitioners consider sustainable agriculture to be a set of management practices, others see it as an ideology or set of specific aims. However, there is increasing agreement on the framework for sustainable agriculture based on its influence on the three sustainability pillars environmental, economic, and social pillars (Zhang et al., 2021).

Investing in agriculture has the potential to spur technical advancements in the agribusiness sector, which will result in enhanced welfare for both corporate players and society as a whole. Development in the agricultural sector in Indonesia is directed at improving the quality, production, and marketing of agricultural products as well as developing integrated farming businesses in order to establish self-sufficiency in food, meet the nutritional needs of the community, increase export commodities, commodities for domestic industrial materials, and improve the standard of living of farmers. In addition, it encourages the expansion and equal distribution of business opportunities and employment opportunities, as well as the private sector's participation in investing their capital in developing agricultural potential (Nasir, Faizun, & Syechalad, 2017).

According to Ernita, Amar, and Syofyan (2013), Investing may be defined as the purchase of capital goods and manufacturing equipment by investors or firms in order to boost economic output. In economics, investment is defined as spending activities that expand the economy's potential to create something. Many people see consumption as the satisfaction of food and drink in daily language. The term "consumption" refers to the ultimate commodities and services that are required to meet human requirements. These are the items and services that may be purchased and enjoyed by customers. Single-use and reusable products are both included in this group of consumer goods.

RESEARCH METHOD

This study took 36 years, from 1985 to 2020 by modeling "autoregressive vectors" to understand the causal relationship between variables. This research is based on secondary data from the world bank. We use the variables of agriculture value-add, investment, and consumption in Indonesia. The following multivariate regression model was used to evaluate the causal relationship between agriculture, investment, and consumption in Indonesia.

$A_t = \beta_0 + \beta_1 I_t + \beta_2 CO_t + e_t$ eql 1
$I_t = \beta_0 + \beta_1 A_t + \beta_2 CO_t + e_t$ eql 2
$CO_t = \beta_0 + \beta_1 A_t + \beta_2 I_t + e_t$ eql 3

Description:
A: Agriculture
I: Investment
CO: Consumption
E: error term
t: time series
β: the magnitude of the effect of causality
eql: equation

This study uses vector calculations where each regression relationship will be brought together so that each variable will alternately become the dependent variable and the independent variable. The zero theory of Dickey-Fuller, taken from the PP test, and p=1 is the formula in $\Delta yt = (\rho - 1)yt\text{-}1 + ut$, in which Δ – for the first time different operators. This research used the following equation for the "unit root test":

$\Delta Y_1 = \alpha_0 + \beta_0 T + \beta_1 Y_{t\text{-}1} + \sum_{i-1}^{q} \alpha_1 \Delta Y_{t\text{-}1} + e_t$

Description:
Y as the variable is being examined for unit root
T as the variable which indicates the "linear trend," the "lag difference" means is $\Delta Yt-1$,
$\alpha 0$ are shown as "constant term," with the
"t" as a "time trend" indicator.
The null and alternative hypotheses for the "unit root test" are as follows:
$H_{0:}\ \alpha=0$
$H_1: \alpha\neq0$

RESULTS

Before a causality or vector assumption can be satisfied, a stationarity test must be performed. The Augmented Dickey-Fuller test (ADF) can determine if a series is non-stationary by examining the error term, which includes the possibility of autocorrelation if the series is non-stationary. The unit root test yielded the following results:

Table 1. ADF's Unit Root Test on A, CO, and I data in Indonesia

Variable	Unit Root	Include in the examination Equation	Statistics for the ADF Test	5% Critical Value	Description
Agriculture (A)	Level	Intercept	-1.866468	0.3436	
	First Diff	Intercept	-4.964410	0.0003	Stationer
Consumption (CO)	Level	Intercept	-2.866238	0.0596	
	First Diff	Intercept	-6.432081	0.0000	Stationer
Investment (I)	Level	Intercept	-2.672406	0.0895	
	First Diff	Intercept	-9.683934	0.0000	Stationer

Data A, CO, and I are stationary at the first difference. This is demonstrated by the Augmented Dickey-Fuller Test, with a probability of 0.0003. Less than 5%, in this case, data A shows stationary at the first difference compared to the original data. The same thing happened to the CO and IU data which were stationary at the first difference from the original data. From here we can take the next step in determining vector analysis.

For causality and vector tests, an appropriate sense of the lag length is required. It is essential to know the optimal pause duration before conducting a VAR analysis or causality test. In this experiment, the shortest or lowest Akaike Information Criteria (AIC) is used to identify the optimal time lag. The gap length ranges from 0 to 6 because the data used in this test contains annual data with a data range of 36 years. This delay is considered long enough to describe A, CO, and I over a yearly period.

Table 2. AIC value at Lag 0 to 3 A, CO, and I data in Indonesia

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-186.1565	NA	60.15192	12.61043	12.75055	12.65526
1	-132.0650	93.75859	2.990653	9.604331	10.16481	9.783633
2	-113.3732	28.66066*	1.601363*	8.958215	9.939054*	9.271994*
3	-104.4365	11.91568	1.695948	8.962431	10.36363	9.410687
4	-94.72482	11.00654	1.795560	8.914988	10.73654	9.497719
5	-84.45952	9.580940	1.985272	8.830635*	11.07255	9.547843
6	-75.61066	6.489169	2.742457	8.840710	11.50299	9.692395

Table 2 shows the findings of the Optimum Lag test. The AIC values at Lag 0 to 6 indicate that the lengths of the Lag A, CO, and I variables are at LR, FPE, SC, and HQ at Lag 2. Because the results of the four criteria are both in lag 2, then lag two will be chosen. The interactions between A, CO, and I are shown in the table during this period. Based on the data, there is no preliminary effect for the four variables, so according to FPE requirements, the best lag is at lag 2.

Among the differences between the VECM models with the VAR model, in the VECM model, the variables must have a cointegration relationship. The Johansen Cointegration test is used to determine the cointegration of all variables.

Table 3. Johansen Cointegration Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.485557	33.82758	29.79707	0.0163
At most 1	0.225316	11.89344	15.49471	0.1621
At most 2	0.099772	3.468536	3.841466	0.0625
Trace test indicates one cointegrating eqn(s) at the 0.05 level				

Cointegration test results are presented in Table 3. The results show that from the three variables there is a long-term reciprocal relationship or cointegration occurs. The model estimation stage can be continued from these results by using the VECM.

DISCUSSION

The VECM model is a restricted VAR model. The variables are restricted to long-term relationships (cointegration) while considering the dynamics of short-term relationships.

Table 4. Vector Error Correction Model

Cointegrating Eq:	CointEq1		
A(-1)	1.000000		
CO(-1)	-0.299548		
	(0.09343)		
	[-3.20617]		
I(-1)	-1.515856		
	(0.11213)		
	[-13.5192]		
C	10.23688		
Error Correction:	D(A)	D(CO)	D(I)
CointEq1	0.066371	0.206213	0.370788
	(0.15047)	(0.46245)	(0.08800)
	[0.44110]	[0.44591]	[4.21353]
D(A(-1))	0.409593	-0.703986	-0.284283
	(0.29132)	(0.89534)	(0.17037)
	[1.40601]	[-0.78628]	[-1.66859]
D(A(-2))	-0.412196	-0.235605	-0.513449
	(0.37949)	(1.16634)	(0.22194)
	[-1.08617]	[-0.20200]	[-2.31343]
D(CO(-1))	-0.195511	-0.083581	0.054849
	(0.08609)	(0.26458)	(0.05035)
	[-2.27107]	[-0.31590]	[1.08941]

D(CO(-2))	0.036269	-0.349165	0.181531
	(0.11094)	(0.34096)	(0.06488)
	[0.32693]	[-1.02407]	[2.79790]
D(I(-1))	0.334216	1.082172	-0.461453
	(0.27468)	(0.84419)	(0.16064)
	[1.21677]	[1.28191]	[-2.87258]
D(I(-2))	0.011502	0.162397	-0.087190
	(0.25685)	(0.78942)	(0.15022)
	[0.04478]	[0.20572]	[-0.58042]
C	-0.244731	-0.214312	-0.585438
	(0.23565)	(0.72424)	(0.13782)
	[-1.03855]	[-0.29591]	[-4.24800]
R-squared	0.338285	0.275913	0.622578
Adj. R-squared	0.153005	0.073168	0.516899
Sum sq. resids	26.19846	247.4670	8.960835
S.E. equation	1.023689	3.146217	0.598693
F-statistic	1.825802	1.360888	5.891256
Log likelihood	-43.01666	-80.06867	-25.31484
Akaike AIC	3.091919	5.337495	2.019081
Schwarz SC	3.454708	5.700285	2.381871
Mean dependent	-0.291606	-0.095576	-0.235585
S.D. dependent	1.112314	3.268046	0.861361

The presentation of the VECM model can be seen in Table 4. The results shown in Table 4 can be seen that the table above shows a long-term relationship between the three variables (agriculture, consumption, and investment). While at the bottom of the table is an interpretation of the short-term relationship between the three variables. In the table above, it can be seen that consumption and investment variables have an effect on agriculture. The estimation results show values of -3.20617 and -13.5192. The consumption coefficient of -0.299548 means that an increase in consumption of 1% will affect agriculture by -0.299548%. Likewise, the Investment variable which has a coefficient of -1.515856, means that every 1% increase in investment will affect the increase in agriculture by -1.515856%. Meanwhile, at the bottom of Table 4, it can be seen the short-term relationship between the three variables. In Table 4, it can also be seen that the largest R-square value is found in the investment variable, which is 0.622578.

The purpose of the causality test is to see whether endogenous variables can also play a role as exogenous variables. In other words, whether the two variables influence each other.

Table 5. The Granger Causality Analysis

Null Hypothesis:	Obs	F-Statistic	Prob.
CO does not Granger Cause A	34	3.09956	0.0603
A does not Granger Cause CO		0.44033	0.6481
I does not Granger Cause A	34	4.14371	0.0261

A does not Granger Cause I		3.84405	0.0330
I does not Granger Cause CO	34	0.90168	0.4170
CO does not Granger Cause I		0.08860	0.9155

The results of the Granger causality test analysis can be seen in Table 5. The results show that the causal relationship occurs only in investment variables that affect agriculture, with a probability value of 0.0261. Vice versa for agricultural variables that affect investment with a probability of 0.0330. At the same time, the causality relationship between other variables is not significant.

CONCLUSIONS

The implications of the results of this study indicate that macroeconomic variables in the form of value-added agriculture, consumption to GDP, and non-financial investment have a mutually influencing relationship. Changes that occur in one variable will affect the other variables. As the decline in agricultural value added will increase the level of the total consumption of GDP in Indonesia. This happens because in Indonesia, a decrease in the added value of agriculture can make consumption increase due to the import of agricultural products which increases along with this. However, increased consumption will also increase agricultural value-added, increased investment in the non-financial sector will increase agricultural value-added, and increased investment will increase consumption. This study has limitations, namely using secondary data so that data outside of the secondary data that we used were not studied, and research outside the period of our study was not studied.

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DECLARATION OF CONFLICTING INTERESTS
The authors declared no potential conflicts of interest

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