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Foreign Direct Investment in Agriculture and Food Security in Developing Countries

Fajar Sari Wardhani and Tri Haryanto

ABSTRACT

The purpose of this study is to evaluate the effect of foreign direct investment in the agriculture sector on food security in developing countries during 2012-2017 using control variables such as rural population, GDP per capita, consumer price index, food import, and food export. This research used the dynamic panel data methods in order to test the data collected. The results showed that FDI in the agriculture sector, rural population, GDP per capita, consumer price index, food import, and food export simultaneously had a significant effect on food security in developing countries. Partially, all variables significantly affect food security, except food import. All variables showed a positive effect on food security, except consumer price index and rural population.

KEY WORDS:

Food security, foreign direct investment, agriculture sector, developing countries, generalized methods of moments.

JEL Classification: D25, L66, N5.

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1. Introduction

Economic development in Indonesia has several objectives, including increasing social welfare (Tanjung et al., 2017) which is realized by improving the regional economy through investment (Nuradi & Fatimah, 2015; Nuradi et al., 2017) and the stability of food security. Food security is crucial in meeting food needs, when a country's food security is threatened it will have a negative effect on the survival of a nation. This view is sufficient to explain why food security has always been a global problem in many countries. Broadly speaking, the main challenge in achieving food security are ensuring the availability of food for a population that continues to increase in population, especially in developing countries and maintaining the quality of food produced and distributed evenly. The problem of realizing food security is complex, so a multi-dimensional approach is needed which considers various perspectives includ-

ing the economy, environment and society.

Food security is impacted by the volatility of international food price which has serious implications for food security. 2012 experienced the highest price increase of agricultural commodities due to a severe drought that hit almost half of the agricultural area in the American Midwest (Pender et al., 2012).

The increase in food prices causes an increase of poverty. The poor spend between 50 percent and 80 percent of their income on sufficient food. As a result, the poor consume more cheap food or eat less in order to survive (Shaw, 2011). In addition, environmental aspects greatly affect food security where natural resources are fundamental assets for food production. Competition to exploit and seize increasingly scarce natural resources and unequal distribution in certain areas exacerbates changes in climate, volatile weather conditions, and water scarcity. The issue of food security from a social perspective can be summarized in three main interrelated areas: human health, demography, socio-political issues (social conflicts and demographic phenomena). In the health aspect, food security problems that often

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occur are malnutrition, obesity, malnutrition, poor hygiene and sanitation, difficulties in accessing drinking water and basic medicines.

The demographic phenomenon with the greatest impact on food security today is population growth. The increase in population results in an increased demand for food while the supply of food is limited. This is in accordance with Malthus's Theory which states that population growth follows a measurement sequence while the growth in food availability follows an arithmetic sequence (Leck et al., 2015).

The World Food Program (WFP) works towards obtaining assets, disseminating knowledge and overseeing the development to create strong and dynamic communities. This program helps people become safer. The World Bank helps invest in programs in agriculture and rural development to increase food production and nutrition. Banks work with partners to improve food security and build good food systems so they can feed everyone, everywhere, every day. These activities include welcoming climate-aware farming and restoring degraded agricultural land, cultivating more resilient and nutritious crops and improving storage and supply chains to reduce food shortages.

The Food and Agriculture Organization of the United Nations (FAO) publishes statistical data, one of which is the food price index, which is a measure of monthly changes in international prices for various agricultural commodities. Various programs have been successfully implemented by FAO. For instance, integrated pest control, known as SL-IPM (Integrated Pest Management School) and IPM (Integrated Pest Management). This program has succeeded in controlling brown planthopper pests in rice commodities so that rice production could increase. Other programs such as Special Programme for Food Security (SPFS) and food security, by developing irrigation and water management, facilitate the development of agricultural systems to increase crop production, livestock, and fisheries, processing agricultural products and food technology (Agriculture Organization of the United Nations, 2000).

International Fund for Agricultural Development (IFAD) focuses on reducing rural poverty, working with poor rural populations in developing countries to eliminate poverty, hunger and malnutrition, increase productivity and income, and improve quality of life.

All IFAD-funded programs and projects address food security and nutrition in several ways. IFAD has supported around 400 million poor rural women and men over the past three decades (United Nations, 2018).

Based on the SDGs target that increasing investment is highly sought, especially in terms of international cooperation to develop agricultural productive capacity, this has led several developing countries to undertake Foreign Direct Investment (FDI) to explore sources of foreign financing. FDI in the agricultural sector has received a lot of attention in recent years (Tessema, 2019). This is because on FDI by, transferring knowledge, capital, and technology contributes to productivity growth.

FDI is widely seen as an instrument to increase economic growth in developing countries through the entry of multinational companies that have a spillover effect in the host country (Meidayati, 2017). FDI is a form of investment in the form of international capital flows that play an important role in the process of economic growth (Rakhman, 2016). Direct investment's name is adequate - the money spent pays off (Ilmi, 2017). FDI can help intensify agriculture and the productivity of labour via: easier ability to access agricultural inputs (e.g., seeds, including improved crop varieties, fertilizers and capital); increase reliance on improved agricultural techniques and agricultural technologies that improve yields and limits the losses arising in the post-harvest period; and the education and training of the farming community (Almfraji & Almsafir, 2014; Anaya, 2012).

Recent research on the effect of FDI on food security argues that investors usually come from developed countries that have narrow agricultural land so that to meet food needs, these investor companies make foreign investments in developing countries. According to Aykut and Sayek (2007), Africa is a food-insecure continent due to FDI causing agricultural investment products to be exported and not available to local consumers. In addition, agricultural FDI has an impact on increasing food prices which is detrimental to consumers in the host country, this depends on whether the production will be sold in the domestic (host) market only, in foreign markets only, or in both markets (Kamran et al., 2016; Limaye & Pednekar, 2019; Nayyar & Mukherjee, 2020).

This study aims to determine the effects of FDI in

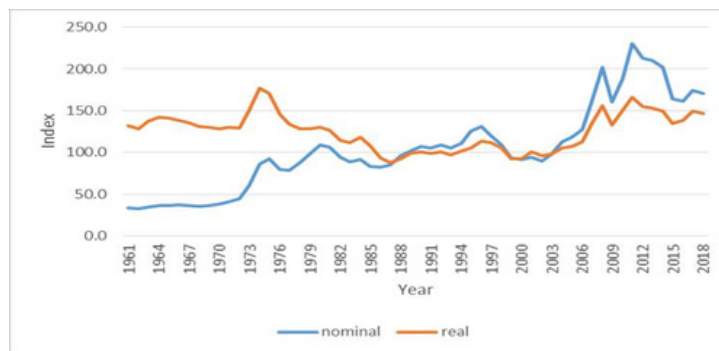


Figure 1. Food price index trends in 1961-2018.

the agricultural sector on food security in developing countries during the period from 2012 to 2017. This study was tested using GMM-SYS (Generalized Method of Moments Systems) by adding control variables, namely rural population, GDP per capita, index. food prices, and international trade, namely food exports and imports. Based on the estimation results, overall the variables of foreign direct investment in the agricultural sector, rural population, GDP per capita, consumer price index, imports and exports of food have a significant effect on food security.

The rest of the manuscript is thus structured as follows: the next section reviews the relevant literature in order to motivate the hypothesis. This is followed by a description of the sample, defines variables as well as provides the specification of the research design. Next, the empirical results are presented. The final section concludes the paper.

2. Literature Review

2.1. Foreign Direct Investment and Food Security

The entry of FDI into developing countries through expanding multinational companies brings knowledge about major technological developments through so-

phisticated agricultural machinery, so that it indirectly supports agricultural land expansion (Sari et al., 2016). Agricultural land expansion increases agricultural production enjoyed by local farmers. Additionally, food access also increases with greater agricultural output and community income as well as job creation so that this spillover can improve livelihoods and food security in the host country (Hallam, 2011). The transfer of technology and knowledge is able to produce land that previously could not be fully utilized by farmers, thereby reducing food supply problems and increasing food security (Santangelo, 2018).

FDI tends to have a negative effect on food security in developing countries in the short and long term (Alvarado et al., 2017; Hanif et al., 2019; Shahbaz et al., 2019). Investment causes weakening of host country institutions, this is influenced by investors if FDI comes from developed countries, it will increase food security because technology transfer, on the other hand, if FDI comes from developing country investors, it will worsen food security because developing countries only take agricultural products. Agricultural FDI causes a decrease in domestic production for local markets and increases in food prices and reduces the competitiveness of domestic food and agricultural production. FDI

also leads to large-scale land acquisitions so that land loss has a negative impact on farmers' livelihoods, reliance on imported inputs is detrimental to environment such as contamination due to chemicals, degradation of land and water resources being depleted. These tend to threaten the food security of host countries.

Other studies have stated different things, namely that FDI can have a positive effect on food security (Hongxing et al., 2020; Santangelo, 2018). The inflow of foreign capital increases the supply of funds, thereby encouraging the formation of capital in the domestic country to purchase agricultural product inputs. Furthermore, FDI provides a transfer of technology and knowledge that is useful for higher productivity of farmers and domestic production, improving quality, thereby increasing food supply. A number of surveys conducted by researchers found that in Morocco, Ghana, Egypt, Uganda, and Tanzania, FDI contributed significantly to productivity growth in the agricultural sector. This transfer of technology and knowledge is able to produce land that previously could not be fully utilized by farmers. Expansion in cropland resulting from FDI by developed country investors in turn reduces food supply problems and improves food security in host developing countries.

Yao et al. (2020) analyze the association between foreign direct investment (FDI) in agriculture sector and its relationship with the food security on Belt and Road Initiative (BRI). Their study has been conducted through a panel framework over the period from 2006 to 2015 while applying the correlation analysis, specific-effect model, and the two stage least square or two-stage least square (2SLS) approach. The study aims to analyze the correlation and level of association among the agricultural FDI and food security for each of the selected region, individually. After that, authors have investigated whether there is an association between the FDI in agriculture sector and food security dynamics while applying the specific effect model. The results show that for the selected countries there is a clear differences in the direction of the association between food security and FDI in agriculture sector. But, in general, the agricultural FDI has a positive direct and indirect effect on food security; this effect is seen clearly when the country attracts agricultural FDIs steadily.

H1: Foreign direct investment in the agricultural sector affected food security in developing countries dur-

ing the period of study.

3. Research Methodology

3.1. Sample and Data Sources

This study uses a quantitative approach. The secondary data in the current study consists in panel data, which is a combination of cross section and time series data with a total of 20 developing countries according to the World Economic Situation and Prospects (WESP) in the 2012 to 2017. The sample in this study consisted of 120 data. observation. The food security index is sourced from the Global Food Security Index website, FDI in the agricultural sector is sourced from the central bank website of 20 developing countries, rural population, GDP per capita, consumer price index, food imports, and food exports sourced from the World Bank website.

3.2. Operational Definition and Measurement of Variable

3.2.1. Food security index

Food Security index is the dependent variable in this study. The country's food security is measured based on the Global Food Security Index (GFSI). The goal of GFSI is to assess which countries are the most resilient and most vulnerable to food insecurity through the Affordability, Availability, and Quality and Safety categories in an index unit with an index value of 0-100 in the period 2012 to 2017 (Global Food Security Index, 2018).

3.2.2. Foreign direct investment

Foreign Direct Investment is a net inflow of investment from abroad that enters developing countries with the aim of opening new markets and making profits. This study uses FDI which enters agriculture, forestry and fisheries in developing countries in 2012-2017 as an independent variable. Data obtained from the central banks of 20 developing countries are expressed in million dollars and then converted into ln with percent units. The use of ln (natural logarithms) in this study aims to reduce the range between independent variables. If the value of agricultural FDI which is expressed in million dollars is not transformed first, the value of the variable will be very large compared to other variables so that it is converted into ln so that the value can be simplified without changing the proportion of the original value.

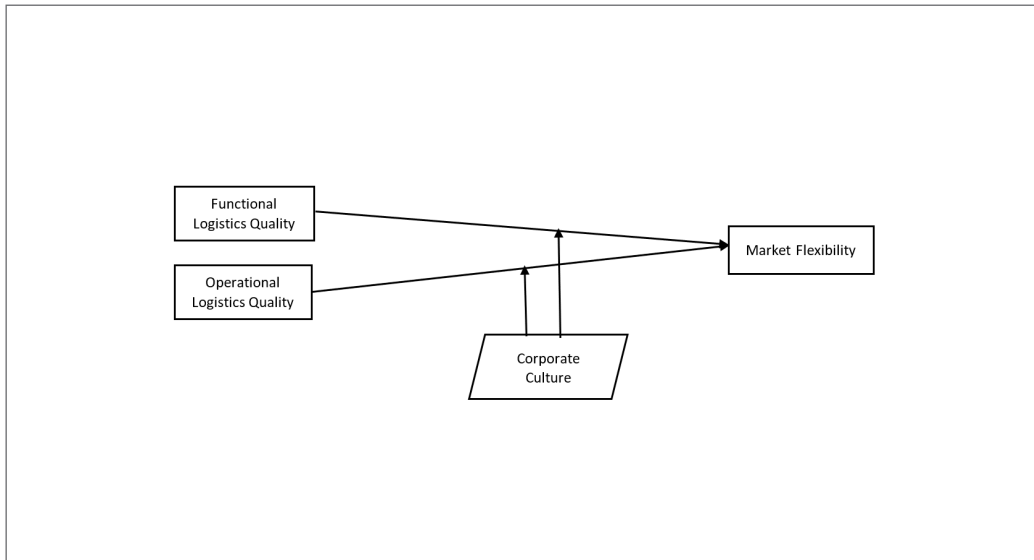


Figure 2. Research framework.

3.2.3. Control variables

This study uses several control variables, including rural population, GDP per capita, inflation, imports and exports of food. Rural residents are people who live in rural areas as defined by the national statistics center. The rural population is calculated by comparing the total population and the urban population (World Bank, 2018c). GDP per capita is based on Purchasing Power Parity. The higher the GDP, the better the country's economic condition and vice versa (Farabi et al., 2019). GDP per capita is the gross domestic product converted to international dollars using the purchasing power parity rate. The international dollar has the same purchasing power of GDP as the US dollar has in the United States. Inflation is an increase in prices in general and continuously over a certain period of time. In this study, price increases are measured by the consumer price index. The consumer price index is the annual percentage change in costs to the average consumer in obtaining goods and services (World Bank, 2018a). Meanwhile, imports or exports of food are all food products imported or exported, including commodities in SITC section 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil nuts, and oil seeds) annually (World Bank, 2018b).

3.3. Research Design

This study uses the dynamic panel regression method Generalized Method of Moments System (GMM) with modified variables from Slimane et al. (2016) and Santangelo (2018) and STATA 13 software assistance. In GMM there are two types of dynamic GMM panels, namely the difference GMM and the GMM system. In this study, the GMM System was used because the estimation results were more efficient because the GMM system added an instrument variable (IV) which could produce a consistent estimator. In addition, GMM specifications and statistical tests were also carried out.

Mathematically, this model can be written as follows:

$$FSI_{it} = \alpha + \beta_1 \ln FDI_{it} + \beta_2 POP_{it} + \beta_3 \ln GDP_{it} + \beta_4 CPI_{it} + \beta_5 FIMPORT_{it} + \beta_6 FEXPORT_{it} + \beta_7 FSI_{it-1} + \mu_{it}$$

Where FSI is the food security index, $\ln FDI$ is the natural foreign direct logarithm investment in agriculture, POP is the rural population, $\ln GDP$ is the natural logarithm of total GDP per capita, CPI is the consumer price index, $FIMPORT$ is imports of food, $FEXPORT$ is exports of food, $\ln FDI_{it-1}$ is the food security index lag, α is the intercept, $\beta_1 - \beta_7$ is the regression coefficient and μ is the error term. Various studies have applied the

GMM while analyzing the relationship between their targeted variables. Notable contribution is provided by (Khan et al., 2019; Muhammad & Khan, 2019). It is also believed that the GMM model only works when the number of moment conditions equal with the number of parameters to estimate. However, if there is an issue of more moment condition than the study parameters then the system of equations will be observed as over identified, hence cannot be solved.

4. Result and Discussion

4.1. Description of Results

The food security index has an average of 61,628 with a standard deviation of 7,164 and has a minimum value of 46.60 and a maximum value of 74.7. FDI data from 120 observations in the agricultural sector have an average of 703,484 and a standard deviation of 1,218.2. Whereas in the control variable, the rural population has an average of 30,729 with a standard deviation of 14,218.9. GDP per capita has an average of 18,026.9 with a standard deviation of 6,323.19. The consumer price index measured based on the Global Food Security Index has an average of 123,279 and a standard deviation of 16,222. In the food import and export variables, each has an average of 8,840 and 20,739 with a standard deviation of 3,377 and 18,608.

4.2. Identification of Regression Results Generalized Method of Moments

The first test is the Arrelano-Bond for AR (2) test which is used to see correlation between variables. If the AR (2) value is not significant ($p > \alpha$) then this indicates that there is no autocorrelation between variables. The second test is the Sargan / Hansen test which is used to see the validity of the instrument or model used. If the p-value on the Sargan / Hansen test is greater than α , the instrument or model used is valid. In this case, the greater the p-value, the more valid the model is.

Table 2 shows the regression results of FDI for agriculture, rural population, GDP per capita, consumer price index, imports of food and exports of food on food security in developing countries in the study period using GMM-SYS (Generalized method of moment-System).

4.3. Specification Test Results

An overidentifying restriction identification test is performed to determine the validity of a model. This test is performed using the Hansen test, which is distributed with chi-square statistics. In the GMM-SYS regression results with a Hansen test value of 0.439, it shows that Prob> chi square which means it is not significant at the level of 1%, 5%, or 10% and it can be concluded that H0 is accepted, so the model used is valid.

4.4. Autocorrelation Test Results

In this section, Arrelano-Bond for AR (2) is used to see autocorrelation between variables. Autocorrelation test with z-statistic distribution. In the GMM-SYS regression results with an AR (2) value of 0.743, it shows that $Pr > z$ is not significant at the level of 1%, 5%, or 10%, it can be concluded that H0 is accepted so that there is no autocorrelation between variables.

4.5. Partial Test Results

In the partial test of GMM-SYS, the lag value of the dependent variable is shown, namely L. Food Security Index with a probability of 0.000, which indicates that the food security index has a correlation between times so that it can be stated that this analysis model has a dynamic relationship. The agricultural FDI variable has a coefficient value of 0.050 (sig. 0.098). These results indicate that H0 is rejected, because the p-value $< \alpha$, it can be concluded that the agricultural FDI variable has a significant positive effect on food security. While the control variables found mixed results. Rural population variables and consumer price index proved to have a significant negative effect on food security. Evidenced by the coefficient value of each of these variables of -0.070 (sig. 0.001) and -3.720 (sig. 0.028). The variables GDP per capita and food exports show different directions. Both of these variables are proven to have a significant positive effect on food security with coefficient values of 3.680 (sig. 0.002) and 0.020 (sig. 0.066).

4.6. Simultaneous Test Results

In the GMM-SYS simultaneous test, the F test results show the probability value of F statistical or Prob> F of 0.000 (< 0.010). These results indicate that H0

Table 1. Descriptive Statistics

Variable	Number of Observations	Mean	Std. Deviation	Min.	Max
L.Indeks Food Security	120	61 628	7164	46.60	74.7
Agricultural FDI	120	703 484	1,218.2	-1.337	6.554
Rural Population	120	30 729	14 219	4.76	54.5
GDP per capita	120	18,026.9	6,323.19	4,535.285	29.449
Consumer Price Index	120	123 279	16 222	104 891	174 969
Food Import Of	120	8,840	3,377	2,281	17 234
Exports of Food	120	20,739	18,608	2,708	66,741

is rejected so that the variables of FDI agriculture, rural population, GDP per capita, consumer price index, imports of food and exports of food simultaneously have a significant effect on food security.

4.7 Discussion

4.7.1. Foreign direct investment in agriculture and food security in developing countries

Agricultural FDI has a positive effect in increasing food security. The results of this study were supported by Slimane et al. (2016) which states that FDI flows in the agricultural sector can increase food supplies because food production has increased due to technology transfer, so that in the end the increase in food production can meet the supply of calories needed by the community. Santangelo (2018) also states that with this agricultural FDI, farmers can get greater yields because they are managed using sophisticated machines and more precise and efficient agricultural management. Expansion in cropland resulting from FDI in cropland by developed country investors in turn reduces food supply problems and improves food security in developing countries.

When investors conduct land transactions and acquire land from host countries for agricultural purposes, investors bring knowledge about the latest agricultural technology developments, bring in sophisticated agricultural machinery, improve ecological conditions that limit agricultural land expansion, and limit the environment through zero tillage techniques. , pest resistance varieties and information technology applications for agricultural operations. Foreign investors can then expand their agricultural land using this technology to allow previously unused or underutilized land to be fully utilized.

Research further states that in developing countries the contribution of agriculture to food security is large, but developing countries It is difficult to increase productivity due to a lack of financial capital, technology and knowledge, so to overcome this, developing country governments are opening the way for foreign investors who invest in the form of agricultural land leases so that foreign direct investment (FDI) plays an important role in terms of job creation , technology transfer, and infrastructure development in rural areas (Marchewka, 2019; Mohammed, 2017; Rehman et al., 2020).

Table 2. GMM-SYS Regression Results

Variable	GMM-SYS	
	Coefficient	P-value
L. Food Security Index	0.610	0.000 *
ln Agricultural FDI	0.050	0.098 ***
Rural Population	-0.070	0.001 *
ln GDP Per capita	3,680	0.002 *
Consumer Price Index	-3,720	0.028 **
Import Against Food	-0.010	0.802
Exports to Food	0.020	0.066 ***
Cons	8.101	0.233
Prob> F	0.000	
AR (1)	0.314	
AR (2)	0.743	
Sargan Test	0.000	
Hansen Test	0.439	
Hansen Test (GMM)	0.094	
Hansen Test (Diff GMM)	0.891	
Hansen (IV)	0.261	
Hansen (Diff IV)	0.716	

Note: *, **, *** significant at the level of 1%, 5%, 10%

4.7.2. Additional Analysis

Rural population significantly negatively affects food security in developing countries. This result is supported by Charoenratana and Shinohara (2018) which state that the large number of rural residents with a decreasing agricultural land area causes food insecurity. The

growth of the rural population, which is not matched by less agricultural land, causes the population to be unable to access agricultural land for production so that their income decreases and has an impact on food security.

GDP per capita has a significant positive effect in

increasing food security. The results of this study were supported by several previous researchers, Slimane et al. (2016), and Santangelo (2018) which state that an increase in GDP per capita will lead to increased food security due to changing consumption patterns or spending on food. In addition, other studies such as Stavitsky and Prokopenko (2017) state that GDP per capita describes access to food and when economic growth leads to price growth that far exceeds output growth, it can reduce the level of food security. This is in accordance with the existing theory that GDP per capita or income received by each person is directly proportional to food security. The increase in GDP per capita causes people's preferences for food to change. Residents will choose to buy nutritious food when their income increases.

The consumer price index has a negative and significant effect on food security. The results of this study are supported by Dithmer and Abdulai (2017) that when the food price index increases, poverty increases and affects food security. This is in accordance with the existing theory that the increase in the CPI makes prices unaffordable for people to access food so that the level of food consumption also follows the direction of the consumer price index in the opposite direction. Soaring food prices have an impact on people's purchasing power, their purchasing power decreases so that people cannot reach nutritious food so they choose to replace them with cheaper and less nutritious food (Wahab & Applanaidu, 2015).

International trade consists of food imports and food exports. Food imports negatively affect food security, but not significantly. These results are in accordance with previous research by Zhu (2016) where food imports negatively reduce food security. According to Zhu (2016), the increase in imports of food causes a dangerous dependence on imports, when the world food supply is short, the country will experience food insecurity. Another study is also like previous research, Khor (2015) states that import policies cause farmers to be threatened because people prefer to buy imported food so that local production decreases because the demand is small. In contrast to the import variable, exports of food have a significant positive effect on increasing food security. This result is in accordance with Santangelo (2018) research, food exports can increase income for exporting countries. Exports can cause local produc-

tion that competes in international markets to trigger increased productivity through greater investment Kusumawardani and Mubin (2019), R&D, and technology spillovers. This has a positive effect on exporting countries because technology spillovers lead to better economic development.

5. Conclusion

This study's aim was to determine the effect of foreign direct investment in the agricultural sector on food security in developing countries from 2012 to 2017. This study was tested using GMM-SYS (Generalized Method of Moments Systems) by adding control variables, namely rural population, GDP per capita, food price index, and international trade, namely food exports and imports. Based on the estimation results, the overall variables of foreign direct investment in the agricultural sector, rural population, GDP per capita, consumer price index, imports of food and exports of food have a significant effect on food security. FDI in the agricultural sector can be a good indicator for increasing food security so that developing country governments are expected to facilitate licensing and economic openness to support the entry of FDI in developing countries.

This study has limitations in the scope of foreign direct investment, which is used as a research sample, which only examines the agricultural sector. Research is expected to add variables that are determinants of FDI, such as the exchange rate Future (Reviane, 2017) and expand the sample to other sectors to deepen the studies that have been conducted. In addition, it is also expected to increase the research period and the number of observations so that it has accurate and significant results.

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