
Poverty Reduction Models: Indonesian Agricultural Economic Approach

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Abstract:

The geographic conditions of the Indonesian archipelago vary greatly, causing differences in climate, soil fertility, compatibility with plant species and productivity and its availability. Differences in cultivation techniques and staple food among regions also affect people's choices in meeting the dietary and food.

Panel data from 33 provinces for 10 years (2007-2016) were analyzed by Path Analysis method. In the economics determinant, the decrease of Rice Prices, the decrease of Consumer Prices Indexed on Foodstuff, the increase of Government Expenditure will strengthen Food Security. In the non-economics determinant, the decrease of Food Availability will strengthen Food Security. Food Availability is the dominant factor to Food Security.

The findings of this study are to reduce poverty need to strengthen food security. Government policies in spending budgets, rice price stability and inflation, and strengthening of domestic rice production need to be understood within the framework of Indonesia's geographical diversity.

Keywords: *Agricultural Economic, Food Security, Welfare, Poverty, Geographical Diversity.*

JEL Classification:

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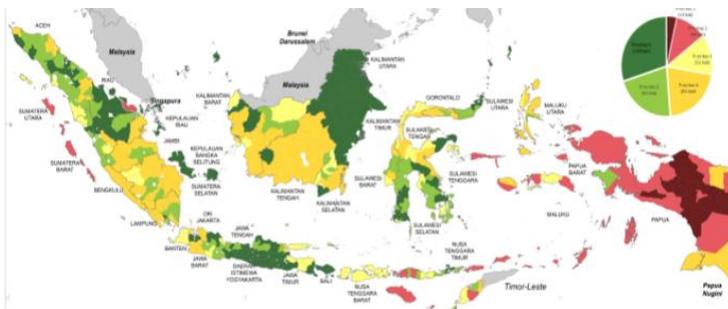
1. Introduction

The Global Hunger Index (GHI) is established based on indicators of undernourishment, child underweight, and child mortality. GHI of Indonesia ranked 72 in 2016 with index 21.9 decreases compared to 2008 at 28.6. Compared to other ASEAN countries, Indonesia is better than the Myanmar, but still under Singapore, Malaysia, Thailand, and Vietnam (Index, 2015). Based on the size of the Human Development Index (HDI), Indonesia ranked 113 with index of 0.689, life expectancy index indicator 69.1 years, education index 12.9 years, mean years of schooling 7.9, and Gross National Income per capita index 10,053 PPP \$ (UNDP, 2016). The percentage of poor people in 2015 is 11.13% decline from the previous year. Based on the above data, food security, nutrition, health, education and income per capita is still a problem that must immediately get the solution.

The food security of a country determines economic, social and political stability. Food security is the condition of the fulfillment of food for the state up to the individual, which is reflected in the availability of adequate food, both quantity, and quality, safe, diverse, nutritious, equitable, and affordable and not contradict religiously, culturally and productively in a sustainable manner (RI, 2015). The three pillars of food security are the availability, accessibility both physically and economically, and the stability that must be available and affordable at all times.

The total area of Indonesia is 1,922.57 km², consists of 17,504 islands and is divided into 34 provinces. The last province was formed in 2012 namely the province of North Kalimantan (BPS, 2016). The geographic conditions of the Indonesian archipelago vary greatly, causing differences in climate, soil fertility, compatibility with plant species and productivity and its availability. Differences in cultivation techniques and staple food among regions also affect people's choices in meeting the dietary and food. Food security and vulnerability atlas of Indonesia on 2015 has been developed as a tool to detect food security and food insecurity conditions in a region to get appropriate interventions as a reference in the hope of future changes (Ketahanan *et al.*, 2015; Polychronidou *et al.*, 2014).

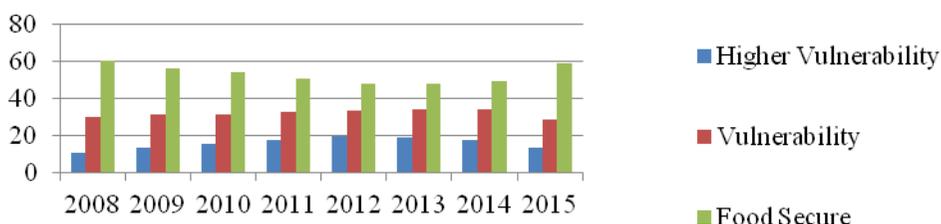
Figure 1. Food security and vulnerability atlas of Indonesia on 2015



Source: (Ketahanan *et al.*, 2015)

Figure 1 describes that food insecurity occurs in eastern Indonesia and food security only on the Java Island, parts of the Sumatra Island, and parts of the Kalimantan Island, the Sulawesi Island and the Bali Island.

Figure 2. Graph of Food Security based on Nutritional Adequacy Rate



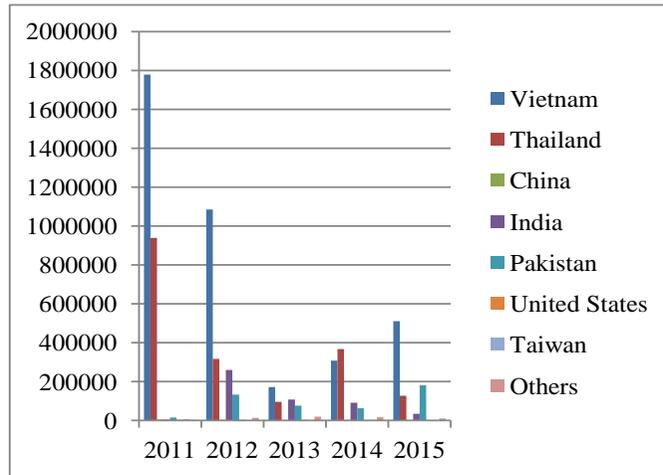
Source: Food Security Council and WFP, 2016

Food safety and vulnerability Indonesia in 2008 - 2015 based on nutritional adequacy ratio presented Fig. 2. Based on Nutritional Adequacy Rate (NAR), food safety is grouped into high vulnerability (NAR <70%), vulnerability (NAR 70-89.9%), and food secure ($\geq 90\%$ NAR) (Badan Ketahanan Pangan, 2016).

The number of food security people declined from 2008, although it has begun to increase from 2014 but has not been able to meet the established standards. The geographical, economic and cultural disparities of each province are still a challenge in improving the level of food security.

The food security of a country determines economic, social and political stability. Food security is the condition of the fulfillment of food for the state up to the individual, which is reflected in the availability of adequate food, both quantity, and quality, safe, diverse, nutritious, equitable, and affordable and not contradict religiously, culturally and productively in a sustainable manner (RI, 2015). The three pillars of food security are the availability, accessibility and stability both physically and economically, and the stability that must be available and affordable at all times.

For Indonesia, food is identified with rice, because it is the main staple food. Experience has proven that the 1997/1998 economic crisis caused the rise in rice prices to develop into multi-dimensional crises that disturb on economic and national stability. For Indonesia, it meets the growing demands of its population and spread its population over a wide geographic scope, keeping national stocks up by increasing domestic production and import. Indonesia's rice imports from 2011 to 2015 from various countries are presented Figure 3. Imports are declining from 2011, reflecting an increasing domestic production.

Figure 3. *Import of Rice by Major Countries of Origin, 2011-2015*

Source: *Statistic Year Book of Indonesia, 2016*

Behind the success of food provision, food insecurity increased. During the period of 2009-2013, the number of food insecure population increased from 61.57 million people to 83.65 million people or an increase of 35.86%. The very vulnerable to increase from 33.28 million people to 47.02 million people or an increase of 41.28% (Food Security Agency, 2014). Of 399 regencies in Indonesia, 100 regencies are food insecure. The cause of the vulnerability is (1). Lack of access economically to obtain adequate food; (2). Lack of physical access to adequate food; (3). Inadequate food for a productive life; (4). Insufficient food fulfillment in quantity, quality, variety, security and affordability of prices (Food Security Council and WWF, 2009).

This study aims to examine the magnitude of the influence of dominant factors of economic and non-economic determinants on food security and its implications for increasing welfare and poverty reduction in Indonesia with the geographical diversity of the province.

2. Literature Review

The definition of food security has developed to evolve since the 1943 Conference of Food and Agriculture, which proclaimed the concept of secure, adequate, and suitable supply of food for everyone (Shaw, 2009). From various concepts of food security, the effort to realize food security is the condition of fulfillment of various requirements, namely: (1). Fulfillment of food with sufficient availability conditions; (2). The fulfillment of food with the safe condition; (3). The fulfillment of food with equitable conditions, available in every region; and (4). Fulfillment of food with economically and physically affordable condition.

The use of the term food security at the national level tends to focus on supply side the food equation (Pinstrup-Andersen, 2009). Measurement of food security index according to FAO consists of four pillars namely availability, accessibility, utilization and stability (Nurhemi *et al.*, 2014; Vhurumuku, 2014). In Indonesia, resilience indicators are developed in three pillars namely availability, accessibility, and stability (RI, 2015).

Indicators of measuring food security at the micro level of individuals are anthropometric measurements, health, feeding practices, and caring practices. While indicators at the household level include demographics (for gender disaggregation), income (for households classification), asset (for asset score, wealth ranking), expenditure for percent share of food, food consumption and copying (for overall food security classification), water sources, sanitation and access, and health (for utilization) (Vhurumuku, 2014).

Indicators of macro food security measures at the regional and national level are developed based on the four pillars of availability, accessibility, utilization, and stability (Vhurumuku, 2014). Availability of them average dietary energy supply adequacy, the average value of food production, share of dietary energy supply derived from cereals, roots and tubers, average protein supply and average supply of protein of animal origin. Access consist percent of paved roads over the total road, road density, rail lines density, gross domestic product per capita (in purchasing power equivalent), domestic food price index, the prevalence of undernourishment, the share of food expenditure of the poor, depth of the food deficit, and prevalence of the food inadequacy. Stability consist cereal import dependency ratio, percent of arable land equipped for irrigation, value of food imports over total merchandise exports, political stability and absence of violence/terrorism, domestic food price volatility, per capita food production variability, per capita food supply variability. Utilization, i.e. access to improved water sources, access to improved sanitation facilities, percentage of children under 5 years of age affected by wasting, percentage of children under 5 year of age who are stunted, percentage of children under 5 years of age who are underweight, percentage of adults who are underweight, prevalence of anemia among pregnant women, prevalence of anemia among children under 5 years of age, prevalence of vitamin A deficiency in population, prevalence of iodine deficiency (FAO, 2013 in Nurhemi *et al.*, 2014).

Inflation can be interpreted as rising prices that can lead to price increases in other goods. Inflation can be measured by Consumer Price Indexed (CPI). CPI is an indicator of inflation in Indonesia. Since January 2014, the CPI has been developed from the 2012 Cost Living Survey (CLS) of 82 cities which is covering 225-462 commodities. Commodities of CPI consist 7 groups including foodstuff, especially food commodity that is rice (Statistic Year Book of Indonesia, 2015).

Government expenditure is the amount of realization of government expenditure spending for various needs. Government expenditure or spending includes all

government consumption, investment, and transfer payment. Fiscal multiplier is often seen as a way that spending can boost growth in the economy. This multiplier state that with the increase in the government spending leads to increase some measure of economic wide output such as GDP (Gross Domestic Product) (Jawal, 2016). There is unidirectional causality between the rate of inflation and economic growth and; economic growth and government expenditure (Attari and Javed, 2013).

Rising government expenditure has not translated to meaningful development in Nigeria (Abu Nurudeen, 2010). The results reveal that government total capital expenditure, total recurrent expenditures, and government expenditure on education have the negative effect on economic growth. On the contrary, rising government expenditure on transport and communication, and health results to an increase in economic growth (Abu Nurudeen, 2010). The government should increase 1). both capital expenditure and recurrent expenditure, including expenditures on education, as well as ensuring that funds meant for the development of these sectors are properly managed; 2). The government should increase its investment in the development of transport and communication, in order to create an enabling environment for business to thrive; 3). The government should raise its expenditure in the development the health sector since it would enhance labor productivity and economic growth. 4). The government should encourage and increase the funding of anti-corruption agencies in order to tackle the high level of corruption found in public office.

The government is to be responsible for regulating the quality and safety of food (Henderson *et al.*, 2010). Government controls food safety through the improvement of various economic sectors and non-economics to achieve food security, poverty alleviation, and welfare. Food system is more appropriate as it encompasses all aspect of food production, storage, distribution and consumption (Tacoli *et al.*, 2013).

China's connections to global agricultural markets are also having important effects on food supply and food safety within the country. Although the Chinese Government has shown determination to reform laws, establish monitoring systems, and strengthen food safety regulation, weak links in implementation remain (Lam *et al.*, 2013).

Expenditure per capita is the amount of individual expenditure per year for commodity food and non-food. Expenditure per capita is measured by the percentage of average monthly expenditure per capita by commodity food or non-food (Statistic Year Book of Indonesia, 2015). Food problems are directly related to economics status (Grace and McDermott, 2015). The lower economics status tended to choose food which would have cost less (Lo *et al.*, 2012). The greater of spending increase Dietary Diversity Score (DDS). Financial status does not reflect food quality. Food-money management in the poor has limitations to meet healthy eating. Food expenditures either low or more have an effect on healthy eating (Fan *et al.*,

2007), excessive spending leads to obesity. The influence of geographical conditions on food security and poverty is put forward by Seaman *et al.* (2014). Geographical conditions affect the condition of climate, water, land and local culture (Abdullah *et al.*, 2017). Climatic anomalies, droughts, floods, landslides, soil fertility and others have an effect on agricultural production. Agricultural productivity directly affects food security, poverty, and welfare (Abdullah *et al.*, 2017; Gebbers and Adamchuk, 2010; Soom, 2016).

Climate change and its diversity, directly related to food safety and poverty (Tirado *et al.*, 2010; Malik *et al.*, 2010) affect the food chain distribution and producers to consumers. Distribution is not good can reduce the quality of food. The length of the food chain affects the price disparity (Aung and Chang, 2014). Climate change affects agricultural production, thereby affecting the food availability (Vermeulen *et al.*, 2012; Global Panel on Agriculture and Food Systems for Nutrition, 2014). In many developing countries, food subsidy program for poor households in rural targeted to increase agricultural product, increase farmers income, and decrease poverty level (Shmaefsky, 2013).

Factors that influence household food insecurity that age, gender, education, remittance, unemployment, inflation, asset and disease are important (Abdullah *et al.*, 2017; Burchi and De Muro, 2016), calorie intake, farm size (Soom, 2016). Household liquidity constraint and asset in adequate were linked with increased risk of food insecurity at income level (Chang *et al.*, 2013). Household Economic Approach used to assessment of household vulnerability to poverty and food security (Seaman *et al.*, 2014). Low income household a net buyers of food, access and affordability are central concern (Agboola and Balcilar, 2012).

Food safety is measured by nutritional adequacy rate (NAR) (Daniels, 2006). In Indonesia, based on Nutritional Adequacy Rate (NAR), food safety is grouped into high vulnerability (NAR <70%), vulnerability (NAR 70-89.9%), and food secure ($\geq 90\%$ NAR). FAO defines food deprivation, or undernourishment, as the consumption of fewer than 1800 kcal a day, the minimum that most people require to live a healthy and productive live (Index, 2015).

Food security not enough availability, but assure access, and enough calories assure healthy and nutritional diet (Pinstrup-Andersen, 2009). Domestic food availability is defined a domestic production plus changes in stock and imports minus exports. Per capita food availability is total food availability divided by the number of population in the middle of the year. It is presented in terms of quantity as well as nutrient content, such as calories, protein, and fat. Average daily consumption of calorie and protein per capita is calories (kcal) and protein (g) daily consumption divided by the number of population on province. Availability of per capita calories and protein is availability calories and protein of various food commodities.

Food security is a valuable concept (Pinstrup-Andersen, 2009). Estimated of household food security combined with individual anthropometric estimate for children. Infant mortality rate is number of infant deaths per 1000 live births. Infant mortality is an important indicator of health nation (MacDorman *et al.*, 2013). Changes in infant mortality rates over time are examined by age at death, maternal race and ethnicity, cause of death, and state. Infant mortality affected by food intake, access and affordability and poverty (Agboola and Balcilar, 2012).

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and have a decent standard of living. HDI component indicator i.e. life expectancy of birth, expectancy years of schooling, mean years of schooling, and Gross National Income per capita (UNDP, 2016). HDI reflected people's welfare (Castles, 2014). GDP, HDI and others indicator well-being, these are all external indicator that support to privilege different goals. HDI not only measures the economic side, but also human quality. Welfare is a comprehensive construct that comprises different aspect of human life (Martinez-Martinez *et al.*, 2016).

Directly, poverty is whether people satisfy a set of specified basic needs, indirectly poverty is whether people's incomes fall below the poverty line (Alkire and Santos, 2014). Poverty measure: 1) Head Count Index, simply measures the percentage of the population that is counted as poor often denoted by poverty line. 2) Poverty Gap Index measures the extent to which individuals fall below the poverty line, as a proportion of the poverty line. A Higher value of the index shows that the gap between the average expenditure of the poor and the poverty line is wider.

3. Hypothesis Development

Theoretically, the effects of economics and non-economics are determinant toward food security. The fall in inflation and the consumer price index can maintain price stability. Increased Gross Domestic Regional Product, Consumer Expenditure and Government Expenditure will facilitate access to food. Food availability, calories consumption, protein consumption and Infant Mortality are the pillars of availability and utilization. Indonesia's geographical diversity condition is a useful natural factor if it is understood wisely.

From the above description, the decrease of the Price of Rice, Inflation, Consumer Price Index for Foodstuff, and Infant Mortality under 5 year, and the increase of Gross Domestic Regional Product, Consumer Expenditure, Government Expenditure, Food Availability, Calories Consumption, and Protein Consumption will increase Food Security. Increased Food Security will increase Welfare and reduce Poverty.

3.1 Theoretical Methodology

In this research, the magnitude of influence tested with Path Analysis. Path Analysis is one method of multivariate analysis to evaluate hypothesized causal relationship among the traits represented in a study. The analytical procedure of path analysis is described in terms of its use in non-experimental settings in the social science. Path analysis can show the dominant factor through the magnitude of Beta Standardized Coefficients.

4. Research Methodology

This research is quantitative with simultaneous equations model building using secondary panel data of time series during ten years 2007-2016 of 33 province $n = 330$. The model consists of three structural equations that are: (1) The influence of economic and non-economics determinants on food security; (2) The influence of food security on welfare; and (3) The influence of food security on poverty.

Exogenous variables consist economics determinant i.e. Rice Prices, Inflation, Consumer Price Indexed on Foodstuff, Gross Domestic Regional Product per capita, Expenditure per capita, and Government Expenditure. Therefore non-economics determinant i.e. Infant Mortality under five years, Food Availability, Calorie Consumption and Protein Consumption. Endogenous variables i.e. Food Security, Welfare, and Poverty. The model equations are:

Food Security :

$$FS = \rho RP + \rho I + \rho CPI + \rho GDP + \rho EC + \rho EG + \rho IM + \rho FA + \rho CC + \rho PC + \mu_1 \quad (1)$$

$$\text{Welfare: } W = \rho FS + \mu_2 \quad (2)$$

$$\text{Poverty: } P = \rho FS + \mu_3 \quad (3)$$

Data analysis used Path Analysis to know the magnitude influence. Therefore, to estimate the parameters of the structural equation used method of two stage least squares (2SLS). To determine the autocorrelation using Durbin Watson test.

5. Result and Discussion

The response of Food Security model on economics and the non-economics determinant is presented in Table 1. Coefficient determination (adjusted R square) 89.8 %, shows the magnitude contribution of the effect of exogenous variables toward Food Security is high. Inflation, Gross Domestic Product per capita, Government Expenditure, Food Availability, Calorie Consumption have the significant effect on Food Security. Therefore, Rice Prices, Consumer Price Indexes on Food, Expenditure per capita, and Infant Mortality under five years, and Protein Consumption have non-significant effect on Food Security. In the economics determinant, the decrease of rice prices, the decrease of consumer prices indexed on food, the increase of Government Expenditure will strengthen Food Security. In the non-economics determinant, the decrease of Food Availability will strengthen Food Security.

Table 1. *The Magnitude Influence of Exogenous Variables toward Food Security*

Variables	Beta Standardized Coefficients	P value	Standard Dev.
Rice Prices	-0.009	0.688	2258.36
Inflation	0.046	0.018	3.42
Consumer Price Indexed for Foodstuff	-0.001	0.939	18.89
Gross Domestic Regional Product	0.125	0.000	30349.94
Consumer Expenditure per Capita	-0.028	0.173	4.34
Government Expenditure	0.128	0.000	144532332.50
Infant Mortality under 5 year	0.018	0.416	18.33
Food Availability	0.866	0.000	3087745.72
Calorie Consumption	-0.102	0.001	121.99
Protein Consumption	0.039	0.246	4.54

Source: data processed

The magnitude of the standard deviation of Rice Prices, Gross Domestic Product, Government Expenditure, Food Availability, and Food Security indicates the magnitude of diversity between provinces. Indonesia's geographical diversity as an archipelagic country is a basis for depth understanding of every effort to strengthen food security. The magnitude influence indicated by Beta Standardized Coefficients i.e. Food Availability 86.6%, Government Expenditure 12.8%, Gross Domestic Product per capita 12.5%. This show that Food Availability is the dominant factor to Food Security.

The influence of Food Security toward Welfare model is presented in Table 2. Food Security has non-significant toward Welfare. Coefficient determination (adjusted R square) 0.7%, shows the magnitude of the effect of Food Security toward Welfare. The low influence of Food Security on the results of this study can be understood that the HDI used as an indicator of Welfare has three components, namely the indicators of life expectancy index, education index, and Gross National Income per capita index. In this study, Food Security is only a small part of life expectancy index indicator indicated by low coefficient determination.

Table 2. *The Magnitude Influence of Food Security toward Welfare*

Variable	Beta Standardized Coefficients	P value	Standard Dev.
Food Security	0.102	0.64	19179684.31

Source: data processed

The value of standardized coefficient Beta 10%, Food Security is not a dominant factor of Welfare. The influence of Food Security toward Poverty model is presented in Table 3. Food Security has significant toward Poverty. Coefficient determination

(adjusted R square) is 86.7%, and shows the magnitude of the effect of Food Security toward Poverty is high. The high standard deviation reflects the diversity of data between provinces. Standardized Coefficient Beta of 93.2% indicates that Food Security is a dominant factor in Poverty. However, the direction of a positive relationship between Food Security and Poverty shows that Food Security has not been able to reduce poverty quantitatively in Indonesia.

Table 3. *The Magnitude Influence of Food Security toward Poverty*

Variable	Beta Coefficient	Standardized P value	Standard Dev.
Food Security	0.932	0.000	19179684.31

Source: data processed

6. Conclusion

Economic determinant i.e. Inflation, Gross Domestic Product per capita, Government Expenditure, and non-economic determinant i.e. Food Availability, Calories Consumption have significant effect on Food Security. Price Rice, Consumer Price Index, Consumer Expenditure, Infant Mortality, and Protein Consumption have non-significant effect on Food Security. Food Availability is the dominant factor to Food Security.

Food Security has the non-significant toward Welfare. Food Security has significant toward Poverty. Food Security is the dominant factor to Poverty. However, that Food Security has not been able to reduce poverty quantitatively in Indonesia. The magnitude of the standard deviation of Rice Prices, Gross Domestic Product, Government Expenditure, Food Availability, and Food Security indicates the magnitude of diversity between provinces.

The findings of this study are to reduce poverty need to strengthen food security. Government policies in spending budgets, rice price stability and inflation, and strengthening of domestic rice production need to be understood within the framework of Indonesia's geographical diversity.

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