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Analysis of rice imports in Indonesia: AIDS approach

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A B S T R A C T

Rice is a staple food for Indonesian households. After achieving self-sufficiency of rice in 1984, Indonesia still had to import rice because the domestic rice consumption always exceeded the domestic rice production. This study attempts to analyze a rice import during the 1998-2014 period. The rice import was analyzed based on the main partner of Indonesian rice imports encompassing of Vietnam, Thailand, USA, Other countries. This research applied the demand system method using Almost Ideal Demand System (AIDS). The results indicate that price elasticity of rice import from Vietnam and Thailand was inelastic while from other countries, they were elastic. Based on the expenditure elasticity of rice import, rice is the normal goods for rice import from Thailand and USA. The policy simulation shows that the increase in the price of rice import leads to the decrease of rice import. However, rice import from certain countries such as Thailand still increase. Rice is the staple food, therefore, the government must set up policy to increase domestic rice production for reducing dependency on rice imports.

A B S T R A K

Beras adalah makanan pokok bagi rumah tangga di Indonesia. Setelah mencapai swasembada beras pada 1984, Indonesia masih harus mengimpor beras karena konsumsi beras domestik selalu melebihi produksi beras domestik. Studi ini mencoba menganalisis impor beras selama periode 1998-2014. Impor beras dianalisis berdasarkan mitra utama impor beras Indonesia yang meliputi Vietnam, Thailand, AS, dan negara-negara lain. Penelitian ini menerapkan metode demand system dengan menggunakan Almost Ideal Demand System Almost Ideal Demand System (AIDS). Hasilnya menunjukkan bahwa elastisitas harga impor beras dari Vietnam dan Thailand tidak elastis sementara dari negara lain, elastis. Berdasarkan elastisitas pengeluaran impor beras, ternyata beras adalah barang normal untuk impor beras dari Thailand dan Amerika Serikat. Simulasi kebijakan menunjukkan bahwa kenaikan harga impor beras menyebabkan turunnya impor beras. Namun, impor beras dari negara-negara tertentu seperti Thailand masih meningkat. Beras adalah makanan pokok, oleh karena itu, pemerintah harus menetapkan kebijakan untuk meningkatkan produksi beras domestik untuk mengurangi ketergantungan pada impor beras

1. INTRODUCTION

There has been a world food price crisis since 2008. Moreover, the world food prices index have exceeded above 200. However, the food price index then decreased in 2013 and 2014 but was still relatively high at 209.8 and 201.8 respectively but declined sharply to 164 by 2015. The most interesting was that the food price index for staple food which was still relatively high. The grain food price index was 219.3 and 191.1 in 2013 and 2014 and then it decreased to 162.4 in 2015. Food prices in Indonesia have similar patterns. Food prices in domestic market have been moving in line with food price in the world market. Inflation of the food group was a quite high. In addition, the inflation rate for food groups during 2012-2104 were 5.61%, 11.35% and 10.57% respectively while inflation from beverages and tobacco and its products was 6.11%, 7.45% and 8.11 %.

Indonesia is one of the largest rice producing countries in the world. In 2015 Indonesia was the third largest rice producer in the world after China and India. Rice production share of Indonesia was about 9% of the world's total production. China and India are a net exporter of rice country. However, Indonesia is a net importer of rice. Rice production in Indonesia experienced rapid growth in the period 1997-1983 so that Indonesia could achieved self-sufficiency in rice in 1984. But after achieving self-

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sufficiency in rice, production growth has declined since 1990 Simatupang & Timmer (2008).

Although rice is the staple food of households in Indonesia, Indonesia must import rice. The dependency of rice as a staple food occurred during the New Order Administration. The New Order administration under Suharto set up rice policy known as a rice self-sufficiency policy. The policy stated that domestic rice consumption must be fulfilled from own domestic production. As a result of this policy, there has been a shift in consumption as well as production of local staple foods such as sago and maize for eastern Indonesia into rice. Although rice consumption continues to decline, rice consumption is still relatively high. In 2002 rice consumption reached 115.5 kg per capita. Rice consumption subsequently decreased to 104.9 kg per capita in 2008 and was 84 kg per capita in 2014 .

With a population of 250 million and a high level of urbanization, Indonesia is facing a problem of food security. The large population and urbanization has caused the conversion of agricultural land to non-agricultural activities such as industry and housing. The largest land conversion occurs in Java Island where Java is also the largest producer of rice in Indonesia. In addition, Indonesia also faces issues of nutritional deficiencies. The government already set up minimum standard for calorie consumption by 2000 kcal. The average per capita consumption of calories per capita on average at national level during 2014 - 2016 was 1,859.3; 1 992.69; and 2,037.40 Kcal respectively. The average calorie consumption was still below the minimum calorie consumption before 2016. The biggest contribution of calorie consumption is from rice as the staple food of the Indonesian households. For example, the contribution of rice to calorie consumption was 327 kcal or 17.58% of total calorie consumption in 2014. As the main source of calories, spending on rice is a quite dominant. Expenditures for rice consumption in the last three years 2014-2015 was to Rp. 60,235 (15.51%); Rp. 66,929 (16.2%); and Rp. 64,566 (14.01%). Total expenditure for this type of grain over three years was 15.25% of total food expenditure.

As a staple food, the high consumption of rice must be fulfilled by importing rice. Indonesia imported 0.687 million tons of rice in 2010 but there was a sharp increase in rice import in 2011 to reach 2.750 million tons. In the next two years, rice imports declined by 1.810 million tons in 2012 and declined drastically to 0.477 million tons in 2013. However, in 2014 and 2015, rice import increased again to 0.844 million and 0.861 tons respectively.

The purpose of this research is to estimate the demand for rice import in Indonesia using demand system. The demand system used is Almost Ideal Demand System (AIDS). Rice as the staple food of the Indonesian households heavily depends on rice imports because domestic rice production was less than the domestic rice consumption. This research estimates elasticity of demand for rice import both the price elasticity and the income or expenditure elasticity of rice import. The price elasticity of rice import is very useful for formulating rice import policy in Indonesia. Proper policy of rice import, therefore, could overcome the problem of low consumption of calorie as source of energy for Indonesian households.

2. THEORETICAL FRAMEWORK

A country imports goods because their domestic consumption exceeds domestic production. Import, in other words, is the consumption of goods originating from abroad. Therefore, the factors affecting imports is similar to the demand for goods consisting of import prices, income of importing countries, the price of imported goods from other countries and taste. Because imports involve two countries that have different currencies, a country's import is also affected by the exchange rate between the domestic currency and its partner currency.

Several previous studies have been conducted to analyze rice import in Indonesia. For example, Syahnur, (2011) examined rice import in Indonesia during 1975-2009 using dynamic model known as the Partial Adjustment Model (PAM). This study tried to determine the variables affecting rice imports using data from Central Bureau of Statistics (BPS). The dependent variable used in this study is the volume of rice import. The independent variable consists of the price of rice imports in term of cost insurance freight (CIF) price, domestic price, GDP, domestic rice production. The results show that the price of import rice, prices of domestic rice and GDP per capita affect rice imports.

Another study was by Syamsuddin, Hamzah, & MA, (2013) who investigated the factors affecting Rice Imports in Indonesia. This study used time series data from 1982-2011 from the Central Bureau of Statistics (BPS) and the Ministry of Agriculture. The method is a multiple linear regression model with independent variable consisting of price of domestic rice, gross domestic product and exchange rate. The results show that prices of domestic rice have a positive impact and GDP negatively affects on rice import. The next study was conducted by Christianto,

(2013). His study analyzed the factors affecting rice imports in Indonesia. The method is multiple linear regression during 2001-2010. The independent variables are prices of world rice, prices of domestic rice and consumption levels. The results show that domestic rice consumption has a positive effect on rice imports.

Prasetyo & Anindita, (2016) also analyzed the factors affecting rice Imports in Indonesia during 1999-2012. The data are from Central Bureau of Statistics (BPS) and Food and Agriculture Organization (FAO). Their study applied a dynamic model of Error Correction Model (ECM). The independent variable is rice imports. The independent variables consist of domestic rice consumption, world rice price and GDP. The results show that the world rice price had a negative effect and GDP had a positive effect on rice imports.

Previous empirical studies of rice imports have focused on the analysis of factors affecting Indonesian rice imports. A single regression equation was applied to analyze factors affecting imports. In this regression, rice import is a function of variables affecting rice import such as income, price and exchange rate. This research is different from previous research. First, this study investigates rice imports using demand system analysis. The demand system of this study is the Almost Ideal Demand System (AIDS) developed by Deaton & Muellbauer, (1980). The use of demand system has been widely used in Indonesia to analyze rice demand such as Widarjono, (2013), Mulyana & Yamin (2015), Widarjono & Rucbha (2016), Mayasari, Satria, & Noor, (2018). However, investigating import using demand system are still rare. Second, analyzing import using a single equation is ad hoc without any underlying theory. A Single equation, therefore, will produce a biased demand elasticity of import. The advantages of demand system model with several equation regression is that demand system is built using the demand theory approach to produce more appropriate demand elasticity of import Deaton & Muellbauer (1980).

3. RESEARCH METHODS

The main objective of rice imports is to fulfill rice shortage in domestic market and to keep domestic rice stocks stable. The study of rice imports in this study applied the demand system. This study examines the economic variables in influencing rice import. The framework of this research using demand system can be explained on figure 1. Based on this framework, this research analyzes the demand of rice import in indonesia consisting of four countries consisting of vietnam, thailand, usa and other countries which encompass china, japan, india, pakistan, singapore, myanmar and taiwan.

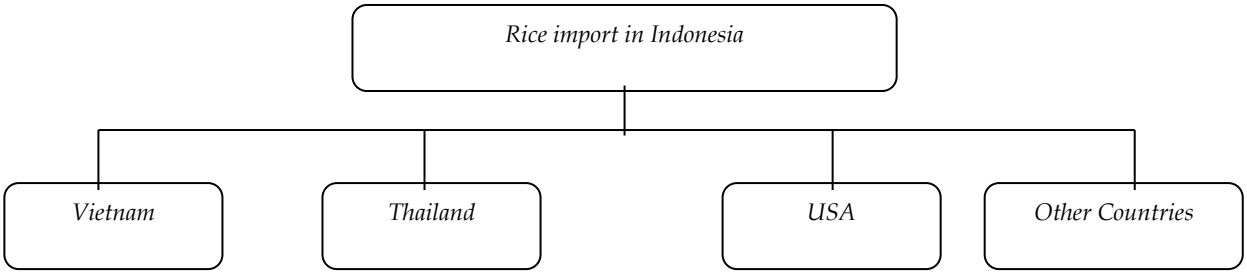


Figure 1
Framework of rice import in Indonesia

This research applied demand system of Almost Ideal Demands System (AIDS) which was first introduced by Deaton & Muellbauer (1980). The AIDS is a model for estimating a demand system in order to fulfill demand Theory. The AIDS developed by Deaton and Muellbauer has advantages over the previously demand system models such as the linear expenditure system model, the Rotterdam model and the Translog model. First, AIDS is a first order approximation on every demand system. Second, AIDS fits the axiom of consumer choice in demand theory that satisfies homogeneity, symmetry and adding up conditions. Third, AIDS has a form of function that is consistent with consumer budget data. The AIDS Equation can be formulated as follows:

$$w_i = \alpha_{0i} + \sum_{j=1}^{n=4} \alpha_{ij}\, lnp_j + \beta_i ln\left(\frac{X}{a(P)}\right) + u_i \qquad (1)$$

Where: w_i = the budget share allocated for rice import from each country consisting of Vietnam, Thailand, USA and other countries, α_{0i} = intercept or constants; α_{ij} and βi = estimated parameter, p_j = price of rice import from country j consisting of Vietnam, Thailand, USA and other countries, X = ex-

penditure of rice import, a(P) = price index; u_i = error.

In order to make the aids model consistent with demand theory, there are three conditions to be fulfilled:

1) *Adding Up,* $\sum_{i=1}^{n}\rho_{i0}=1;\sum_{i=1}^{n}\rho_{ik}=0;$ $\sum_{i=1}^{n}\gamma_{ij}=0;\sum_{i=1}^{n}\beta_i=0;\sum_{i=1}^{n}\lambda_i=0$ *(2)*
2) *Homogeneity,* $\sum_{=1}^{n}\gamma_{ij}=0$ *for each i (3)*
3) *Slutsky Symmetry,* $\gamma_{ij}=\gamma_{ji}, i\neq j$ *(4)*

In equation (1), there are four demand equations of rice import from Vietnam, Thailand, USA and other countries. In estimating the Indonesian rice import demand system, three restrictions were applied: Adding-up, Homogeneity and Slutsky symmetry as equation (2) - (4). The demand for rice imports from other countries is estimated using the add-up restriction. Homogeneity means that sum of all price coefficients of rice import from Vietnam, Thailand, USA and other country on equation of rice import from Vietnam equal to zero. This condition also occurs in the coefficient on the rice import equation of the other three countries. Slutsky symmetry means: (1) parameter of price of rice import from Thailand on Thailand equation is equal to parameter of price of rice import from Thailand on Vietnam equation; (2) the parameter of price of rice import from Vietnam on USA equation is equal to the parameter of price of rice import from USA on Vietnam equation; and (3) the parameter of price of Thailand's rice import on the US equation is same as the parameter of price of USA's rice import on Thailand equation.

An important issue associated to the AIDS is calculating of the price index. The price index is measured by both the nonlinear and the linier price index. Non-linear approach which is the original AIDS model can be written as follows:

$$\ln[a(P)]=\alpha_0+\sum_{i=1}^{n}\alpha_i\, lnp_i+0.5\sum_{i=1}^{n}\sum_{j=1}^{n}\gamma_{ij}\, lnp_i \qquad (5)$$

The use of non linear price makes it difficult for researchers to estimate the demand system so that many researchers use the linear price index instead of non linier price index. The linear price index approach is used as one of the methods to estimate the demand system. This linear price index approach is known as Linear Approximation AIDS (LA-AIDS). One approach to the linear price index that is widely used is the Stone's price index as follows:

$$lna(P)=\sum_i w_i\, ln\, p_i \qquad (6)$$

Where w_i is a budget share of each commodity in the system of equation.

However, the use of the LA-AIDS model results in bias demand elasticity for both price and expenditure elasticity Alston, Foster, & Green (1994). Therefore, this study uses both price indexes to estimate the demand for rice imports in Indonesia.

The elasticity of rice import in both LA-AIDS and AIDS models is calculated from the estimated coefficient of equation (1). Own-price elasticity is calculated using the following formula:

$$e_{ii}=\frac{1}{W_i}\{\gamma_{ii}-\beta_i\}-1 \qquad (7)$$

Cross-price elasticity is calculated using the following formula:

$$e_{ij}=\frac{1}{W_i}\{\gamma_{ij}-\beta_i\} \qquad (8)$$

Expenditure elasticity is calculated using the following formula

$$i=\frac{1}{W_i}\{\beta_i\} \qquad (9)$$

The next step is to perform policy simulation by investigating the effects of price of rice import and income changes on rice import using the elasticity of rice import for both price and expenditure elasticity. Following Zheng & Henneberry, (2012), the change of rice import is a function of the change in price of rice import and income and can be formulated as follows:

$$\Delta\, ln\,\theta_k=\sum_j \pi_{kj}\,\Delta\, ln\, p_j+\eta_k\Delta\, ln\, y \qquad (10)$$

where $\Delta\, ln\,\theta_k=\Delta\theta_k/\theta_k$ is a percentage change in rice import, $\Delta\, ln\, p_j=\Delta p_j/p_j$ is a percentage change in price of rice import and $\Delta\, ln\, y=\Delta y/y$ is a percentage change in income.

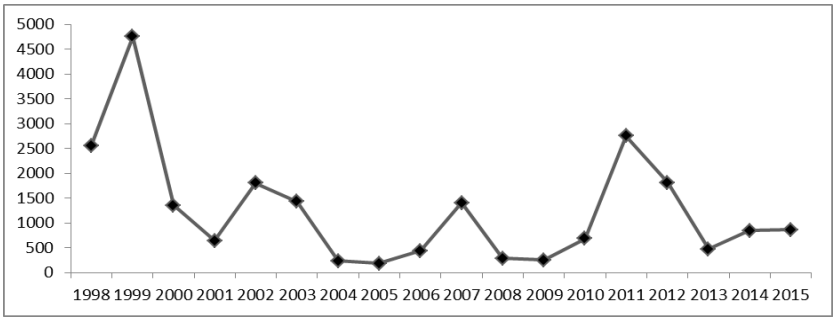
This study uses secondary data from the Central Bureau of Statistics (BPS). The data used in this study is rice import data from 1998 to 2014. Indonesia's largest rice imports are from Thailand, Vietnam and USA. While from other countries such as from China, Japan, India, Pakistan, Myanmar and Taiwan are small. Therefore, for the purposes of this study, the small rice exporting countries to Indonesia then are grouped into one group called as

other countries. The Central Bureau of Statistics (BPS) notes that Indonesia's rice imports consist of two measurement both value and net weight. The price of rice from each country is the average price of rice in term of FOB price which is calculated by dividing the import value with net import weight.

4. DATA ANALYSIS AND DISCUSSION

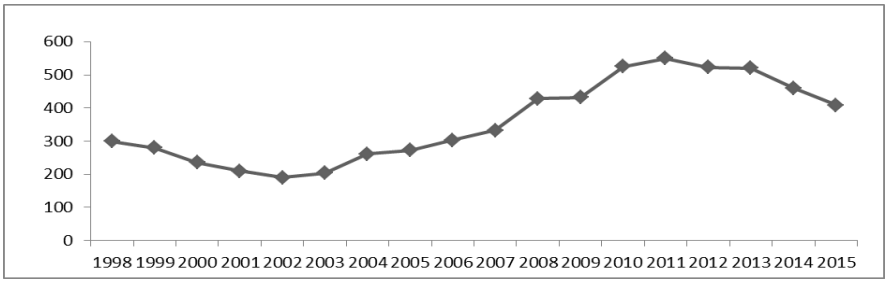
Descriptive Analysis

Graph 1 shows quantity of rice import during 1998-2014 period which is the study conducted. After achieving rice self-sufficiency in 1984, rice imports were inevitable due to the increasing number of people and the reducing agricultural land for rice production. Indonesia's rice imports have fluctuated with the average rice import in that period was 1260 thousand tons per year. The import of rice was quite high in 1998-1999. Rice import was almost 5,000 tons in 1999 due to the economic crisis. However, rice imports declined after 1999 with average below 2,000 tons per year. In the period of 2000-2010 the average import of rice was 794 tons per year. Imports of rice again increased over 2,000 tons of 2,750 tons in 2011. However, rice imports declined again until 2015. Graph 2 explains price of rice import during 1998-2015. In that period the average price of rice import was 357 US $ per ton. The price of rice import decreased from 1998 to 2002. The price of rice imports then increased to reach the highest price of 550 US $ per ton in 2011. However, the price of rice import fell down after 2011 even though the price of rice import was still above 400 US $ per ton.



Source: Bureau Central of Statistics (BPS). www.bps.go.id.

Graph 1
Volume of Rice Import 1998-2015 (000 tons)



Source: Bureau Central of Statistics (BPS). www.bps.go.id.

Graph 2.
Price of Rice Import, 1998-2015 (US$ per ton)

Indonesia's rice imports come from various countries such as Vietnam, Thailand, USA, Pakistan, India, China, Taiwan, Singapore, Myanmar and other countries. However, there are only a few countries that are the main exporters of rice to Indonesia coming from Vietnam, Thailand, USA and Pakistan. Thailand and Vietnam are not the largest rice producers in the world market but both countries are able to export rice to Indonesia because rice is not the main staple food in both countries. USA is not also a major producer of rice in the world market but USA can export rice to Indonesia because the staple food at that country is wheat. Table 1 shows Indonesian rice imports from 2012 -2015 based on the origin of the country in terms of both quantity and value. Rice imports have declined since 2013 with rice imports less than 1 million tons. However, rice imports increased again to close to one million tons in 2014 and 2015. There are three countries which are the biggest rice exporting countries to Indonesia encompassing of Thailand, Vietnam and USA. USA was the third rank before 2012 but USA then is replaced by Pakistan and India since 2012.

Table 1
Rice Import, Indonesia, 2012-2015

Country	2012		2013		2014		2015	
	Weight Ton	Value 000 US$	Weight Ton	Value 000 US$	Weight Ton	Value 000 US$	Weight Ton	Value 000 US$
Vietnam	1084782.8	564925.7	171286.6	97303.3	306418.1	143536.0	509374.2	202563.1
Thailand	315352.7	186171.4	94633.9	61787.5	366203.5	175387.4	126745.7	66772.4
USA	2445.5	2718.6	2790.4	2983.6	1078.6	1294.3	0.0	0.0
Pakistan	133078.0	52483.4	75813.0	29996.9	61715.0	23909.3	180099.5	62949.2
India	259022.6	122189.0	107538.0	44989.1	90653.8	34299.5	34167.5	13671.7
China	3099.3	11205.6	639.8	1526.5	1416.7	4101.5	479.9	1631.0
Taiwan	0.0	0.0	1240.0	465.6	840.0	252.0	0.0	0.0
Singapore	22.5	32.2	0.5	1.4	0.0	0.0	0.0	0.0
Myanmar	11819.6	4754.5	18450.0	6498.9	15616.0	5082.8	8775.0	2732.3
Others	749.3	1142.8	272.5	449.2	222.0	315.7	1959.2	1282.5
Total	1810372.3	945623.2	472664.7	246002.1	844163.7	388178.5	861601.0	351602.2

Source: BPS, www.bps.go.id.

Table 2 describes data used in the analysis of Indonesian rice imports from 1998 to 2014 coming from Vietnam, Thailand, USA and other countries. Other countries are all countries other than those three countries. The data describes the average quantity of rice import, the value of rice import, the price of rice import and the share of rice import from rice exporting countries to Indonesia. The average total import of rice during this period was 1.290 million tons per year with an average value of 455.613 million US$. Of the total imports, Vietnam was first rank with an average of 0.581 million tons and with a value of 209.719 million per year. While the budget share of rice import from Vietnam was 0.391. The price used in this research is the import price of FOB. The average price of rice import per ton from Vietnam, Thailand, USA and other countries is respectively 3,047 US $; 3,175 US $; 1,988 US $ and 2,886 US $.Table 2.

Estimation of LA-AIDS Model

The AIDS used in analyzing rice import demand in Indonesia results in import elasticity both price elasticity and expenditure elasticity. Price and expenditure elasticity of rice import are calculated from the estimation parameters in the AIDS model. Therefore, there are two steps to be done. The first is to estimate rice import using AIDS model as in (1). Second steps is to calculate both price and expenditure elasticity of rice import based on estimated parameter in the first step by using equation (7), (8) and (9). There are two approaches to calculating price and expenditure elasticity of import, namely Linear AIDS or LA-AIDS and non-linear AIDS.

The estimation results of rice import demand with LA-AIDS model are shown in table 3. There are four equations in demand system of rice import. There are 6 variables that must be estimated including constants in each equation. Thus, there are 24 parameters estimated within the system of rice import demand in Indonesia. The dependent variable is the budget share of import from each of 4 countries studied. The result of the estimated parameter of LA-AIDS is used to calculate the elasticity of the demand for rice import consisting of price elasticity of rice import both own price and cross price elasticity and expenditure elasticity of rice import.

The price elasticity consisting of own price and cross-price elasticity of rice import and the expenditure elasticity of rice import is shown in Table 4. On the diagonal of the table shows the own-price elasticity of Vietnam's rice, Thailand's rice, USA's rice, and other country's rice. The results show that all own price elasticities of rice import for the four countries show negative signs which are consistent to economic theory.

The own price elasticities of rice import are -3.267, -2.155, -1,437, -0.85259 for Vietnam's rice for Thailand's rice, USA's rice, and for other Country's rice respectively. All own price elasticity of rice import are elastic except for other country. The own price elasticity of rice import from Vietnam is most elastic, then followed by Thailand and USA. The own price elasticity of rice import from Vietnam is -3.267. Its value means that if import price of Vietnam's rice increase by 1% then rice import from Vietnam will decrease by 3.26%. Cross-price price elas-

ticity of rice import is shown in off-diagonal on Table 4.

Cross price elasticity of rice import measures how much change in the amount of rice imports from one country due to changes in prices of rice import from other countries. The cross price elasticity of rice import explains whether a country's rice import is a substitute or complementary rice for other countries. In Vietnam rice import equation, all rice imports from other countries are substitute rice to Thailand's rice. In Thailand rice import equation, Vietnam's rice and USA's rice are substitute rice while other country's rice is complementary rice to Thailand's rice.

Expenditure elasticities of rice Import from Vietnam, Thailand, USA and other countries are shown in the bottom of Table 4. All expenditure elasticities of rice import from all countries are positive. The expenditure elasticity of rice import ranges from 0.548 to 1.199. The expenditure elasticity of rice import from Vietnam's rice and other country's rice is elastic while it is inelastic from USA's rice and Thailand's rice. The finding shows that Thailand's rice and USA's rice are staple goods.

Table 2
Descriptive Statistics of Data, Rice Import, Indonesia, 1998-2014

Variable	Mean	Std Dev	Minimum	Maximum
Import Quantity from Vietnam (ton)	581232	579381	20970	1803959
Import Value from Vietnam (000 US$)	209719	250171	7936	946490
Import Price of Vietnam (000$/ton)	3.407	1.341	1.760	6.080
Import Quantity from Thailand (ton)	406485	360884	94633	1373617
Import Value from Thailand (000 US$)	152843	146306	32489	533001
Import Price of Thailand (000$/ton)	3.175	1.330	1.001	5.618
Import Quantity from USA (ton)	28156	49235	801	177889
Import Value from USA (000 US$)	9647	15109	646	52889
Import Price of USA (000$/ton)	1.988	1.331	0.660	4.713
Import Quantity from other countries (ton)	274393	393253	6198	1498866
Import Value from other countries (000 US$)	83404	123153	2799	508200
Import Price of other countries (000$/ton)	2.886	1.906	0.419	6.887
Budget share of import from Vietnam	0.391	0.191	0.073	0.717
Budget share of import from Thailand	0.388	0.166	0.199	0.758
Budget share of import from USA	0.043	0.094	0.002	0.392
Budget share of import from other countries	0.178	0.136	0.019	0.454

Source: BPS. www.bps.go.id

Table 3
Estimated parameter of LA-AIDS, Import rice, Indonesia, 1998-2014

	Vietnam	Thailand	USA	Other Countries
Constant	-0.226	1.375***	0.187	-0.335*
	(-0.577)	(0.442)	(0.315)	(0.167)
Import price of Vietnam	-0.807**	0.564***	0.009	0.235
	(0.312)	(0.201)	(0.113)	(0.167)
Import price of Thailand	0.564***	-0.531***	0.048	-0.080
	(0.201)	(0.178)	(0.089)	(0.111)
Import price of USA	0.009	0.048	-0.038	-0.018
	(0.113)	(0.089)	(0.084)	(0.078)
Import price of Other Countries	0.065	-0.165***	0.048	0.052
	(0.079)	(0.061)	(0.049)	(0.067)
Expenditure	0.078**	-0.084**	-0.020	0.026
	(0.041)	(0.033)	(0.024)	(0.037)

Source: estimated from BPS 1998-2014
Standard error is in parenthesis
*** ; **; * are statistically significant at α=1%; α =5%; α=10% respectively

Table 4.
Price and Expenditure Elasticity, Rice Import, LA-AIDS, Indonesia

	Vietnam	Thailand	USA	Other Countries
	Price Elasticity			
Import price of Vietnam	-3.262	1.242	-0.177	-0.033
Import price of Thailand	1.670	-2.155	0.340	-0.209
Import price of USA	0.650	1.567	-1.437	1.572
Import price of Other Countries	1.175	-0.595	-0.246	-0.853
	Expenditure Elasticity			
Expenditure	1.199	0.784	0.548	1.144

Source: estimated from Table 3

Estimation of AIDS Model

Table 5 presents estimation of rice import demand using the AIDS model. Like LA-AIDS model, there are four equations that must be estimated in the rice import demand system. There are 24 parameters estimated in Indonesian rice import demand system where the dependent variable is the budget share of rice import from each of 4 countries. The next step is to calculate the elasticity of rice import consisting of price elasticity both own price and cross price elasticity and import expenditure elasticity of rice import based on AIDS parameter estimation.

Table 6 shows own price, cross prices elasticity and expenditure elasticity of rice import using the AIDS model. Own price elasticity of rice import from Vietnam, Thailand, USA, other Country is displayed on the diagonal of the Table 6. All own price elasticities of rice import are negative. Like LA-AIDS, these findings are in line with the theory of import demand.

The own price elasticity of rice import from Vietnam, Thailand, USA and other country is respectively -0.94367; -0.746; -3.020; and -1.440. The elasticity of the LA-AIDS model is higher than that of the AIDS model because LA-AIDS estimation is only approximation of the AIDS model and is usually overestimated (Alston et al, 1994). The own prices elasticity of rice import from Vietnam and Thailand is inelastic and the own price elasticity of rice import from USA and other country is elastic. These findings indicate that Indonesia depends on rice imports from both Thailand and Vietnam as the main source of Indonesia rice imports. The cross-price elasticity of rice import is shown in off-diagonal in table 6. In every equation of rice import in each country, rice imports from other countries are substitute and complementary rice. For example, in Vietnam equation, Thailand's rice and other country's rice are substitute rice while USA's rice is complementary rice.

The expenditure elasticity of rice import from Vietnam, Thailand, USA and other countries are shown in bottom of Table 6. All expenditure elasticities of rice import from all countries are positive. The expenditure elasticity of rice import is from 0.021 to 1.368. Like the price elasticity of rice import, the expenditure elasticity of rice import with the LA-AIDS model is overestimated compared to the AIDS model. The expenditure elasticity of rice import from Vietnam and other country is elastic and it is inelastic from USA and Thailand. These findings indicate that Indonesia imports more rice from Vietnam than rice from Thailand.

Policy Simulation

Having import price and expenditure elasticity of rice, these elasticities are then used to perform policy simulations. This policy simulation is to analyze the impact of changes in rice import prices and expenditure on rice import in Indonesia using the equation (10) previously. From this simulation can be investigated how the change of rice import if price of rice import and expenditure change

Based on the budget share, rice import from Vietnam and Thailand are two countries from which is mostly rice import. In this study, policy simulations were conducted to analyze the impact of price import changes on rice import. The scenario is the increase in prices of rice import by 10% to rice import holding that income does not change. The results of the policy simulation are shown on Table 7.

Based on LA-AIDS method, an increase in price of rice import will increase rice import from Vietnam, Thailand and Other countries except USA. However, AIDS method results in an increase in rice import from Thailand and other countries and a decrease in rice import from Vietnam and USA if prices of rice import rise. Both methods show that if there is an increase in the price of rice import, the total import of rice has decreased. However, rice imports from certain countries such as Thailand continue to rise if price of rice import increases. Both LA-AIDS and AIDS show that increase rice import will reduce rice import form USA. These results indicate that if

there is an increase in the price of rice import, Indonesia still imports rice from other countries by reducing imported rice from the USA because rice is a staple food of the Indonesian households.

Table 5.
Estimated Parameter of AIDS, Rice Import, Indonesia, 1998-2014

	Vietnam	Thailand	USA	Other Countries
Constant	-0.140	1.048	0.519	-0.427
	(0.493)	(0.388)	(0.485)	(0.524)
Import price of Vietnam	0.057	0.085	-0.234	0.092
	(0.375)	(0.326)	(0.170)	(0.195)
Import price of Thailand	0.085	0.041	0.158	-0.284*
	(0.326)	(0.314)	(0.129)	(0.153)
Import price of USA	-0.234	0.158	-0.129	0.205
	(0.170)	(0.129)	(0.202)	(0.175)
Import price of Other Countries	0.092	-0.284*	0.205	-0.013
	(0.195)	(0.153)	(0.175)	(0.231)
Expenditure	0.034	-0.058*	-0.042	0.066
	(0.045)	(0.036)	(0.045)	(0.048)

Source: estimated from BPS 1998-2014
Standard error is in parenthesis
*** ; **; * are statistically significant at α=1%; α =5%; α=10% respectively

Table 6
Price and Expenditure Elasticity, Rice Import, AIDS, Indonesia

	Vietnam	Thailand	USA	Other Countries
			Price Elasticity	
Import price of Vietnam	-0.943	0.129	-0.685	0.147
Import price of Thailand	0.368	-0.746	0.557	-0.584
Import price of USA	-4.440	4.649	-3.020	5.730
Import price of Other Countries	0.148	-1.963	0.782	-1.440
			Expenditure Elasticity	
Expenditure	1.088	0.851	0.021	1.368

Source: estimated from Table 5

Table 7
Effect of Change in Price of rice import on Rice Import, Indonesia

Country	LA AIDS			AIDS	
	Average import (ton)	Change (%)	Change Quantity (ton)	Change (%)	Change Quantity (ton)
Vietnam	581,232	0.0234	13,577	-0.4867	-282,877
Thailand	406,485	0.0059	2,414	0.2070	84,132
USA	28,156	-0.1520	-4,280	-0.2367	-6,664
Other Countries	274,393	0.0477	13,094	0.3853	105,718
Total	1,290,267	-0.0750	24807	-0.1311	-99690

Source: estimated from Table 4 and 6.

5. CONCLUSION, IMPLICATION, SUGGESTION AND LIMITATION

This study estimated the demand for rice imports coming from Vietnam, Thailand, USA and other countries. It used demand system model both LA-AIDS and AIDS model. The period of rice import under this study was 1998-2014 using secondary data from Indonesian Central Bureau of Statistics. The demand system model for rice import result in price and expenditure elasticity of rice import. The elasticity of rice import is then used to perform policy simulation in case of changes in price of rice import.

The results showed that the price elasticities of rice import are negative and the expenditure elasticities of rice import are positive. As expected, the elasticity of rice imports from the four countries is line with economic theory. The own price elasticity of rice imports shows that the most elastic of rice im-

port is from USA. Meanwhile, the own price elasticity of rice import from Vietnam and Thailand as the main sources of Indonesian rice import is inelastic. The expenditure elasticity of rice import shows that it is elastic from Vietnam and other countries and it is inelastic from Thailand and USA. Policy simulations show that if there is an increase in prices of rice import, total rice imports will decline. However, rice import from some countries such as Thailand still increases.

There are several implications that can be drawn from this study. First, based on price elasticity of rice import, Indonesia's rice imports highly depend on rice import from Vietnam and Thailand. Therefore, the government should diversify rice imports from other countries such Pakistan and India so that domestic rice consumption can be fulfilled anytime as shock of rice production occurs in Vietnam and Thailand. Second, based on the simulation shows that the increase in price of rice import will reduce rice import. Therefore, domestic rice production should be increased to reduce dependency on rice imports.

There are several drawbacks to this study. First, this study focuses on the rice imports from the three largest countries, namely Thailand, Vietnam and the USA while the import of rice from the other countries is grouped into one country only, namely the other countries. This grouping has been changing because the Indonesian rice imports from countries such as India and China trend to increase recently. Therefore, future research must consider to this recent condition. Second, this study uses AIDS. One disadvantage of using AIDS is that the Engel curve is linear with respect to income. Rice is a staple food. Rice imports are not linearly related to income so the Engel curve should be nonlinear. The right model for estimating rice imports in Indonesia, therefore, is the quadratic almost ideal demand (QUAIDS) model in which is a quadratic Engel curve.

REFERENCES

Alston, J. M., Foster, K. A., & Green, R. D. (1994). Estimating Elasticities with the Linear Approximate Almost Ideal Demand System : Some Monte Carlo Results Author (s): Julian M . Alston , Kenneth A . Foster and Richard D . Gree Source : The Review of Economics and Statistics , Vol . 76 , No . 2 (May ,. The Review of Economics and Statistics, 76(2), 351–356.

Christianto, E. (2013). Faktor Yang Memengaruhi Volume Impor Beras Di Indonesia. Jurnal JIBEKA Agustus, 7(2), 38–43.

https://doi.org/10.1145/1978542

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. The American Economic Review, 70(3), 312--326. https://doi.org/10.1016/0014-2921(94)90008-6

Mayasari, D., Satria, D., & Noor, I. (2018). Analisis Pola Konsumsi Pangan Berdasarkan Status IPM di Jawa Timur The Pattern of Food Consumption Based on HDI in East Java. Jurnal Ekonomi Dan Pembangunan Indonesia, 18(Januari), 191–213.

Mulyana, A., & Yamin, M. (2015). ANALISIS POLA KONSUMSI PANGAN DI SUMATERA SELATAN 2013 : PENDEKATAN QUADRATIC ALMOST IDEAL DEMAND SYSTEM Analysis of Food Consumption Patterns in South Sumatra in 2013 : A Quadratic Almost Ideal Demand System Approach.

Prasetyo, A., & Anindita, R. (2016). Import Demand Function of Rice in Indonesia. Habitat, 27(1), 1–6.https://doi.org/10.1016/j.energy.2018.05.038

Simatupang, P., & Timmer, C. P. (2008). Indonesian rice production: Policies and realities. Bulletin of Indonesian Economic Studies, 44(1), 65–79. https://doi.org/10.1080/00074910802001587

Syahnur, S. (2011). ANALISIS Short-Run dan Long-Run PERMINTAAN IMPOR BERAS DI INDONESIA 1. Ekonomi, XVI(1), 1–9.

Syamsuddin, N., Hamzah, P. D. A., & MA, D. M. N. M. S. (2013). Analisis Faktor-faktor yang Mempengaruhi Impor Beras di Indonesia. Jurnal Ilmu Ekonomi, Pascasarjana Universitas Syiah Kuala, im(2014), 58–70. Retrieved from http://repositori.uin-alauddin.ac.id/6442/1/Musdalifa Mukhdar_opt.pdf.

Widarjono, A. (2013). Food Demand in Yogyakarta : Susenas 2011. Jurnal Bisnis Dan Ekonomi, 17 No.2 (September), 104–118. https://doi.org/http://dx.doi.org/10.24002/kinerja.v17i2.374

Widarjono, A., & Rucbha, S. M. (2016). Household Food Demand in Indonesia: a Two-Stage Budgeting Approach. Journal of Indonesian Economy and Business, 31(2), 163–177.

Zheng, Z., & Henneberry, S. R. (2012). Estimating the impacts of rising food prices on nutrient intake in urban China. China Economic Review, 23(4), 1090–1103. https://doi.org/10.1016/j.chieco.2012.07.001