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Abstract

This study aims at measuring the impact of world price volatility and import tariffs on rice on poverty in Indonesia. Applying a Computable General Equilibrium-Microsimulation approach and the endogenous poverty line, this study found that the volatility of world rice prices during 2007 to 2010 had a large effect on the poverty incidence in Indonesia. The simulation result showed that a 60 per cent increase in world rice price raises the head count index by 0.81 per cent which is equivalent to an increase in the number of poor by 1,687,270. However, both the 40 per cent decrease in the effective import tariffs on rice enacted by regulation No.93/PMK.011/2007 and the zero import tariffs implemented by regulation No. 241/PMK.011/2010 in response to high world rice prices could not perfectly absorb the negative impact of increasing world rice prices on poverty. The 40 per cent decrease in the effective import tariffs on rice reduced the head count index by 0.08 per cent equal to 161,546 people while the zero import tariffs on rice reduced the head count index by 0.19 per cent equal to 390,160 people. These policies might not be enough to absorb the negative impact of an increase in world rice prices from 2007-2010, because, during this period, the world rice prices increased on average by almost 71 per cent, which have impoverished approximately two million people. Moreover, protection in the agricultural sector, such as raising import tariffs, intended to help agricultural producers will have the reverse effect of raising the head count index.

Keywords: Rice Policy, Import Tariffs, Poverty, CGE, Microsimulation.
JEL Classifications: D12, D58, I32, Q18

1. Introduction

Since 2007, the world has experienced a dramatic fluctuation in the world price of rice. The world price of rice jumped from $313.48/metric ton (January 2007) to $1,015/metric ton (April 2008) then dropped to $472.48/metric ton (May 2009) and again increased to $536.78 (Dec. 2010)[1]. The increases in the price of rice raise the real incomes of those selling rice, many of whom are relatively poor, while hurting net rice consumers, many of whom are also relatively poor. Ivanic and Martin (2008), using household data for

[1] IMF Primary Commodity Statistics, accessed in January 2011. (**http://www.imf.org/external/np/res/commod/index.asp**)

ten observations on nine low-income countries, showed that the short-run impact of higher staple food prices on poverty differ considerably by commodity and by country, but poverty increases are much more frequent, and larger, than poverty reductions. However, responding to drastically increasing rice prices and protecting low-income groups, in December 2010 the government imposed the short period of zero import tariffs (during December 22, 2010 to March 31, 2011) on rice through Regulation Ministry of Finance No. 241/PMK.0011/2010.

It is widely accepted that in most developing countries, especially where rice normally accounts for larger shares of both the consumers' budgets and total employment, controlling price and quantity policy through tariff and trade barriers are always politically sensitive. In Indonesia, rice represents 8.18 per cent of average consumer expenditure, and even agricultural households spend 12.61 per cent to 14.17 per cent of their consumer expenditures on rice (Table 1). Moreover, approximately 65 per cent of agricultural households holding land and almost 90 per cent of landless agricultural households are net buyers. Food and Agriculture Organization (FAO) showed that Indonesia is the fourth-largest importing country in the world, and in 2007 the country imported about 1.37 million metric tons of rice, which equals 2.35 per cent of domestic production. Consequently, an increase in the world price of rice will directly raise the domestic price and create hardship to most households in Indonesia.

Table 1: Overview of Rice's Consumption in 2005

Sector	Population	Initial Poverty 2005 (% of Population)	Net Producer (% of Household)	Net Consumer (% of Household)	Rice Exp. (IDR/Capita /Month)	Rice Expenditure (% of Total Expenditure)
Total Agriculture	77,780,606	24.31	28.66	71.34	25,935	13.74
Agriculture (without Land)	20,448,294	25.73	10.62	89.38	25,418	12.61
Agriculture (with Land)	57,332,312	23.81	35.06	64.94	26,119	14.17
Owning Land 0-0.5 Hectare	27,376,123	26.95	35.01	64.99	23,974	13.86
Owning Land > 0.5 Hectare	29,956,189	20.94	35.10	64.90	28,014	14.42
Industry	19,916,155	11.25	7.58	92.42	21,882	6.46
Electricity, Water, Gas and Constructions	14,312,875	17.66	9.17	90.83	21,987	7.87
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	10.81	5.83	94.17	22,103	6.47
Banking, Financial Int., Government and Private Services	26,863,587	6.94	6.17	93.83	22,569	5.15
Others	23,201,581	15.81	10.97	89.03	23,398	7.31
Total	**209,309,307**	**16.40**	**15.38**	**84.62**	**23,711**	**8.18**

Source: Author's Calculation based on Socio Economic Survey (SUSENAS 2005).

Note: Not included Nanggroe Aceh Darussalam. Net Consumer (Buyer) is a household whose rice consumption exceeds its rice production (included harvest sharing). Net Producer (Seller) is a household whose rice production (harvest sharing) equals to or greater than its rice consumption. The summation of Net Producer and Net Consumer equals to 100 per cent.

According to the 2003 Agricultural Census, approximately 56 per cent of agricultural household only own less than 0.5 hectares of land, meaning that many of them are small and subsistence farmers. Thus, an increase in the rice price may not benefit them, since their agricultural production is probably not sufficient to meet their needs. On the contrary, a drop in the rice price will lower the incomes of farmers and create fewer jobs for workers, particularly in the rural areas where a large share of employment depends on the agricultural sector. According to the 2003 Agricultural Census, the agricultural sector employs 46.34 million people, almost a half of total employment in Indonesia. About one-fourth of them are engaged in rice paddy and crop activities. Hence, a price decrease of rice and other crop commodities will directly cause suffering for about 11.6 million farmers.

The impact of price volatility on poverty will certainly be very diverse, but the average impact on poverty depends upon the balance between the two effects, both on consumers and producers. There are many studies applying either a general or partial equilibrium model concerning rice price and poverty in Indonesia. Leith *et al.* (2003), using a general equilibrium representative household model found that an *ad valorem* increase in the rice import tariff from 25 per cent to 45 per cent would increase poverty in both urban and rural areas by 0.06 per cent and 0.04 per cent, respectively, in the medium-term. Warr and Yusuf (2009), applying a general equilibrium multi household model, observed that the main beneficiaries of the food price increases during 2007 to 2008 were not the poor, but the owners of agricultural land and capital. In the case of rice, it showed that a 212 per cent increase in real world rice prices did not have a significant effect on poverty in Indonesia. This is because the increase in the rice price produces almost no increase in the producer price of rice, or the output of rice, or its consumer price, and no reduction at all in imports of rice. The reason is the (partially effective) ban on rice imports.

Warr (2005), utilizing a general equilibrium multi-household model, showed that a 90 per cent effective ban on Indonesia's rice imports increases the poverty incidence in that country by a less than one per cent of the population. Utilizing a net benefit analysis model, McCulloch (2008) found that high rice prices hurt the large majority of Indonesians—perhaps 80 per cent—and benefit only a minority. Ikhsan (2003), using a partial equilibrium model, found that a 10 per cent increase in the domestic rice price is associated with a one per cent increase in poverty incidence.

Unlike the previous studies, this study aims at estimating the impact of the volatility of the world price of rice and import tariffs of rice on poverty in Indonesia by applying a computable general equilibrium-microsimulation approach (top-down approach) and also the endogenous poverty line. It is expected that this study could identify comprehensively who will benefit or lose from the change in the world rice price and import tariffs of rice. The comprehensive results are valuable for policy makers in proposing an effective rice

policy which could accommodate both consumers' and producers' interests.

First, this study provides a brief overview of the rice policy in Indonesia. The next part will explain the methodologies, including a computable general equilibrium (CGE)-microsimulation model, the endogenous poverty line and the poverty calculation. It will continue to analyze the impact of world rice price's volatility and import tariff policy on poverty incidence. Like many CGE studies, this study is also complemented with the sensitivity analysis to show the robustness of simulation results. This study will conclude with some important findings and policy recommendations.

2. Overview of Rice Policy and Fluctuation of Rice Price in Indonesia

2.1 Rice Policy

Food policy in Indonesia is mainly dominated by rice policy. Three types of rice policy could be distinguished: 1) pricing policy through price protection, 2) support programs through subsidies, credits and training, and 3) investments in the rehabilitation, improvement and extension of irrigated areas. By the end of the 1960s, *BULOG,* the National Logistics Agency, was established to carry out three main mandates: stabilizing price, controlling a national food security stock and distributing rice to the military and civil servants on a monthly basis. However, after the 1998 financial crisis, the latter task was abolished. The combination effect of three policies led to significant achievements, as rice production doubled from 12 to 24 million tons between 1969 and 1983, while self-sufficiency was attained in 1985.

In 1998, under the structural adjustments agreements with the International Monetary Fund (IMF), *BULOG*'s monopoly was abolished and private companies were allowed to import rice. However, *BULOG* still accounted for around 75 per cent of total rice imports. On September 22, 1998 rice imports were freed (that is, with a 0 per cent tariff). On January 1, 2000, the Ministry of Trade began imposing tariffs on rice imports of IDR (Indonesian Rupiah) 430 per Kg (equivalent to 21 per cent *ad-valorem* tariff at that time). Based on *BULOG*'s recommendation, the Directorate General of Customs and Excise in September 2000 introduced a red lane inspection on rice imports in place, meaning stricter standards of customs inspection than other food items (Leith *et al.*, 2003). In 2003, the import tariff was increased from IDR 430 per Kg to 750 per Kg, raising the *ad valorem* equivalent tariff from 21 per cent to approximately 37 per cent (Warr, 2005). In early 2004, a seasonal ban on rice imports was introduced.

Responding to a dramatic increase in the world rice price, in August 2007 the government reduced the import tariff from IDR 750 per Kg to IDR 550 per Kg which was again reduced to IDR 450 per Kg in December 2007. These policies were enacted by the Ministry of Finance Regulations No. 180/PMK.011/2007 and No.93/PMK.011/2007, respectively. The government again imposed a short period of

zero import tariffs on rice starting from December 22, 2010 to March 31, 2011. This policy was enacted through the Ministry of Finance Regulation No. 241/PMK.011/2010. Starting from April 1, 2011, the import tariffs of rice were set again at IDR 450 per Kg. In addition to tariff policies, the government also actively intervened in the rice market through market operations, distributing *raskin* (cheap rice for the poor) and setting a floor price for dry paddy *(harga gabah kering giling)*.

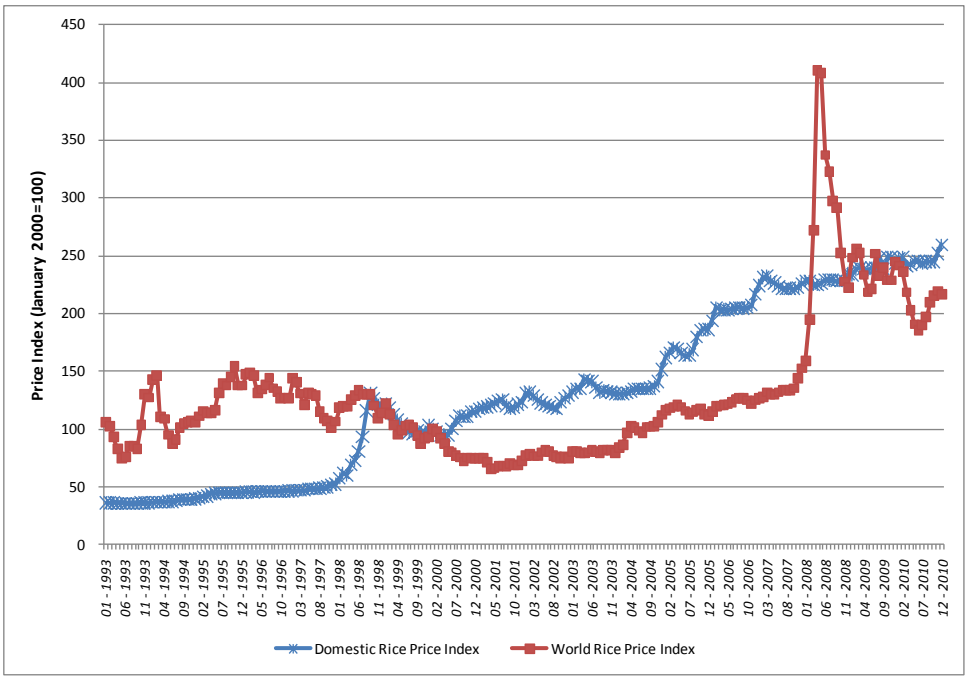
2.2 Fluctuation of Rice Price

The world price and import tariff of rice can affect the domestic price of rice following a simple formula: $P_r^c = \phi P_r^d + \gamma(1+t)\varepsilon P_r^w$. Where, P_r^c is consumer price of rice; P_r^d is domestic producer price of rice; P_r^w is price of imported rice in foreign currency; ϕ is proportion of domestic rice production to total domestic consumption; γ is proportion of imported rice to total domestic consumption; t is import tariff of rice; and ε is exchange rate USD/IDR. To what extent the world price can influence the domestic price depends on the exchange rate, the share of imported rice in domestic consumption and the import tariffs.

Figure 1 shows the trend of the indices of the monthly world and domestic prices of rice from 1993 to 2010. During 1993 to 1996, the domestic price was less volatile compared to the world price, which was indicated by low ratio of the standard deviation between domestic and world prices (0.19). It is apparent that the effects of *BULOG*'s market interventions were relatively effective. Nevertheless, due to the liberalization of the rice market and exchange rate volatility, the ratio of imported rice to total rice production increased from 0.57 per cent (1997) to 5.55 per cent (1998) and 7.25 per cent (1999). During 1998-2003 the domestic rice prices were also more volatile following the volatility in the world rice price. During 2001-2003 the fluctuation of the domestic rice price was 1.5 times larger than that of world rice price.

The import ban imposed in early 2004 was able to reduce the ratio of imported rice below one per cent, but was not able to stabilize the domestic rice price. It was also found that during 2004-2007 the fluctuation of the domestic rice prices was 2.5 times larger than that of the world rice price. An increase in production, reduction in the import tariff, and restricted import policy were able to insulate the domestic price from the dramatic fluctuations in the world price of rice during 2008-2010. This study also calculates that the correlation between the domestic and world price of rice during 1993 to 2010 is 0.56, meaning the fluctuations of the domestic price of rice are more influenced by internal factors, such as weather changes, production and government policies rather than the fluctuations in the world price of rice.

Figure 1: The Indices of Monthly World Price and Domestic Price of Rice, 1995-2010 (January 2000=100)



*Source: Author's compilation. The world rice's price refers to FOB Bangkok of nominal price. (**http://www.imf.org/external/np/res/commod/index.asp**). The domestic rice price during the period January 1993 to November 2008 refers to an average retail price of medium quality rice from 31 cities (CEIC Database). Starting from December 2008 to December 2010, the domestic rice price refers to the average daily rice price for medium quality of rice. These data are available at the homepage of the Ministry of Agriculture (http://database.deptan.go.id/smsharga/LapHarian.asp) and also at the BULOG's Website (http://www.bulog.co.id/gabahberas_v2.php).*

3. Research Methodology

3.1 A CGE-Microsimulation

In recent years, a number of papers have presented different approaches using CGE models to analyze poverty and income distribution. Savard (2003 and 2005) summarized that there are four main categories. First is the CGE model with a representative household (CGE-RH). The poverty analysis performed used a variation of income of the representative household generated by the CGE model with household survey data to perform ex-ante poverty comparisons. Many researchers have used this approach, such as Devis *et al.* (1982) and Damuri and Perdana (2003). Second is the integrated multi-households CGE analysis (CGE-IMH). Compared to the CGE-RH approach, this method incorporates a larger number of representative households. Cororatan and Cockburn (2001), Warr (2005), Warr (2009), Yusuf (2008), Yusuf and Resosudarmo (2008), and Warr and Yusuf (2009) have applied this method.

The third approach is the CGE-Microsimulation approach (CGE-MS) which uses a CGE model to generate prices that link to a micro-econometric household microsimulation model. Chen and Ravallion (2003), Ikhsan *et al.* (2005), Boccafunso and Savard (2006) and Dartanto (2009) utilized this approach to address many issues related to poverty analysis. Lastly, the CGE-Household micro-simulation approach (CGE-HHS) pioneered by Savard (2003 and 2005), which attempts to use the advantages of the CGE-IMG and CGE-MS methods. CGE-HHS proposed to examine coherence between the household model and the CGE model, introducing a bi-directional link and, therefore, obtaining a converging solution between the two models.

This research will utilize the CGE-Microsimulation approach (CGE-MS) in order to calculate how the volatility in rice prices in the international market and import tariffs of rice influence poverty in Indonesia. This approach is applied because it provides richness in household behavior, while remains extremely flexible in terms of specific behaviors that can be modeled. The general idea of the CGE-MS approach is that a CGE model feeds market and factor price changes into a microsimulation household model. Chen and Ravallion (2003) used this methodology and built micro simulations on economic assumptions that are consistent with the CGE model, notably that a household takes prices as given and that those prices clear all markets. They also did not attempt to assure full consistency between the micro-analysis and the CGE model's predictions.

There are five steps in calculating the impact of the volatility in world rice prices and tariffs policy on poverty: First, calculating the initial condition of poverty utilizing the 2005 *SUSENAS* data (National Socio-Economic Survey), covering 64,407 households, published by the Central Statistical Agency of Indonesia *(Badan Pusat Statistik (BPS))*. Second, using the CGE model, simulating the impact of world price changes and import tariffs of rice on domestic prices (including factor incomes). Third, entering data on the increases in prices (including factors income) obtained from the CGE model into the *Susenas* data set, to calculate the impact of the fluctuations in world price and import tariffs on household welfare. This step is known as the microsimulation procedure. Fourth, adjusting the poverty line using price changes obtained from the CGE in which the poverty line becomes endogenous. Fifth, recalculating the poverty incidence using data from steps three and four, and then compare it with the initial poverty incidence.

3.2 Indonesian Computable General Equilibrium

The General Equilibrium Theory follows the Walrasian tradition/Walras theory that equilibrium prices and quantities are determined by the interaction between producers and consumers in a perfectly competitive market. Consumers (or households) are assumed to choose their consumption bundle to maximize their utility subject to the income constraint. Producers (or firms) maximize their profits subject to production technology.

The modern concept of the General Equilibrium Theory was provided by Kenneth Arrow, Gerard Debreu and Lionel W. McKenzie in the 1950s.

Computable General Equilibrium (CGE) models are a class of economic models that use actual economic data to estimate how an economy might react to changes in policy, technology or other external factors. The static CGE model is built based on the extension of the 2005 Indonesian Social Accounting Matrix (SAM) and follows the algorithm of the International Food Policy Research Institute (IFPRI) standard CGE model developed by Lofgren, Harris and Robinson (2001). The data used for the extension of SAM refers to the 2005 Input-Output Table, the 2005 National Socio-Economic Survey, the Labor Force Survey, and other sources.

Activities/Commodities

The extended 2005 Indonesian SAM has 26 industry/commodity categories: food crops, soybeans, other crops, livestock, forestry, fishery, oil and metal mining, other mining and quarrying, rice, food-beverage industry, textile-clothes-leather industry, wood processing industry, pulp-paper and metal industry, chemical industry, electricity-gas-water, construction, trade, restaurants, hotels, land transportation, air-water transportation and telecommunication, warehousing, financial services, real estate, government and private services, and individual/other services.

Factors of Production

The factors of production in this SAM are basically classified into five factors: agricultural labor, production-operator-unskilled labor, sales and administration (semi-skilled), skilled labor and non-labor factors, including land and capital. However, each factor except the non-labor factor, is divided into two categories: rural and urban labor. Hence, the factors of production consist of 9 categories overall.

Institutions and Households

There are three main institutions in the 2005 SAM: government, enterprises and households. The representative household is basically divided into four categories: agricultural households, non-agricultural households. Agricultural households are classified into agricultural labor, agricultural households with less than 0.5 hectares of land, agricultural households with land between 0.5 to 1 hectares, and agricultural household with more than 1 hectare of land. Non-agricultural households are separated into rural and urban households. Each category of households in the urban and rural grouping is further classified into low-income, non-labor force households and high-income households. Other accounts in the CGE model are the rest of the world (export-import), saving-investment and taxation. Taxation is divided into indirect taxes, subsidies, income

tax and import tariff.

Elasticity

The elasticity data used in this CGE refers to sources such as elasticity in the Indonesian IFPRI CGE model[2], *Wayang* model and other estimations of elasticity. The Armington elasticities, the elasticity of substitution between imports and domestic output in domestic demand, are 0.5 for all commodities except soybeans (1.5), rice (1.5), food crops (1.5) and food and beverage industry (1.5). The constant elasticity of transformation (CET) for domestic marketed output between exports and domestic supplies is set at 0.5 for all commodities except rice (1.5), soybeans (1.5), food crops (1.5), and food-beverage industry (1.5). The elasticity of substitution (CES) between factors of production is 0.25 for all activities. The elasticity of substitution between aggregate factors and intermediate input is 0.5 and the elasticity of output aggregation for commodities is 3. Household consumption is modeled under the Linear Expenditure System (LES), whereby elasticities vary between commodities, and is less than 1 for food products and more than 1 for industrial products and services.

3.3 Microsimulation

The world prices and import tariffs of rice will influence household welfare through changes in the price of domestic commodities and factor incomes. A microsimulation procedure basically translates how price (factor income) changes from the CGE can influence household welfare. This research modified Chen and Ravallion's work (2003)[3] to calculate the monetary value of household welfare changes in response to changes in prices and factor incomes. Increasing prices would reduce households' ability to afford an initial bundle of consumption while increasing factor incomes would increase household incomes. An increase in income means an increase in the ability to consume more. The formula for household welfare change is shown below:

$$\Delta W_i = -\sum_{j=1}^{m} p_j (q_{ij} - s_{ij}) \frac{dp_j}{p_j} + \sum_{k=1}^{n} \left(w_k L_{ik} \frac{dw_k}{w_k} \right) + \sum_{l=1}^{1} \left(r_l K_{il} \frac{dr_l}{r_l} \right) \qquad (1)$$

Where, ΔW_i is the welfare change of household-i, i: 1,2,3,…,64,407; q_{ij} is the quantity of product-j consumed by household-i, j=1,2,3,…,26; product-*j* refers to classification in the CGE model; s_{ij} is the quantity of product-*j* provided/supplied by household-*i*; $(q_{ij} - s_{ij})$ is the net consumption of product-*j* which must be bought by household-*i*. According to

[2] Presentation Material of CGE Training at Department of Economics, University of Indonesia in 2002

[3] This formula is derived from the maximizing behavior of both consumer and producer, using the envelope theorem (see Chen and Ravallion, 2003).

SUSENAS data set, the value of household consumption is always larger than or equal to the value of household production $(q_{ij} \geq s_{ij})$; p_j is the price of product-*j*; dp_j is price change of product-*j*; L_{ik} is the labor supply of household-*i* in sector-*k*; sector-*k* refers to a labor category in the CGE model; w_k is wage in sector-*k*; dw_k is the wage change in sector-*k*; K_{il} is the non-labor endowment of household-*i*; r_l is the rate of return; and dr_l is the change in the rate of return.

The change of household welfare is the sum of the change in household expenditure and household income. The negative sign in the first part of the formula indicates that increasing prices will increase household expenditure, and consequently lower household welfare. Conversely, the positive signs of the last two parts of the formula indicate that increasing wages and the non-labor rate of return will increase household income, and thus increase household welfare. This study assumes that the consumption pattern of households do not change following the price change. This assumption might be unrealistic in the long run. However, due to the lack of information about the elasticity of substitution and also to simplify the model, this study is forced to assume "no change in the consumption pattern" to calculate the household welfare change.

The model also assumes that the change of household welfare will directly influence household consumption (expenditure) and there is no saving activity, i.e. households are not allowed to save the net welfare. The new expenditure function is shown as below:

$$E_i((p_{0j} + dp_j), (y_{0i} + \Delta W_i)) = E_{0i}(p_{0j}, y_{0i}) + \Delta W_i \qquad (2)$$

$E_i((p_{0j} + dp_j), (y_{0i} + \Delta W_i))$ is household-*i*'s expenditure after the simulations in the world prices and import tariffs of rice; $E_{0i}(p_{0j}, y_{0i})$ is the initial household-*i*'s expenditure; p_{0j} is the initial vector price and y_{0i} is the initial endowment/income of household-i. $E_i((p_{0j} + dp_j), (y_{0i} + \Delta W_i))$ is used to calculate the new poverty incidence.

3.4 Endogenous poverty line and poverty calculation

BPS (the Central Statistical Agency of Indonesia) uses 2,100 calories/capita/day

from 52 commodities to calculate the food poverty line. The food poverty line is heterogeneous among regions due to differences in food prices and consumption patterns among regions. To obtain the poverty line, expenditure on food must be added with non-food expenditures, such as health, education, transportation, etc.

The increasing commodity price would also increase the money metric of obtaining 2,100 calories, therefore the poverty line will become endogenous following a variation in relative prices (Decaluwe, Savard and Thorbecke, 2005). Hence, the initial food poverty line should be adjusted with the price change of food products in proportion to the share of those products in the poverty line; and also be adjusted with the price change of non-food products. This study assumes that the composition of commodities in the poverty line does not change following the change in prices. This assumption follows the fact that the commodities in the poverty line are basic need products which are price inelastic. It also observes that the composition and quantity of commodities in the poverty line do not much change from *SUSENAS* 2002, 2005 and 2008. Therefore, the new poverty line that changes following a variation in prices is known as the endogenous of poverty line that theoretically can be calculated as follows:

$$z = \sum_{f=1}^{n} p_f \bar{\phi}_f \left(1 + \frac{dp_f}{p_f}\right) + \sum_{nf=1}^{m} p_{nf} \bar{\phi}_{nf} \left(1 + \frac{dp_{nf}}{p_{nf}}\right) \quad (3)$$

Where, z is the poverty line; $\sum_{f=1}^{f} p_f \bar{\phi}_f$ is the food poverty line; $\sum_{nf=1}^{nf} p_{nf} \bar{\phi}_{nf}$ is the non-food poverty line; p_f is the food price-*f*, *f=1,…,n*; $\bar{\phi}_f$ is the minimum consumption of food product-*f*; dp_f is the change in food price-*f, f=1,…,n*; p_{nf} is the non-food price-*nf*, *nf=1,…,m;* $\bar{\phi}_{nf}$ is the minimum consumption of non-food product-*nf*, *nf=1,..,m;* dp_{nf} is the change in non-food price-*nf, nf=1,…,m.*

However, the Central Statistical Agency (BPS) only annually publishes the aggregate value of the food poverty line (PFL) and the non-food poverty line (NFPL) for each province at the rural and urban level; therefore, equation (3) is modified as below:

$$z_{pr} = PL_{pr} = FPL_{0pr}\left(1 + \frac{\Delta FP_{pr}}{FP_{0pr}}\right) + NFPL_{0pr}\left(1 + \frac{\Delta NFP_{pr}}{NFP_{0pr}}\right) \quad (4)$$

Where, $z_{pr} = PL_{pr}$ is the poverty line in province-*p, p=1,…,30,* at region-*r*, *r=urban and rural*; FPL_{0pr} is the initial food poverty line in province-*p* at region-*r*; ΔFP_{pr} is the change in

composite food price in province-*p* at region-*r*; FP_{0pr} is the initial composite food price in province-*p* at region-*r*; $NFPL_{0r}$ is the initial non-food poverty line in province-*p* at region-*r*; ΔNFP_{pr} is the change in composite non-food price in province-*p* at region-*r*; and NFP_{0pr} is the initial composite non-food price in province-*p* at region-*r*.

The price changes for either food or non-food prices are the same across all regions, because the CGE model can only produce price and factor income changes at the national level. The composite prices of either food or non-food products are calculated based on the composition of consumption in the 2005 Social Accounting Matrix and in the 2005 *SUSENAS* data set. By 2005, the monthly monetary value of the national poverty line was IDR 117,259 in rural areas ($11.7) and IDR 150,799 ($15) in urban areas. BPS is updating the poverty line for each province every year. The 2005 provincial poverty line and simulated changes in the poverty line under various changes in the world rice price and import tariffs are shown in Appendix 4.

In order to calculate poverty, this study applies the FGT (Foster, Greer and Thorbecke, 1984) formula. The modified formula is shown below:

$$HC_{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{PL_r - E_{ir}}{PL_r}\right)^{\alpha} \qquad (5)$$

Where, HC_{α} is the head count index (poverty incidence); n is the number of population; i is the individual-*i*; PL_r is the poverty line in region-*r*; E_{ir} is the expenditure of individual-*i* in region-*r*; q is the number of individuals below or at the poverty line; and α is the parameter for the FGT. When α is zero, the poverty measurement is the headcount index which represents the percentage of population below the poverty line. The poverty-gap index, PG, which measures the depth of poverty, is calculated by setting α to 1 and the squared poverty gap is obtained with α equal to 2. This study focuses only on analyzing the head count index and the poverty gap index.

3.5 Scenarios Simulations

The aim of simulations is to find out how much change occurred in the poverty under the various scenarios of the world prices and import tariffs of rice. The scenarios simulations are done referring to the fact that the world price of rice could sharply increase (decrease) only in short period. In 2008, the monthly world price of rice could increase or decrease in the range from -17.31 per cent to 50.93 per cent. In addition, the

government also actively intervenes in the domestic rice market through changing the import tariffs of rice. It is counted that the effective import tariff of rice in the 2005 SAM is equivalent to 5.6 per cent; thus a decrease in the import tariff from IDR 750/Kg to IDR 450/kg as a response to a dramatic increase in the world rice prices is identical to a decrease of 40 per cent of the effective import tariff. This is equal to a decrease of the import tariff from 5.6 per cent to 3.36 per cent. As mentioned before, in December 2010 the government again imposed a zero import tariff on rice.

The simulations are done under several scenarios which are basically divided into four categories: first, simulating an increase in the world rice price by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent; second, simulating a decrease in world rice prices by 20 per cent, 40 per cent, 60 per cent and 80 per cent[4] respectively; third, simulating various decreases in import tariffs on rice by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent respectively; lastly, simulating various increases in import tariffs on rice by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent respectively. Various simulations are conducted in order to ascertain the sensitivity of poverty in respect to the change in world prices and import tariffs.

The simulations are done under the following closure rules: investment driven saving, flexible government saving and fixed direct tax rates, flexible exchange rates and fixed foreign saving, fixed capital formation, labor fully employed and mobile across activities, capital fully employed and activity-specific and fixed domestic producer price (price numeraire).

4. The Impact of World Rice Prices and Import Tariffs on Poverty in Indonesia

4.1 CGE Result

4.1.1 Changes in Macroeconomic Indicators, Consumer Prices and Factor Incomes

Generally, an increase (decrease) in world rice prices will be followed by a decrease (increase) in macroeconomic indicators, such as private consumption, imports, net indirect tax, exports and gross domestic product (GDP), while the consumer price index (CPI) moves in the same direction to change the world prices (Appendix 1). The simulation results shows that a 60 per cent increase in world rice prices decreases private consumptions by 0.107 per cent, imports by 0.201 per cent, net indirect tax by 0.439 per cent, exports by 0.031 per cent and GDP by 0.032 per cent, while increasing CPI by 0.431 per cent. An increase in the CPI depletes households' welfare that in the end decreases household (private) consumptions as well as GDP. The same magnitude of change in macroeconomic indicators is also observed on increases (decreases) in the import tariffs

[4] We did not simulate a 100 per cent decrease in the world rice price. This is because a 100 per cent decrease means the world rice price equal to 0 which is impossible in the CGE's simulation.

on rice.

An increase (decrease) in the world rice price would decrease (increase) the composite good supply in the domestic market. A 60 per cent increase in the world price leads to a decline in the composite supply of rice by 0.93 per cent. Theoretically, an increase in import prices reduces demand for imported goods and provides incentives to domestic producers to raise production. However, due to the lack of flexibility in domestic production of rice to respond to price increases, an increase in the domestic production of rice is unable to fill a gap of composite supply resulting from massive decreases in imported rice. Hence, the composite rice supply declines below the previous level.

Turning to changes in consumer price and factor incomes, the CGE simulations shows that an increase in the world prices of rice by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent raises the domestic consumer price of rice by 2.49 per cent, 4.60 per cent, 6.30 per cent, 8.00 per cent and 9.40 per cent respectively. Moreover, if the world price decreases by 20 per cent, 40 per cent, 60 per cent and 80 per cent, the domestic price of rice decreases by 2.92 per cent, 6.76 per cent, 12.07 per cent and 20.96 per cent respectively (Appendix 2). The domestic price is apparently sensitive to the decrease in the world price of rice since the volume of imported rice tends to increase when the world price decrease.

An increase in the world price of rice is advantageous only for non labor factors (capital or land). All labor categories are worse off under this condition due to a sharp decrease in average wage rates. In contrast, all labor categories are better off if the world rice price decrease up to 40 per cent. However, a high decrease in the world rice price of more than 60 per cent adversely affects agricultural labor due to declining wage rates (Appendix 3). This contradicts to what many theories predict that agricultural labor should benefit (suffer) from an increase (decrease) in the world rice prices, because responding to the rise in the domestic price of rice as a result of an increase in the world prices, households might choose or combine three alternatives: 1) allocating more resources to afford rice through reduced consumption of others products, 2) reducing consumption of rice and 3) substituting rice for other products. These three alternatives would affect the decrease in aggregate demand in an economy that would be followed by decreasing factor incomes.

On the other hand, the reduction of import tariffs by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent will lower the domestic price of rice by 0.30 per cent, 0.70 per cent, 1.10 per cent, 1.40 per cent and 1.90 per cent respectively. This policy is able to raise the average incomes of all factors of production, except for non labor factor varying from 0.017 per cent to 0.301 per cent. Meanwhile, the increase in import tariffs at the same rate can raise the domestic price of rice by 0.40 per cent, 0.70 per cent, 1.00 per cent, 1.40 per cent and 1.70 per cent respectively. An increase in the import tariffs at any

level will increase wage rates of agricultural labors and the returns of non-labor factor. However, all labor categories, except agricultural labor, are worse off when responding to an increase in the import tariffs. Agricultural labor is the only factor that consistently gets benefits from any increase or decrease in the import tariffs. These simulation results appear to contradict the common belief that a decrease in the import tariffs of rice would adversely affect labor in the agriculturalal sector, because a decrease in the import tariffs of rice lowers the domestic rice prices driving up the domestic consumption of both non agricultural and agricultural products and at the end bidding up the wage rates of all labor factors.

According to the CGE simulations, there are differences in the percentage change of domestic consumer prices when the world rice prices (import tariffs) increase or decrease at the same percentage points. For instance, a 60 per cent increase (decrease) in the world price will be followed by a 6.3 per cent increase (12.07 per cent decrease) in the domestic consumer price of rice. Declines in world rice prices directly decrease domestic rice prices through lowering the imported rice prices and dropping the domestic prices as consequence of excess supply in the domestic market. The other transmission is that a decrease in the price of domestic rice lowers the real incomes of those selling rice. When incomes fall, goods and services will be demanded less, and domestic price will decline. On the contrary, increases in the world rice price directly raise the imported rice price as well as the domestic rice price. Unfortunately, a high price of domestic rice forces households to reduce their demand and in the end lowers its price. Therefore, in the case of a world price decrease, both direct and indirect effects move in the same direction; while in the case of a world price increase, the direct and indirect effect cancel out each other. Hence, this clearly shows that a change in domestic prices in response to a decrease in world prices is larger than the response to an increase in world prices.

4.2 CGE-Microsimulation Analysis

4.2.1 World Rice Prices and Poverty

In a CGE-Microsimulation analysis, the impact of world price volatility and import tariffs of rice on poverty solely depends on how large the effect of these shocks on changing the price level and factors income in the economy are. However, how large the price changes, including factors income, can influence the poverty incidence depends on the poor's consumption pattern and the poor's source of income. It also depends on how sensitive the poverty line is in responding to the price change.

Table 2 summarizes the impact of various world prices and import tariffs of rice on poverty in Indonesia. As many other imported countries, an increase in the world prices of rice raises the incidence of poverty, while a decrease in the world price also reduces poverty. The 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent respectively

of an increase in the world price raises poverty by 819,189; 1,245,530; 1,687,270; 2,292,026; and 2,581,536 respectively. This is equivalent to an increase in the poverty index by 0.39 per cent, 0.60 per cent, 0.81 per cent, 1.10 per cent and 1.23 per cent respectively. On the other hand, a decline in the world price of rice at any rate is good for all household categories. The decrease in the world price at 20 per cent, 40 per cent, 60 per cent and 80 per cent respectively reduces poverty by 622,857; 1,628,371; 2,910,403; and 3,719,739 respectively which are equal to a decrease in the poverty index by 0.30 per cent, 0.78 per cent, 1.39 per cent and 1.78 per cent respectively. The fluctuations in the world rice price and the poverty incidence move in the same direction. However, the elasticity of poverty in relation to the world rice price is not constant and decreases in line with the higher price change.

At the disaggregate level, all household categories, agricultural and non-agricultural, suffer from an increase in the world rice price. Landless agricultural households suffer most from an increase in the world price. If the world price rises by 40 per cent, the head count index rises by 0.90 per cent. In terms of absolute numbers, poverty increases are more frequently observed among small landowners of agricultural households. An increase of 40 per cent in the world price raises the number of poor by 247,061. Landless households and small landowning households are basically low-income groups characterized by a high proportion of their expenditure on rice and a high dependency on agricultural activity as a main source of income. Therefore, a sudden increase in rice prices to unaffordable level adversely affects these groups.

These simulations show that, in contrast to what many theories predict, households working in the agricultural sector do not benefit from an increase in the world price of rice, because of the high proportion of their budgets going towards rice, subsistence level of production and rigidity in the domestic production of rice in response to an increase in price. BPS reports that even though the budgeted share on food has been continuously decreasing since 1999, food expenditure in 2009 still represented 50.62 per cent of average consumer expenditure, which is mostly spent on food crops. An increase in the world rice prices that suddenly increases the domestic rice prices forces agricultural households to choose two difficult options - either reduce food consumption or use substitutes. However, substitution is not a feasible option because rice consumption is related to taste and customs. Even though agricultural households benefit through a gradual increase in the wages of agricultural labor, it can only compensate partially for the increase in expenditure as a result of price increases. Therefore, increases in world commodity prices hurt agricultural households rather than benefits them.

On the other hand, the decrease of world price of rice at any level is advantageous not only for non-agricultural households, but also for agricultural households with and without land. The poverty of agricultural households with land declines by 224,551 and

997,545 responding to an increase in 20 per cent and 60 per cent of the world price of rice. This is equivalent to a decline in the poverty incidence by 0.39 per cent and 1.74 per cent respectively. Meanwhile, landless agricultural households benefit most from lower world rice prices. The head count index decreases by 2.33 per cent responding to a 60 per cent decline in the world price. From these results, the argument that a high price of rice is better and low price of rice is bad for agricultural households do not have strong empirical support.

In order to complement the head count index analysis, Table 3 provides the Poverty Gap Index. This index represents the gap between poor people's standard of living and the poverty line, which shows the shortfall in the poor's expenditure from the poverty line expressed as an average of the population. This can be interpreted as how far the poor are below the poverty line. This index can also be utilized as an indicator of the minimum cost of eliminating poverty using perfectly targeted transfers. The pattern of change in the poverty gap index responding to an increase (decrease) in world rice prices (import tariffs) is not different from the changes in the head count index. The higher the world rice prices, the wider the poverty gap index and vice versa. A 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent increase in the world price raises the poverty gap index by 0.09 per cent, 0.15 per cent, 0.20 per cent, 0.27 per cent and 0.31 per cent, respectively.

Table 2: Simulated Changes in the Head Count Index (%) **under Various Changes in the World Rice Prices**

Sector	Population	Initial Poverty 2005	Increase in the World Rice Price					Decrease in the World Rice Price			
			20%	40%	60%	80%	100%	20%	40%	60%	80%
Total Agriculture	77,780,606	24.31	0.51	0.76	1.07	1.38	1.54	-0.43	-1.14	-1.89	-2.30
Agriculture (without Land)	20,448,294	25.73	0.59	0.90	1.24	1.60	1.82	-0.54	-1.50	-2.33	-2.69
Agriculture (with Land)	57,332,312	23.81	0.49	0.71	1.00	1.30	1.44	-0.39	-1.01	-1.74	-2.16
Owning Land 0-0.5 Hectare	27,376,123	26.95	0.60	0.90	1.12	1.42	1.59	-0.44	-1.09	-1.95	-2.44
Owning Land >0.5 Hectare	29,956,189	20.94	0.38	0.54	0.90	1.18	1.30	-0.35	-0.93	-1.55	-1.91
Industry	19,916,155	11.25	0.38	0.59	0.71	0.94	1.06	-0.28	-0.60	-1.23	-1.53
Electricity, Water, Gas and Constructions	14,312,875	17.66	0.39	0.65	0.71	1.04	1.22	-0.31	-1.05	-2.15	-2.68
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	10.81	0.28	0.39	0.57	0.88	0.96	-0.21	-0.55	-1.00	-1.27
Banking, Financial Int., Government and Private Services	26,863,587	6.94	0.33	0.47	0.60	0.85	1.01	-0.16	-0.40	-0.71	-1.06
Others	23,201,581	15.81	0.28	0.57	0.80	1.04	1.18	-0.20	-0.46	-0.96	-1.54
Total	**209,309,307**	**16.40**	**0.39**	**0.60**	**0.81**	**1.10**	**1.23**	**-0.30**	**-0.78**	**-1.39**	**-1.78**

Source: Author's calculation.

Note: Nanggroe Aceh Darussalam was not surveyed in the SUSENAS 2005.

Table 3: Simulated Changes in the Poverty Gap Index (%) **under Various Changes in the World Rice Prices**

Sector	Population	Initial Poverty Gap Index 2005	Increase in the World Rice Price					Decrease in the World Rice Price			
			20%	40%	60%	80%	100%	20%	40%	60%	80%
Total Agriculture	77,780,606	4.93	0.13	0.20	0.28	0.38	0.44	-0.11	-0.26	-0.46	-0.57
Agriculture (without Land)	20,448,294	5.52	0.15	0.24	0.33	0.45	0.52	-0.14	-0.32	-0.55	-0.71
Agriculture (with Land)	57,332,312	4.71	0.12	0.19	0.26	0.35	0.41	-0.10	-0.24	-0.43	-0.52
Owning Land 0-0.5 Hectare	27,376,123	5.44	0.14	0.22	0.29	0.40	0.46	-0.11	-0.27	-0.48	-0.60
Owning Land >0.5 Hectare	29,956,189	4.05	0.11	0.17	0.23	0.31	0.36	-0.09	-0.21	-0.38	-0.46
Industry	19,916,155	2.10	0.07	0.11	0.15	0.21	0.24	-0.06	-0.14	-0.26	-0.35
Electricity, Water, Gas and Constructions	14,312,875	3.01	0.10	0.17	0.23	0.31	0.36	-0.10	-0.23	-0.40	-0.51
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	2.01	0.07	0.10	0.14	0.19	0.21	-0.05	-0.13	-0.24	-0.30
Banking, Financial Int., Government and Private Services	26,863,587	1.36	0.05	0.09	0.11	0.16	0.19	-0.05	-0.10	-0.19	-0.28
Others	23,201,581	3.40	0.09	0.14	0.19	0.26	0.30	-0.07	-0.18	-0.33	-0.43
Total	**209,309,307**	**3.24**	**0.09**	**0.15**	**0.20**	**0.27**	**0.31**	**-0.08**	**-0.19**	**-0.34**	**-0.43**

Source: Author's calculation.
Note: Nanggroe Aceh Darussalam was not surveyed in the SUSENAS 2005.

4.2.2 Import Tariff Policies and Poverty

The impact of import tariffs of rice on poverty is not that much different in pattern with the impact of world price volatility of rice on poverty. Table 4 shows that an increase in import tariffs of rice by 20 per cent, respectively 40 per cent, 60 per cent, 80 per cent and 100 per cent will be followed by an increase in poverty by 141,900; 215,060; 312,875; 474,441; and 578,952 persons which equals to an increase in the poverty incidence by 0.07 per cent, 0.10 per cent, 0.15 per cent, 0.23 per cent and 0.28 per cent respectively. Both landless and landholder households are worse off responding to an increase in import tariffs. If the import tariffs of rice increase by 20 per cent, those working in the trade-hotels-restaurants and transportation sectors suffer most. However, the high protection on agricultural sectors, i.e. 100 per cent increase in the import tariff of rice, intended to help agricultural producers, will result in the opposite direction. The poverty index of this group rises by 0.36 per cent. On the other hand, generally most of the households acquire benefits from lower import tariffs. The number of poverty will be reduced by 68,694; 161,546; 258,569; 293,618; and 390,160 persons responding to the decrease in import tariffs of rice by 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent (zero import tariffs) respectively. The numbers are equivalent to the decrease in the poverty index by 0.03 per cent, 0.08 per cent, 0.12 per cent, 0.14 per cent and 0.19 per cent respectively.

Table 4 shows three important findings: first, both a 40 per cent decrease in the effective import tariff of rice enacted by Regulation No. 180/PMK.011/2007 and No.93/PMK.011/2007 in response to high world rice price during 2007 to 2009 and the zero import tariffs implemented by regulation No. 241/PMK.011/2010 in response to

high world prices in 2010 could not perfectly absorb the negative impact of rising world rice prices on poverty in Indonesia. Second, high import tariffs on rice, intended to help agricultural producers, does not have strong empirical support. Third, a surprising finding was that agricultural households, whether they own land or not, will benefit from lower import tariffs and suffer from higher import tariffs. This appears to contradict a common belief that a decrease in import tariffs would cause suffering for agricultural households while an increase in import tariffs would be advantageous for agricultural households.

Theoretically, increases in import tariffs have two effects: an income effect from an increase in incomes of those who sell either rice or agricultural labor, and the price effect which results from an increase in the price of rice. It is observed that the price effect is more dominant than the income effect when import tariffs either increase or decrease. Similar to the earlier finding, this is due to the high budget share of food and rigidities in domestic production of rice in response to an increase in price. Therefore, both landless agricultural households and landowning agricultural households are worse off in the presence of high import tariffs on rice.

Table 5 shows changes in the poverty gap index under various changes in the import tariffs of rice. A 20 per cent, 40 per cent, 60 per cent, 80 per cent and 100 per cent decrease in the import tariffs reduce the poverty gap index by 0.02 per cent, 0.03 per cent, 0.04 per cent, 0.05 per cent and 0.06 per cent, respectively. The poverty gap index of some groups, such as industry and service employees, does not change in response to a decrease in import tariffs of rice up to 20 per cent. This shows that the poverty gap index is insensitive to a change in the import tariffs of rice because adjustments in the import tariffs have little effect on changing prices and factor incomes in the economy.

Table 4: Simulated Changes in the Head Count Index (%) **under Various Changes in the Import Tariffs of Rice**

Sector	Population	Initial Poverty 2005	Increase in the Import Tariffs of Rice					Decrease in the Import Tariffs of Rice				
			20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
Total Agriculture	77,780,606	24.31	0.06	0.12	0.19	0.29	0.36	-0.02	-0.09	-0.18	-0.20	-0.25
Agriculture (without Land)	20,448,294	25.73	0.09	0.13	0.26	0.34	0.47	-0.04	-0.11	-0.26	-0.26	-0.33
Agriculture (with Land)	57,332,312	23.81	0.05	0.12	0.17	0.28	0.32	-0.01	-0.09	-0.14	-0.18	-0.22
Owning Land 0-0.5 Hectare	27,376,123	26.95	0.10	0.18	0.23	0.40	0.45	0.00	-0.07	-0.15	-0.19	-0.23
Owning Land > 0.5 Hectare	29,956,189	20.94	0.01	0.06	0.10	0.16	0.21	-0.03	-0.10	-0.14	-0.17	-0.21
Industry	19,916,155	11.25	0.04	0.07	0.11	0.17	0.18	-0.02	-0.06	-0.11	-0.11	-0.18
Electricity, Water, Gas and Constructions	14,312,875	17.66	0.05	0.06	0.10	0.19	0.34	-0.12	-0.17	-0.17	-0.17	-0.22
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	10.81	0.10	0.12	0.15	0.22	0.25	-0.03	-0.05	-0.10	-0.11	-0.14
Banking, Financial Int., Government and Private Services	26,863,587	6.94	0.03	0.07	0.13	0.16	0.16	-0.03	-0.03	-0.03	-0.05	-0.10
Others	23,201,581	15.81	0.09	0.09	0.10	0.16	0.21	-0.04	-0.09	-0.09	-0.11	-0.15
Total	**209,309,307**	**16.40**	**0.07**	**0.10**	**0.15**	**0.23**	**0.28**	**-0.03**	**-0.08**	**-0.12**	**-0.14**	**-0.19**

Source: Author's calculation.

Note: Nanggroe Aceh Darussalam was not surveyed in the SUSENAS 2005.

Table 5: Simulated Changes in the Poverty Gap Index (%) under Various Changes in the Import Tariffs of Rice

Sector	Population	Initial Poverty Gap Index 2005	Increase in the Import Tariffs of Rice					Decrease in the Import Tariffs of Rice				
			20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
Total Agriculture	77,780,606	4.93	0.02	0.03	0.05	0.07	0.09	-0.01	-0.02	-0.04	-0.05	-0.07
Agriculture (without Land)	20,448,294	5.52	0.02	0.04	0.05	0.08	0.10	-0.01	-0.03	-0.05	-0.06	-0.08
Agriculture (with Land)	57,332,312	4.71	0.02	0.03	0.05	0.06	0.08	0.00	-0.02	-0.03	-0.04	-0.06
Owning Land 0-0.5 Hectare	27,376,123	5.44	0.03	0.04	0.05	0.07	0.09	0.00	-0.02	-0.04	-0.05	-0.07
Owning Land > 0.5 Hectare	29,956,189	4.05	0.02	0.03	0.04	0.06	0.07	0.00	-0.02	-0.03	-0.04	-0.06
Industry	19,916,155	2.10	0.01	0.02	0.03	0.04	0.05	0.00	-0.01	-0.02	-0.03	-0.03
Electricity, Water, Gas and Constructions	14,312,875	3.01	0.02	0.03	0.04	0.05	0.07	-0.01	-0.02	-0.04	-0.05	-0.06
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	2.01	0.01	0.02	0.02	0.03	0.04	0.00	-0.01	-0.02	-0.02	-0.03
Banking, Financial Int., Government and Private Services	26,863,587	1.36	0.01	0.01	0.02	0.03	0.03	0.00	-0.01	-0.02	-0.02	-0.03
Others	23,201,581	3.40	0.02	0.03	0.04	0.05	0.06	0.00	-0.01	-0.02	-0.03	-0.04
Total	**209,309,307**	**3.24**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.00**	**-0.02**	**-0.03**	**-0.04**	**-0.05**

Source: Author's calculation.
Note: Nanggroe Aceh Darussalam was not surveyed in the SUSENAS 2005.

5. Sensitivity Analysis

The CGE estimation results are known to be sensitive to the values of the Armington elasticities. However, there have been few empirical studies on estimating these elasticities. Many studies show that the resulting estimates of these elasticities varied widely. McDaniel and Balistreri (2003) confirmed that the wide range estimates of Armington elasticities depend on the data used, disaggregating sector and methodology applied.

Many CGE studies in Indonesia also applied a wide range of Armington elasticity on Rice. Indonesian IFPRI CGE Model, Leith *et al.* (2003), Warr (2005), Warr (2009), Warr and Yusuf (2009) assumed the Armington elasticity to be 10, 6, 6, 6 and 6 respectively. However, Warr (2008) estimated that though imported and domestically produced rice are considered relatively close substitutes in the demand in Indonesia, the Armington elasticity ranges from 2 to 5. For comparison, Kapuschinki and Warr (1999) found that the estimated Armington elasticities of the Philippines' economy range from 0.2 for metal product to 4 for sugar milling and refining and particularly for rice, the elasticity ranges from 0.61 to 2.05 depending on the methodology applied.

Table 6 shows that the impact of a 60 per cent increase in the world rice price and a 100 per cent decrease in the import tariffs of rice on poverty (zero import tariffs) are slightly sensitive to the variation of Armington elasticity. An increase (decrease) in the Armington elasticity will be followed by an increase (decrease) in the poverty incidence. At

the national level, when the world rice price increases by 60 per cent, changing elasticity from 1.5 to 3 will increase the head count index from 0.81 per cent to 1.99 per cent which is equivalent to an increase of poor persons from 1,687,270 to 4,156,883. On the contrary, changing elasticity from 1.5 to 0.5 will decrease the number of poverty from 1,687,270 to 590,291 persons. On the other hand, when the import tariffs of rice decrease by 100 per cent, changing elasticity from 1.5 to 3 will reduce the head count index from 0.19 per cent to 0.51 per cent.

Table 6: Simulated Changes in the Head Count Index: Varying Armington Elasticity of Substitution in Rice Demand

Sector	Population	Initial Poverty 2005	60% Increase in the World Rice Price				100 % Decrease in the Import Tariffs of Rice			
			0.5	1.5	2.0	3.0	0.5	1.5	2.0	3.0
Total Agriculture	77,780,606	24.31	0.36	1.07	1.53	2.52	-0.03	-0.25	-0.38	-0.72
Agriculture (without Land)	20,448,294	25.73	0.48	1.24	1.81	2.82	-0.07	-0.33	-0.49	-0.90
Agriculture (with Land)	57,332,312	23.81	0.32	1.00	1.43	2.42	-0.01	-0.22	-0.35	-0.65
Owning Land 0-0.5 Hectare	27,376,123	26.95	0.45	1.12	1.58	2.58	0.00	-0.23	-0.37	-0.70
Owning Land > 0.5 Hectare	29,956,189	20.94	0.21	0.90	1.30	2.27	-0.03	-0.21	-0.33	-0.62
Industry	19,916,155	11.25	0.18	0.71	1.05	1.58	-0.02	-0.18	-0.38	-0.45
Electricity, Water, Gas and Constructions	14,312,875	17.66	0.34	0.71	1.22	2.01	-0.12	-0.22	-0.38	-0.65
Trade, Hotel, Restaurant, Transportation and Telecommunication	47,234,503	10.81	0.26	0.57	0.95	1.60	-0.03	-0.14	-0.18	-0.38
Banking, Financial Int., Government and Private Services	26,863,587	6.94	0.23	0.60	0.99	1.50	-0.03	-0.10	-0.14	-0.29
Others	23,201,581	15.81	0.17	0.80	1.15	1.87	-0.04	-0.15	-0.20	-0.29
Total	**209,309,307**	**16.40**	**0.28**	**0.81**	**1.22**	**1.99**	**-0.04**	**-0.19**	**-0.29**	**-0.51**

Source: Author's calculation.

Note: Nanggroe Aceh Darussalam was not surveyed in the SUSENAS 2005.

Therefore, the crucial question is, what the appropriate Armington elasticity of substitution of rice is? Since the domestic rice market is not fully liberalized, the government actively intervenes in the rice market through tariff and non-tariff policies and paddy's production increased significantly in recent years. Thus it is believed that setting the Armington elasticity of rice equal to 1.5 as a moderate degree of trade openness are fair and reasonable. However, these findings appear higher than that of other studies' findings, such as Leith *et al.* (2003), Warr (2005), Warr (2009) and Warr and Yusuf (2009), Ikhsan (2003) and McCulloch (2008). The difference in results might come from differences in the methodology applied (CGE-Microsimulation), the utilized database (SAM 2005), the endogenous poverty line, the choice of parameters in CGE, and the change in economic environments.

6. Concluding Remarks

In Indonesia, rice is always a sensitive and controversial issue since rice expenditure accounts for a larger share of household expenditure and also many

households depend on rice activities as their income source. This study, utilizing a CGE-Microsimulation approach and the endogenous poverty line, analyzes the poverty impact of the world price volatility and import tariffs of rice in Indonesia. It found that the fluctuations of the world price of rice during 2007 to 2010 significantly increased (decreased) the poverty incidence in Indonesia. The simulation results showed that a 60 per cent increase in the world price of rice raises the head count index by 0.81 per cent which is equivalent to an increase in the number of poor by 1,687,270 persons, while a decline in the world price at the same rate decreases poverty by 1.39 per cent equal to 2,910,403 persons. In contrast to what many theories predict, households working in the agricultural sectors do not benefit from an increase in world prices due to their spending a high proportion of their budgets on food and lack of flexibility in the domestic production of rice in response to price increases.

On the contrary, government policies involving both a 40 per cent decrease in the effective import tariffs of rice in response to high world prices of rice during 2007 to 2009 and the zero import tariffs in response to high world prices in 2010 could not perfectly absorb the negative impact of rising world rice prices on poverty in Indonesia. The decrease in import tariffs of rice from IDR 750 per Kg to IDR 450 per Kg (40 per cent decrease in import tariffs) decreased the head count index by 0.08 per cent, which equals a decrease in the number of poor by 161,546 persons. The zero import tariff of rice reduced the head count index by 0.19 per cent which equals 390,160 persons. This policy might be not enough to absorb the negative impact of an increase in world rice prices from 2007 to 2010 because, during this period, world rice prices increased on average by almost 71 per cent which had impoverished approximately 2 million people. On the contrary, protection of the agricultural sector, such as raising import tariffs which is actually intended to help agricultural producers, will yield the opposite. The simulations clearly showed that the agricultural households - that would theoretically be worse off in the presence of low import tariffs on rice- are in fact better off.

Lastly, this study suggests that the government should complement tariff policies with the other policies, such as distributing cheap rice, market operations or even cash transfers in order to protect the poor from the adverse impacts of increase in the world rice prices. In order to precisely estimate the poverty impact of changes in the world prices and import tariffs on rice, the used elasticities in CGE model should be also precisely estimated.

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8. References

Boccafunso, D. and Savard, L. (2006), *Impacts Analysis of Cotton Subsidies on Poverty: A CGE Macro-Accounting Approach,* Universite De Sherbrooke, Faculte d'Administration, Department D'Economique, Working Paper 06-03, January 2006. http://pages.usherbrooke.ca/gredi/wpapers/GREDI-0604.pdf

BPS (2005), Sistem Neraca Social Ekonomi, BPS: Jakarta.

___ (2005), Survei Sosial Ekonomi Nasional, BPS: Jakarta.

___ (2003), Sensus Pertanian 2003, BPS: Jakarta.

Chen, S. and Ravallion, M. (2003), *Household Welfare Impact of China's Accession to the World Trade Organization*, World Bank Policy Research: Working Paper 3040, May 2003.

Cororatan, C.B. and Cockburn, J. (2001), *Trade Reform and Poverty in the Philippines: A Computable General Equilibrium Micro-simulation Analysis,* CIRPEE Working Paper No.05-13. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=721623

Damuri, Y.R. and Perdana, A.A. (2003), *the Impact of Fiscal Policy on Income Distribution and Poverty: A Computable General Equilibrium Approach for Indonesia*, CSIS:WPE068, May 2003. http://www.csis.or.id/papers/wpec068

Dartanto, T (2009), *Measuring the Effectiveness of Fiscal Policies in Alleviating Poverty in Indonesia: A CGE-Microsimulation Analysis*, LPEM FEUI Staff Paper No.9.

Decaluwé, L.B., Savard, L. and Thorbecke, E.(2005), General Equilibrium Approach for Poverty Analysis: With an Application to Cameroon, *African Development Review Volume 17 Issue 2, Page 213-243, September 2005.*

Devis, K. *et al.* (1982), General Equilibrium Models for Development Policy: A World Bank Research Publication, Cambridge: Cambridge University Press, 1982.

Foster,J.E., Greer,J., and Thorbecke, E., (1984), A Class of Decomposable Poverty Measures, *Econometrica, 52, 761-776, 1984.*

Ikhsan, M., *et al.* (2005), *Study of the Impact of Increasing Fuel Price 2005 to Poverty*, LPEM FEUI: Working Paper 10.

Ikhsan, M.(2003), *Kemiskinan dan Harga Beras,* LPEM FEUI:Working Paper 3.

Ivanic, M. and Martin, W. (2008), *Implications of Higher Global Food Price for Poverty in Low Income Countries*, WPS4594, The World Bank.

Kapuschinki, C. A. and Warr, Peter G. (1999), Estimation of Armington Elasticities: an Application to the Philippines, *Economic Modelling 16(1999) 257-278.*

Leith, *et al.* (2003), *Indonesian Rice Tariff*, Poverty and Social Impact Analysis Report, www.prspsynthesis.org/Indonesia_Final_PSIA.doc

Lofgren, H., Harris, R. L., and Robinson, S. (2001), *A Standard Model of Computable General Equilibrium (A Standard Computable General Equilibrium (CGE) Model in GAMS*, Washington DC: IFPRI-TMD Discussion Paper No.75, May 2001). http://www.ifpri.org/pubs/microcom/5/mc5.pdf

McDaniel, C. A. and Balistreri, E. J. (2003), A Review of Armington Trade Substitution Elasticities, *Economie Internationale 94-95 (2003), p.301-304.*

McCulloch (2008), Rice Prices and Poverty in Indonesia, *Bulletin of Indonesian Economic Studies, Vol. 44, No.1, 2008:45-63.*

Savard, L. (2003), *Poverty and Income Distribution in a CGE-Household Micro-Simulation Model: Top-Down/Bottom Up Approach*, CIRPEE Working Paper No. 03-43, October 2003.

_____ (2005), Poverty and Inequality Analysis within a CGE Framework: A Comparative Analysis of the Representative Agent and Microsimulation Approaches*, Development Policy Review, 2005, 23 (3): 313-331).*

Warr, Peter G. (2005), Food Policy and Poverty in Indonesia: a General Equilibrium Analysis, *The Australian Journal of Agricultural and Resource Economics, 49, 429-451.*

_____ (2008), the Transmission of Import Prices to Domestic Prices: an Application to Indonesia, *Applied Economics Letters, 15:7, 499-503.*

_____ (2009), *Agricultural Protection and Poverty in Indonesia: A General Equilibrium Analysis*, Agricultural Distortions Working Paper 99, June 2009. (www.worldbank.org/agdistortions)

Warr, Peter G. and Yusuf, Arief A. (2009), *International Food Price and Poverty in Indonesia*, The Arndt-Corden Division of Economics, ANU College of Asia and the Pacific, Working Paper no. 2009/19.

Yusuf, Arief A. & Resosudarmo, B. (2008), `Mitigating Distributional Impact of Fuel Pricing Reform, the Indonesian Experience`, *ASEAN Economic Bulletin,* Vol. 25, No. 1 (2008), pp. 32–47, DOI: 10.1355/ae25-1d

Yusuf, Arief A. (2008), `INDONESIA-E3: An Indonesian Applied General Equilibrium Model for Analyzing the Economy, Equity, and the Environment`, Working Papers in Economics and Development Studies (WoPEDS), No 200804, Department of Economics, Padjadjaran University.

Appendix 1: Simulated Changes in Selected Macroeconomic Indicators under Various Changes in the World Rice Prices and the Import Tariffs of Rice (in per cent)

Indicators	Initial Value*	Increase in the World Rice Price					Decrease in the World Rice Price				Decrease in the Import Tariffs of Rice					Increase in the Import Tariffs of Rice				
		20%	40%	60%	80%	100%	20%	40%	60%	80%	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
Selected Macroeconomic Indicators (Real Value)																				
Private Consumption	23658.74	-0.045	-0.079	-0.107	-0.129	-0.147	0.060	0.148	0.291	0.596	0.001	0.002	0.002	0.002	0.003	-0.001	-0.002	-0.003	-0.005	-0.006
Exports	9988.57	-0.012	-0.022	-0.031	-0.039	-0.047	0.015	0.113	0.221	0.456	0.007	0.015	0.024	0.033	0.042	-0.007	-0.014	-0.020	-0.026	-0.032
Imports	-9169.37	-0.099	-0.161	-0.201	-0.226	-0.242	0.165	0.473	1.176	3.711	0.008	0.017	0.026	0.035	0.046	-0.008	-0.015	-0.022	-0.028	-0.034
Net Indirect Tax	759.45	-0.207	-0.344	-0.439	-0.505	-0.552	0.330	0.928	2.250	6.902	0.022	0.046	0.071	0.097	0.125	-0.021	-0.041	-0.061	-0.079	-0.096
GDP	31444.82	-0.009	-0.019	-0.032	-0.044	-0.055	0.002	-0.015	-0.104	-0.599	0.001	0.001	0.002	0.002	0.002	-0.001	-0.002	-0.003	-0.004	-0.005
Consumer Price Index (CPI)	120.00	0.235	0.331	0.431	0.571	0.662	-0.225	-0.410	-0.717	-1.428	0.037	0.063	0.087	0.100	0.100	-0.010	-0.032	-0.029	-0.053	-0.089
Selected Sectoral Changes**																				
Food Agriculture	2573.5	0.032	0.057	0.078	0.096	0.111	-0.044	-0.102	-0.203	-0.603	-0.007	-0.014	-0.021	-0.029	-0.038	0.006	0.013	0.018	0.024	0.029
Soybeans	108.5	-0.026	-0.047	-0.065	-0.079	-0.092	0.032	0.075	0.098	0.198	-0.001	-0.001	-0.002	-0.004	-0.005	0.000	0.001	0.001	0.001	0.000
Non Food Agriculture	983.1	-0.017	-0.030	-0.042	-0.052	-0.061	0.022	0.053	0.101	0.201	0.003	0.006	0.009	0.013	0.016	-0.003	-0.006	-0.008	-0.011	-0.013
Livestocks	794.7	-0.038	-0.068	-0.092	-0.102	-0.103	0.049	0.100	0.201	0.501	0.004	0.008	0.012	0.016	0.020	-0.004	-0.007	-0.011	-0.014	-0.018
Forestry	278.8	-0.007	-0.012	-0.017	-0.021	-0.025	0.009	0.021	0.042	0.089	0.002	0.003	0.005	0.007	0.009	-0.001	-0.003	-0.004	-0.006	-0.007
Fishery	742.4	-0.017	-0.030	-0.040	-0.049	-0.056	0.023	0.057	0.100	0.300	0.001	0.003	0.004	0.006	0.008	-0.001	-0.003	-0.004	-0.006	-0.007
Rice Industry	1375.4	-0.408	-0.618	-0.930	-1.145	-1.362	0.506	1.110	2.112	4.013	0.052	0.100	0.200	0.200	0.300	-0.050	-0.099	-0.100	-0.200	-0.200
Food and Beverage Industry	4125.8	-0.021	-0.037	-0.051	-0.061	-0.070	0.028	0.067	0.098	0.298	-0.001	-0.002	-0.003	-0.004	-0.005	0.001	0.001	0.001	0.001	0.001
Textile and Garment Industry	1639.6	0.002	0.005	0.008	0.012	0.016	-0.002	-0.003	-0.003	0.004	-0.003	-0.007	-0.010	-0.014	-0.019	0.003	0.006	0.009	0.011	0.013
Chemical Industry	6300.9	0.005	0.010	0.015	0.020	0.025	-0.006	-0.012	-0.017	-0.016	-0.004	-0.008	-0.012	-0.017	-0.022	0.004	0.007	0.010	0.013	0.016
Electricity, Gas and Water	923.4	0.004	0.007	0.010	0.012	0.015	-0.004	-0.009	-0.012	-0.009	-0.003	-0.005	-0.008	-0.011	-0.015	0.002	0.005	0.007	0.009	0.011
Restaurants	2460.5	-0.101	-0.201	-0.302	-0.303	-0.404	0.100	0.301	0.601	1.300	0.010	0.021	0.032	0.043	0.054	-0.010	-0.021	-0.031	-0.041	-0.050
Land Transportation	1121.6	0.001	0.002	0.004	0.006	0.010	-0.001	-0.003	-0.011	-0.053	-0.006	-0.012	-0.018	-0.025	-0.033	0.005	0.010	0.015	0.019	0.023
Banking and Insurances	1961.9	0.012	0.017	0.022	0.027	0.006	-0.008	0.299	0.599	1.199	-0.002	-0.005	-0.007	-0.010	-0.012	0.002	0.004	0.006	0.008	0.010
Government Services	3655.1	-0.004	-0.007	-0.009	-0.011	-0.011	0.006	0.014	0.027	0.050	-0.002	-0.004	-0.006	-0.008	-0.011	0.002	0.003	0.005	0.006	0.007

Source: CGE Simulations

*Note: * value in 10 billion IDR except in Consumer Price Index and ** is the Quantity of Composite (domestic and Imported) Good Supply*

Appendix 2: Simulated Changes in Domestic Consumer Price under Various Changes in the World Rice Prices and Import Tariffs of Rice (in per cent)

Commodity	Increase in the World Rice Price					Decrease in the World Rice Price				Decrease in the Import Tariffs of Rice					Increase in the Import Tariffs of Rice				
	20%	40%	60%	80%	100%	20%	40%	60%	80%	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
Food Croops	-0.001	-0.055	-0.086	-0.155	-0.174	0.101	0.072	0.017	-0.764	0.020	0.030	0.064	0.072	0.070	0.007	0.004	-0.002	0.001	0.001
Soybeans	-0.075	-0.191	-0.307	-0.385	-0.516	0.233	0.321	0.632	0.745	0.039	0.067	0.100	0.200	0.200	-0.010	-0.030	-0.051	-0.063	-0.076
Other Croops	-0.017	-0.080	-0.188	-0.157	-0.277	0.124	0.115	0.124	-0.563	0.023	0.034	0.071	0.082	0.082	0.005	-0.001	-0.008	-0.007	-0.009
Livestock	-0.060	-0.180	-0.288	-0.257	-0.377	0.229	0.315	0.424	0.103	0.026	0.041	0.081	0.095	0.099	0.001	-0.007	-0.018	-0.020	-0.025
Forestry	-0.051	-0.185	-0.196	-0.269	-0.394	0.131	0.218	0.428	0.048	0.030	0.049	0.094	0.100	0.100	-0.002	-0.014	-0.028	-0.033	-0.040
Fishery	-0.069	-0.280	-0.387	-0.456	-0.575	0.229	0.415	0.724	0.836	0.029	0.046	0.089	0.100	0.100	-0.001	-0.013	-0.026	-0.031	-0.038
Oil and Metal Mining	-0.079	-0.302	-0.424	-0.511	-0.651	0.236	0.527	1.039	1.653	0.052	0.095	0.200	0.200	0.200	-0.023	-0.055	-0.087	-0.100	-0.100
Other Mining and Quarrying	-0.073	-0.187	-0.299	-0.374	-0.501	0.231	0.419	0.929	1.542	0.035	0.060	0.100	0.100	0.200	-0.007	-0.024	-0.042	-0.051	-0.062
Rice	2.490	4.600	6.300	8.000	9.400	-2.915	-6.759	-12.068	-20.964	-0.300	-0.700	-1.100	-1.400	-1.900	0.400	0.700	1.000	1.400	1.700
Food and Beverage Industry	-0.074	-0.290	-0.404	-0.382	-0.511	0.232	0.521	0.931	1.444	0.039	0.068	0.100	0.200	0.200	-0.011	-0.031	-0.052	-0.064	-0.078
Textile-clothes-leather Industry	-0.073	-0.188	-0.300	-0.376	-0.503	0.231	0.519	0.929	1.542	0.036	0.062	0.100	0.100	0.200	-0.008	-0.025	-0.044	-0.053	-0.065
Wood Processing Industry	-0.073	-0.188	-0.300	-0.376	-0.503	0.231	0.419	0.929	1.442	0.036	0.061	0.100	0.100	0.200	-0.008	-0.024	-0.043	-0.052	-0.064
Pulp-Paper and Metal Industry	-0.076	-0.295	-0.412	-0.393	-0.527	0.234	0.523	0.934	1.647	0.044	0.078	0.100	0.200	0.200	-0.015	-0.040	-0.065	-0.081	-0.098
Chemical Industry	-0.076	-0.295	-0.413	-0.394	-0.529	0.234	0.523	0.934	1.548	0.044	0.079	0.100	0.200	0.200	-0.016	-0.040	-0.066	-0.082	-0.100
Electricity-Gas-Water	-0.069	-0.179	-0.286	-0.354	-0.472	0.229	0.515	1.023	1.736	0.026	0.042	0.082	0.097	0.100	0.001	-0.007	-0.018	-0.020	-0.024
Constructions	-0.074	-0.189	-0.303	-0.379	-0.508	0.232	0.520	0.930	1.543	0.038	0.065	0.100	0.100	0.200	-0.009	-0.028	-0.048	-0.059	-0.072
Trade	-1.500	-1.600	-1.600	-2.800	-1.600	-2.100	-1.100	-3.400	0.100	-0.400	-0.400	-1.200	-1.200	-0.800	-0.500	-0.700	-0.800	-1.100	-1.400
Restaurants	0.238	0.336	0.440	0.585	0.681	-0.076	-0.394	-0.587	-1.176	-0.016	-0.043	-0.047	-0.078	-0.100	0.042	0.073	0.100	0.100	0.200
Hotels	-0.074	-0.189	-0.303	-0.380	-0.509	0.232	0.420	0.931	1.543	0.037	0.063	0.100	0.100	0.200	-0.008	-0.026	-0.045	-0.055	-0.067
Land Transportation	-0.072	-0.186	-0.298	-0.372	-0.498	0.231	0.519	0.928	1.641	0.034	0.058	0.100	0.100	0.100	-0.006	-0.022	-0.039	-0.047	-0.057
Air-Water Transp. and Telecommunication	-0.071	-0.184	-0.293	-0.365	-0.488	0.230	0.417	0.927	1.539	0.030	0.050	0.096	0.100	0.100	-0.002	-0.015	-0.028	-0.033	-0.040
Warehousing	-0.073	-0.187	-0.299	-0.374	-0.501	0.231	0.419	0.929	1.542	0.034	0.059	0.100	0.100	0.100	-0.006	-0.022	-0.039	-0.048	-0.058
Financial Services	-0.066	-0.172	-0.274	-0.337	-0.349	0.226	0.411	0.919	1.731	0.018	0.024	0.055	0.060	0.053	0.009	0.009	0.006	0.010	0.013
Real Estate	-0.072	-0.285	-0.396	-0.369	-0.493	0.230	0.518	1.028	1.840	0.033	0.057	0.100	0.100	0.100	-0.005	-0.021	-0.037	-0.045	-0.055
Government and Private Services	-0.068	-0.177	-0.282	-0.349	-0.365	0.228	0.413	0.822	1.434	0.022	0.034	0.070	0.081	0.080	0.005	0.000	-0.007	-0.006	-0.008
Individual Services	-0.069	-0.280	-0.287	-0.355	-0.474	0.229	0.515	1.024	1.836	0.028	0.045	0.087	0.100	0.100	0.000	-0.010	-0.022	-0.025	-0.030

Source: CGE Simulations

Appendix 3: Simulated Changes in Factor Incomes under Various Changes in the World Rice Prices and Import Tariffs of Rice (in per cent)

Commodity	Increase in the World Rice Price					Decrease in the World Rice Price				Decrease in the Import Tariffs of Rice					Increase in the Import Tariffs of Rice				
	20%	40%	60%	80%	100%	20%	40%	60%	80%	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
Rural Agricultural Labour	0.012	-0.033	-0.075	-0.086	-0.167	0.083	0.022	-0.095	-1.102	0.017	0.023	0.053	0.057	0.050	0.010	0.010	0.007	0.012	0.015
Urban Agricultural Labour	-0.011	-0.073	-0.130	-0.152	-0.244	0.113	0.099	0.061	-0.754	0.019	0.027	0.060	0.067	0.062	0.008	0.006	0.005	0.004	0.005
Rural Production-Operator-Unskilled Labour	-0.052	-0.136	-0.205	-0.234	-0.330	0.189	0.331	0.668	1.138	0.030	0.050	0.095	0.115	0.126	-0.002	-0.013	-0.026	-0.031	-0.037
Urban Production-Operator-Unskilled Labour	-0.092	-0.208	-0.304	-0.356	-0.472	0.242	0.455	0.906	1.597	0.034	0.057	0.106	0.130	0.145	-0.006	-0.021	-0.037	-0.045	-0.054
Rural sales and administration (semi-skilled) labour	-0.480	-0.909	-1.264	-1.538	-1.844	0.739	1.643	3.165	5.996	0.065	0.120	0.200	0.256	0.301	-0.037	-0.083	-0.131	-0.169	-0.209
Urban sales and administration (semi-skilled) labour	-0.397	-0.758	-1.057	-1.281	-1.545	0.634	1.394	2.696	5.095	0.057	0.103	0.176	0.223	0.259	-0.029	-0.067	-0.107	-0.137	-0.170
rural skilled labour	-0.229	-0.457	-0.647	-0.779	-0.964	0.412	0.853	1.625	2.836	0.039	0.067	0.120	0.148	0.165	-0.011	-0.032	-0.055	-0.070	-0.086
Urban skilled labour	-0.223	-0.446	-0.630	-0.757	-0.937	0.407	0.845	1.622	2.886	0.039	0.067	0.121	0.149	0.167	-0.011	-0.032	-0.055	-0.069	-0.086
Non Labor Factor	0.162	0.264	0.361	0.482	0.524	-0.060	-0.222	-0.267	-0.290	0.000	-0.012	0.001	-0.012	-0.035	0.028	0.046	0.062	0.085	0.106

Source: CGE Simulations

Appendix 4: Simulated Changes in Poverty Line under Various Changes in the World Rice Prices and Import Tariffs of Rice

Province	the 2005 Poverty Line (IDR/Month)		Increase (Decrease) in the 2005 Poverty Line Line Under Selected Simulation (Change in IDR/Month)															
			Increase in the World Rice Price				Decrease in the World Rice Price				Decrease in Import Tariffs of Rice				Increase in Import Tariffs of Rice			
			20%		60%		20%		60%		20%		60%		20%		60%	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Nanggroe Aceh D.	195,882	166,608	565.46	532.08	1140.89	1101.13	-421.78	-423.45	-1989.39	-1969.86	-25.7	-28.3	-143.5	-145.3	98.9	92.1	209.0	198.0
North Sumatera	175,152	117,578	505.62	375.49	1020.16	777.08	-377.15	-298.84	-1778.86	-1390.16	-23.0	-20.0	-128.3	-102.6	88.4	65.0	186.9	139.7
West Sumatera	175,730	125,602	507.29	401.12	1023.52	830.11	-378.39	-319.23	-1784.73	-1485.03	-23.1	-21.3	-128.7	-109.6	88.7	69.4	187.5	149.3
Riau	196,892	151,718	568.38	484.52	1146.78	1002.72	-423.96	-385.60	-1999.65	-1793.81	-25.8	-25.8	-144.2	-132.3	99.4	83.8	210.1	180.3
Jambi	187,608	122,185	541.58	390.21	1092.70	807.53	-403.97	-310.54	-1905.36	-1444.63	-24.6	-20.8	-137.4	-106.6	94.7	67.5	200.2	145.2
South Sumatera	172,684	120,331	498.50	384.29	1005.78	795.28	-371.83	-305.83	-1753.79	-1422.71	-22.7	-20.4	-126.5	-105.0	87.2	66.5	184.3	143.0
Bengkulu	172,659	110,275	498.43	352.17	1005.63	728.82	-371.78	-280.27	-1753.54	-1303.82	-22.7	-18.7	-126.5	-96.2	87.2	60.9	184.3	131.0
Lampung	164,909	113,728	476.05	363.20	960.50	751.64	-355.09	-289.05	-1674.83	-1344.64	-21.6	-19.3	-120.8	-99.2	83.2	62.8	176.0	135.1
Bangka Belitung	197,082	178,701	568.93	570.70	1147.88	1181.05	-424.37	-454.18	-2001.58	-2112.84	-25.9	-30.4	-144.4	-155.9	99.5	98.8	210.3	212.4
Riau Island	231,346	156,453	667.84	499.64	1347.45	1034.01	-498.15	-397.64	-2349.57	-1849.79	-30.4	-26.6	-169.5	-136.5	116.8	86.5	246.9	185.9
DKI Jakarta	237,735	-	686.28	-	1384.66	-	-511.90	-	-2414.45	-	-31.2	-	-174.2	-	120.0	-	253.7	-
West Java	151,235	113,964	436.58	363.95	880.85	753.20	-325.65	-289.65	-1535.95	-1347.43	-19.9	-19.4	-110.8	-99.4	76.3	63.0	161.4	135.4
Central Java	143,776	120,115	415.05	383.60	837.41	793.85	-309.59	-305.28	-1460.20	-1420.16	-18.9	-20.4	-105.3	-104.8	72.6	66.4	153.4	142.7
DI Yogyakarta	160,690	130,807	463.87	417.74	935.92	864.52	-346.01	-332.46	-1631.98	-1546.57	-21.1	-22.2	-117.7	-114.1	81.1	72.3	171.5	155.4
East Java	146,743	115,272	423.61	368.13	854.69	761.84	-315.97	-292.97	-1490.33	-1362.90	-19.3	-19.6	-107.5	-100.5	74.1	63.7	156.6	137.0
Banten	183,927	108,855	530.95	347.64	1071.26	719.43	-396.04	-276.66	-1867.98	-1287.03	-24.1	-18.5	-134.7	-94.9	92.8	60.2	196.3	129.4
Bali	166,962	136,897	481.98	437.19	972.45	904.76	-359.51	-347.94	-1695.68	-1618.58	-21.9	-23.3	-122.3	-119.4	84.3	75.7	178.2	162.7
West Nusa Tenggara	134,488	109,403	388.23	349.39	783.31	723.05	-289.59	-278.06	-1365.87	-1293.51	-17.7	-18.6	-98.5	-95.4	67.9	60.5	143.5	130.0
East Nusa Tenggara	141,168	89,764	407.52	286.67	822.22	593.26	-303.97	-228.14	-1433.71	-1061.31	-18.5	-15.3	-103.4	-78.3	71.3	49.6	150.7	106.7
West Kalimantan	164,397	109,777	474.57	350.58	957.51	725.53	-353.99	-279.01	-1669.63	-1297.93	-21.6	-18.7	-120.4	-95.8	83.0	60.7	175.4	130.5
Central Kalimantan	161,231	125,980	465.44	402.33	939.07	832.61	-347.17	-320.19	-1637.47	-1489.50	-21.2	-21.4	-118.1	-109.9	81.4	69.6	172.1	149.7
South Kalimantan	163,565	107,455	472.17	343.17	952.67	710.18	-352.20	-273.11	-1661.18	-1270.48	-21.5	-18.3	-119.8	-93.7	82.6	59.4	174.6	127.7
East Kalimantan	213,378	161,910	615.97	517.07	1242.80	1070.08	-459.46	-411.51	-2167.08	-1914.31	-28.0	-27.5	-156.3	-141.2	107.7	89.5	227.7	192.4
North Sulawesi	150,421	118,675	434.23	379.00	876.11	784.33	-323.89	-301.62	-1527.69	-1403.13	-19.7	-20.2	-110.2	-103.5	75.9	65.6	160.5	141.0
Central Sulawesi	173,991	121,193	502.27	387.04	1013.39	800.98	-374.65	-308.02	-1767.07	-1432.90	-22.8	-20.6	-127.5	-105.7	87.8	67.0	185.7	144.0
South Sulawesi	138,576	97,027	400.04	309.86	807.12	641.26	-298.39	-246.60	-1407.39	-1147.18	-18.2	-16.5	-101.5	-84.6	69.9	53.6	147.9	115.3
South East Sulawesi	122,067	107,902	352.38	344.59	710.97	713.13	-262.84	-274.24	-1239.72	-1275.76	-16.0	-18.3	-89.4	-94.1	61.6	59.6	130.3	128.2
Gorontalo	135,837	115,018	392.13	367.32	791.17	760.16	-292.49	-292.33	-1379.57	-1359.90	-17.8	-19.5	-99.5	-100.3	68.6	63.6	145.0	136.7
West Sulawesi	189,173	150,271	546.10	479.90	1101.82	993.15	-407.34	-381.93	-1921.26	-1776.70	-24.8	-25.5	-138.6	-131.1	95.5	83.0	201.9	178.6
Maluku	174,425	122,936	503.52	392.61	1015.92	812.50	-375.58	-312.45	-1771.47	-1453.51	-22.9	-20.9	-127.8	-107.2	88.0	67.9	186.1	146.1
Papua	193,307	145,610	558.03	465.02	1125.90	962.35	-416.24	-370.08	-1963.24	-1721.59	-25.4	-24.7	-141.6	-127.0	97.6	80.5	206.3	173.0
National	**165,565**	**117,365**	**477.95**	**374.81**	**964.32**	**775.68**	**-356.50**	**-298.29**	**-1681.49**	**-1387.64**	**-21.7**	**-19.9**	**-121.3**	**-102.4**	**83.6**	**64.9**	**176.7**	**139.5**

Source: CGE Simulations