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Impact of Rice Import Tariff and Quota on Food Security in Indonesia

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Abstract

Food is an essential need for human beings to survive, particularly for Indonesia as one of the fifth most highly populated countries in the world. Food security should become one of the most important issues in Indonesia. This paper tries to answer these following questions: what is the existing condition of food security? How do the import tariff and quota affect the National food security? National series data from 1980 to 2013 for 4 main staple foods: rice, maize, cassava and wheat were employed. The Simultaneous Equations Model consisting of 22 structural equations and 29 identity equations were estimated using Two Stage Least Square method. The results show that: (1) during the last 4 decades the food diversification indicator tends to be concentrated; however, the food independence indicator improved; (2) a high tariff rate on rice and ban on rice import will increase consumption food diversification, food independence and food self-sufficiency indicators for rice; however, the food independence indicators for maize and cassava would decreasee; (3) The implementation of tariff and quota results in a trade-off situation between diversifying the food consumption and maintaining food independence indicators.

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In order to reach food diversification, food independence and food self-sufficiency for rice, a ban on import is pertinent to be implemented.

Keywords: Food Policy; Food Diversification; Food Dependence: Indonesia.

1. Introduction

Indonesia is a vast country with a large population; therefore, food security should be a priority in its economic development. Food insecurity is a sensitive issue in the dynamics of Indonesia's social, economic, and political life; therefore, food security which is based on independence in the domestic food supply is of the utmost importance to the Indonesian people [10].

Management of food-related issues in Indonesia is governed through the Law Number 18 Year 2012 which replaced Law Number 7 Year 1996 which was developed based on food sovereignty and food independence. Based on this law, to achieve food security, there needs to be a constant availability of food which is safe, high quality, nutritious and varied with affordable prices to the public [1]. This law clearly states that food availability, independence, and diversification are important pillars in the effort to realise food security, especially in order to improve, utilise, and provide more diversified, more balanced, and safer foods.

In addition to the food and food diversification-related policies, Indonesia's long-standing food issue (mainly about rice) is related to the unbalance between production and consumption which has caused the government to issue various policies that were aimed to meet the domestic food consumption, such as those related to food import [6]. Since the early independence days, Indonesia seemed to be constantly importing food, especially rice. Even during the economic crisis, the doors for import were opened wide with the excuse to fulfil the people's food consumption needs [5].

In the last four decades, Indonesia has continued to import rice even though the trend is decreasing with sharp fluctuations, particularly in the decade before rice self-sufficiency in 1984. In 1973 the domestic consumption dependence on import reached 12.13 percent. This means that 12.13 percent of the domestic rice consumption came from imported rice. In 1977, 1978 and 1980 the percentage was also relatively high, approximately 11 percent. The following decade was the golden years for the national rice production with an approximate 1 percent dependence on imported rice. Dependence on import increased again during the economic crisis in 1998 when the dependence on import reached 9.7 percent and reached a peak in 1999 at 13.9 percent [2].

The facts above demonstrate how dependent Indonesia is in general on the global rice market. This is of course a threat to the national food security. Based on this hypothesis, this study aims to analyse the development of the condition of the diversification of staple foods and analyse the impact of the import quota and rice import tariff policy on the national food security condition evaluated from three indicators: food consumption diversification, food independence and food self-sufficiency.

In this study, food security was determined only by food availability, diversification and dependency. The food quality and safety have not been taken into account on this analysis. Moreover, this study employed data at

national level so the analysis could not consider the diversity among regions and the analysis only accounted for 4 staple foods: rice, maize, cassava, and wheat flour.

2. Material and Method

2.1. Data sources, concept and measurement

This study used a series of data from 1980 to 2013 from various formal institutions and agencies such as the BPS-Statistics Indonesia, Food Security Agency (Badan Ketahanan Pangan (BKP)), Indonesian Centre for Agricultural Socio-Economic Studies (PPSE), Directorate General of Food Crops and Horticulture and international institutions such as FAOSTAT, IFRI, and the World Bank. Food security in this study was limited to staple food security only. The types of staple food that were the objects of the study were four commodities, rice, maize, cassava and wheat flour. Food security was assessed using three indicators: food independence, food diversification and food self-sufficiency.

Food independence was assessed using the food independence index which is the ratio between the domestic food production and the domestic food consumption for each food commodity [6, 7]. Rice self-sufficiency was assessed through the difference between food domestic supply (production plus stock) and the domestic food consumption. Food diversification was assessed through three indices: the food diversity index (FDI), the entropy index (EI) and the Berry Index (the Berry and Simpson Index/BI) as done by Gaiha and his colleagues [3] on the data of the people of India's consumption. For simulation purposes, only the FDI was included in the model with the rule that the lower the index, the more diversified the staple food production/consumption pattern is. As for the EI and BI, the higher the index, the more diversified the staple food pattern is.

2.2 The Model and procedure for analysis

In order to represent the dependence of consumption behaviour on imported staple food in Indonesia, an econometric model was developed. This model was formulated in the form of a simultaneous equation system which consisted of 22 structural equations and 29 identity equations. In general, the model structure was arranged based on the commodities analysed as follows: (1) the rice block, (2) the maize block, (3) the cassava block and (4) the wheat flour block. From the formulation model, it could be seen that there were 45 predetermined variables so the total number of variables in the model was 99 (K=99). The maximum number of variables in an equation is 9 variables (M=9); therefore, the result of the identification of the model above was (99-9) > (45-1). Based on the order condition criteria, the identification of the structural equations in the model were over identified, so the model estimation could be generated using the 2SLS (Two Stage Least Squares) [4]. The statistical criteria for the model validation of an econometric model used in this study were the Root Mean Square Percent Error (RMSPE) and Theil's Inequality Coefficient (U). Policy simulation was conducted on an historical simulation (*ex post)* for 1980-2013 and was meant to evaluate the policies in that period so that they could be used as an input for future policy implication. The impact analysis and policy alternatives for the food dependence model consisted of (1) limitation of import quota, and (2) changes in the import price which represents the application of an import tariff.

3. Results

3.1. Result for model validation

As mentioned before, the validation of the model was conducted to assess whether the model was valid enough to create a policy simulation.

Table 1: Validation results of Indonesian staple food model for rice, maize and cassava

Variable	Unit	Actual	Prediction	RMS % Error	U
Rice harvest area	(000) Ha	13158.1	13359.2	2.4117	0.0117
Paddy production	000 Tons	66224.5	67215.6	2.4117	0.0116
Rice production	000 Tons	41522.8	42144.2	2.4117	0.0116
Rice import	000 Tons	1043.5	814.1	130.2	0.4515
Household rice consumption	000 Tons	21394.9	21735.9	2.3379	0.0115
Total rice consumption	000 Tons	38566.7	38907.6	1.2402	0.0064
Rice supply	000 Tons	43975.3	44367.3	3.1314	0.0149
Paddy price	Rp/Kg	3603	3435.8	9.3107	0.0498
Rice price	Rp/Kg	8279.1	7706.6	11.0523	0.0619
Imported rice price	US$/Tons	4635.5	4536.2	5.8815	0.0301
Rice self-sufficiency	000 Tons	4367.9	4648.4	24.6189	0.1129
Rice energy consumption	Kcal	322775	327834	2.3379	0.0112
Maize harvest area	(000) Ha	3989.6	3977.3	4.9187	0.0245
Maize production	000 Tons	17964.4	17956.7	4.9187	0.0244
Maize import	000 Tons	1831.7	1942.6	127.5	0.1929
Household maize consumption	000 Tons	441	416.6	25.2957	0.108
Total maize consumption	000 Tons	13663.7	13639.3	0.6752	0.0036
Maize supply	000 Tons	21590.9	21694.2	1.9072	0.01
Producer price of maize	Rp/Kg	2920.6	2686.6	9.8061	0.0494
Consum er price of maize	Rp/Kg	4163.3	3999.3	8.1643	0.0423
import price of maize	US$/Ton	2750	2744.5	15.3958	0.0863
Maize energy consumption	Kcal	666.8	633.1	25.2957	0.1037
Cassava harvest area	(000) Ha	1157.3	1137.2	3.2945	0.0166
Cassava production	000 Tons	23314.6	22937.8	3.2945	0.0169
Household cassava consumption	000 Tons	1220	1131.7	12.5083	0.0749
Total cassava consumption	000 Tons	20855.1	20766.8	0.8672	0.0043
Domestic cassava supply	000 Tons	24145.6	23768.9	3.1971	0.0163
producer price of cassava	Rp/Kg	1887.4	1556.6	21.965	0.1159
Consumer price of cassava	Rp/Kg	2705.2	2769.8	5.8063	0.0292
Cassava energy consumption	Kcal	6687.9	6203.5	12.5083	0.0745

The criterion for good model estimation is a model that results in diminishing RMSPE and U-Theil values. The U-Theil coefficient (U) ranges between 0 and 1. If the value of U is 0, it means that the model estimation is perfect, whereas if the U is 1, the model is judged to be naive [9]. The results of the validation conducted on the staple food model are presented in table 1.

Based on the table 1 and table 2, the RMSPE indicator demonstrated that 96 percent of the variables had an RMSPE value of less than 30 percent and most had percentages of less than 10 percent. Only two variables had an RMSPE value higher than 100, the rice import and maize import variables. This demonstrates that during the period observed, 2008 to 2013, the endogenous variable resulted of estimation was fairly close to the actual value. Based on the U-Theil validation indicator, almost all equations had a U-Theil value less than 0.3 and only 1 equation out of the 51 equations had a U-Theil value higher than 0.3. The number of equations that had a U-Theil value below 0.1 was 43 equations.

Table 2: Validation results of Indonesian staple food model for wheat flour and the food indicator variables

Variable	Unit	Actual	Prediction	RMS % Error	U
Domestic wheat flour production	000 Ton	3880	4368.9	16.8491	0.0693
Wheat import	000 Ton	5426	6171.1	17.4535	0.0721
Wheat flour supply	000 Ton	4407.1	4896	14.0949	0.0616
Household wheat flour consumption	000 Ton	312.6	348.9	14.2444	0.0647
Producer proice of wheat flour	Rp/Kg	3331.4	2797.9	22.2646	0.119
Consumer price of wheat flour	Rp/Kg	7121.7	6048	15.6808	0.0837
Imported price of wheat flour	US$/Ton	3427.1	3386.3	15.8626	0.0931
Wheat flour energy consumption	Kcal	4336	4841.3	14.2444	0.0651
Total staple food energy consumption	Kcal	334466	339512	2.2981	0.011
Rice's proportion of energy	Unit	0.9651	0.9657	0.3231	0.0016
Maize's proportion of energy	Unit	0.00199	0.00186	25.8817	0.112
Cassava's proportion of energy	Unit	0.0199	0.0182	12.6541	0.0753
Wheat flour's proportion of energy	Unit	0.013	0.0143	13.0987	0.0599
Consumption diversification	Unit	0.9321	0.9331	0.6346	0.0032
Share of energy production from rice	Unit	0.8024	0.8071	1.0686	0.0053
Share of energy production from maize	Unit	0.0346	0.0342	5.7454	0.0287
Share of energy production from cassava	Unit	0.163	0.1587	4.3574	0.0223
Production diversification	Unit	0.6717	0.6778	1.7012	0.0085
Food independence index for rice	Unit	1.077	1.0848	2.5315	0.0127
Food independence index for maize	Unit	1.3214	1.3176	5.5259	0.0275
Food independence index for cassava	Unit	1.1243	1.1107	2.8327	0.0142

Based on the indicators above which demonstrate the criteria of a good model, the Indonesia staple food model could be used to create a policy-impact simulation on a number of endogenous variables which are the core of this study. Through the policy-impact simulation, we could find which policy give optimum impact on national

food security.

3.2. Development of staple food independence indicator in Indonesia

The development of the staple food independence index in the last 4 decades is presented in Figure 1. IMPBR represents the rice independence index, IMPJG represents the maize independence index, and IMPUK represents the cassava independence index. Among the three staple foods, rice had the lowest food independence index, whereas cassava had the highest. During the 4 periods, the rice and maize's independence indices demonstrated similar trends, but the fluctuations in the rice's independence index were less apparent. The rice and maize (IMPJG) independence index experienced a fairly significant decrease when the economic crisis hit Indonesia. During that time, Indonesia's food condition, especially for rice and maize, was fragile and Indonesia imported rice in large amounts. The opposite was demonstrated by cassava's independence index (IMPUK); during the crisis it exhibited good performance with an increased index. Unfortunately, after 2002 the index for cassava dropped constantly until it was below that of maize.

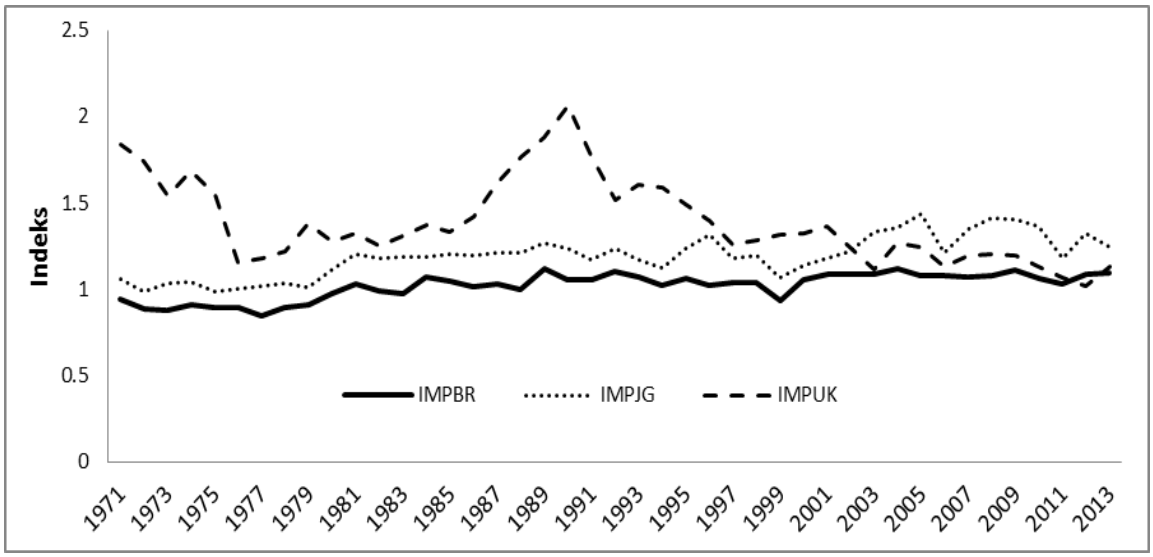

Figure 1: The development of the food independence indices for rice, maize and cassava between 1971-2013

The diversification index for in the past four decades has demonstrated changes in both production and consumption with a trend towards concentration. The results of the measurement of the three indices are presented in Figure 2 and Figure 3. In the first decade, the production diversification index tended to approach 0. This showed that the production was more diversified during this period. The index in the next period demonstrated a stagnant trend with slight fluctuations in 1984, 1989 and 1996. These years were the golden years of rice production in Indonesia. The year 1984 was a huge accomplishment in Indonesia's rice production because during this year Indonesia achieved rice self-sufficiency for the first time with a rice production exceeding 38.17 million tonnes. Unfortunately, in the last decade the production diversification index demonstrated an upward trend which could be interpreted as the production of food in Indonesia has become concentrated on one type of food only.

The consumption diversification pattern during the course of the study demonstrated a decreasing trend (more concentrated) with a pattern of slight fluctuations. Surprisingly, the years immediately preceding the economic crisis in Indonesia exhibited a more diversified consumption pattern in Indonesia. There was a slight shock in 1998 when the entropy index (EI) increased from 0.1759 to 0.2116 and the FDI index decreased from 0.9318 to 0.9147. Between 2000 and 2010, the people's consumption pattern had not experienced any significant changes. However, if the forming index is observed, the share of energy consumption from wheat flour (EI1, BI1 and FDI1) exhibited an increasing trend. This means that the decrease in diversification index was due to the shift of the people's consumption pattern from rice to wheat flour.

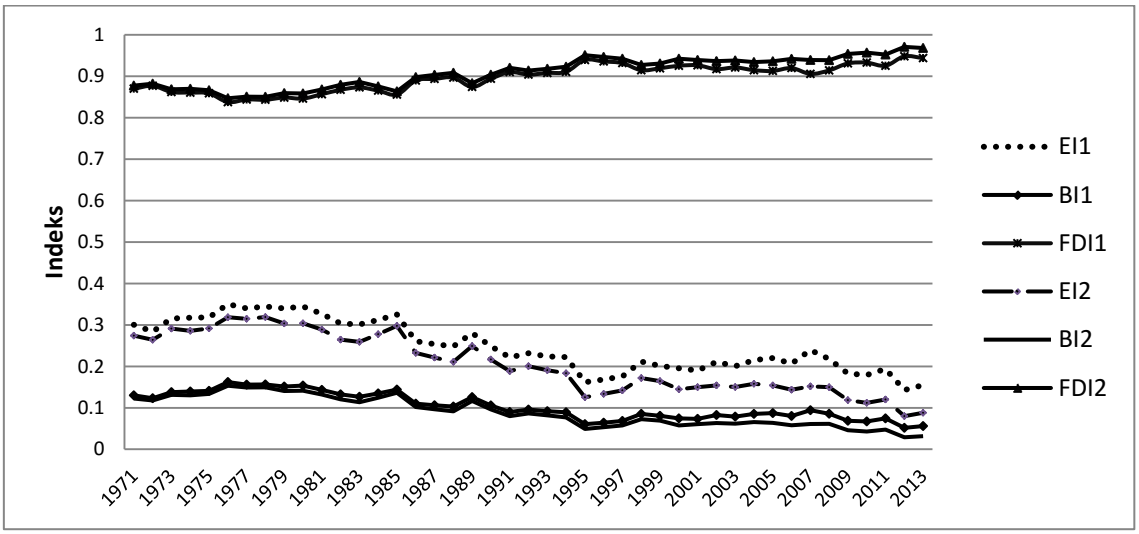

Figure 2: Development of food diversification index year 1971-2013

3.2 Impact of rice import tariff on food security

In order to discover the impact of imposing tariff on rice import, a simulation for changes in the imported rice price was conducted in four scenarios: an increase in the price of imported rice of 5 percent (S1), 30 percent (S2), and a decrease of the price of imported rice of 10 percent (S3). The simulations were selected based on the tariff implementation during the length of the study. The results for an overall increase had a similar effect in direction but different result in magnitude. The increased price of imported rice had a direct impact on the decrease in the amount of rice imported, so the domestic rice supply also decerased, causing the price of this commodity to rise in the domestic market. The decrease in the component of supply which originated from import was substituted by the increased domestic rice production due to the increased size of land harvested and the incentive effect of the rise in rice price in the market. The impact on these variables led to staple food production that is more concentrated on rice or a decrease in the production diversification level. On the other hand, the reduced import tariff simulation had an opposite effect. In general, the decreased price of imported rice or the tariff would cause the import of rice to increase, and the decreased price of rice would lead to a decrease in rice production. From the consumption point of view, the decrease in the price of rice would cause rice consumption to increase and would thus cause the food consumption diversification to be more

concentrated.

Based on the results of the staple food diversification model in Table 3, the rise in the global price of rice by 5 percent would have an impact on the decrease in import by 0.64 percent which would cause the supply of rice to decline by 0.01 percent. The decline in domestic rice supply would be responded by the rise in the domestic price of rice by 0.03 percent which would cause rice consumption to decrease by 0.01 percent, while maize consumption, cassava and wheat flour would increase by 0.1, 0.02 and 0.03 percent, respectively. In the end, this situation would lead to a more diversified staple food consumption. The domestic production of rice as a substitute for the decrease in import increased 0.002 percent, while the production of maize and cassava each declined by 0.003 percent. This means that the implementation of the 5 percent tariff on rice import would increase the consumption diversification but decrease production diversification in very small amounts.

Table 3: The impact of an increase in the price of imported rice by 5% and 30%, and a decrease by 10%.

Nama Variable	Unit	Base value	Simulation result (%)		
			S1	S2	S3
Imported rice	(000) Ton	830	-0.6386	-3.8554	1.2892
Domestic rice supply	(000) Ton	44387	-0.0101	-0.0608	0.0203
Domestic rice price	Rp/Kg	7715.2	0.0285	0.1711	-0.0570
Rice consumption	(000) Ton	21727.3	-0.0101	-0.0608	0.0203
Maize consumption	(000) Ton	418.3	0.0956	0.5259	-0.1673
Cassava consumption	(000) Ton	1132.8	0.0177	0.1059	-0.0353
Wheat flour consumption	(000) Ton	349.2	0.0286	0.1432	-0.0286
Proportion of rice consumption	Percent	0.97	0.0000	-0.0104	0.0000
Proportion of maize consumption	Percent	0.00	0.5376	0.5376	0.0000
Proportion of cassava consumption	Percent	0.02	0.0000	0.5495	0.0000
Proportion of wheat flour consumption	Percent	0.01	0.0000	0.0000	0.0000
Consumption diversification	Index	0.9330	0.0000	-0.0107	0.0000
Rice production	(000) Ton	42147.9	0.0021	0.0121	-0.0040
Maize production	(000) Ton	17952.9	-0.0033	-0.0217	0.0072
Cassava production	(000) Ton	22933.8	-0.0031	-0.0183	0.0065
Share of rice production	Percent	0.81	0.0000	0.0000	-0.0124
Share of maize production	Percent	0.03	0.0000	0.0000	0.0000
Share of casssava production	Percent	0.16	0.0000	0.0000	0.0000
Production diversification	Index	0.6779	0.0000	0.0000	-0.0148
Rice self-sufficiency	(000) Ton	4660.7	0.0665	0.3926	-0.1309
Food independence index of rice	Index	1.0851	0.0092	0.0461	-0.0092
Food independence index of maize	Index	1.3172	0.0000	-0.0304	0.0152
Food independence index of cassava	Index	1.1104	0.0000	-0.0180	0.0090

If other food security indicators are observed, rice self-sufficiency and food self-dependence, a 5 percent

increase in tariff would lead to an increase in rice self-sufficiency by 0.067 percent. The rice's food independence increases by 0.0092 percent, whereas the maize and cassava's food independence index remains unchanged.

The second simulation, where the import price is increased by 30 percent, demonstrated a change in the same direction but with a larger magnitude. This simulation had an effect of decreasing the rice import by 3.85 percent and increasing the rice production by 0.012 percent. Even though the rice supply experienced a decrease (0.061 %) which was caused by the decrease in import, but the food independence indicator increased quite significantly, 0.05 percent, as a result of the increased rice production and the decreased rice consumption. Unfortunately, the negative effect that could threaten food security is the decline in the food independence indices for maize and cassava.

In this simulation, the effect caused by diversification of staple food consumption was evident in the decrease in the proportion of rice consumption by 0.01 percent and increase in the proportion of maize consumption and cassava by 0.54 percent and 0.55 percent, respectively. On the other hand, there was a smaller change in the production diversification indicator, an increase in rice production by 0.012 percent and a decrease in the production of maize and cassava by 0.02 percent each. These changes nearly did not change the production diversification index.

The effect of the decrease in the price of imported rice (in the decreased import tariff simulation) on import was stronger than that of the increased import tariff. The decrease in rice import tariff by 10 percent would cause an increase in import by 1.289 percent and an increase in the domestic rice supply by 0.203 percent. The increase in supply would of course lower the price of rice, leading to the increased household rice consumption. The increase in rice consumption would decrease the consumption of its competitor staple foods, maize, cassava and wheat flour, which would ultimately lead to the decrase in staple food consumption diversification. The positive effect is that the decrease in the price of rice is an incentive for producers to produce maize and cassava, causing the production of these two staples to increase and increase the staple food production diversification.

The decrease in tariff and increase in rice import are disincentives for domestic rice producers, signified by the decrease in rice production by 0.004 percent. The increased supply and decrease in the price of rice are good news for consumers, demonstrated by the increase in rice consumption by 0.02 percent. These two opposing conditions cause the food independence index for rice to decrease. The increased food independence index for maize and cassava as a resultant of the increased production of maize and cassava is not good news, considering that the consumption of the two staples decreased, leading to a steeper fall in consumption diversification.

3.3. The impact of the import quota on food security

In supporting programs for increasing the agricultural productivity and reducing the dependence on food import, the new government took a strategic policy by banning import. The policy to ban import (S4) became the first simulation scenarion, whereas the other simulations were the decreased import quota by 20 percent (S5) and an increased import quota by 10 percent (S6). The results of these simulations established that the import ban

policy in general had an effect of an increase domestic rice price caused by the decrease in the drop in rice supply. This policy had a strong effect on consumption diversification by increasing maize and cassava consumption, but unfortunately the maize and cassava food independence fell.

A ban on rice import would have an impact on the continued supply of domestic rice, approximately 702 thousand tonnes or 1.58 percent. The drop in supply would certainly have an effect on the price of rice so that the price of rice would rise to 7,750 Rupiahs per Kg and rice consumption would decrease by 1.58 percent. From the production point of view, the increase in the price of rice would become an incentive for farmers to increase the production of rice so that production would rise from 42,147 thousand tonnes to 42,275 thousand tonnes. The decrease in consumption and increase in production would improve the rice's food independence indicator.

Table 4: The impact of the ban on import, a decrease in import quota by 20% and an increase in import quota by 10 %

Name of Variable	Unit	Base value	Simulation result (%)		
			S4	S5	S6
Domestic rice supply	(000) Ton	44387	-1.5824	0.0511	0.6635
Domestic rice price	Rp/Kg	7715.2	4.4250	0.4562	-1.0330
Rice consumption	(000) Ton	21727.3	-1.5777	-0.1266	0.4174
Maize consumption	(000) Ton	418.3	12.8138	2.5819	-1.2670
Cassava consumption	(000) Ton	1132.8	2.3658	0.6974	0.0706
Wheat flour consumption	(000) Ton	349.2	3.4937	0.5155	-0.6014
Proportion of rice consumption	Percent	0.9656	-0.1657	-0.0311	0.0207
Proportion of maize consumption	Percent	0.00186	14.5161	3.2258	-1.0753
Proportion of cassava consumption	Percent	0.0182	3.8462	1.0989	0.0000
Proportion of wheat flour consumption	Percent	0.0143	4.8951	0.6993	-1.3986
Consumption diversification	Index	0.933	-0.3430	-0.0643	0.0429
Rice production	(000) Ton	42147.9	0.3030	0.0425	-0.0553
Maize production	(000) Ton	17952.9	-0.4930	-0.1159	0.0256
Cassava production	(000) Ton	22933.8	-0.4060	-0.1609	-0.0689
Share of rice production	Percent	0.8072	0.1363	0.0248	-0.0124
Share of maize production	Percent	0.0342	-0.5848	0.0000	0.0000
Share of cassava production	Percent	0.1586	-0.5675	-0.1261	0.0000
Production diversification	Index	0.6779	0.2065	0.0590	-0.0148
Rice self-sufficiency	(000) Ton	4660.7	10.0951	0.9720	-2.4460
Food independence index of rice	Index	1.0851	1.1796	0.1290	-0.2580
Food independence index of maize	Index	1.3172	-0.8503	-0.1898	0.0683
Food independence index of cassava	Index	1.1104	-0.4953	-0.1801	-0.0630

The increase in rice production as a substitute for import is traded-off by the decrease in the production of maize and cassava as these two commodities compete in land allocation. The production of the two commodities would decrease by 0.49 and 0.41 percent from the base value. This condition would cause the production diversification index to become more concentrated, demonstrated by the index which rose from 0.6779 to 0.6793 or experienced a change of 0.2 percent.

The decrease in rice consumption due to the rise in the price of rice would make the people shift their staple food consumption to maize, cassava and wheat flour. Maize consumption would increase fairly significantly, 12.81 percent from 418 thousand tonnes to 472 thousand tonnes, while cassava consumption would increase from 1.133 thousand tonnes to 1.159 thousand tonnes, and wheat flour consumption would increase 3.5 percent. The decrease in rice consumption and increase in the consumption of other staple foods would cause the consumption diversification index to drop by 0.34 percent, which means that the people's staple food pattern would be more diversified.

The next simulation related to the import quota was by decreasing the import by 20 percent. The effect of this policy was that it was expected to become an incentive for domestic farmers to increase rice production though still giving an opportunity for import to maintain the stability of price of rice and the domestic rice stock. The impact of this scenario demonstrated a similar direction to the previous scenario, but with a difference in the size of change. As expected, the scenario to reduce import by 20 percent could increase the national rice production by 0.04 percent from 42,148 thousand tonnes to 42,166 thousand tonnes. Different from the previous scenario, even though the rice import decreased, the increased rice production could maintain the rice supply. In this scenario, rice consumption decreased as a result of the rise in the price of rice from 7,715 Rupiahs per Kg to 7,750 Rupiahs per Kg.

The increased rice production as a result of this scenario must be traded-off by the decrease in competitor staple food production, maize and cassava, causing food production to be more concentrated on rice. From the consumption point of view, the decrease in rice consumption would be followed by an increased consumption of its competitor staple foods which would be signified by the increased consumption of maize, cassava and wheat flour, causing the consumption diversification index to drop, which means that the staple food consumption would be more diversified.

An increased rice production and decreased rice consumption as expected would cause rice's food independence index to rise from 1.0851 to 1.0865. Unfortunately, the food independence index of maize and cassava could not be maintained, which means that the production of these commodities would decrease and the consumption would increase, leading to a decreased independence.

The scenario where import is increased was created to give an illustration of what might happen if import were continued to be allowed or even permitted to increase. An increase in rice import by 10 percent as expected would result in an increased rice supply and a decrease in the domestic rice price. This would be a disincentive for the farmers to produce, leading to a decrease in rice production by 0.055 percent and the rice self-sufficiency indicator to drop by 2.45 percent. The drop in rice production would become an incentive for maize farmers,

leading to an increase in maize production by 0.0256 percent, whereas the production of cassava would drop. The decrease in rice production by 0.055 percent and the increase in maize production would cause the production diversification index to decrease and approach 0 which signifies that the production of staple foods would be more diversified compared to the conditions without any scenarios.

An increase of import by 20 percent would cause the domestic rice price to decrease by 1.03 percent and would be responded by the increased rice consumption by 0.42 percent. Another effect of this scenario would be the decrease in other staple food consumption. Household maize consumption would decrease by 2.27 percent and wheat flour consumption would decrease by 0.6 percent. These conditions would cause staple food consumption to be more concentrated on rice which is exhibited by the movement of the index farther away from 0. If the impact on the food independence indicators are observed, the scenario where rice import is increased would decrease the food independence index of both rice and cassava, while the independence index of maize would increase; the decrease in maize consumption by 1.27 percent would be much higher than the decrease in production which would be merely 1.07 percent.

4. Conclusion and recommendation

4.1. Conclusion

The import and quota policies clearly have an impact on the national food security condition, and if the quota is not limited, it might even become a threat to the national food security. The results of the study and simulations of scenarios where the tariff and quota are changed demonstrated that if the government is concerned about consumption diversification as a solution to future food crises, a policy of higher tariff (increased by 30 percent) could be an alternative. The tariff increase by 5 percent which had been applied by the government, raising it from 430 Rupiahs per Kg imported rice to 450 Rupiahs per Kg was not quite effective as it could not change the production diversification and people's staple food consumption pattern which was signified by the slight change in the diversification index in both production and consumption.

If the government wishes to force the people to diversify their staple food consumption, the import ban policy could be an alternative policy. Banning rice import and limiting the rice import quota would have a positive impact on the national food security, significantly improving the rice independence indicators, diversifying staple food consumption, and improving the rice and cassava food security indicators. Unfortunately, this condition must be traded-off with the concentration of staple food production on rice, and the decrease in maize and cassava's food independence index.

4.2. Recommendation

In order to improve national food security and decrease dependence on imported foods, the application of tariff and quota policies are still very relevant. This was proven by the fact that the increase in the price of imported rice (tariff policy), the ban on imported rice, and the decrease in import quota import became incentives for the producers to produce. On the other hand, the diversification of staple food consumption would enable rice self-sufficiency to be more easily attained and the rice food independence index to rise.

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