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The Impact of Domestic Policy on Farmers' Welfare and Maize Processing Industry in Indonesia

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ABSTRACT

Maize is a strategic commodity for Indonesia, besides being used as community consumption, it is also used as input for industries such as animal feed and food processing industries as well as inputs for independent farmers. Industrial maize is obtained from two sources, namely domestic and imported. This study aims to determine the impact of government policies on the welfare of farmers and maize processing industries in Indonesia. The welfare of farmers is measured by producer surplus and consumer surplus. Using the econometric approach with a simultaneous equation system model, the estimation technique used is two stages least squares, a range of data series from 1985 to 2017. The analysis shows that the corn harvest area is negatively related to farm labor wages, urea fertilizer prices, working capital interest rates and significant statistically. The level of maize productivity is positively related to the amount of use of urea and hybrid seeds, while the number of composite seed uses actually decreases maize productivity. The scenario of subsidizing urea fertilizer prices and subsidizing hybrid seed prices, can increase farmers' maize production, but does not improve the welfare of farmers, because the additional production produced by farmers is not able to be absorbed by the market and prices drop dramatically, but the policy scenario is economically efficient. While the scenario of increasing import tariffs can actually increase farmers' welfare even though the overall policy is not efficient. The role of the government is very necessary especially in maintaining price stability when overproduction, this can be implemented by procuring maize by the government when overproduction, so prices remain stable.

Keywords: Hybrid Seed, Import Tariff, Maize Production, Urea Fertilizer, Welfare
JEL Classification: Q17

1. INTRODUCTION

Maize is a strategic food commodity. Strategic in terms of food security and maize use in Indonesia. Food security is interpreted as the availability of normative consumption food as measured by the availability of rice, maize, sweet potato and cassava products. Maize is used by the feed and food industry, community consumption and independent farmers. It is undeniable that the Indonesian people in some regions still treat maize as a reliable food commodity in the sense that as a source of income and employment, it is also a tradable commodity that can affect the country's foreign exchange in world trade. Maize production in Indonesia was initially limited to meet household food consumption, but in its journey it has developed as the most important food commodity after rice in the trade of national and international agricultural products.

In 2014 the use of maize was dominated by industry (92.96%), while the rest was used by households (7.04%). The shift in the use of maize has occurred since 1989. In the industry, the use of maize is more to fulfill intermediate demand (Swastika, et al., 2011). While the use of maize for direct consumption has decreased relatively from year to year, in 2014 it decreased by 5.85 percent (Kementerian Pertanian, 2016).

The development of the maize processing industry in both the food and feed industries has caused domestic demand for maize to continue to increase. Even though domestic maize production is relatively increasing, the number of imports has also experienced quite high growth, so the trade balance was deficit. In 2015 Indonesia's maize commodity trade deficit in the amount of 3,249,273 tons (Kementerian Pertanian, 2016).

Low national productivity and maize production, resulting in an imbalance between domestic production and demand. To overcome the excess demand, the government opened the door of imports which every year seemed to increase. In 2014 the amount of maize used by the food and food industry were 11,386 thousand where the use of maize by the feed industry were 7,479 thousand tons sourced from the domestic in the amount of 4,460 thousand tons (59.64%) and sourced from imports were 3,018 thousand tons (40.36%). Whereas for the food processing industry were 3,907.05 thousand tons, sourced from domestic at 3,747.73 thousand tons (95.92%) and those sourced from imports were 159.32 thousand tons (4.08%) (BPS, 2014). This indicates that Indonesia is still depend on imports (Kariyasa and Sinaga, 2004). In the future, maize will not be easily obtained in the world market, because of the world trade volume is very small and not profitable for the development of domestic food and feed processing industries.

The importance of maize commodities for Indonesia, so that every year the government has intervened. The last intervention was carried out by the government through special efforts of rice, maize, soybeans known as "pajale" to accelerate self-sufficiency in rice and maize, which basically aims to increase the production and income of maize farmers in Indonesia. Maize commodity is the main commodity for the people of Indonesia after rice, because besides being a source of food, it is also a main livelihood for the population of Indonesia, so that changes to production and prices will directly affect the amount of income of farmers in Indonesia. This study aims to determine the factors that influence maize production and the impact of domestic policies (seed subsidies, fertilizer prices and import tariffs) on the level of welfare of farmers and maize processing industry in Indonesia.

2. RESEARCH METHOD

2.1.Data Collection Method

This study used secondary data with a span of 33 years, from 1985 to 2017. To eliminate the effect of inflation, each price has been deflated with a price index that matches the base year 2010=100. Data on animal feed processing industries and food processing industries are obtained from IBS data rows. Data is obtained from various agencies such as Statistics Indonesia (BPS), the Data and Information Center (Pusdatin) of the Ministry of Agriculture, Bank of Indonesia, Ministry of Trade Republic of Indonesia, Food and Agriculture Organization Statistics, and the United Nations Commodity Trade Statistics (UN Comtrade).

2.2. Model Specifications

The model built is a simultaneous equation model. The econometric model is a special pattern of algebraic models, namely a stochastic element that includes one or more disturbing variables (Intriligator, 1978). Model specifications that have been formulated are:

$$LAPJ_t=a_0+a_1\ HJTP_t+a_2\ HPUK_t+a_3\ HBNH_t+a_4\ UPAH_t+a_5\ SBM_t+a_6\ DK_t+a_7\ LAPJ_{t-1} \quad (1)$$

Hipotesis: $a_1 > 0$; $a_2, a_3, a_4, a_5, a_6 < 0$; $0 < a_7 < 1$;

$$PRDJ_t=b_0+b_1 DPUK_t+b_2 DBNH_t+b_3\ DBNK_t \quad (2)$$

Hipotesis: b_1, $b_2 > 0$; $0 < b_3 < 1$;

$$DPUK_t=c_0+c_1 HPUK_t+c_2 LAPJ_t+c_3 DPUK_{t-1} \quad (3)$$

Hipotesis: $c_1 < 0$; $c_2 > 0$; $0 < c_3 < 1$;

$$DBNH_t=d_0+d_1\ HBNH_t+d_2\ LAPJ_t+d_3\ T_t+d4\ DBNH_{t-1} \quad (4)$$

Hipotesis: $d_1 < 0$; d_2, $d_3 > 0$; $0 < d_4 < 1$;

$$DBNK_t=e_0+e_1\ (HBNK_t-HBNH_t)+e_2\ T_t+e3\ DBNK_{t-1} \quad (5)$$

Hipotesis: $e_1 < 0$; $e_2 > 0$; $0 < e_3 < 1$;

$$DJLS_t=f_0+f_1\ HJTK+f_2\ HBRSt+f_3\ POPI_t+f_4\ DK+f_5\ T_t \quad (6)$$

Hipotesis: f_1, f_4, $f_5 < 0$; f_2, $f_3 > 0$;

$$DJTM_t=g_1 HJTK_t+g_2 POAL_t+g_3\ HSRG_t+g_4\ HKDL_t+g_5\ DJTM_{t-1} \quad (7)$$

Hipotesis: g_1, $g_4 < 0$; g_2, $g_3 > 0$; $0 < g_5 < 1$;

$$DJPKD_t=h_0+h_1\ HJTK_t+h_2\ HMJI_t+h_3\ SBM_t+h_4\ CAPK_t+h_5\ T_t+h_6\ DJPKD_{t-1} \quad (8)$$

Hipotesis: h_1, h_2, $h_3 < 0$; h_4, $h_5 > 0$; $0 < h_6 < 1$

$$DJPKM_t = i_0+i_1\ HJTK_t+i_2\ HMJI_t+i_3\ TRIF_t+i_4\ SBM_t+i_5.CAPK_t+i_6\ DJPKM_{t-1} \quad (9)$$

Hipotesis: i_1, $i_5 > 0$; i_2, i_3, $i_4 < 0$; $0 < i_6 < 1$

$$DJPND_t=j_0+j_1\ HJTK_t+j_2\ HMJI_t+j_3\ SBM_t+j_4\ DK_t+j_5\ T_t+j_6\ DJPKD_{t-1} \quad (10)$$

Hipotesis: j_1, $j_3 < 0$; j_2, j_4, $j_5 > 0$; $0 < j_6 < 1$

$$DJPNM_t=k_0+k_1\ HJTK_t+k_2\ HMJI_t+k_3\ SBM_t+k_4\ CAPK_t+k_5 DJPNM_{t-1} \quad (11)$$

Hipotesis: k_1, $k_3 > 0$; k_2, $k_4 < 0$; $0 < k_5 < 1$

$$HJTP_t=l_1\ HJTK_t+l_2\ QDJI_t+l_3\ QSJI_t+l_4\ QMJI_t \quad (12)$$

Hipotesis: l_1, $l_2 > 0$; l_3, $l_4 < 0$;

$$HJTK_t=m_0+m_1\ HMJI_t+m_2\ HJTP_t+m_3\ HJTK_{t-1} \quad (13)$$

Hipotesis: $m_1, m_2 > 0; 0 < m_3 < 1$;

$$HMJI_t=n_0+n_1\ HMJW_t+n_2\ NTRP_t+n_3\ QXJW_t+n_4\ TRIF_t+n_5\ T_t \quad (14)$$

Hipotesis: $n_1, n_2, n_4, n_5 >0; n_3 <0$;

Description of Variables
$LAJPA_{t-1}$ =Maize harvest area
$HJTP_t$=Maize producer price
$HPUK_t$=Price of urea fertilizer
$HBNH_t$=Price of hybrid seed
$UPAH_t$=Farmer's wage
SBM_t=Working capital interest rate
DK_t=Dummy crisis
$LAPJ_{t-1}$ =Lag LAPJ
DPUK=Total use of fertilizers
$DPUK_{t-1}$ =Lag DPUK
$DBNH_t$=Total use of hybrid seed
$DBNK_t$=Total use of composite seeds
$HBNK_t$=Price of composite seeds
$DBNH_{t-1}$ =Lag DBNH
$DBNK_{t-1}$ =Lag DBNK
T_t=Trend
$DJLS_t$=Demand for direct consumer of maize
$DJLS_{t-1}$ =Lag DJLS
$HJTK_t$=Price of domestic maize
$HBRS_t$=Price of rice
$POPI_t$=Indonesian population
$POAL_t$=Layer chicken and duck population
$HKDL_t$=Price of soybean
$DJTM_t$=Maize demand for independent farmers
$DJTM_{t-1}$ =Lag DJTM
$DJPKD_t$=Domestic source maize demand for feed industry
$HMJI_t$=Imported price of indonesian maize
$CAPK_t$=Capacity of installed feed industry
$DJPKD_{t-1}$ =Lag DJPKD
$DJPKM_t$=Imported source maize demand for feed industry
$TRIF_t$=Import tariff
$DJPKM_{t-1}$ =Lag DJPKM
$DPJND_t$=Domestic source maize demand for food industry
$DPJND_{t-1}$ =Lag DPJND
$DJPNM_t$=Imported source maize demand for food industry
$CAPN_t$=Capacity of installed food industry
$DJPNM_{t-1}$ =Lag DJPNM
$QDJI_t$=Indonesian maize demand
$QSJI_t$=Indonesian maize supply
$QMJI_t$=Indonesian maize import
$HJTK_{t-1}$ =Lag HJTK
$HMJW_t$=World maize import prices
$NTRP_t$=Rupiah exchange rate
$QXJW_t$=The world export of maize

2.3.Model Identification and Estimation Method

The model that has been formulated in the model specification consists of 14 structural equations and 6 identity equations, 42 predetermined variables consisting of 28 exogenous variables and 14 lags of endogenous variables. The model is declared over identified or just identified, then the OLS estimation will be biased and inconsistent, because the model is a system of simultaneous equations. Rey, (1999); Rey (2000), suggested using model estimation done by two stage least squares), because this approach will eliminate classic problems (Intrilligator et al., 1996. p. 360-368), Verbeek, (2000. p. 138-139), Johnston and Dinardo, (1997. p: 157); Pindyck and Rubinfeld, (1991. p. 322-325). Hansen, (2004. p. 65), dan Creel, (2006. p. 197-198). Estimated results from the final model specifications are displayed in the results and discussion section.

2.4. Validation and Model Simulation

To find out whether the model is valid enough to make a simulation, a model accuracy or model validation is carried out, with the aim of analyzing the extent to which the model can represent the real world. In this study, the statistical criteria for validating the estimation value of the econometric model used were: Root means square error, root means percent square error (RMSPE) and Theil's inequality coefficient (U) (Pindyck and Rubinfield, 1991). The RMSPE statistic is used to measure how far the values of endogenous variables as a result of estimation deviate from the flow of actual values in relative size (percent), or how closely the predicted value follows the development of its actual value. The value of the U-Theil's statistics is useful for knowing the ability of the model for model simulation analysis (Sitepu, and Sinaga, 2018). The value of the Theil (U) coefficient ranges between 1 and 0. If U=0, the estimation of the model is perfect, if U=1 the estimation of the model is naive. Basically, the smaller the RMSPE and U-Theil's values, the better the estimation of the model will be.

Four policy scenarios were carried out, namely (1) decreasing the price of urea fertilizer inputs, (2) subsidizing hybrid seed prices (3) increasing corn import tariffs and (4) simulating combinations of scenarios 1, scenario 2 and scenarios 3. Simulation period carried out from 2010 to 2017. The selection of this policy scenario is based on conditions in Indonesia.

3. RESULTS AND DISCUSSION

3.1. Performance of Results Estimation Model

The results of the behavioral equations estimation (structural behavior) based on the sign and magnitude, the coefficient of determination (R^2). R^2 of each behavior equation ranges from 0.581 to 0.989. This shows that the exogenous variables in the behavioral equation are able to explain well the endogenous variables. Each structural equation has a parameter size and the sign is in line with

Table 1: Result of Parameter Estimates for structural equation

Equations	Parameter	Estimate	t Value
$LAPJ_t$	INT	4812.351	3.67
$R^2 = 0.670$	$HJTP_t$	0.070958	0.42
$D_w = 2.237$	$HPUK_t$	−0.60672	−1.74
	$HBNH_t$	−0.00047	−0.26
	$UPAH_t$	−0.01116	−2.34
	SBM_t	−42.9118	−1.71
	DK_t	1360.461	2.48
	$LAPJ_{t-1}$	0.316322	1.48
$PRDJ_t$	INT	−2.04284	−2.61
$R^2 = 0.884$	$DPUK_t$	0.003488	7.19
$D_w = 0.931$	$DBNH_t$	0.049046	3.35
	$DBNK_t$	−0.00385	−0.38
$DPUK_t$	INT	−301.194	−2.36
$R^2 = 0.823$	$HPUK_t$	−0.00809	−0.21
$D_w = 1.892$	$LAPJ_t$	0.282004	5.03
	$DPUK_{t-1}$	0.376171	2.80

(Contd...)

Table 1: ***(Continued)***

Equations	Parameter	Estimate	t Value
$DBNH_t$	INT	−10.9769	−1.23
$R^2 = 0.842$	$HBNH_t$	−0.00001	−0.59
$D_w = 1.106$	$LAPJ_t$	0.009365	3.62
	T_t	0.029253	0.11
	$DBNH_{t-1}$	0.430384	2.53
$DBNK_t$	INT	7.2337	0.55
$R^2 = 0.684$	$HBNK_t$–$HBNH_t$	−0.00004	−1.00
$D_w = 1.632$	T_t	−0.02218	−0.07
	$DBNK_{t-1}$	0.629704	4.29
$DJLS_t$	INT	−2978.14	−3.94
$R^2 = 0.925$	$HJTK_t$	−0.19122	−2.00
$D_w = 0.387$	$HBRS_t$	−0.03778	−0.66
	$POPI_t$	1.525623	6.06
	DK_t	79.73994	0.53
	T_t	−9.7821	−1.37
$DJTM_t$	$HJTP_t$	−0.18542	−4.57
$R^2 = 0.989$	$POAL_t$	14.61177	7.90
$D_w = 1.385$	$HSRG_t$	0.002567	0.58
	$HKDL_t$	−0.01261	−0.94
	$DJTM_t$	0.424265	4.94
$DJPKD_t$	INT	233.8616	0.23
$R^2 = 0.903$	$HJTK_t$	−0.18836	−0.54
$D_w = 2.219$	$HJMI_t$	−0.09774	−0.04
	SBM_t	−59.0846	−1.92
	$CAPK_t$	10.75451	0.78
	T_t	77.98374	1.32
	$DJPKD_{t-1}$	0.7453	3.64
$DJPKM_t$	INT	1507.644	1.66
$R^2 = 0.581$	$HJTK_t$	0.192126	1.00
$D_w = 1.900$	$HJMI_t$	−1.62683	−0.64
	$TRIF_t$	−93.0855	−2.04
	SBM_t	−45.6714	−1.48
	$CAPK_t$	5.260745	0.42
	$DJPKM_{t-1}$	0.22154	0.99
$DJPND_t$	INT_T	−574.73	−0.95
$R^2 = 0.956$	$HJTK_t$	−0.09956	−0.61
$D_w = 2.375$	$HJMI_t$	1.791036	1.17
	SBM_t	−11.5096	−0.38
	DK_t	1286.104	1.94
	T_t	73.29143	2.24
	$DJPND_{t-1}$	0.702057	3.86
$DJPNM_t$	INT	7.48625	0.16
$R^2 = 0.838$	$HJTK_t$	0.010868	1.10
$D_w = 2.198$	$HJMI_t$	−0.1296	−0.93
	SBM_t	−0.12565	−0.09
	$CAPN_t$	0.111856	0.16
	$DJPNM_{t-1}$	0.825722	5.41
$HJTP_t$	$HJTK_t$	0.120794	0.23
$R^2 = 0.817$	$QDJI_t$	0.272792	2.23
$D_w = 0.181$	$QSJI_t$	−0.02259	−0.28
	$QMJI_t$	−0.22435	−1.21
$HJTK_t$	INT	−93.6047	−0.71
$R^2 = 0.994$	$HJMI_t$	0.079666	0.52
$D_w = 1.891$	$HJTP_t$	0.640943	4.02
	$HJTK_{t-1}$	0.656197	6.73
$HJMI_t$	INT	−30.3434	−1.15
$R^2 = 0.927$	$HMJW_t$	0.989114	9.47
$D_w = 1.880$	$NTRP_t$	0.003016	0.99
	QJW_t	−0.00215	−4.28
	$TRIF_t$	2.519228	2.18
	T_t	9.41719	5.80

expectations and is quite logical from the standpoint of economic theory. The following are the results of model estimates for each structural equation (Table 1).

Factors that affect the maize harvest area are the price of urea fertilizer, interest rates for working capital, statistically significant at the 10% level, while the farmer's wage is significant at the level of 5%. While the output price represented by the price of maize at the producer level is not significant even though it still has a positive influence on the increasing harvested area. The price of hybrid seeds has a negative influence on area although it is not statistically significant. Maize productivity is positively influenced by the used level of urea fertilizer and hybrid seed, and significant at the 99% confidence level, while the number of composite seed used negatively affects maize productivity even though statistically it is not significantly different from zero.

3.2.Model Validation Result

Before conducting a policy impact simulation analysis, the model has been validated with RMSPE and U-Theil's indicators. The results of model validation show that 90% of the RMSPE value is below 25% and the remaining 10% is above the 25% value while the U-Theil's indicator value shows that from 20 endogenous equations, there is only one equation that has a U-Theil value >0.2, that is, the equation demand for maize by imported food-based food industries (DJPNM) (Table 1), however, there is no systematic bias, because UM values approach 1, which is 0.81. Overall, this model is quite well used as an estimation model and can be used for alternative policy simulations. The results of the validation model are shown in Table 2.

3.2.1. Alternative impact of policy on welfare of farmers and maize processing industry

Four policy scenarios were carried out, namely (1) decreasing the price of urea fertilizer input by 10% (SIM-1), (2) subsidizing hybrid seed prices by 10% (SIM-2), (3) increasing import tariffs by 5% (SIM-3), and (4) a combination of SIM-1, SIM-2 and SIM-3 simulations. The results of alternative policy scenarios and their impact on welfare are presented in Table 3.

3.3. Impact of Policy for Decreasing Fertilizer Prices by 10% Against Welfare

The policy of reducing fertilizer prices by 10% will have an impact on increasing maize harvest area and productivity of (4.76%) and (10.36%) respectively, so that the amount of domestic maize production and supply also increases. Additional maize production is due to an increase in the composition of hybrid seed use rising by 6.91% while the use of fertilizer amounts has increased by 7.02%. The increase in domestic maize production will have an impact on the decline in maize prices both maize prices at the producer level and consumer level, so that the demand for maize by the domestic feed industry and food industry has increased by 1.04% and 0.57% respectively. Overall this alternative policy will reduce the demand for maize by the feed industry sourced from imports by 0.61% and the food industry decrease by 1.90%, while the demand for maize sourced from domestic has increased by 0.38%. This alternative policy scenario will also increase maize production by 2.92 million tons which can be used as raw material for the feed processing industry, food processing industry and also for independent farmers. In general, it can be concluded that interventions in production factors such as the price of urea inputs can increase maize production and productivity nationally.

Table 2: Model validation results

No.	Variable	RMS % error	U-Theil	Label
1	LAPJ	5.09	0.03	Maize harvest area
2	PRDJ	8.13	0.04	Maize productivity
3	DPUK	9.34	0.05	Urea fertilizer demand
4	DBNH	12.11	0.06	Hybrid seed demand
5	DBNK	23.20	0.11	Composit seed demand
6	QJIN	9.67	0.06	Indonesian maize production
7	QSJI	7.71	0.04	Indonesian maize supply
8	DJLS	10.23	0.12	Direct maize consumption/household
9	DJTM	1.98	0.01	Maize demand for independent farmers
10	DJPKD	23.05	0.09	Domestic source maize demand for feed industry
11	DJPKM	12.10	0.20	Imported source maize demand for feed industry
12	DJPK	13.86	0.05	Total maize demand for feed industry
13	DJPND	11.55	0.07	Domestic source maize demand for food industry
14	DJPNM	36.04	0.21	Imported source maize demand for food industry
15	DJPN	10.31	0.06	Total maize demand for food industry
16	QMJI	14.40	0.19	Indonesian maize import
17	QDJI	13.61	0.16	Indonesian maize demand
18	HJTP	18.13	0.11	Maize producer price
19	HJTK	19.10	0.08	Domestic maize price
20	HMJI	25.25	0.15	Imported price of indonesian maize

Table 3: Alternative impacts of policy on production and consumer welfare and maize processing industry producers in indonesia

No.	Label	Unit	Baseline	SIM-1	SIM-2	SIM-3	SIM-4
1	Maize harvest area	000 ha	4,050.88	4.76	0.08	0.002	4.84
2	Maize productivity	ton/ha	4.64	10.36	0.37	0.005	10.73
3	Urea fertilizer demand	000 ton	1,301.51	7.02	0.12	0.003	7.14
4	Hybrid seed demand	% ha	46.68	6.91	0.39	0.003	7.31
5	Composit seed demand	% ha	23.57	0.00	−2.67	0.000	−2.67
6	Indonesian maize production	000 ton	18,869.72	15.48	0.45	0.007	15.96
7	Indonesian maize supply	000 ton	19,214.17	15.11	0.43	−3.277	12.29
8	Direct maize consumption/household	000 ton	116.99	9.43	0.27	−0.569	9.14
9	Maize demand for independent farmers	000 ton	3,211.61	0.40	0.01	−0.007	0.41
10	Domestic source maize demand for feed industry	000 ton	4,570.33	1.04	0.04	−0.197	0.88
11	Imported source maize demand for feed industry	000 ton	2,357.34	−0.61	−0.02	−26.375	−27.01
12	Total maize demand for feed industry	000 ton	6,927.67	0.48	0.02	−9.105	−8.61
13	Domestic source maize demand for food industry	000 ton	3,717.79	0.57	0.02	1.949	2.54
14	Imported source maize demand for food industry	000 ton	215.67	−1.90	−0.08	−4.248	−6.24
15	Total maize demand for food industry	000 ton	3,933.46	0.43	0.01	1.610	2.06
16	Indonesian maize import	000 ton	2,573.01	−0.72	−0.02	−24.520	−25.27
17	Indonesian maize demand	000 ton	19,537.48	0.38	0.01	−2.909	−2.52
18	Maize producer price	Rp/Kg	4,301.35	−0.95	−0.02	0.015	−0.96
19	Domestic maize price	Rp/Kg	7,022.41	−1.04	−0.03	0.060	−1.01
20	Imported price of indonesian maize	US$/Kg	3,265.44	0.00	0.00	0.386	0.39
	Perubahan Kesejahteraan	**Unit**		**SIM-1**	**SIM-2**	**SIM-3**	**SIM-4**
1	Producer	Rp Million		−828,646	−20,091	12,526	−839,807
2	Consumer	Rp Million		1,036,441	29,071	−61,182	1,027,478
	Household	Rp Million		8,163	239	−496	7,946
	Independent farmers	Rp Million		234,719	6,580	−13,576	228,125
	Feed industry	Rp Million		506,125	14,193	−30,617	514,315
	Food industry	Rp Million		287,434	8,059	−16,493	277,091
3	Net surplus	Rp Million		207,795	8,979	−48,656	187,671

It is clear that this policy seen from the producer side can increase production, but to the level of producer welfare does not get better that the level of producer welfare decreases, as indicated by a decrease in producer surplus of Rp 828,646, on the other hand consumers benefit from a surplus of Rp. 1,036,441 billion. The consumer surplus is distributed or enjoyed by the feed processing industry by 48.83%, the food processing industry is 27.73%, independent breeders is 22.65% while household consumers are only 0.79%. Nonetheless, overall the alternative policy of decreasing fertilizer prices is economically efficient which is illustrated by a net surplus of Rp. 207,795 Billion (Table 3). To be able to overcome the losses received by producers, the government role is needed such as regulating cropping patterns, buying excess production and also being able to develop food storage as a storage, the aim is to maintain the stability of maize prices. From this scenario it can be concluded that the policy of reducing input prices is trade-off.

3.4. Alternative Policy for Decreasing the Price of Hibrida Seeds by 10%

The alternative policy of reducing the price of hybrid seeds is almost the same as the policy of reducing fertilizer prices, but quantitatively the impact of the decline in fertilizer prices is greater than the policy of decreasing seed prices. This policy will increase the composition of the use of hybrid seeds by 0.39%, while the composition of local/composite seed use fell by 2.67%. The greater use of hybrid seed composition will lead to increased productivity and the amount of domestic maize production. The increase in domestic maize production will have an impact on declining maize prices both at maize producer prices (0.02%) and consumer level maize prices (0.03%) while import prices do not change, so the demand for maize by the feed and food industries sourced from domestic increased 0.04% and 0.02% respectively. This condition explains that prices are the main signal for the maize processing industry. If domestic prices are lower, the maize processing industry will switch to domestic maize and will apply otherwise. This is indicated by decreasing the amount of demand for maize sourced from imports (the feed industry fell by 0.02% and the food industry fell by 0.08%), on the other hand the demand for maize from domestic sources increased both in the feed industry and food industry.

The increase in demand for maize also occurs in household consumption by 0.27% and also for independent farmers at 0.01%. This alternative policy will increase maize production by 0.84 million tons which can be used as raw material for the feed processing industry, food processing industry and also for independent farmers.

This study is consistent with the findings of Lameck (2016) on the Impact of Agricultural Subsidies to Smallholders Maize Farmers of Mbeya District Council in Tanzania, explaining that farmers who receive subsidies can significantly increase maize production in Tanzania. The comparison of the average output before and after showed an increase in the number of sacks (100 kg) per acre from an average of 5.35 sack bags to 10.10 bags (i.e., about twice that of a corn harvest).

Viewed from the aspect of alternative welfare policies, the decline in prices of hybrid seeds can increase corn production, but the level of welfare of corn farmers does not improve even tends to decrease by Rp. 20,091 billion, on the other hand consumers benefit from the consumer surplus of Rp. 29,071 billion. This consumer surplus is distributed or enjoyed by the feed processing industry by 48.82%, the food processing industry is 27.72%, independent breeders is 22.63% while household consumers are only 0.82%. These results indicate that this alternative policy is a trade-off that shows that there are those who benefit and some are disadvantaged. However, overall the policy alternatives for the decline in prices of hybrid seeds are economically efficient, which is illustrated by a net surplus of Rp.8,979 billion (Table 2). Similar to what happened in the first policy scenario, where in order to overcome the losses received by producers, the role of the government is needed such as buying excess production and developing food storage, the purpose is to maintain the stability of maize prices. Price stability that occurs, will provide an increase in income for farmers due to increased productivity and production.

3.5. Alternative Policies for Increasing Import Tariff by 5%

The Ministry of Trade Republic of Indonesia Regulation Number 21 year 2018 concerning Maize Import Provisions, article (2) states that maize can be imported to meet the needs of food, feed, and industrial raw materials. The policy without maize import tariffs began since Indonesia joined the cooperation in the ASEAN free trade area known as the ASEAN Free Trade Area (AFTA). Policies in the AFTA agreement include reducing tariffs from zero to 5%, eliminating quantitative and other non-tariff barriers. Of course by making an import tariff policy of 5% does not violate international trade rules. The alternative policy of increasing import tariffs by 5% has an impact on the increase of Indonesia's maize import prices by 0.39%, so that the demand for maize in the feed industry and food industries sourced from imports has decreased by 26.38% and 4.25% respectively. The increase in the price of Indonesia's maize imports will result in maize prices at the producer level and maize prices at the consumer level to increase (Pangestika, et al., 2016). The price increase was responded to by the feed processing industry by reducing the demand for maize sourced from domestic by 0.19% while the food industry actually experienced an increase in demand of 1.95%. In addition to the decline in demand for the industrial sector, the decline in demand also occurred in households and independent farmers. Overall the total demand for maize in Indonesia fell by 2.91%, additional maize production only increased by 1.30 thousand tons which could be used as an additional raw material for the maize processing industry.

This research is actually in line with the findings of Umbo et al. (2011) in their study found that eliminating the maize import tariff policy caused an increase in maize imports and the price to be lower. This policy makes domestic supply of this commodity increase. On the other hand, less attractive maize prices were responded to by farmers through reducing maize land use and using fertilizer inputs. This change in farmers' decisions caused maize production and income from maize farming to decline. In addition, this policy that causes lower maize prices will have a positive impact on the demand for maize for consumption and the feed industry. It was further explained that this policy led to an increase in consumption of chicken and eggs in all household categories, as well as national consumption.

According to Erwidodo et al. (2003), maize farming business are able to provide net profits in the range of 29-35%, and to compete with imported maize. Thus, there is no strong reason for the government to impose maize import tariffs at this time. Import tariffs are needed when the rupiah exchange rate strengthens significantly and/or the price of maize in the world market drops dramatically to below production costs. Taking into account the possible range of price and exchange rate fluctuations that will occur, the application of a 5-10% import tariff is deemed sufficient to guarantee a reasonable profit (30%) for maize farming business. This policy is indeed directly seen as profitable for producers as indicated by a producer surplus of Rp. 12,526 billion, on the other hand the consumers who were harmed were represented by a consumer surplus which decreased by Rp.61,182 billion. The biggest consumer losses are in the feed processing industry, followed by the food processing industry and independent farmers.

These results indicate that this alternative policy is also a trade off which shows that there are those who benefit and some are disadvantaged. Overall the alternative policy of increasing this import tariff is economically inefficient which is illustrated by the decrease in net surplus of Rp.48,656 billion (Table 3).

3.6. Alternative to Reduce the Price of 10% Urea Fertilizer, Reduce the Price of Hybrid Seeds 10% and Increase in Import Tariff by 5%

The impact of the combination of the policy of reducing the price of urea fertilizer by 10%, reducing the price of hybrid seeds by 10% and increasing in import tariffs by 5% is shown in Table 3. This policy encourages the increase of maize harvest area and productivity (4.84%) and (10.73%) so that the amount of domestic maize production and supply also increases. The increase in maize production was caused by increasing the composition of the use of hybrid seeds by 7.32% while the number of composite seed use fell by 2.67%. Domestic maize production increased by 15.96% which resulted in a decrease in maize prices both maize prices at the producer level and domestic maize prices, so the demand for maize by the domestic feed and food industry increased by 0.88% and 2.54% respectively. While the demand for maize by independent farmers increased by 0.41% and households increased by 9.14%. The availability of maize in the domestic as a whole will reduce the demand for maize by the feed industry sourced from imports by 27.01% and the food industry to decline by 6.24%, and the total demand for Indonesian maize from imports decreases by 25.27%. 3.01 million tons of maizewhich can be used as raw material for the feed processing industry, food processing industry and also for independent farmers. This combination of policy scenarios seen from the producer side can increase production, but the producer welfare level does not improve even the level of producer welfare decreases, as indicated by a decrease in producer surplus of Rp. 839,807, on the other hand consumers benefit from a Rp. 1,027,478 billion. Nevertheless, overall this policy alternative is economically efficient which is illustrated by a net surplus of Rp. 187,671 billion (Table 3). To be able to overcome the losses received by producers, government intervention is needed such as holding market operations by buying excess production that occurs in the market, and also can develop food barns as a place of storage, with the aim of maintaining stability in maize prices, so that expected to increase income at the farm level.

4. CONCLUSIONS AND RECOMMENDATIONS

The policy of reducing the price of urea fertilizer, reducing the price of hybrid seed prices, and increasing corn import tariffs had an impact on increasing maize production, which led to lower farm and domestic maize prices, so that the maize processing industry would be able to replace imported maize from domestic maize. This policy will cause the price of maize to be lower and have a positive impact on the demand for maize both for independent farmers and those who directly consumed by households. This policy scenario provides additional domestic maize production and simultaneously reduces the amount of Indonesian maize imports. Alternative policy scenarios (SIM-1), (SIM-2) and (SIM-4) can generally increase maize productivity and production in Indonesia, but at the producer level does not cause maize farmers to be better and even tend to be disadvantaged, but on the other hand consumers benefited. While the scenario of the import tariff policy (SIM-3) can improve the welfare of Indonesian maize farmers, this policy is economically inefficient. The results of the analysis of alternative policy scenarios in the study are entirely trade off.

In order to achieve maize self-sufficiency, of course in addition to the land extensification program policy, the government must also implement policies (intensification) that can be a stimulant for farmers and the maize processing industry in Indonesia. The intensification policy can be in the form of developing cultivation technology such as hybrid maize production technology. The development of maize varieties is still very much needed to increase Indonesia's maize production. Fertilizer subsidy policies that are right on target become a necessity and the government must establish trade policies that can have a positive impact on maize farmers such as the ban on maize imports or at least set maize import tariffs that are in accordance with world trade rules. To overcome the trade off from this policy, government intervention is needed to maintain price stability. Increase or excess production in the country, the government should be able to carry out market operations by buying excess production in the market, so the price of maize can be maintained stable.

REFERENCES

BPS, (2014), Row Data Large Medium Industry Statistics. Central Bureau of Statistics. Republic of Indonesia. Jakarta.

Creel, M. (2006), Econometrics. London: Department of Economics and Economic History, Universitat Autònoma De Barcelona.

Erwidodo, N.F.N., Hermanto, N.F.N., Pudjihastuti, H. (2003), Impor jagung: Perlukah tarif impor diberlakukan? Jawaban analisis simulasi. Jurnal Agro Ekonomi, 21(2), 175-195.

Hansen, B.E. (2004), Econometrics. Madison: University of Wisconsin.

Intriligator, M.D., (1978), Econometric Model, Techniques, and Applications. Prentice Hall Inc, New Jersey.

Intrilligator, M.D., Bodkin, R.G., Hsiao, C. (1996), Econometric Models, Techniques, and Applications. 2nd ed. New Jersey (US), Upper Saddle River: Prentice-Hall, Inc.

Johnston, J., Dinardo, J. (1997), Econometric Methods. 4th ed. New York: McGraw-Hill.

Kariyasa, I.K., Sinaga, B.M. (2004), Faktor-faktor yang mempengaruhi perilaku pasar jagung di Indonesia. Jurnal Agro Ekonomi, 22(2), 167-194.

Pertanian, K. (2016), Outlook Komoditas Pertanian Sub Sektor Tanaman Pangan. Pusat Data dan Sistem Informasi Pertanian. Kementerian Pertanian. Republik Indonesia. Jakarta

Lameck, C. (2016), Impact of Agricultural Subsidies to Smallholder Maize Farmers of Mbeya District Council in Tanzania. (Thesis). Columbus (US): The Ohio State University.

Pangestika, V.B., Syafrial, S., Suhartini, S. (2016), Simulasi kebijakan tarif impor jagung terhadap kinerja ekonomi jagung di Indonesia. Habitat, 26(2), 100-107.

Pindyck, R.S., Rubinfeld, D.L. (1991), Econometric Models and Economic Forcasts. 3th ed. New York (US): McGraw-Hill Inc.

Putri, A.I., Sinaga, B.M., Hastuti, N.K.H. (2014), Dampak kebijakan tarif impor terhadap pasar jagung di Indonesia. Jurnal Ekonomi Pertanian, Sumberdaya dan Lingkungan (JAREE), 1, 68-80.

Rasahan, C.A. (1997), Kesiapan sektor pertanian menghadapi era perdagangan bebas. Agro-Ekonomika, 27(2), 15-24.

Rey, S.J. (1999), Integrated Regional Econometric and Input-Output Modeling. San Diego: Department of Geography San Diego State University.

Rey, S.J. (2000), Integrated regional econometric+input output modelling: Issues and opportunities. Regional Sciences, 79(1), 271-292.

Sitepu, R.K.K., Sinaga, B.M. (2018), Aplikasi Model Ekometrika: Estimasi, Simulasi dan Peramalan Menggunakan Program SAS 9.2. Bogor (ID): IPB Press.

Swastika, D.K.S., Adang, A., Sudaryanto, T. (2011), Analisis senjang penawaran dan permintaan jagung pakan dengan pendekatan sinkronisasi sentra produksi, pabrik pakan, dan populasi ternak di Indonesia. Informatika Pertanian, 20(2), 65-75.

Umbo, S.J.K., Hakim, D.B., Sinaga, B.M., Kariyasa, I.K. (2011), Impact of maize import tariff policy changes on production and consumption in Indonesia: A multimarket model analysis. International Journal of Food and Agricultural Economics, 2(2), 113-126.

Verbeek, M. (2000), A Guide Modern Econometrics. New York (US): Jhon Wiley and Son Ltd.