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Impacts of Domestic Maize Price Changes on the Performance of Small-scale Broiler Farming in Indonesia

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ABSTRACT

This research aimed at analyzing the impact of maize price changes on the performance of small-scale broiler farming in Indonesia using a multimarket model analysis. The multimarket model analysis is partial equilibrium analysis that contains six blocks of equations: prices, supply, input demand, consumption, income and equilibrium. This model analysis was originally designed in *General Algebric Modelling System* (GAMS) using the *Path NLP* solver. Employed data in this study were classified into 3 types, namely: (1) production and input, consumption, and household income; (2) inputs and outputs, and (3) elasticities. Decreased domestic maize price was responded by farmer through reducing maize planted area and fertilizers uses. It further had undesired impact on the maize production and maize farmer's income. Whereas, this policy had positive impact on meat production and small-scale broiler farming income. The opposite impact will happen on those variables, if government increases domestic maize price. This policy caused the maize demand for feed industry decreased. As a result of this condition, it decreased the chicken meat production and small-scale broiler farming income.

Key words: maize, broiler, price, multimarket

ABSTRAK

Penelitian ini bertujuan untuk menganalisis dampak perubahan harga jagung domestik terhadap kinerja usaha peternakan rakyat ayam ras pedaging di Indonesia dengan menggunakan analisis model multimarket. Analisis model multimarket merupakan model keseimbangan parsial yang terdiri atas enam blok persamaan: harga, penawaran, permintaan input, konsumsi, pendapatan, dan kondisi keseimbangan. Model ini secara original dibangun dalam software *General Algebric Modelling System* (GAMS) dengan metode solusi *Path NLP*. Data terdiri atas: (1) data produksi dan input, konsumsi, dan pendapatan rumahtangga, (2) harga input dan output, dan (3) elastisitas. Untuk data produksi, penggunaan input, konsumsi, pendapatan dan harga menggunakan data dari Badan Pusat Statistik dan Kementerian Pertanian, sedangkan untuk elastisitas menggunakan data hasil penelitian sebelumnya. Penurunan harga jagung domestik direspon petani dengan mengurangi luas pertanaman jagung dan penggunaan input pupuk sehingga menyebabkan turunnya produksi dan pendapatan dari usahatani jagung. Sebaliknya kebijakan ini berdampak pada meningkatnya permintaan jagung untuk pakan sehingga meningkatkan produksi daging ayam ras dan pendapatan peternak rakyat ayam ras pedaging. Kondisi berbeda jika terjadi peningkatan harga jagung domestik. Kebijakan ini menyebabkan permintaan jagung untuk pakan menurun, akibatnya produksi daging ayam ras dan pendapatan peternak rakyat ayam ras pedaging menurun.

Kata kunci: jagung, ayam ras pedaging, price, multimarket

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INTRODUCTION

Broiler farming in Indonesia has become an industry with complete components from upstream to downstream. The contribution of Gross Domestic Product (GDP) of livestock sub-sector to the agriculture sector GDP based on market prices reached 12%. Of this figure, poultry meat contribution was 64%, and of the total poultry meat contribution, it is about 70.24 percent coming from chicken meat (Saptana & Sumaryanto, 2009; Directorate General of Livestock and Animal Health, 2012). This figure has shown that the chicken meat has an important role in providing meat for Indonesian (Ilham, 2009). It also explained that chicken meat has been the main driver on the development of the poultry business in Indonesia.

In cost structure side, feed placed the biggest portion in broiler and egg production cost. It was accounting to 70% of the total production cost, while other costs such as DOC (Day Old Chick) was only about 13 percent (Yusdja & Pasandaran, 1998). Feed demand for broilers and layers during the period 2000-2010 increased by 6.85% and 8.31%, respectively (Swastika *et al.*, 2011). In 2010, its demand for broiler reached 3.51 million tons and 2.06 million tons for layers (Directorate General of Livestock and Animal Health, 2012). This indicated that feed available plays a significant role in broilers and eggs production. Therefore, if there is shock happening in feed prices, it brings a great influence on broiler farming performance, especially small-scale broiler farming.

The main components of chicken feed are maize, soybean meal, and fish flour. The composition of maize in the feed ranges from 55%-65%. In 2010, maize demand for broiler feed was 1.11 million tons and 1.65 million tons for layer. The average increase in maize demand for broiler and layer feeds during the period 2000-2010 increased by 6.85% and 8.31%, respectively (Swastika *et al.*, 2011; Directorate General of Livestock and Animal Health, 2012, processed). Some factors caused the use of maize for feed is high, among others are its prices is relatively cheap, easy to produce, as well as palatable to poultry. In addition, maize contains high calorie and protein with complete amino acids are also as consideration or reasons why the use of it is still higher compared to others (Swastika *et al.*, 2011). Attempts have been done to replace maize with other grains are not succesfully. Therefore maize remains as the main raw material for livestock feed.

The sustainability of broiler farming was determined by price changes of inputs and outputs. The change of input and output prices affected to input allocation (feed) and the production decision of small-scale broiler farming. Saptana & Sumaryanto (2011) revealed that large-scale broiler farming dominated market structure of chicken meat. In addition, the large-scale broiler farming was dominant in the input market of poultry industry by making business agreements with feed companies and such association of integrated firms that operated from upstream to downstream activities, e.g. PT. Charoen Phokphan Indonesia, PT. Japfa Comfeed, and PT. Sierad Produce. Feed price was determined by feed industry that collaborated with poultry companies, therefore could affect the sustainability of small-scale broiler farming.

Related to feed, maize, and chicken meat price data, the increasing of average feed price have the same trend with increasing of average maize price of by 6.78% and 7.96%, respectively, while chicken meat price incereased around 5.90% (Pusdatin, 2012).

Viewed from efficiency as a result of business integration, breeding farms and feed mills which belong to foreign investors sell DOC and feed to independent farmers in high prices, making their business inefficient. Indarsih *et al.* (2010) revealed that there was a disparity in feed prices to be paid by large-scale and small-scale broiler farming, which was around 30%-50%. No wonder the production costs of small-scale broiler farming are much higher that those of broiler farming large-scale. If all chicken meat production goes to traditional markets, independent farmers will lose money because they can not keep up with the production cost of large-scale.

This research excluded feed market into model, therefore feed demand was approximated by a proxy from maize demand. This proxy was reliable as maize proportion in feed ingridient was constant about 66%. During 2000-2010, the feed price of broiler and maize price tended to increase (Table 1). The fluctuation of maize price was being concern of feed manufacturer to decide production capacity. This finding was in line with Kariyasa & Sinaga (2007) that concluded that feed manufacturer concerned more to maize price than

Table 1. Maize and feed prices in Indonesia (Period 2000–2010)

Year	Domestic price of maize (IDR)	Impor price of maize (IDR)	Feed price of broiler (IDR)
2000	1 440	1 029	2 345
2001	1 450	1 227	2 470
2002	1 493	1 069	2 577
2003	1 547	1 084	2 687
2004	1 605	1 497	2 796
2005	1 362	1 577	2 905
2006	1 500	1 425	3 194
2007	2 269	1 963	3 250
2008	3 301	3 160	3 693
2009	2 585	2 378	4 461
2010	2 547	2 340	4 450
Trend (%/year)			
	Domestic price of maize (%)	Impor price of maize (%)	Feed price of broiler (%)
2000-2001	0.69	19.24	5.33
2001-2002	2.96	-12.87	4.33
2002-2003	3.61	1.40	4.27
2003-2004	3.74	38.09	4.06
2004-2005	-15.14	5.34	3.89
2005-2006	10.13	-9.60	9.95
2006-2007	51.27	37.75	1.75
2007-2008	45.48	60.97	13.63
2008-2009	-21.69	-24.74	20.80
2009-2010	-1.47	-1.60	-0.25
	7.96	11.40	6.78

Source: BPS (2012), Pusdatin Ministry of Agriculture (2012), processed

feed price when decided the quantity of feed production. Moreover, the quantity demanded of maize was determined by maize price itself rather than feed price. The problem of this research was how the change of domestik maize prices impact on the performance of small-scale broiler farming.

Multimarket model is a partial equilibrium model was used to analyze the impact of changes in price and quantity in a particular market on household income and expenditures. Multimarket model analysis was used to measure the impact of policy changes on the poor households (Dorosh *et al*., 1995; Minot & Goletti, 1998), and it was focused on analyzing the impact of food imports on the poverty level of poverty in Mozambique. In Indonesia, Hutabarat *et al*. (2012) investigate the impact of climate changes on the production, imports, and consumption of horticulture.

Based on the description above, this research analyzed the impact of domestic maize price changes on the performance of broiler industry in Indonesia with the problem statement of how the domestic maize price changes has impacted the performance of maize farming, broiler farming, and income of small-scale broiler farming household. This study therefore was conducted with the aims at analyzing the impact of domestic maize price changes on: (1) the performance of maize farming, (2) the performance of broiler farming, and (3) small-scale broiler farming household income.

METHODS

Product Categories

There are 6 (six) commodities in the model, namely: rice (rc), maize (m), broiler (br), eggs (lr), urea (ur), and *triple super phosphate* (TSP). The model assumes that commodities (rice, maize, chicken meat, and eggs) are used as final consumption by household and maize as input in feed industry.

Data

This research used data of 2011 consisted of: (1) production, input utilization, consumption, and income, (2) price of inputs and outputs, and (3) elasticity. The data source of production, input utilization, consumption, and income were Bureau of Statistics Central, Directorate General of Livestock and Animal Health, Bureau of Food Security of Ministry of Agriculture.

Structure of the Model

This research employed multimarket model from Umboh *et al*. (2014) and it was divided into 6 blocks of equations, namely: (1) price, (2) supply, (3) input demand, (4) consumption, (5) income, and (6) equilibrium condition. The model was originally designed in *General Algebric Modelling System* (GAMS) using the *Path NLP* solver consist of fifteen steps, namely: (1) set declaration, (2) database, (3) parameter declaration, (4) parameter definition, (5) variable declaration, (6) variable definition, (7) equation declaration, (8) equation definition, (9) model definition, (10) fixing variables, (11) model closure, (12) display of parameters and variables, (13) solution statement, (14) optional solution, and (15) solution reports.

Price block. The producer prices (PP) are lower than the consumer prices (PC) due to the presence of the domestic marketing margin (MARG), hence:

$$PC_{c,h} = PP_{c,h} * (1 + MARG) \quad \text{.....(1)}$$

where the subscripts *c* and *h* refer to commodity and household type, respectively. The border prices (*PM*) for tradable products are linked to the world price by the exchange rate (*er*), import tariffs (tm) and the international marketing margin (RMARG).

$$PM_c = PW_c * er * (1 + tm_c) \quad \text{.....(2)}$$
$$PC_{c,h} = PM_c * (1+RMARG) \quad \text{.....(3)}$$

In addition, the large-scale (PRSHN) of broiler consumer prices differ from the small-scale (PTRYT) by an internal marketing margin (INTMARG). The consumer prices can be defined as:

$$PC_{c,pr} = PC_{c,p} * (1 + INTMARG) \quad \text{.....(4)}$$
$$PC_{c,rt} = PC_{c,pr} \quad \text{.....(5)}$$

We included a price index for each household group to reflect changes in prices weighted by their shares of consumption:

$$PINDEX = S_i PCWT_{h,i} * (PC_{1\,h,i}/PC_{0\,h,i}) \quad \text{.....(6)}$$

where w is the budget share for each commodity. The superscript on the PC terms refers to periods 0 denote starting prices and 1 end of simulation prices.

Supply block. Household's supply of food products is determined by total amount of land available, share of that land allocated to the specific crops, and yield of the crops. The share of land (SH) is a function of:

$$\log(SH_{h,f}) = \alpha^s_{h,f} + \sum_{ff} \beta^s_{h,f,ff} \log(PP_{h,ff}) \quad \text{.....(7)}$$

where f refers to crop commodities (rice and maize).

Yields (YLD) of household groups are determined by output producer price and input consumer prices.

$$\log(YLD_{h,f}) = \alpha^y_{h,f} + \beta^y_{h,f} \log(PP_{h,f}) + \sum_{iin} \gamma^y_{h,f,iin} \log(PC_{h,iin}) \quad (8)$$

where the coefficients (α, β, γ) represent the price elasticities.

The production of food crops by each household determined by total land devoted to the crop, the share of land devoted to the crop, and the yield. After that, total production available at the market is adjusted by losses, use of the food crops for seed (*loss*), and conversion factors (*conv*), hence:

$$SCR_{h,f} = \overline{AREA} * SH_{h,f} * YLD_{h,f} * \overline{(1 - loss_f)} * \overline{conv_f} \quad (9)$$

The total supply of each of the food crops are:

$$SCR_f = \Sigma_h SCR_{h,f} \quad \text{.....(10)}$$

The poultry production by households is a function of poultry prices and poultry input prices of feed.

$$\log(SLV_{h,l}) = \alpha^1_{h,l} + \Sigma_{ll} \beta^1_{h,l,ll} \log(PP_{h,l}) + \Sigma_{ffe} \gamma^1_{h,l,ffe} \log(PC_{h,ffe}) \quad (11)$$

Total poultry supply is given by:

$$SLV_l = \Sigma_h SLV_{h,l} \quad \text{.....(12)}$$

Demand input block. Household demand for input (HDIN) is a function of output prices (PP) and input prices (PC), where the subscript in refers to Urea and TSP. Household demand for urea and TSP:

$$\log(HDIN_{h,f,in}) = \alpha^f_{h,in} + \Sigma_f \beta^f_{h,f,in} \log(PP_{h,f}) + \gamma^f_{h,in} \log(PC_{h,in}) \quad (13)$$

Total demand for urea and TSP are given by:

$$DIN_{in} = \Sigma_h HDIN_{h,in} \quad \text{.....(14)}$$

Household demand maize for poultry feed:

$$\log(HDFE_{h,fe}) = \alpha^l_{h,fe} + \Sigma_l \beta^l_{h,l,fe} \log(PP_{h,l}) + \Sigma_{ffe} \gamma^l_{h,fe,ffe} \log(PC_{h,ffe}) \quad (15)$$

where fe refer to maize for poultry feed.

Total demand for maize is given by:

$$DFE_{fe} = \Sigma_h HDFE_{h,fe} \quad \text{.....(16)}$$

Consumption block. The demand for each commodity is modeled as the consumption function of household groups as follow:

$$\log(HC_{h,i}) = \alpha^h_{h,i} + \Sigma_j \beta^h_{h,i,j} \log(PC_{h,j}) + \gamma^h_{h,i} \log(YH_h) \quad (17)$$

where YH is household income, PC are consumer prices.

Total consumption is given by :

$$CONS_i = \Sigma_h HC_{h,i} \quad \text{.....(18)}$$

Income block. Agricultural income (YHAG) is the sum of crop and poultry revenue minus input costs:

$$YHAG_h = \Sigma_f (PP_f * SCR_{h,f}) + \Sigma_l (PP_l * SLV_{h,l}) - (PC_{in} * DIN_{h,in}) - (PC_{fe} * DFE_{h,fe}) \quad \text{.....(9)}$$

and total household income (YH) is the sum of agricultural income and the exogenously determined non-agricultural income (YHNAG). The latter component is adjusted by a price index and the price index is as defined in equation (6).

$$YH_h = YHAG_h + YHNAG_h * PINDEX \quad \text{.....(20)}$$

Equilibrium conditions. In this block, it is assumed that there is "market clearing condition" for all commodity markets. In this regard, the sum of quantity supplied (domestic production plus net imports) is equal to the quantity demanded for both human consumption and feed demand. Those are mathematically defined as

$$SCR_f + SLV_l + M_C = CONS_i + DFE_C \quad \text{.....(21)}$$

where M equals imports and CONS and DFE denote human and livestock consumption respectively.

Model Simulation

Two simulations were conducted to answer the objectives of this study, i.e: (1) Decreased domestic price of maize by 10%, and (2) Increased domestic price of maize by 10%. These simulations concerned to the increasing trend of maize price during 2000-2010 that reached about 7.96%. In 2011, maize price increased remarkably from IDR 2547 to IDR 2933 or increased around 15%.

RESULTS AND DISCUSSION

Supply and Demand of Maize

During the period 2005-2011, the development trend of harvested area, production and productivity of maize nationally showed an increase by 2.62%, 7.86% and 5.23%, respectively. In 2011, the national maize harvested area reached 3.86 million hectares with production and productivity levels of 17.63 million tons and 4.57 ton/ha, respectively (BPS, 2012).

Although increased, the national maize productivity is still low due to most of farmers still have used seeds local varieties. Some other farmers eventhough they grow maize hybrids and composites, but they managed it less intensively. This conditions have caused maize yield is still far from its potency (Swastika *et al.*, 2005). Indeed, if farmers are willing to manage their maize farm intensively or use input according to recommended technology, the productivity can reach 6-10 tons per hectare for maize hybrid and 5-8 tons/ha for maize composite. This means that farmers have not utilized the production potential optimally and the possibility in getting more income through using new superior varieties of maize. This condition is caused by several things, among others are: (1) farmers do not have enough money to buy superior seeds, fertilizers and pesticides needed and (2) the seed available is frequent delay, so that planting activity cannot be done on time. As a result, the maize productivity level is not as expected (Yusdja & Agustian, 2003).

To meet domestic demand for maize, some attempts have been done such as increasing productivity, expanding planted maize areas, improving technical assistance, empowering agricultural institution, and providing financial support. As a result, there was a significant production increase of 7.86% per year during the period 2005-2011 (BPS, 2012). It is hoped that the domestically produced maize will be able to close the domestic demand.

Supply and Demand of Maize and Chicken Meat

Comparing with the national maize production data, in 2005 national maize production reached 12.52 million ton, then decreased to 11.61 million ton in 2006 and increased again to 17.63 million ton in 2011. Based on that, in 2006 there was a deficit so for answered the demand, the government did an import around 1.84 million ton. In 2007-2011, national maize production reached over the demand. However, maize still imported around 414 thousand ton in 2007 and increased to 3.1 million ton in 2011 (BPS, 2012).

Maize import was done by the feed industries with some reasons such as, the difficulties to find maize from the farmer, national maize production does not available in a whole year, and maize import buying mechanism is more easier than local corn buying, because they do not need to get in touch with the farmers or producers directly (Malian, 2004; Hakim, 2005; Swastika *et al.*, 2011). In 2005, the total maize requirement reached around 11.86 million ton, then increased to 13.71 million ton in 2008, and became 16.50 million ton in 2011 (BPS, 2012).

Related to production and price chicken meat, although there was broiler feed price increasing because of maize price increasing, there was still broiler production increasing. This was because of the input price increasing (feed) compensated with the output price increasing (chicken meat), so that this gave an incentive to the farmer to increase their production. During 2000-2010, chicken price and production increased around 5.86% and% 14.453, respectively (BPS, 2012).

Theoritically, the cause of chicken meat price increasing, besides caused by production cost increasing, also caused by the increasing of demand because of population, nutritional consumption awareness, and income increasing (Ilham, 2009; Ilham & Yusdja, 2010). By the time, chicken meat contribution to the national meat consumption has reached around 70.24% (Saptana & Sumaryanto, 2009). During 2000-2009, chicken meat consumption was around 2.33 kg per capita per year. The demand for chicken meat continuously increased to 3.10 kg per capita in 2010 and reached around 4.53 kg per capita per year in 2011 (Bureau of Food Security of Ministry of Agriculture, 2012).

The most broiler population are located in 14 provinces, namely West Java, East Java, Central Java, Banten, North Sumatra, Riau, East Kalimantan, South Kalimantan, West Kalimantan, South Sumatra, South Sulawesi, Lampung, Riau, and Jambi. Meanwhile, for layer are located in 12 provinces: East Java, Central Java, West Java, North Sumatra, West Sumatra, Banten, South Sulawesi, South Sumatra, Bali, Lampung, and West Kalimantan (Directorate General of Livestock and Animal Health, 2012.)

Impact of Domestic Maize Price Changes on the Performance of Maize Farming

The reseach result showed that domestic maize price decrease by 10% had a negative impact on the performance of maize farming in Indonesia as shown in Table 2. For maize farmers, the reduction in domestic maize price was responded by reducing the land share for planted maize land by 3.120% for small-scale broiler farming households and by 3.133% for other households, respectively. At the same time both two types of households have decided to reduce in Urea and TSP fertilizers uses of by 5.668% and 2.011%, respectively. The changes of farmer decision for maize planted area size and fertilizers uses, then had impact on maize production decrease by 2.615%. But, opposite impact accoured when the maize price goes down, in which farmers will be more interesting to increase rice planted area size. In this condition, planting rice gives more interesting benefit than that of planting maize. This was showed by the increased share of rice planted land for small-scale broiler farming households and other households by 1.1436% and 1.140%, respectively. Therefore, when there was a decline in the maize price, farmers would divert their planted maize area to rice farming. In this case, the farmers also are willing to use more input production for rice that had positive impact on rice productivity. Therefore, at level of productivity and land share increase would lead the increase in rice production by 1.7481%.

Domestic maize price increased was responded by farmers by increasing maize planted area by 2.84% and 2.876% on the households of small-scale broiler farming and other households, respectively. In addition, the improvement of maize price led to Urea and TSP fertilizers uses for maize farming increased by 5.371% and 5.383%, respectively and then improved maize productivity by 2.39971 and 2.39910 on the households of small-scale and other households. Increased land share for and productivity of maize would cause the increase in national maize production by 5.34606%. On the other side, this condition has a negative impact on rice production by 1.41942%. This indicated that when the price of maize increases, farmers would use part of their rice land for planting maize. These results were in line with other research results, such as Sayaka *et al.* (2007); Huang *et al.* (2009); and Dorosh *et al.* (2009).

Impact of Domestic Maize Price Changes on the Performance of Broiler Farming

Domestic maize price decrease and the existing margin between the large-scale and small-scale broiler farming by 20%, where by IDR 2933 on the broiler farming of large-scale and IDR 3519.60 on the small-scale, respectively (Table 2), had an impact on the performance of broiler farming as shown in Table 3. For small-scale broiler farming, when the price of maize to be paid by the small-scale was 20% higher than the price paid by the broiler large-scale, increasing the maize demand for feed by 0.5268%, this in turn would increase chicken meat production by 0.5279%. The same phenomenon also occured in large-scale production, where the increased maize demand for broiler feed triggered the increase in production large-scale of by 0.5285%. Furthermore, the impact of domestic maize price decrease by 10% leading the increase in maize demand for feed by the large and small-scale broiler farming, increasing the national

Table 2. The results of simulation of domestic maize price changes on the performance of maize farming in Indonesia

Variables	Base value (Unit)	Alternative simulation			
		Simulation 1*		Simulation 2**	
		(Unit)	(%)	(Unit)	(%)
PMm (Imported Maize Price)	2346.40	0.00	0.00	0.00	0.00
PCm,p (Maize Price of PRSHN)	2933.00	293.30	10.00	-293.30	-10.00
PCm,pr (Maize Price of PTRYT)	3519.60	351.96	10.00	-351.96	-10.00
PMrc (Imported Rice Price)	6150.40	0.00	0.00	0.00	0.00
PCrc (Domestic Rice Price)	7688.00	0.00	0.00	0.00	0.00
SH1,2 (Rice Land Share of PTRYT)	0.078	-0.001	-0.872	0.001	1.144
SH1,2 (Rice Land Share of RTOTH)	0.526	-0.005	-0.880	0.006	1.14
YLD1,2 (Rice Productivity of PTRYT)	4.207	-0.018	-0.419	0.025	0.594
YLD1,2 (Rice Productivity of RTOTH)	5.58	-0.023	-0.419	0.033	0.591
HSCR1 (Rice Production of PTRYT)	2598.32	-36.877	-1.419	45.425	1.748
HSCR2 (Rice Production of RTOTH)	23240.54	-329.885	-1.419	406.30	1.748
SCR1,2(Rice Production of Indonesia)	25838.86	-366.762	-1.419	451.69	1.748
SH3,4 (Maize Land Share of PTRYT)	0.025	0.001	2.84	-0.001	-3.12
SH3,4 (Maize Land Share of RTOTH)	0.160	0.005	2.876	-0.005	-3.133
YLD3,4 (Maize Productivity of PTRYT)	3.50	0.084	2.400	-0.091	-2.611
YLD3,4 (Maize Productivity of RTOTH)	4.56	0.109	2.399	-0.119	-2.610
HSCR3 (Maize Production of PTRYT)	1107.53	59.209	5.346	-62.80	-5.67
HSCR4 (Maize Production of RTOTH)	9211.81	492.47	5.346	-522.24	-5.669
SCR3,4 (Maize Production of Indonesia)	10319.34	551.68	5.346	-585.03	-5.669
HDIN1 (Demand for Urea PTRYT)	1.679	0.09	5.36	-0.095	-5.658
HDIN2 (Demand for Urea RTOTH)	1049.36	56.48	5.382	-59.50	-5.67
DIN1,2 (Demand for Urea Indonesia)	1051.04	56.57	5.371	-59.58	-5.668
HDIN3 (Demand forTSP PTRYT)	0.705	0.038	5.39	-0.04	-5.673
HDIN4 (Demand for TSP RTOTH)	440.73	23.72	5.381	-11.53	-2.616
DIN3,4 (Demand for TSP Indonesia)	441.43	23.763	5.383	-11.53	-2.611
CONS1,2 (Consumption for Rice)	24789.08	42.60	0.172	-90.65	-0.365
CONS3,4 (Consumption for Maize)	7941.02	-52.46	-0.66	124.32	1.565
IMrc (Net Import of Rice)	4499.991	409.36	9.096	-542.339	-12.052
IMm (Net Import of Maize)	3182.356	-607.83	-19.10	709.364	22.29

Note: *) increasing domestic maize price by 10%; **) decreasing domestic maize price by 10%.

Table 3. The results of simulation of domestic maize price changes on the performance of broiler farming in Indonesia

Variables	Base value (Unit)	Alternative Simulation			
		Simulation 1*		Simulation 2**	
		(Unit)	(%)	(Unit)	(%)
PCbr (Domestic Chicken Meat Price)	27500.00	0.000	0.000	0.000	0.000
PClr (Domestic Egg Price)	18058.00	0.000	0.000	0.000	0.000
HSLV1(Chicken Meat Production of PRSHN)	1137.12	-5.40	-0.474	6.010	0.529
HSLV2(Chicken Meat Production of PTRYT)	181.83	-0.867	-0.477	0.960	0.528
SLV1,2 (Chicken Meat Production of Indonesia)	1318.95	-6.207	-0.470	6.970	0.528
HSLV3(Egg Production of PTRYT)	0.10	-0.000	-0.460	0.001	1.300
HSLV4(Egg Production of RTOTH)	1025.91	-4.879	-0.476	5.420	0.528
SLV3,4 (Egg Production of Indonesia)	1026.01	-4.880	-0.477	5.427	0.529
HDFE1 (Demand for Maize PRSHN)	1066.37	-5.070	-0.475	5.640	0.529
HDFE2 (Demand Maize for Broiler Feeds PTRYT)	227.00	-1.080	-0.476	1.196	0.527
HDFE3 (Demand Maize for Layer Feeds PTRYT)	0.127	-0.001	-0.472	0.001	0.787
HDFE4 (Demand for Maize RTOTH)	1292.25	-6.140	-0.475	6.834	0.529
DFE1,2,3,4 (Demand for Maize Indonesia)	2585.747	-12.290	-0.475	13.671	0.528
CONSP1,2 (Consumption for Chicken Meat Indonesia)	1137.21	-0.630	-0.055	1.032	0.090
CONSP1,2 (Consumption for Eggs Indonesia)	1027.80	-3.980	-0.387	7.717	0.750

Note: *) increasing domestic maize price by 10%; **) decreasing domestic maize price by 10%.

Table 4. The results of simulation of domestic maize price changes on households income of small-scale broiler farming (Million Rupiahs)

Variables	Base value (Unit)	Alternative Simulation			
		Simulation 1*		Simulation 2**	
		(Unit)	(%)	(Unit)	(%)
a. YHAG1 (Income of PRSHN)	21888976	-415240.45	-1.897	430092.870	1.965
b. YHAG2 (Income of PTRYT)	22286608	-153717.82	-0.690	210125.455	0.943
1. Rice	15968858.530	-226640.48	-1.419	279174.770	1.748
2. Maize	3115440.070	167759.37	5.385	-176713.795	-5.672
3. Broiler	3201210.80	-94787	-2.961	97182.470	3.036
4. Laying hens	997.65	-49.08	-4.920	58.510	5.865
c. YHAG3 (Income of RTOTH)	1049290416	-7219118.062	-0.688	9621993.115	0.917
Total (a+b+c)	1093466000	-10597552.96	-0.969	10262211.120	0.938
d. YHNAG1(Income of PRSHN)	0.00	0.00	0.000	0.000	0.000
e. YHNAG2(Income of PTRYT)	3039080	0.00	0.000	0.000	0.000
f. YHNAG3(Income of RTOTH)	6445640124	0.00	0.000	0.000	0.000
Total (d+e+f)	6448679204	0.00	0.000	-3025496.54	-1.878
g. YH1 (Income of. PRSHN)	21888976	-415240.45	-1.897	430092870	1.965
h. YH2 (Income of PTRYT)	25325688	-153718.77	-0.607	210124.51	0.829
i. YH3 (Income of RTOTH)	7494930540	-9768894	-0.130	9621993	1.284
Total (g+h+i)	7542145204	-10337853	-0.137	10262211.17	0.136

Note: *) increasing domestic maize price by 10%; **) decreasing domestic maize price by 10%.

production of by 0.5284%. This condition also had a positive impact on the improvement of layers production of by 0.5289%.

In contrast, when the domestic maize price increased by 10%, in which maize demand by both large and small-scale broiler farming went down by 0.4754% and 0.4757%, respectively. Consequently, the production for meat also decreased by 0.474% and 0.477%, respectively, both in large and small-scale broiler farming. These results were in accordance with Kariyasa & Sinaga (2007).

Impact of Domestic Maize Price Changes on the Household Income of Small-scale Broiler Farming

The decrease of domestic maize price by 10% and if the price margin to be paid by small-scale broiler farming is 20% higher than the price large-scale had to pay, the household income of small-scale broiler farming would decrease by 5.572% from maize farming, but it increased their income from rice farming, broiler business and layer business by 1.748%, 3.036%, and 5.865%, respectively (Table 4). This policy caused the increase in agricultural income (YHAG) as well as national income (YH) of by 0.938% and 0.136%, respectively. In contrast, when government issued the policy of increasing domestic maize price of by 10%, it caused the household income of small-scale broiler farming from maize increased by 5.385%, but decrease of the income of small-scale broiler farming from rice farming, broiler, and layer business by 1.419%, 2.961%, and 4.920%, respectively. Furthermore, this policy caused the agricultural sector income (YHAG) and the national income (YH) go down by 0.969% and 0.137%, respectively.

CONCLUSION

The price policy to increase maize price had positive impacts on performance of maize farming and farmer income by increasing maize cultivated area and input utilization to increase domestic maize production and to reduce maize import. On the other hand, the lowering of domestic maize price was responded by farmers through reducing maize planted land and fertilizer input uses, causing maize production and farmer income from maize farming decline; in addition, price policy to increase maize price showed a negative impact on the performance and income of small-scale broiler farming as it caused the increase of production cost due to the increasing feed price. In contrast, reduction maize price would have an impact on increasing maize demand for feed industry. Aside from that, other impacts from this policy were increasing broilers production and small-scale broiler farming income. In general, this policy could improve the level of agricultural income and national income.

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