

ANALYSIS OF THE EFFECTS OF BEEF IMPORT RESTRICTIONS POLICY ON BEEF SELF-SUFFICIENCY IN INDONESIA

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ABSTRACT

Beef consumption tends to increase over time, but the growth of domestic beef production is lower than the growth of consumption. This has led to the increase in import. In line with the launch of a beef self-sufficiency program, the government has attempted to reduce import quotas on beef and feeder cattle to encourage the growth of cattle and beef production. This study aims to analyze the impact of the restrictions of beef import on the performance of the beef cattle industry and livestock subsector and the forecast of beef self-sufficiency achievement in Indonesia. This study utilized time series data during the period 1990–2011. By using econometrics approach with simultaneous equations model, which is based on the Two Stages Least Squares method, the results of the analysis give some conclusions including: 1) restrictions on imports of feeder cattle and beef would increase domestic beef production and beef demand, but would reduce the population and production of cattle and livestock subsector performance; 2) reduction in imports of beef and feeder cattle followed by technology improvement will accelerate the achievement of beef self-sufficiency in Indonesia.

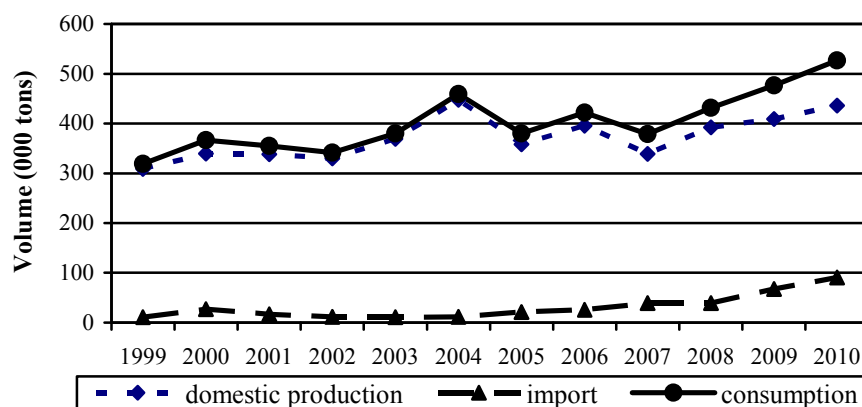
Key words: beef domestic production and consumption, import quota, estimated beef self-sufficiency level

INTRODUCTION

Livestock subsector plays an important role in food supply for the people, especially animal protein. As a source of animal protein, beef is needed to meet the nutritional needs of the people. Beef contains 10 kinds of amino acids and essential fatty acids especially conjugated linoleic acid which is beneficial for the growth of neurons in the brain that determines the level of human intelligence (Daryanto, 2009).

National beef demand has been met from three sources, namely local cows, imported cows, and imported beef (Hadi and Ilham, 2002). Along with population growth, rising incomes, and changing public tastes, consumption of beef in Indonesia tends to increase over time. During the 1999-2010 period beef consumption increased by 4.66 percent per year. On the other hand, the growth of domestic beef production is lower at 3.20 percent per year. As a result, beef import rose by 21.58 percent annually (Fig. 1). In this case, domestic beef production includes the slaughtered cattle from imported feeder cattle. Feeder

cattle imports are also likely to increase. According to the Directorate General of Livestock Services (DGLS), imported beef and feeder cattle has accounted for approximately 30 per cent of the national beef demand (DGLS, 2011).



Source: Directorate General of Livestock Services, BPS-Statistics Indonesia (processed)

Fig.1. Trends in consumption, production, and import of beef in Indonesia, 1999-2010 (000 tons).

The low growth rate in the national cattle production encourages the rise in import of feeder cattle and beef. This condition will threaten national food security. Livestock industry, which has a high level of dependence on imports, has a big risk (Yusdja and Ilham, 2006). In the case of occurrence of import barriers, such as a sharp depreciation of rupiah, rising import tariffs, and impaired bilateral relationships, the volume of imports will decrease. This will lead to cut domestic cattle in a larger number to meet domestic consumption. As the growth of domestic cattle is relatively slow, this will deplete domestic resources that can lead to extinction (Ilham, 2006). Another risk is when there is an increase the volume of import, it will drain foreign exchange substantially.

To reduce the dependency of imported beef products, domestic beef production should be increased. The increase in domestic beef production will replace the import of beef supply. This is known as imports substitution strategy, which is also known as inward-looking policy (Bulmer-Thomas, 1982; Hess and Ross, 1997; Todaro and Smith, 2009). Efforts to encourage domestic production can be done through various policies such as tariffs and import quotas policy. If the imports quota is set smaller than the volume of imports on the free trade condition, then domestic price will increase and this will encourage domestic production (Houck, 1986; Pindyck and Rubinfeld, 1998b).

To encourage domestic beef production and reduce imports, the government has set the Self-Sufficiency Program on Beef and Buffalo policy in 2014 (PSDSK 2014). It is a revision of Beef Self-Sufficiency Program in 2005 and the Accelerating Beef Self-Sufficiency Program (P2SDS) in 2010, in which both programs failed to achieve (Syamsu, 2010). One operational step in the PSDSK 2014 is setting stock regulation on feeder cattle and beef through setting import quotas. This policy aims to reduce beef imports, in the form of either imported of feeder cattle or beef, with the hope of encouraging the growth of beef production and value-added of livestock subsector, creating job opportunities, and saving foreign exchange. Beef self-sufficiency can be achieved if domestic beef production is able to meet the minimum 90 percent of the total national consumption of beef. The program was implemented since 2010 and Indonesia has targeted to achieve beef self-sufficiency by 2014 (DGLS, 2011). Currently, there is no pre-determined import quota level on beef import, but the volume of beef import in a certain year is jointly determined by the Ministry of Agriculture and Ministry of Trade.

Based on the above explanation, this study sought to: 1) assess the impact of reducing import quota of feeder cattle and beef on the performance of beef cattle industry and livestock subsector in Indonesia; 2) evaluate the impact of reducing import quota policy of feeder cattle and beef on beef self-sufficiency in Indonesia.

PREVIOUS STUDIES ON THE BEEF SUPPLY AND DEMAND IN INDONESIA

Several studies on the supply and demand for beef in Indonesia have been done by Ilham (1998), Kariyasa (2004), Priyanto (2003), and Tseuo et al. (2012). Ilham (1998) and Priyanto (2003) differentiated supply into supply from feedlot and smallholders. These studies examined factors that influence supply, demand, imports, and the price of beef in Indonesia. Tseuo et al. (2012) emphasized their study on the impact of tariff reduction on the performance of beef cattle industry in Indonesia. The forecast of demand and supply of beef using various techniques was done by Ilham (2006), Kariyasa (2004), and Tseuo et al. (2012). In these studies, the behavior of cattle production and beef cattle population has not been taken into account. Research on cattle production and beef cattle population was carried by Sukanata (2008) but for the Bali Province only.

METHODOLOGY

Data Type and Sources

This study utilized secondary time series data during the period 1990 – 2011. Data were taken from various sources including BPS-Statistics Indonesia, Central Bank of Indonesia (BI), Food and Agriculture Organization (FAO), Directorate General of Livestock and Animal Health Services (DGLS), and Directorate General of Customs and Excise. In addition to this, certain data and information were also taken from the study of the literature related to this study.

In this study, beef production from slaughtered imported feeder cattle was differentiated into beef imports and additional domestic beef production. Beef imports is the conversion of live weight imported feeder cattle. Additional beef production from fattening of imported feeder cattle was categorized as domestic production because it is the value added of the production process in Indonesia. To obtain beef production from the imported feeder cattle, a conversion factor adopted from BPS-Statistics (2002) was used. On average, the live weight of imported cattle slaughtered is 487.02 kg and produces 232.01 kg of carcass. The conversion factor of carcass to meat was found to be 0.8 (period 1990-2001) and 0.7493 (period 2002-2011). The averaged live weight of imported feeder cattle was 346.34 kg head⁻¹. So the extra weight during the fattening process was approximately 40.62 percent. This study is different from the study conducted by Tseuo et al. (2012), where all beef production of imported feeder cattle were cocategorized as beef import. In addition, their study did not consider the fattening process as part of domestic production.

Model Constructions

By using econometric approach, the simultaneous equations model was used to answer the research objectives. The model consists of 2 blocks of equations, namely beef cattle industry and livestock subsector. The model was modified from Ilham (1998), Kariyasa (2004), Sukanata (2008), and Tseuo et al. (2012). The overall model is described in the following equations:

1. Block of beef cattle industry

Equation of beef cattle production

$$QTS_t = a_0 + a_1POPT_{t-2} + a_2MSBT_{t-2} + a_3VIB_{t-1} + a_4CH_{t-1} + a_5RIR + U_1 \dots\dots\dots (1)$$

Hypothesis: $a_1, a_2, a_3, a_4, a_6 > 0$ and $a_5 < 0$

Equation of imported feeder cattle

$$MSBK_t = b_0 + b_1RHSBK_t + b_2RNTR_t + b_3WA_t + b_4QSDSL_t + b_5QDDS_t + b_6D1_t + b_7D2_t + U_2 \dots \dots \dots (2)$$

Hypothesis: $b_1, b_2, b_4, b_6, b_7 < 0$ and $b_3, b_5 > 0$

Equation of total imported beef cattle

$$MTS_t = (MSBT_t/1000) + MSBK_t \dots \dots \dots (3)$$

Equation of beef cattle population

$$POPT_t = c_0 + c_1QTS_t + c_2MTS_t + c_3QSD_t + c_4POPT_{t-1} + U_3 \dots \dots \dots (4)$$

Hypothesis: $c_3 < 0$; $c_1, c_2 > 0$; and $0 < c_4 < 1$

Equation of local beef production

$$QSDSL_t = d_0 + d_1RHDS_{t-1} + d_2QTS_{t-2} + d_3QSM_t + d_4D1_t + d_5QSDSL_{t-1} + U_4 \dots \dots \dots (5)$$

Equation of extra beef production from imported feeder cattle

$$QSDSM_t = 0.4062 * QBM_t \dots \dots \dots (6)$$

Equation of domestic beef production

$$QSDS_t = QSDSL_t + QSDSM_t \dots \dots \dots (7)$$

Hypothesis: $d_3 < 0$; $d_1, d_2, d_4 > 0$; and $0 < d_5 < 1$

Equation of beef import

$$QDM_t = e_0 + e_1RHSM_t + e_2RNTR_t + e_3QSDSL_t + e_4QDDS_t + e_5QDM_{t-1} + U_5 \dots \dots \dots (8)$$

Hypothesis: $e_1, e_2, e_3 < 0$; $e_4 > 0$; and $0 < e_5 < 1$

Equation of beef production from imported feeder cattle

$$QBM_t = k * MSBK_t \dots \dots \dots (9)$$

$k = 0.3811$ (1990 – 2001) and 0.3570 (2002 – 2011) (BPS-Statistics, 2002) (processed)

Equation of total beef imports

$$QSM_t = QDM_t + QBM_t \dots \dots \dots (10)$$

Equation of total beef productions

$$QSD_t = QSDS_t + QBM_t \dots \dots \dots (11)$$

Equation of national beef demand

$$QDDS_t = f_0 + f_1RHDS_t + f_2RHDAY_t + f_3GDP_t + f_4D1_t + f_5D2_t + U_6 \dots \dots \dots (12)$$

Hypothesis: $f_1, f_5 < 0$ and $f_2, f_3, f_4 > 0$

Equation of excess demand of beef

$$EQDS_t = QDDS_t - QSDS_t \dots \dots \dots (13)$$

Equation of domestic beef price

$$RHDS_t = g_0 + g_1RHDSJ_t + g_2RHSM_t + g_3RNTR_t + g_4QSDS_t + g_5QDDS_t + g_6T_t + g_7RHDS_{t-1} + U_7 \dots \dots \dots (14)$$

Hypothesis: $g_4 < 0$; $g_1, g_2, g_3, g_5, g_6 > 0$ and $0 < g_7 < 0$

2. Block of livestock subsector

Equation of GDP of beef cattle

$$GDPSP_t = h_0 + h_1 QTS_t + h_2 MSBK_t + h_3 GDPSP_{t-1} + U_8 \dots\dots\dots (15)$$

Hypothesis: $h_1, h_2 > 0$ and $0 < h_3 < 0$

Equation of GDP of livestock subsector

$$GDPP_t = GDPSP_t + GDPNSP_t \dots\dots\dots (16)$$

Equation of employment in livestock subsector

$$DLP_t = i_0 + i_1 RWP_t + i_2 GDPP_t + i_3 DLP_{t-1} + U_9 \dots\dots\dots (17)$$

Hypothesis: $i_1 < 0$; $i_2 > 0$; and $0 < i_3 < 1$

where:

- QTS : beef cattle production (million heads)
- MSBK : imported feeder cattle (000 tons)
- POPT : beef cattle population (million heads)
- QSDSL : local beef production (000 tons)
- QDM : beef import (000 tons)
- QDDS : national beef demand (000 tons)
- RHDS : real domestic beef price (rupiahs kg^{-1})
- GDPSP : GDP of beef cattle (trillion rupiahs)
- DLP : employment in livestock subsector (000 workers)
- MTS : total imported beef cattle (000 tons)
- QSDSM : additional domestic beef production from imported feeder cattle (000 tons)
- QBM : imported beef from conversion live weight imported feeder cattle (000 tons)
- QSDS : domestic beef production (000 tons)
- QSM : total beef imports (000 tons)
- QSD : total beef production (000 tons)
- EQDS : excess demand of beef (000 tons)
- GDPP : GDP of livestock subsector (trillion rupiahs)
- GDP : GDP without oil and gas (trillion rupiahs)
- RHSM : real price of beef import (US\$ ton^{-1} , cif)
- MSBT : imported breeding cattle (tons)
- VIB : Artificial Insemination technology doses (000 doses)
- CH : number of rainfall (mm $year^{-1}$)
- RIR : real interest rate (percent)
- RHSBK : real price of imported feeder cattle (US\$ ton^{-1} , cif)
- RNTR : real exchange rate (rupiahs $US\$^{-1}$)
- WA : number of foreign tourists (000 persons)
- RHDAY : real chicken price (rupiahs kg^{-1})
- RHDSJ : real beef price in Jakarta (rupiahs kg^{-1})
- T : time trend
- RWP : real wage in livestock subsector (000 rupiahs $month^{-1}$)
- D1 : dummy PSDSK 2014 policy (1990 – 2009 = 0; 2010 – 2011 = 1)
- D2 : dummy economic crisis (1998 – 1999 = 1; the others = 0)

Analysis Procedure and Policy Simulation

Based on the order condition criteria, it was found that the model is over identified. Therefore, the estimation of parameter was done by using the Two Stage Least Square (2SLS) method (Koutsoyiannis, 1977). To test whether the model experienced a serial correlation or not, Durbin Watson and Durbin-h statistics wer used. To test whether variables gave an influence simultaneously or not on the endogenous variable, statistical F-test was used. Finally, to test whether each variable gave a significant effect individually or not on the endogenous variable, statistical t-test was used (Pyndick and Rubinfeld, 1998a).

Before running the simulation for various selected policies, the model was validated using a statistical measure of Root Mean Square Percent Error (RMSPE) and Theil's Inequality (U-Theil). Theil U-statistic can be decomposed into components of bias, variance, and covariance. Bias portion (UM) indicated a systematic error, which measures the deviation of average values of estimation results with the actual data. Variance portion (US) measures the deviation of variance values of estimation results with the actual data. Covariance portion (UC) is the proportion of covariance and a residual bias from UM and US, and is often referred to as non-systematic errors (Pyndick and Rubinfeld, 1998a).

The simulation analysis aims to assess the impact of reducing the import of feeder cattle and the import of beef by 25 percent and 35 percent respectively, on cattle production, beef production, and beef consumption. In addition to this, the performance of the livestock subsector in Indonesia, which includes the GDP and employment creation, is also assessed. Finally, given the most appropriate policy simulation, the econometric model was used to forecast the demand and domestic production of beef.

RESULTS AND DISCUSSION

Factors Affecting the Performance of Beef Cattle Industry and Livestock Subsector

In general, the estimation results of the model are representative to explain the behavior of the endogenous variables with coefficient of determination (R^2) ranging from 0.7612 to 0.9961, except beef cattle production equation (QTS) which has a R^2 value of 0.6302. This suggests that the variation of the explanatory variables in each equation can explain variation in endogenous variables. Concerning statistical-F tests, the p-values <0.01 were observed for all equations. This indicates that in each equation, together, the explanatory variables have significant effect on each endogenous variable. Most of the estimated parameters signs were in line with expectations and in line with economic theory. The identification of factors affecting the performance of the beef cattle industry and livestock subsector are presented in Table 1. A discussion of the factors affecting the performance of beef cattle industry and livestock sector in Indonesia will be divided into two sub-sections, namely the performance of beef cattle industry that includes equation (1) to (7) and the performance of the livestock sector that includes equation (8) and (9).

Table 1. Results of parameter estimation, statistical tests, and elasticity of the model.

Variables	Parameter Estimation	Pr > t	Elasticity		Description of Variables
			Short run	Long run	
1. Beef cattle production (QTS)					
Intercept	-2.2274	0.1969			
POPT _{t-2}	0.1842	0.2179	0.8253	-	Lag2 of beef cattle population
MSBT _{t-2}	0.0002	0.0639	0.0921	-	Lag2 of imported breeding cattle
VIB _{t-1}	0.0004	0.0572	0.1974	-	Lag of Artificial Insemination (AI)
CH _{t-1}	0.0009	0.0018	0.7477	-	Lag of rainfall

Variables	Parameter Estimation	Pr > t	Elasticity		Description of Variables
			Short run	Long run	
RIR	-0.0040	0.2913	-0.0113	-	Real Interest rate
R ² = 0.6302		F _{stat} = 4.77*	DW = 2.99		
2. Imported beef cattle (MSBK)					
Intercept	21.4883	0.2046			
RHSBK	-0.0100	0.0524	-0.1217	-	Real price of imported feeder cattle
RNTR	-0.0033	0.0306	-0.2073	-	Real exchange rate
WA	0.0053	0.1263	0.2551	-	Number of foreign tourists
QSDSL	-1.2062	<.0001	-2.5477	-	Local beef production
QDDS	1.1979	<.0001	3.4200	-	Beef demand
D1	-50.4575	0.0002			Dummy PSDSK 2014 policy
D2	-8.1855	0.0975			Dummy economic crisis
R ² = 0.9925		F _{stat} = 226.15*	DW = 2.0373		
3. Beef cattle population (POPT)					
Intercept	-0.0982	0.3644			
QTS	1.0569	<.0001	0.2148	4.7211	Beef cattle production
MTS	0.0035	<.0001	0.0307	0.6749	Total imported cattle
QSD	-0.0073	<.0001	-0.1654	-3.6351	Total beef production
POPT _{t-1}	0.9545	<.0001			Lag of beef cattle population
R ² = 0.9961		F _{stat} = 945.43*	DW = 2.4595		Dh = -1.9338
4. Local beef production (QSDSL)					
Intercept	87.3049	0.1248			
RHDS _{t-1}	0.0044	0.0086	0.4504	0.4816	Lag of real domestic beef price
QTS _{t-2}	32.1121	0.0068	0.3271	0.3498	Lag2 beef cattle production
QSM	-0.8408	<.0001	-0.2482	-0.2654	Total beef imports
D1	70.8991	0.0005			Dummy PSDSK 2014 policy
QSDSL _{t-1}	0.0648	0.3687			Lag of local beef production
R ² = 0.7612		F _{stat} = 8.92*	DW = 1.7784		Dh = 0.5708
5. Beef import (QDM)					
Intercept	-7.2747	0.3668			
RHSM	0.0025	0.3253	0.1816	0.2997	Real price of beef import
RNTR	-0.0001	0.4628	-0.0340	-0.0561	Real exchange rate
QSDSL	-0.2987	<.0001	-2.4520	-4.0473	Local beef production
QDDS	0.2922	<.0001	3.2418	5.3509	Beef demand
QDM _{t-1}	0.3942	0.0016			Lag of beef import
R ² = 0.9675		F _{stat} = 83.33*	DW = 1.4897		Dh = 1.1505

Variables	Parameter Estimation	Pr > t	Elasticity		Description of Variables
			Short run	Long run	
6. National beef demand (QDDS)					
Intercept	-7.2747	<.0001			
RHDS	-0.0095	0.0385	-0.7511	-	Real domestic beef price
RHDAY	0.0092	0.0621	0.3817	-	Real chicken price
GDP	0.1408	0.0007	0.6844	-	Non-oil GDP
D1	62.1068	0.0058			Dummy PSDSK 2014 policy
D2	-38.5104	0.0661			Dummy economic crisis
R ² = 0.8797		F _{stat} = 20.46*	DW = 2.5496		
7. Real domestic beef price (RHDS)					
Intercept	-8394.96	0.0383			
RHDSJ	0.755	<.0001	0.8571	0.9227	Real beef price in Jakarta
RHSM	2.124	0.0310	0.1781	0.1918	Real price of beef import
RNTR	0.314	0.1210	0.0868	0.0935	Real exchange rate
QSDS	-27.239	0.0051	-0.2727	-0.2936	Domestic beef production
QDDS	24.798	0.0189	0.3136	0.3376	Beef demand
T	226.560	0.0199			Trend
RHDS _{t-1}	0.071	0.2770			Lag of real domestic beef price
R ² = 0.9675		F _{stat} = 53.30*	DW = 2.3842		Dh = -1.0076
8. GDP of beef cattle (GDPSP)					
Intercept	-0.2523	0.4312			
QTS	3.1117	<.0001	0.8407	0.8928	Beef cattle production
MSBK	0.0114	0.0189	0.1308	0.1389	Imported feeder cattle
GDPSP _{t-1}	0.0584	0.3711			Lag of GDP of beef cattle
R ² = 0.7867		F _{stat} = 19.68*	DW = 2.2635		Dh = -0.9606
9. Employment in livestock subsector (DLP)					
Intercept	771.6793	0.1371			
RWP	-3.2432	0.0704	-0.3312	-0.9290	Real wage in livestock subsector
GDPP	47.8612	0.0144	0.4544	1.2747	GDP of livestock subsector
DLP _{t-1}	0.6435	0.0010			Lag of employment in livestock subsector
R ² = 0.7849		F _{stat} = 19.46*	DW = 2.2542		Dh = -0.8977

Note : * indicates 1 percent level of significance

Performance of beef cattle industry

The performance of beef cattle industry includes supply and demand for beef. Beef supply in the domestic market comes from local production and imports. Local beef production is the result of slaughter cattle that are raised in the country.

Cattle production (QTS) is the number of animals born alive in one year. Technology improvements through increased doses of Artificial Insemination (AI), additional productive cows through imported breeding cattle, and the increase in the volume of rainfall that will increase the availability of forage will increase the cattle production. The increase in cattle population in year $t-2$ tends to have a positive impact on the increase in cattle production, while the rising interest rates tend to reduce the production of cows cattle. But the effect of these two variables is not significant ($p>0.2$). Only a small portion of farmers i.e., smallholders cattle raisers, access bank for credit. However, interest rate variable is included in the equation because there is an interest rate subsidy program from the Government to support 2014 PSDSK – beef self sufficiency – policy.

The response of cattle production to changes in the volume of imported breeding cattle, IB dose, and the amount of rainfall is inelastic in the short run. According to Marsh (1994), the response of the production of big livestock, such as beef cattle, to technological changes takes a long time due to biological factors.

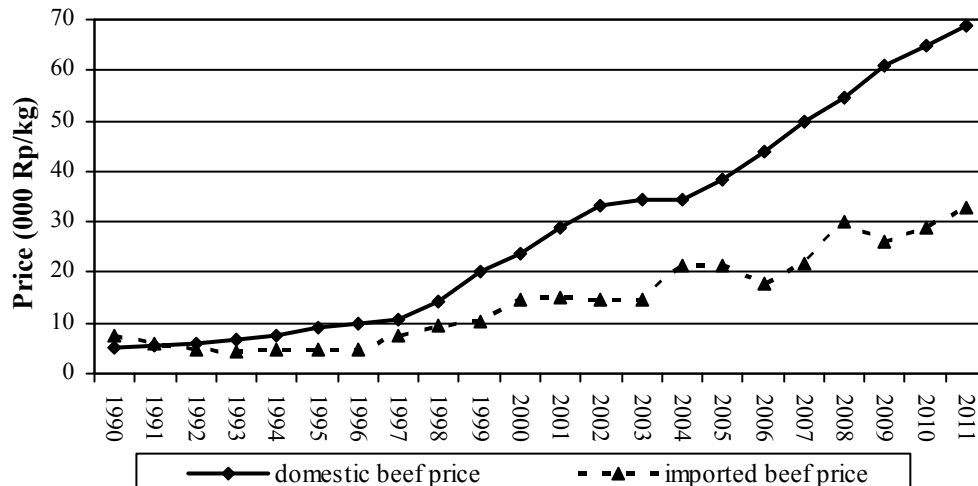
An increase in cattle production will encourage local beef production (QSDSL). Moreover, the increase in beef prices in the domestic market will also stimulate beef producers to increase their production. In contrast, the increase in the volume of imported beef will reduce local beef production. With the lower imported beef price, the local beef production could not compete with imported beef. The response of local beef production to changes in the domestic beef price, cattle production and beef imports is inelastic both in the short run and in the long run. PSDSK 2014 policy has positive effects to local beef production.

Cattle population (POPT) is affected by cattle production, total imported cattle, total beef production, and livestock population in the previous year. Increased cattle production and imported cattle will increase the cattle population, while the increase in beef production that reflects an increase in the number of the slaughtered cattle will reduce cattle population.

Indonesia's beef imports are in the form of feeder cattle and beef. The price of imported feeder cattle and the exchange rate negatively affect imported feeder cattle volumes (MSBK). The increase in price of imported feeder cattle followed by a depreciation of the rupiah as it happened during the economic crisis will lead to the increase in the price of feeder cattle in the domestic market and will decrease the volume of imported feeder cattle. Local beef production negatively affects the volume of imported feeder cattle. The increasing local beef production will reduce the excess demand for beef. This leads to the reduction of imported feeder cattle. In contrast, the increase in beef demand will increase the volume of imported feeder cattle. The increase in foreign tourists will increase the volume of imported feeder cattle. Most of the foreign tourists who come to Indonesia come from countries with higher beef per capita consumption than Indonesian (BPS, 2012). Thus, the increase of foreign tourists will increase the beef demand, especially from the hotel and restaurant business to support the tourism industry in Indonesia. With the lower growth rate of domestic cattle production, this will push the imported beef levels. The imported feeder cattle is one of the sources to meet the needs of domestic beef consumption. The PSDSK 2014 policy and economic crisis negatively affect the volume of imported feeder cattle. One operational step in this policy is setting stock feeder cattle through restrictions on imports to encourage domestic beef production.

The volume of beef imports (QDM) is affected by the local beef production, beef demand, and the volume of beef imports in the previous year. The increase in local beef production will reduce beef import volumes, while the increase in demand will increase the volume of beef imports. As a net importer country of beef, importing beef is a solution to close the gap between demand and domestic beef production. The response of beef imports to changes in local production and demand of beef in the short run and in the long run is elastic. The experience of imports in the previous year is used as a reference for the government to set import quotas for the next period.

Import price did not significantly affect the volume of beef imports. This condition indicates that import of beef in Indonesia is not only determined by the price of imported beef itself, but also by another factor i.e. a consumer demand to meet the needs resulting from the gap between supply and demand for beef in the country. Moreover, in the import process of beef there is a large government intervention in determining the import quota. Domestic prices are affected by supply and demand. Reduction in import quotas will encourage domestic production, thereby decreasing domestic prices. On the other hand, the increase in demand will increase domestic prices. On the other hand, the price of beef imports after being converted into rupiah was much lower than the price of local beef (Fig. 2). The greater the difference in price is an incentive for importers to import beef although the price goes up. This is because they have benefited from this activity. Thereby, beef imports tend to increase if additional import quota is approved by the government.



Source : BPS-Statistics (processed)

Fig. 2. Trend of Domestic Beef Price and Imported Beef Price in Indonesia, 1990 – 2011 (000 Rp/kg)

The national beef demand (QDDS) is influenced by domestic beef price, chicken meat price, non-oil GDP, PSDSK 2014 policy, and economic crisis. The increase in domestic beef prices will reduce beef demand. The economic crisis led to lower purchasing power, and this in turn will reduce beef demand. In contrast, the rise in chicken price will increase beef demand. This suggests that chicken is a substitute of beef. The increase in non-oil GDP will increase purchasing power, and this will increase beef demand. The response of beef demand to changes in the domestic beef price, chicken meat price, and non-oil GDP is inelastic in the short run. A study conducted by Hadi and Ilham (2002) also showed that beef demand is inelastic to own price changes. The PSDSK Policy 2014 is expected to encourage the production of local beef, decrease the domestic beef price, and increase income. These all together will increase beef demand.

The analysis result of domestic beef price (RHDS) shows that beef price in Jakarta, imported beef price, domestic beef demand, and the trend has a positive effect on the domestic beef price. Jakarta is the center of economic activity and the primary consumer of beef in Indonesia. Changes in beef prices in Jakarta will be transmitted to other regions in Indonesia, especially those with having a big influence on Indonesian beef prices. As a small country and a price taker, the rising prices of beef imports will be transmitted to the domestic market, thereby increasing domestic beef price. The increase in beef demand as a result of an increase in income or in population will increase the excess demand for beef, so beef price in the domestic market will increase. And conversely, the increase in domestic beef production will reduce the excess demand for beef, so prices will tend to decline.

Performance of livestock subsector

The assessment of livestock subsector performance is based on GDP and employment indicators. The GDP of livestock subsector is the total of beef cattle GDP and non-cattle GDP. Cattle production and imports of feeder cattle have positive effect on GDP of beef cattle (GDPSP). The increase in cattle production will increase the value-added of this commodity. Meanwhile, the process of fattening imported cattle will also obtain a value-added in the form of extra weight cattle. The increase in GDP of beef cattle will increase the GDP livestock subsector.

The increase in the livestock sector GDP reflecting the rising scale of livestock sector will increase demand for inputs required in the production process, including labor. The value of parameter estimation of 47.86 implies that if the GDP of livestock subsector rose by Rp. 1 trillion, *ceteris paribus*, the demand for labor would increase by 47.86 thousand people.

The rising wages negatively affect the demand for labor (DLP). The increase in labor costs would increase the marginal cost of production. In this case, the rational producer will reduce the use of labor input to obtain the maximum profit. The response of labor demand to changes in the wage rate is inelastic in both the short run and the long run.

Impact of Beef Import-quota Reduction

1) Model validation

The results of model validation show that most of equations have RMSPE values below 25 percent. This indicates the predicted values follow the historical trend of the data well. Most of the equations have a U-Theil values close to zero. Based on it's components, it seems that bias portion (UM) and variance portion (US) are close to zero, and covariance portion (UC) approaches one. Therefore, it can be said that the model can follow the actual data and it is quite valid for simulation. Model validation results are presented in Table 2.

Table 2. Model validation results

Variable	Description of Variables	RMSPE	Bias (UM)	Reg (UR)	Dist (UD)	Var (US)	Covar (UC)	U
QTS	Beef cattle production	20.67	0.07	0.02	0.92	0.05	0.88	0.074
MSBK	Imported feeder cattle	111.40	0.05	0.36	0.59	0.08	0.87	0.230
QSDSL	Local beef production	18.77	0.04	0.56	0.40	0.03	0.93	0.106
QDM	Beef imports	105.90	0.02	0.17	0.80	0.03	0.94	0.177
POPT	Beef cattle population	8.99	0.46	0.32	0.22	0.20	0.34	0.045
QDDS	Beef demand	7.28	0.02	0.28	0.70	0.52	0.46	0.042
RHDS	Domestic beef price	5.01	0.03	0.02	0.95	0.07	0.90	0.020
GDPSP	GDP of beef cattle	23.37	0.10	0.04	0.86	0.01	0.89	0.080
DLP	Employment in livestock subsector	13.63	0.03	0.00	0.97	0.07	0.90	0.057
QSM	Total beef imports	104.50	0.04	0.31	0.64	0.09	0.87	0.202
QSDS	Domestic beef production	15.01	0.03	0.52	0.45	0.00	0.96	0.085
GDPP	GDP of livestock subsector	5.92	0.10	0.16	0.74	0.09	0.81	0.025

2) Simulation results

The import quota reduction policy is intended to reduce the proportion of imported beef in the form of both imported feeder cattle and beef imports. Policy simulations are based on the targets stated in the road map of PSDSK 2014. It is stated that the number of imported feeder cattle will be reduced gradually from 520 thousand heads in 2010 to 175.4 thousand heads in 2014, or by an average of 23.8 percent per year, while the amount of beef imports will be reduced gradually from 120 thousand tons in 2010 to 23.3 thousand tons in 2014, or by an average of 33.6 percent per year (Ministry of Agriculture, 2012). The result of policy simulation through reducing import-quotas of feeder cattle and beef by 25 percent and 35 percent respectively during the period 2012–2021 is presented in Table 3.

Table 3. Impact of reduction import-quotas on feeder cattle by 25 percent and beef imports by 35 percent on performance of beef cattle industry and livestock subsector in Indonesia, 2012 – 2021 .

Variables	Description of Variables	Unit	Base Value	Simulation Value	Changes	
					Unit	%
QTS	Beef cattle production	million heads	4.70	4.09	-0.61	-12.95
MSBK	Imported feeder cattle	000 tons	180.40	135.30	-45.10	-25.00
QSDSL	Local beef production	000 tons	265.70	358.80	93.10	35.04
QDM	Beef imports	000 tons	57.66	37.48	-20.18	-35.00
POPT	Beef cattle population	million heads	24.13	18.73	-5.39	-22.35
QDDS	Beef demand	000 tons	396.00	464.40	68.40	17.27
RHDS	Domestic beef price	Rp/kg	29,955.50	29,242.00	-713.50	-2.38
GDPSP	GDP of beef cattle	trillion Rp	17.41	14.89	-2.53	-14.51
DLP	Employment in livestock subsector	000 peoples	5,354.50	5,114.40	-240.10	-4.48
QBM	Beef imports from imported feeder cattle	000 tons	64.39	48.30	-16.10	-25.00
QSM	Total beef imports	000 tons	122.10	85.78	-36.32	-29.75
QSDSM	Additional domestic beef production from imported feeder cattle	000 tons	26.16	19.62	-6.54	-25.00
QSDS	Domestic beef production	000 tons	291.80	378.40	86.60	29.68
EQDS	Excess demand of beef	000 tons	104.20	85.96	-18.24	-17.50
GDPP	GDP of livestock subsector	trillion Rp	49.44	46.91	-2.53	-5.11

If the feeder cattle and beef import quotas are reduced by 25 percent and 35 percent respectively, the average volume of imports of feeder cattle and beef will decline respectively by 45.1 thousand tons and 20.2 thousand tons, bringing total reduction of imports to 36.3 thousand tons (29.75 percent) per annum. The decrease in the volume of beef imports encourage an increase in local beef production by 35.04 percent, equivalent to 93.1 thousand tons, to replace imports in order to meet domestic needs. The increase in local beef production and the decline in feeder cattle imports resulted

in a decrease of 22.35 percent in cattle population. This led to the decrease in cattle production of 12.95 percent, equivalent to 0.61 million head per year.

On the other hand, the reduction of feeder cattle imports also reduced the beef production from the additional weight of imported feeder cattle amounting to 6.54 thousand tons. Therefore, the total domestic beef production increased by 86.6 thousand tons (29.68 percent) and this causes a decrease in the domestic beef price of 2.38 percent. As a result of the falling price, the national beef demand rose by 68.4 thousand tons (17.27 percent). As the increase in production was greater than that in domestic beef demand, the gap between demand and domestic production of beef decreased by 17.5 percent.

From the aspect of livestock subsector performance, the decrease in imported feeder cattle by 45.1 thousand tons and cattle production by 0.61 million head resulted in a decrease in the GDP of beef cattle by 14.51 percent or about Rp. 2.53 trillion. As a result, the value of livestock sub-sector GDP dropped 11 per cent, while employment in the livestock sub-sector fell by 4.48 percent, equivalent by 5 to 240.1 thousand people.

Projection of Production and Consumption of Beef

The projection of national demand and production of beef is obtained from econometric models that have been constructed previously. The projection is done to see the extent to which domestic beef production meets domestic consumption. The impact of reduction of imported feeder cattle and beef import on the demand and production of beef during the period 2012–2021 is presented in Table 4.

Table 4. Impact of reduction import-quotas on feeder cattle and beef on production and demand of beef in Indonesia, 2012 – 2021

Year	Beef Demand (000 tons)	Domestic Beef Production			
		Simulation A		Simulation B	
		(000 tons)	% ¹⁾	(000 tons)	% ¹⁾
2012	441.29	337.24	76.42	337.24	76.42
2013	453.94	374.49	82.50	374.50	82.50
2014	457.07	353.55	77.35	362.12	79.23
2015	460.97	366.05	79.41	373.47	81.02
2016	463.91	366.86	79.08	375.35	80.91
2017	466.90	369.19	79.07	378.67	81.10
2018	473.45	388.23	82.00	398.63	84.20
2019	476.08	389.24	81.76	400.85	84.20
2020	484.10	413.84	85.49	426.80	88.16
2021	490.42	425.48	86.76	439.98	89.71

Note : ¹⁾ = percent to beef demand

Simulation A : imported feeder cattle decrease by 25% and beef import decrease by 35%

Simulation B : imported feeder cattle decrease by 25%, beef import decrease by 35% and doses AI increase by 25%

In 2014, domestic beef production would not be able to meet the national demand. Beef consumption in 2014 is expected to reach about 457.07 thousand tons, while domestic beef production

is estimated to be around 353.55 thousand tons. Thus, domestic production can only meet about 77.35 percent of the beef demand, so that the rest of 22.65 percent is expected to be met from imports. The government is targeting to achieve beef self-sufficiency in 2014, in which the national beef production is able to meet the minimum 90 percent of the national beef consumption.

The projection calculated until 2021 shows that the national beef production would not be able to meet the needs of national consumption. The beef consumption in 2021 is expected to reach around 490.42 thousand tons, while domestic production is predicted to be around 425.48 thousand tons. Therefore, domestic production would only meet about 86.76 percent of the domestic demand.

If the reduction in import-quotas is followed by technology improvements through increased doses of Artificial Insemination (AI) by 25 percent (Simulation B), then the domestic beef production will increase more. Domestic beef production reached 362.12 thousand tonnes (79.23 percent) in 2014 and 439.98 thousand tonnes (89.71 percent) in 2021. Improved technology will encourage the performance of beef cattle industry with increase of beef cattle production and beef cattle population, so it will increase the supply of cattle and local beef. In the long run, the import restriction policies followed by technology improvement will accelerate the achievement of beef self-sufficiency in Indonesia.

CONCLUSION AND POLICY IMPLICATION

Self-sufficiency policy implementation through reduction in import quota on feeder cattle and beef imports will encourage local beef production and reduce the domestic beef price. However, the increase in local beef production and the decrease in imports of feeder cattle could lead to the decrease in cattle population. This, in turn, could reduce the production of beef cattle. The decline in beef price would lead to the rising beef demand. The increase in domestic beef production is greater than the increase in beef demand so that the excess demand decreases. The decrease in the production of beef cattle and imported feeder cattle will reduce GDP of beef cattle and GDP of livestock subsector. As a result, employment in the livestock subsector will also decrease.

With the decline on imported feeder cattle by 25 percent and beef imports by 35 percent per year, Indonesia has not been able to achieve beef self-sufficiency in 2021. Import restriction policies followed by technology improvement will accelerate the achievement of beef self-sufficiency in Indonesia.

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