Is a Beef Deficiency Payment Pareto-Superior in South Korea?

Gerald C. Nelson and Yong Kee Lee

South Korea uses a quota and a tariff on beef imports to keep farm prices high. Part of the quota rents are used to support indirect benefits to producers. The welfare costs of these policies are analyzed. Following a suggestion of Hayami, a deficiency payment financed by tariff revenues from increased imports is considered as an alternative to the quota. As Anderson (1983) found for Japan, a deficiency payment is Pareto-superior only if indirect benefits from the quota revenue are ignored.

Key words: South Korea, Pareto-efficiency, deficiency payments, beef imports.

In the latter half of the 1980s the U.S. began applying pressure for more liberal trade policies to countries with large trade surpluses with the U.S., and South Korea was one of the prime targets. South Korean beef import restrictions, which are designed to raise domestic prices to support farm incomes, were singled out for attention. However, South Korean beef producers have been violently opposed to any policy change which would lower their incomes. For South Korean policy makers, a highly desirable policy change would be one that could maintain beef producer incomes, provide consumers with cheaper beef by allowing more imports, and not raise government expenditures.

South Korean import restrictions on beef are similar to those of Japan, so an exchange of ideas in the *American Journal of Agricultural Economics* in 1979 and 1983 about the possibility of a Pareto-superior liberalization of Japanese beef imports is of interest. Hayami argued that the Japanese beef quota could be replaced with a deficiency payment set to keep the effective producer price constant. The cost of the deficiency payment could be met with levy revenue from increased imports. The consumer price could be lowered substantially and imports increased dramatically. However, Anderson (1983) argued that the analysis for this apparently Pareto-superior policy choice ignored some of the current beneficiaries of the quota rents and the levy revenues. When transfers to these beneficiaries were included in the analysis, it was no longer clear that the deficiency payment approach was Pareto-superior.

As in Japan, South Korea imposes a beef import quota of varying amounts (including zero) and an import tariff of 25% (until 1987 when it was lowered to 20%). The tariff revenue becomes part of general revenue, but the remaining quota rent is captured by the National Livestock Cooperatives Federation (NLCF) which is in charge of purchasing beef on the world market and selling it in the domestic market.[1] The profits are accumulated in the Livestock Development Fund (LDF) and used to provide indirect support to livestock producers. We examine the welfare costs of the quota system and their distribution throughout the economy. Second, we follow Anderson's approach and examine the direct and indirect effects of a deficiency payment scheme which keeps the producer price constant and at the same time does not increase net government expenditures (see Anderson 1986 which reports the results from Anderson

The authors are an assistant professor and a Ph.D. candidate, respectively, Department of Agricultural Economics, University of Illinois, Urbana–Champaign.

They thank David Bullock and Steven Schmidt for valuable comments on the second author's thesis from which this article is drawn. Any remaining errors are the authors' responsibility.

[1] The National Livestock Cooperatives Federation became the Livestock Product Marketing Organization in the late 1980s. We use the earlier name in this article because the analysis is based on data from the earlier period.

Western Journal of Agricultural Economics, 16(1): 106–118

1983 and compares them with a brief analysis for South Korea). Within those constraints, we examine various options for the consumer price level and the benefits from LDF expenditures.

The Livestock Sector in South Korea

With rapid economic growth, South Korean meat consumption has increased relative to cereals. Of the various meats, fish and pork are the most important, but consumption of beef and poultry has grown in recent years (table 1). Total beef consumption rose nearly sixfold from 1965 to 1987, increasing at an average annual rate of 8.1%, and reached 152,000 metric tons (mt) in 1987. The positive effect of income growth, together with a strong consumption preference for meat products, has outweighed the negative effect of a rising beef price. However, with per capita consumption of 3.6 kilograms (kg) in 1987, beef consumption in South Korea is still small compared to the U.S. and to neighboring countries such as Japan and Hong Kong.

The total number of cattle, including native[2] and dairy cattle, has steadily increased at an average annual rate of 2.7%, from 1.3 million head in 1965 to 2.4 million head in 1987. Native cattle, which made up over 80% of the beef herd in 1987 and are the main source of beef in South Korea, grew 1.7% during the same period. However, the domestic supply of beef has not kept pace with increasing demand. Limited availability of feedstuffs and land and small farm size have all acted as constraints. Since almost all arable land is devoted to growing food grains, there has been a shortage of land for pasture and fodder crops. In addition, South Korean beef production is based primarily on small-scale cattle raising which is generally carried out as a supplementary activity to grain production, using unimproved hillsides, riverbank grass, or farm byproducts. As a result, most cattle probably receive little commercial feedstuffs, although statistics to document this are not available. Ninety-three percent of farmers raising less than five head of native cattle accounted for almost two thirds of total native cattle. Average herd size per farm was only 2.3 head as of the end of 1987.

Table 1. Total Beef Consumption (Metric Tons) and Per Capita Livestock Consumption (Kilograms)

Year	Total Beef Consumption	Per Capita Consumption of			
		Beef	Pork	Poultry	Fish[a]
1965	27,261	1.0	1.9	.5	20.6
1970	37,340	1.2	2.6	1.4	24.1
1975	70,292	2.0	2.8	1.6	44.3
1980	99,974	2.6	6.3	2.4	46.0
1985	120,342	2.9	8.4	3.1	57.9
1987	151,926	3.6	8.8	3.3	56.3

Sources: For beef, pork, and poultry, the National Livestock Cooperatives Federation, the Ministry of Agriculture, Forestry, and Fisheries, and Shin; for fish, Hayes, Ahn, and Baumel.
[a] Includes fresh fish, dried fish, and sea plants.

Imports and Protection Policy[3]

Imports of beef into South Korea for general consumption were prohibited before 1976. Because of a rapid increase in demand for beef and an improvement in the balance of payments, beginning in 1976 beef imports were allowed but limited by a quota. Imports were suspended in 1980 because of a decrease in the demand for beef and a sharp deterioration in the balance of payments, both associated with a recession in the overall South Korean economy. Along with economic recovery in 1981, beef imports again were permitted. But due to a weakened demand for beef and a significant decline in domestic cattle prices beginning in 1984, the government once more suspended beef imports in order to stop a further decline in cattle prices. As the balance of payments improved and pressure for agricultural trade liberalization strengthened, limited beef imports resumed in 1988.

Beef imports are subject to an import quota the size of which is determined by estimating the difference between expected consumption and production at the existing market price during a given year. If there appears to be a

[2] The cattle herd is classified into three broad categories—native, beef, and dairy. All categories are used for meat, but beef cattle, of which there are few, are raised exclusively for meat. The number of dairy cattle has increased very rapidly since the early 1970s. Native cattle traditionally have been kept by most South Korean farms as draft animals and are one of the most valuable assets for farmers. In general, Koreans prefer the taste of native beef.

[3] This section draws heavily on Shin and Williams, and Johns. See also Jones and Dyck for recent information.

Table 2. Status of Agricultural and Livestock Sectors in the South Korean Economy

	1970	1975	1980	1983	1985	1987
Share of Agriculture[a] in			(%)			
GDP	26.5	24.4	14.6	13.6	13.8	11.5
Population	48.3	40.0	30.6	25.6	22.5	20.0
Labor force	50.4	45.9	34.0	29.7	24.9	21.9
Share of Livestock in						
Agricultural Production Value	7.9	6.2	8.1	14.0	9.7	8.5
Farm Household Income	5.6	7.4	12.1	25.4	17.0	15.8
Percentage of Cattle-Raising Farms	–	54.1	47.3	50.1	56.6	47.7

Sources: The Ministry of Agriculture, Forestry, and Fisheries; the National Livestock Cooperatives Federation.
[a] Includes forestry and fisheries sectors.

production shortfall, the government can import directly or give approval to a firm or a person who applies for an import permit. However, the NLCF, a quasi-governmental organization, actually is given responsibility for all beef importation used for local consumption. The NLCF also is empowered to buy, sell, and stockpile beef to stabilize the domestic price of beef within an economically and politically acceptable stabilization band. Revenues of the NLCF are derived from purchasing beef on the world market at the world price (plus the tariff described below) and selling the beef in the domestic market at wholesale prices set by the NLCF. Net revenues are accumulated in the LDF and used to provide indirect support to livestock producers through various activities such as a livestock improvement and breeding program, dairy products promotion, storage of livestock products, development of pasture land, improvement of the livestock marketing system, research for livestock development, and provision of technical extension services.

In addition to the quota, an import tax is applied. The ad valorem tariff rate on beef imports is 30%, but the lower GATT concession tariff rates are applied to GATT-member countries. This rate was 25% before 1987 and 20% afterwards.

Rationale for Intervention

A central goal of South Korea's agricultural policies has been to increase farm incomes to narrow the disparity with nonfarm income. While 20% of the total population is engaged in agricultural production, only 11.5% of national income is produced in the agricultural sector. South Korean farm size is very small; the cultivated area per farm averages only 1.1 hectares. With high livestock prices caused by import restrictions, livestock production has become attractive to farmers as an income source. The share of livestock in total farm household income increased from 5.6% in 1970 to a peak of 25.4% in 1983 before declining to 15.8% in 1987 (table 2).

Benefits and Costs of the Beef Import Quota

In estimating the benefits and costs arising from the beef imports quota in South Korea, a traditional Marshallian partial equilibrium model is employed, with linear demand and supply functions. The assumptions of Marshallian welfare analysis lead to the definition of social cost as the loss in consumer and producer surplus caused by departures from competitive equilibrium. Thus, if we assume a Hicksian compensated demand curve,[4] consumer surplus is the area under the demand curve above the equilibrium price. Producer surplus is the area above the supply curve below the equilibrium price. The supply curve is assumed to measure the opportunity cost of the resources used to produce that commodity.[5]

[4] If the income effect of the price change is zero, this assumption is not necessary, because the ordinary demand curve and the Hicksian compensated demand curve coincide. See Just, Hueth, and Schmitz for an extended discussion of welfare measures.

[5] By ignoring marketing costs and using demand (supply) price elasticities at the retail (farm) level and prices at the wholesale level, we introduce some bias in our welfare measures. However, the extent of the bias depends on the actual shape of the curves relative to the assumed linear curves and the degree to which prices shift away from the current level. We also introduce some bias because the elasticity estimates from which we chose our parameters are based on functional forms other than linear.

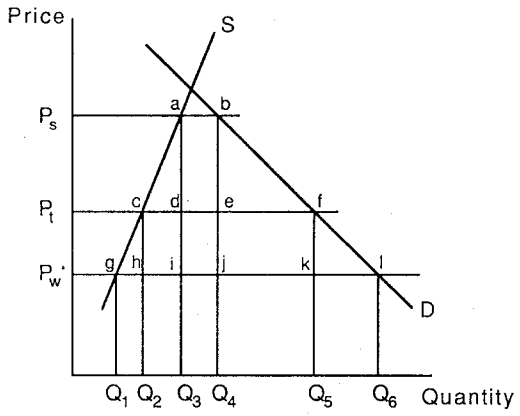

Figure 1. The South Korean beef market

The partial equilibrium effects of South Korea's current import quota scheme and import tax can be seen in figure 1. D and S represent domestic demand and supply functions for beef, both of which are linear approximations of the actual curvilinear functions. The world supply of beef is assumed to be perfectly elastic (the small country assumption) at the world price, P_w. Imports are restricted to the quantity Q_3 Q_4, so that the domestic support price is maintained at a level P_s, higher than world price, P_w. Marketing costs are assumed to be zero, so producer and consumer prices are identical. At price P_s, Q_3 is domestically produced and the quota Q_3 Q_4 is imported to meet domestic demand, Q_4. P_t is determined by adding the ad valorem tariff to the world price. From the current import quota scheme, total rent of area a b j i accrues. Of this, the amount d e j i accrues to the government treasury as tariff revenue, and the remaining, area a b e d, which comes from the import quota, is transferred to the LDF and spent on indirect support for livestock sector development.

Two trapezoidal areas, a c h i and b j k f, represent the social costs due to the import quota scheme (assuming that the tariff is already in place). The production efficiency loss from both the tariff and import quota, the triangle a g i, is the difference between the resource cost of domestic production stimulated by the quota, Q_1 g a Q_3, and the opportunity cost, Q_1 g i Q_3. The production efficiency loss from the imposition of the tariff alone is c g h. Thus, the area a c h i is the net production efficiency loss caused by the import quota. Analogous consumer distortion losses also are generated.

The changes in benefit and cost associated with the removal of the import quota can be measured in terms of point estimates of price elasticities of demand and supply and initial prices and quantities as follows. Following Anderson (1983), r stands for the proportional change in domestic price when the quota scheme is removed, i.e., $r = (P_s - P_t)/P_s$, and e_D and e_S are the price elasticities of demand and supply, respectively, at observed prices and quantities:

$$\Delta S = Q_2 - Q_3 = -re_SQ_3, \tag{1}$$

$$\Delta C = Q_5 - Q_4 = -re_DQ_4, \tag{2}$$

and

$$\Delta M = \Delta C - \Delta S = r(e_SQ_3 - e_DQ_4), \tag{3}$$

where ΔS, ΔC, and ΔM denote changes in production, consumption, and imports, respectively, caused by removal of the quota.

From these basic equations the effects of the elimination of the quota (but retention of the import tax) on producer welfare, consumer welfare, and government revenue can be obtained as follows:

$$\Delta W_p = \text{area } P_s\,a\,c\,P_t = -rP_sQ_3\left(1 - \tfrac{1}{2}re_S\right), \tag{4}$$

$$\Delta W_c = \text{area } P_s\,b\,f\,P_t = rP_sQ_4\left(1 - \tfrac{1}{2}re_D\right), \tag{5}$$

and

$$\begin{aligned}\Delta W_g &= \text{area } c\,f\,k\,h - a\,b\,j\,i \\ &= (P_t - P_s)(Q_4 - Q_3) \\ &\quad - r(P_t - P_w)(e_DQ_4 - e_SQ_3),\end{aligned} \tag{6}$$

where ΔW_p, ΔW_c, and ΔW_g are changes in producer and consumer welfare and change in government revenue, respectively. When the domestic price decreases, ΔW_p and ΔW_c are unambiguously negative and positive, respectively, but ΔW_g is indeterminate. The change in government revenue is affected by both demand and supply elasticities. If the absolute values of the demand and supply elasticities are large enough so that the value of the second term in the right side of equation (6) exceeds that of the first term which is always negative, ΔW_g is positive, and vice versa. As shown in equations (4) and (5), the welfare effect on producers is greater the smaller the price elasticity of supply while the consumer welfare effect is greater the larger the demand elasticity in ab-

solute value. The change in government revenue becomes greater the larger the absolute value of the demand and supply elasticities, *ceteris paribus*. Net social welfare change is derived by adding up equations (4), (5), and (6).

The net social welfare change from eliminating the quota (but retaining the tariff) also can be expressed in terms of deadweight loss as follows:

$$(7) \quad DW_P = \text{area } a\ c\ h\ i = \tfrac{1}{2} r e_S Q_3 (P_s + P_t - 2P_w)$$

and

$$(8) \quad DW_C = \text{area } b\ j\ k\ f = -\tfrac{1}{2} r e_D Q_4 (P_s + P_t - 2P_w),$$

where DW_P and DW_C are the reductions of production efficiency loss and consumption distortion loss from the removal of the import quota, respectively, which depend on the difference between P_s and P_t and supply and demand elasticities, *ceteris paribus*.

The sum of DW_P and DW_C is equal to the sum of three components—producer welfare changes, consumer welfare changes, and the change in government revenue. Thus, the formula of the net social welfare change is as follows:

$$(9) \quad \begin{aligned} \Delta W_s &= \Delta W_p + \Delta W_c + \Delta W_g \\ &= DW_P + DW_C \\ &= \tfrac{1}{2} r (P_s + P_t - 2P_w)(e_S Q_3 - e_D Q_4). \end{aligned}$$

The larger the demand and supply elasticities and r, (the price difference between P_s and P_t), the greater the net social welfare gain from eliminating the quota.

The data used to generate the results are found in the appendix. The parameter which caused the most difficulty was the supply elasticity because of the wide variance in empirical estimates. As a result we use two supply elasticities—1.12 (Case I) and .44 (Case II)—that reflect the range of estimates.

The effects of removing the import quota for beef on production, consumption, and imports are shown in table 3. The effects on welfare are presented in table 4.[6] In Case I, production declines by 57.2% to 30,800 mt, while consumption increases by 50.5% to 161,000 mt, and thus self-sufficiency drops sharply from 67.2% to 19.1%. Consumer surplus increases to $571.7 million, and the losses of producer surplus and the government revenue decline to $219.2 and $71.7 million, respectively, so that the net welfare gain is $280.8 million. In Case II, producer loss is greater and therefore net welfare gain is smaller because the supply elasticity is smaller. In both cases government revenue decreases even though imports increase.

Table 3. Average Annual Effects of Removing the Beef Import Quota on Production, Consumption, and Imports

	Production	Consumption	Imports	Self-Sufficiency
	(000 mt)			(%)
Baseline	71.9	107.0	35.1	67.2
Case I	30.8	161.0	130.2	19.1
Case II	55.8	161.0	105.2	34.7

Source: Own calculations; see appendix.
Note: Case I: $e_S = 1.12$; Case II: $e_S = .44$; in both cases, $e_D = .99$; mt = metric tons; averages are for 1981–84.

Effect on Income Redistribution

The welfare analysis above ignores the possibility of differing social welfare weights for market participants. But a major reason for the beef import policies is to redistribute income in favor of farmers. Table 5 shows to what extent the removal of the beef import quota would reduce producer income in South Korea. In Case II, with an inelastic supply response, the loss of producer surplus of $2.9 million amounts to approximately 2.2% of total agricultural value added.[7] The annual loss per cattle-raising farm is about $281 or 5.9% of farm income. In Case I, with an elastic supply response, the income effects are somewhat smaller.

[6] Note that cross-price effects are ignored. Koo and Watt estimate cross-price elasticities with respect to pork and poultry of .29 and 1.17, respectively. The poultry cross-price elasticity seems implausible. However, assuming it is correct, and using Case I parameters, pork consumption would decline by 40,000 mt (14.8%) and poultry consumption by 63,800 mt (59.7%) if the beef import quota were removed. The corresponding increase in beef consumption would be 54,000 mt. These numbers should be viewed with a great deal of caution.

[7] If cross-price effects were considered and farms raising beef, poultry, and pork were identical, the negative impact on farm incomes would be even larger.

Table 4. Average Annual Estimated Welfare Effects of Removing the Beef Import Quota ($ million)

	ΔW_p	ΔW_c	ΔW_g	DW_P	DW_C	ΔW_s
Case I	−219.2	571.7	−71.7	121.3	159.5	280.8
Case II	−272.4	571.7	−92.2	47.7	159.5	207.2

Source: Own calculations; see appendix.
Note: Case I: $e_S = 1.12$; Case II: $e_S = .44$. W = welfare change; subscripts p, c, and g stand for producer, consumer, and government, respectively. DW is reduction in deadweight loss. The exchange rate used to convert from won to dollars in this and all following tables was 748.6. $\Delta W_p + \Delta W_c + \Delta W_g = DW_P + DW_C = \Delta W_s$. Averages are for 1981–84. Numbers may not sum due to rounding.

If we consider producer benefits from indirect support such as research, extension service, improvement of breed and other technological assistance, which is supported by the quota rent from beef imports, the impact on producers' income would be much larger. About $149.7 million of quota rent would be lost if the beef import quota scheme were dropped. On the assumption that all the preexisting import quota rents have been used to increase the cattle-raising farm income directly and/or indirectly, per farm loss increases to about $436 in Case II or over 9% of farm income (table 6).

The income redistribution effects of the beef import quota scheme between producers and consumers are shown in table 7. Per capita producer welfare change is calculated by dividing total producer welfare change by the population of cattle-raising farms. Per capita change in consumer welfare is computed in the same manner using the total population. For Case II, per capita producer loss amounts to $59 while per capita consumer gain is about $14. These estimates of consumer welfare change are bigger than those found by Anderson (1981) for South Korea, while the producer welfare changes are similar (table 8). It should be noted that Anderson's results are based on removing both the quota and tariff while this study analyzes the effects of removing only the quota. Thus, with the beef import quota scheme each producer gains about four times as much as the amount each consumer loses on average, even though total producer welfare gain is only about half of total consumer welfare loss.[8]

Analysis of Deficiency Payment Schemes with Alternate Objectives

Liberalization of trade in beef without some additional policy change will result in a decline in the domestic beef price with a negative effect on farm incomes in South Korea. The first-best policy instrument to support farm incomes—a direct income transfer—is likely to be politically unacceptable because of its additional burden on the government's budget, even assuming no implementation cost. However, given an appropriate constellation of parameters, it is theoretically possible that a deficiency payment scheme similar to that proposed for Japan by Hayami could permit lower consumer prices and increased imports without reducing producer income and without drawing on general tax revenue. We follow the general approach of Anderson (1983) and

[8] Farmers also consume beef, and a decline in the beef price would reduce their consumption expenditures and partially offset the loss in income. However, the consumption effect is likely to be small for most farmers as their income is less than their urban counterparts and the income elasticity for beef is large.

Table 5. Average Annual Impact of Removal of the Beef Import Quota on Farm Income

	Unit	Case I	Case II
Change in Producer Welfare	$ million	−2.4	−2.9
Share of Producer Loss in Agricultural Value Added[a]	%	1.76	2.19
Per Farm Loss	$	−226.4	−281.3
Share of Loss in Farm Income Per Farm	%	4.75	5.90

Source: Own calculations; see appendix.
Note: Case I: $e_S = 1.12$; Case II: $e_S = .44$; averages are for 1981–84.
[a] Includes forestry and fisheries sectors.

Table 6. Average Annual Adjusted Impact of Removal of the Beef Import Quota on Farm Income

	Unit	Case I	Case II
Change in Producer Welfare	$ million	−219.2	−272.4
Loss in Quota Rent	$ million	−149.7	−149.7
Per Farm Loss	$	−381.1	−436.0
Share of Per Farm Loss in Farm Income	%	7.99	9.14

Source: Own calculations; see appendix.
Note: Case I: $e_S = 1.12$; Case II: $e_S = .44$; averages are for 1981–84.

examine effects of various types of deficiency payment programs. All options keep the producer price at its current level so that producer welfare is unchanged and finance the deficiency payments from the increased tax revenues from imports.

Figure 2 is basically the same as figure 1 except that P_c—the new policy variable—is added. To meet the policy goal of supporting producer income, the domestic producer support price, P_s, and domestic production, Q_1, are fixed at current levels. The import quota is initially $Q_1\ Q_2$ so that the domestic consumption is at point b. The total government import revenue, $a\ b\ j\ i$, consists of tariff revenue, $f\ g\ j\ i$, and the NLCF's profits, $a\ b\ g\ f$, which are accumulated in the LDF.

For any choice of P_c, given P_s, consumer welfare increases by the area $P_s\ b\ e\ P_c$ while producer welfare remains unchanged. The change in government revenue from trade is the difference between two rectangular areas, $c\ e\ k\ i$ minus $a\ b\ j\ i$. In addition, the subsidy payment to compensate for the price difference is $P_s\ a\ c\ P_c$. Thus, the net social welfare gain from the new policy will be the area $b\ e\ k\ j$. The lower the P_c, the larger the net social welfare gain. But since P_s is fixed and the price difference between P_s and P_c is to be subsidized, the increase in net social welfare is much smaller than in the case of no support price.

We denote the new government import revenue ($c\ e\ k\ i$) by G_1, the initial government import revenue ($a\ b\ j\ i$) by G_0, and the deficiency payment ($P_s\ a\ c\ P_c$) by S. $v(=(P_s - P_c)/P_s)$ is a policy variable representing a proportional reduction in domestic consumer price from P_s and varies from zero to $(P_s - P_t)/P_s$. We can express G_1, G_0, and S as functions of v as follows:

$$G_1 = G_{t1} + N_{p1} = \text{area } c\ e\ k\ i$$
$$= P_s Q_2 e_D v^2 - [mQ_2 e_D + P_s(Q_2 - Q_1)]v + m(Q_2 - Q_1), \tag{10}$$

$$G_0 = G_{t0} + N_{p0} = \text{area } a\ b\ j\ i$$
$$= m(Q_2 - Q_1), \tag{11}$$

$$S = \text{area } P_s\ a\ c\ P_c$$
$$= P_s Q_1 v, \tag{12}$$

and

$$\Delta G = \Delta G_t + \Delta N_p, \tag{13}$$

where $m = P_s - P_w$, G_t represents government tariff revenue, and N_p is NLCF's profits from the difference between domestic and import prices. Government revenue, G, is composed

Table 7. Average Annual Income Redistribution Effects of the Quota

	Change in Producer Welfare		Change in Consumer Welfare			
	Total (A)	Per Capita[b] (B)	Total (C)	Per Capita (D)	(A)/(C)[a]	(B)/(D)[a]
	$ million	$	$ million	$		
Case I	−219.2	−47.4	571.7	14.4	0.38	3.29
Case II	−272.4	−59.0	571.7	14.4	0.48	4.10

Source: Own calculations; see appendix.
Note: Case I: $e_S = 1.12$; Case II: $e_S = .44$; averages are for 1981–84; numbers may not sum due to rounding.
[a] Absolute value.
[b] Average number of persons per cattle-raising farm is assumed to be 4.77 during 1981–84.

Table 8. Average Annual Estimates of Consumer and Producer Welfare Effects from Beef Trade Liberalization

	Unit	This Study Case II[a]	Anderson (1981) Results
Change in Producer Welfare			
Total	$ million	−272.4	−244.3
Per Capita[b]	$	−59.0	−40.5
Change in Consumer Welfare			
Total	$ million	571.7	497.2
Per Capita	$	14.4	14.0

[a] See table 7.
[b] Per cattle-raising family member.

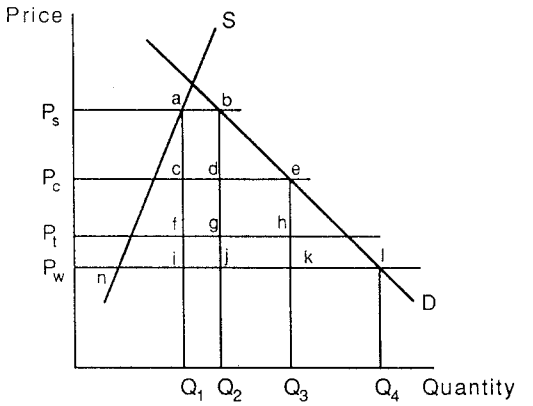

Figure 2. Policy options in the South Korean beef market

of tariff revenue, G_t, and NLCF profits, N_p. A zero subscript indicates the initial state, a one subscript the new state. G_1 is a quadratic equation in v, G_0 is constant, and S increases monotonically with v. It is also clear that G_1 is directly influenced by the price elasticity of demand, e_D, but is independent of the supply elasticity.

The larger the v, the greater is the welfare gain (the trapezoid $b\ e\ k\ j$). How large v can be increased depends on which policy option is adopted. The important constraint influencing policy options is that no additional government expenditure is allowed. The other factor to be considered in choosing the policy options is how to deal with the preexisting producers' indirect support from NLCF's quota rent, area $a\ b\ g\ f$ in figure 2. The more this indirect support is reduced, the more flexible the policy options.

The policy options examined are: (*a*) increase v (the proportional reduction in consumer price) so as to maximize government revenue from imports, G_1; (*b*) increase v to the extent that government revenue is just equal to the deficiency payment, $G_1 = S$; (*c*) increase v to maximize net government revenue, $G_1 - S$; and (*d*) increase v until the point where G_1 covers not only S but also G_0 or $\Delta N_p = N_{p1} - N_{p0} = 0$. In other words, the indirect producers' benefits from N_{p0} are continued. Note that only one option (*d*) ensures Pareto-superiority, while option (*c*) is Pareto-superior if the recipients of indirect support are not counted.

Figures 3a and 3b illustrate the options graphically. Figure 3a represents the case where the demand elasticity is large enough [$|e_D| > P_s/(P_s - P_w)$] that the government revenue curve, G_1, crosses $S + G_0$ [and options (*c*) and (*d*) are feasible], while figure 3b shows the case where the government revenue curve lies below $S + G_0$. $G_1 = G_0$ when v is zero at the intercept of $m(Q_2 - Q_1)$, which is initial government import revenue. At points *a*, *b*, and *c*, the options (*a*), (*b*), and (*c*) are satisfied, respectively, and point *d*, where $G_1 = S + G_0$, satisfies option (*d*). Option (*b*) guarantees the biggest reduction of domestic consumer price, and therefore the largest net social welfare gains of the four policy alternatives, and option (*c*) generates the smallest price reduction policy.

For option (*a*) [maximum government import revenue (G_1)], the solution is to set the first derivative of function G_1 with respect to v at zero and solve for v:

$$(14) \qquad v_a = \frac{1}{2}\left[\frac{P_s - P_w}{P_s} + \frac{1}{e_D}\left(1 - \frac{Q_1}{Q_2}\right)\right].$$

The second-order condition for a maximum is satisfied, that is, $\frac{d^2G_1}{dv^2} = 2P_sQ_2e_D < 0$, so that v_a generates maximum import revenue. The bigger the difference between the domestic producer price and the world price, and the greater the price elasticity of demand in absolute value, the larger the v_a. Also, the larger the current quota amount, i.e., the smaller the ratio of production to consumption (Q_1/Q_2), the smaller is v_a.

For policy option (*b*), v is chosen to set government revenue equal to the deficiency payment. In this case no indirect benefits are possible. The solution for v in this case is obtained

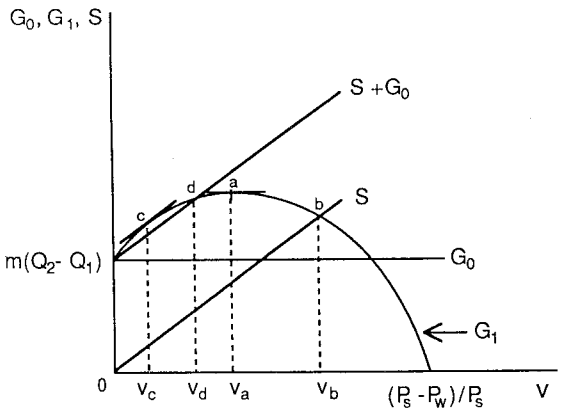

Figure 3a. Comparison of four policy options, $e_D > P_s/(P_s - P_w)$

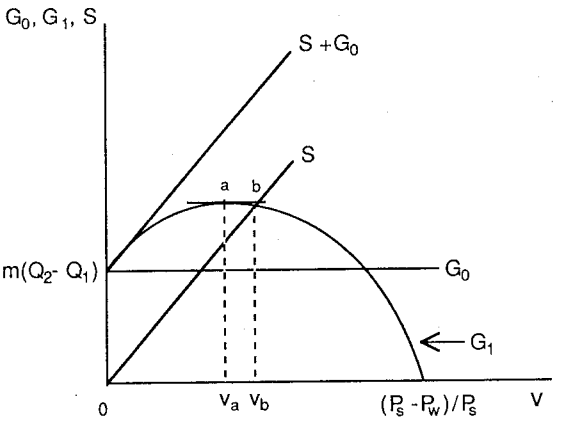

Figure 3b. Comparison of four policy options, $e_D < P_s/(P_s - P_w)$

by solving the quadratic equation that results from setting equation (10) equal to equation (12). The positive root of v_b is chosen:

$$(15)\quad v_b = (me_D + P_s)Q_2 - [(me_D + P_s)^2Q_2^2 - 4P_sQ_2e_Dm(Q_2 - Q_1)]^{1/2} \div 2P_sQ_2e_D .$$

For policy option (*c*), v is chosen to maximize net government revenue ($G_1 - S$). The solution for v is obtained by taking the first derivative of $G_1 - S$ with respect to v and setting it equal to zero:

$$(16)\quad v_c = \frac{1}{2}\left(\frac{P_s - P_w}{P_s} + \frac{1}{e_D}\right).$$

For positive v_c, $|e_D| > P_s/(P_s - P_w)$; an equivalent condition is that the demand curve be elastic at Q_2.

For policy option (*d*), the domestic consumer price can be reduced ($v_d > 0$) only when the increase in government revenue is sufficient to cover the deficiency payment. The original tariff and quota revenue are assumed to be spent on indirect support activities which continue at the same level. The solution for v_d is obtained by setting $\Delta G_t = G_1 - G_0 - S$ and $\Delta N_p = 0$ in (13). That is,

$$\Delta G = \Delta G_t + \Delta N_p = G_1 - G_0 - S.$$

The solution is

$$(17)\quad v_d = 1 + \frac{1}{e_D} - \frac{P_w(1 + t)}{P_s}.$$

v_d is greater than zero [and option (*d*) is feasible] only when $|e_D| > P_s/(P_s - P_t)$. If ΔG_t is also zero so that $G_1 = G_0 + S$, then the solution for v_d becomes:

$$(17')\quad v'_d = 1 + \frac{1}{e_D} - \frac{P_w}{P_s}.$$

Empirical Analysis of Deficiency Payment Options

Of the four possible policy options, options (*c*) and (*d*), and therefore any Pareto-superior outcome, are not possible because the demand elasticity is not large enough. Given domestic and world prices, the consumer price can be reduced, compensating for subsidy payment costs and without reducing indirect benefits from the preexisting quota rent, only if $|e_D| > 1.64$.

Both options (*a*) and (*b*) are feasible (table 9); v_a is .138 and v_b is .291. Domestic consumption increases by 14,700 mt in option (*a*) and by 30,800 mt in option (*b*). These increases in domestic consumption lead to an equivalent increase in imports because domestic production remains unchanged. The net social welfare gains are $66 million for option (*a*) and $119.2 million for option (*b*).

With government revenue from trade policies maximized [option (*a*)], it increases to $195.4 million, only $16.8 million over initial revenue. With this option, the consumer price declines 13.8%. With government revenue set equal to the deficiency payment, revenue declines by $3.7 million, and the consumer price

drops by 29.1%. In both cases, the net change in government revenue is negative, and indirect producer support would have to be reduced.

Conclusions

This article addresses three basic questions about South Korean beef import policies. First, how large are the income transfers among producers, consumers, and government as a result of the import quota scheme? Second, how are the welfare changes distributed intersectorally? Third, are there any Pareto-superior alternatives to existing policies?

We find the expected result that the import quota has led to producer gains together with considerable consumer and deadweight losses. The net positive costs imply that the beef import quota has distorted efficient resource allocation by inducing more production domestically than would exist under free trade and by restricting consumption to a level less than that under free trade.

Income redistribution to farmers is an important policy goal, however, and the current set of beef policy instruments has contributed to that goal. Between $219 million and $272 million (in 1985 won equivalent) were transferred to producers annually at the expense of consumers during 1981–84, equal to about 2% of total agricultural value added. The average annual per farm income gain was between $226 and $281, or over 5% of average per farm income during the same period. The increase in per capita income in the cattle-raising sector far outweighs the decrease in per capita consumer income from the beef import quota scheme. It is also likely that beef consumers are in the upper income classes and can therefore more easily absorb the costs. This result helps to explain why producers respond much more strongly to policy changes related to beef prices than consumers have in the past.

Our analysis has demonstrated that if the demand elasticity were substantially higher, it would be possible to implement a Pareto-superior deficiency payment scheme. However, with the parameter estimates we used, we find (as Anderson 1983 found for Japan) there exists no deficiency payment scheme which can lower consumer prices, keep producer direct incomes constant, and at the same time maintain indirect producer income support from research and extension efforts financed out of quota revenues.[9]

If recipients of the indirect benefits could be ignored, then it would be possible to maintain producer direct income, increase imports, and lower the market price by 14% to 29% depending upon the supply elasticity, without increasing general government expenditures. To achieve this, however, LDF expenditures for research, development, and extension would be severely curtailed. Unfortunately, for South Korea there is no such thing as a "free lunch." So long as lump sum transfers are not feasible, either producers or the government must bear some costs as the government responds to the external pressures for trade liberalization. Either general revenues must be used to maintain support or beef producers must suffer a reduction in income, either directly from a lower price or indirectly via reduced research and development expenditures by the LDF.

[*Received May 1990; final revision received January 1991.*]

Table 9. Average Annual Effects of New Policy Options on Consumer Price, Imports, Social Welfare, and Government Expenditure

	Unit	Option (*a*)	Option (*b*)
v	%	13.8	29.1
P_c	$/kg	7.21	5.94
P_s	$/kg	8.37	8.37
P_w	$/kg	3.28	3.28
ΔS	1,000 mt	0	0
ΔC	1,000 mt	14.7	30.8
ΔM	1,000 mt	14.7	30.8
ΔW_p	$ million	0	0
ΔW_s	$ million	66.0	119.2
G_1	$ million	195.4	174.9
G_0	$ million	178.6	178.6
S	$ million	83.2	174.9
$G_1 - (G_0 + S)$	$ million	−66.4	−178.6

Source: Own calculations; see appendix.
Note: Option (*a*) is to increase v so as to maximize government revenue (G_1); option (*b*) is to increase v so that government revenue is just equal to the deficiency payment ($G_1 = S$). Variables: $v = (P_s - P_c)/P_s$; P_c = policy-determined consumer price; P_s = domestic producer support price; P_w = world price; ΔS = changes in production; ΔC = changes in consumption; ΔM = changes in imports; ΔW_p = changes in producer welfare; ΔW_s = net social welfare change; G_0 = the initial government import revenue; S = the deficiency payment. Averages are for 1981–84.

[9] As income shifts the demand curve out, the areas representing consumer loss and producer gain grow, and it is possible that the demand elasticity that allows a deficiency payment to be Pareto-superior becomes smaller. However, we have not explored that possibility.

References

Anderson, K. "Northeast Asian Agricultural Protection in Historical and Comparative Perspective: The Case of South Korea." Australia-Japan Research Center, Res. Pap. No. 82, 1981.

———. "The Peculiar Rationality of Beef Import Quotas in Japan." *Amer. J. Agr. Econ.* 65(1983):108–12.

———. "The Peculiar Rationality of Beef Import Quotas in Japan and Korea." In *The Political Economy of Agricultural Protection: East Asia in International Perspective,* eds., K. Anderson and Y. Hayami, chapter 7. Sydney and London: Allen and Unwin, 1986.

Hayami, Y. "Trade Benefits to All: A Design of the Beef Import Liberalization in Japan." *Amer. J. Agr. Econ.* 61(1979):342–47.

Hayes, D., H. Ahn, and C. P. Baumel. "Meat Demand in South Korea: A Systems Estimate and Policy Projection." Iowa Agriculture and Home Economics Experiment Station, Project No. 2835, Journal Paper No. J-13721. No date.

Huh, S. H. "Farm Supply Response for Meat under the Controlled Price System in Korea." *J. Rural Develop.* 2(November 1979):171–78.

Hwang, H. "Analysis of Beef Demand and Supply." MS thesis, Kyungsang University, Masan, Korea, 1985. In Korean.

Johns, M. "The Beef Market in the Republic of Korea: Prospects for Demand, Supply and Imports." Occasional Paper No. 53, Bureau of Agricultural Economics, Canberra, Australia, 1980.

Jones, J., and J. Dyck. "Korea's Potential Role in the Pacific Beef Market." Presented at the First Washington Symposium on U.S.-Korea Economic Cooperation, October 1990.

Just, R., D. Hueth, and A. Schmitz. *Applied Welfare Economics and Public Policy.* Englewood Cliffs NJ: Prentice-Hall, Inc., 1982.

Koo, W. W., and D. L. Watt. *Consumer Demand for Meat in Korea: Income Effects and Implications on U.S. Agricultural Exports.* Dep. Agr. Econ. Rep. AE 88005, North Dakota State University, July 1988.

Ministry of Agriculture, Forestry, and Fisheries. *Major Statistics on Agriculture, Forestry, and Fisheries,* 1988. In Korean.

National Livestock Cooperatives Federation. *Materials on Price, Demand, and Supply of Livestock Products,* 1989. In Korean.

Ryu, B. S. "An Analysis of Livestock Product Demand and Supply: Present Status and Prospect." Chungbuk University, *Nonmun Jip* (regular collection of outstanding staff papers), 1978.

Shin, Y. D. "South Korean Livestock Industry Databook." Work. Pap. No. 4-87, Meat Export Research Center, Iowa State University, May 1987.

Shin, Y. D., and G. W. Williams. "The South Korean Livestock Industry: Economic Structure and Policy Intervention." Work. Pap. No. 1-86, Meat Export Research Center, Iowa State University, 1986.

Tyers, R., and K. Anderson. "Price, Trade, and Welfare Effects of Agricultural Protection: The Case of East Asia." *Rev. Mktg. and Agr. Econ.* 53(1985):113–39.

Appendix

Data on domestic production, consumption, and imports were taken from *Major Statistics on Agriculture, Forestry, and Fisheries,* Ministry of Agriculture, Forestry, and Fisheries, and *Materials on Price, Demand, and Supply of Livestock Products,* NLCF. The figures were averaged for the years 1981 to 1984 (table A1). Wholesale prices of boneless beef were used for the domestic beef price, P_s. The proxy for the world price, P_w, was calculated by dividing the cif value of total imports by the quantity of total imports, and then converting it into equivalent South Korean currency, won, using the annual average official exchange rates of corresponding years. It might be argued that consumer surplus should be measured at the retail level and producer surplus at the farm gate level. However, for consistency in handling, marketing, and processing costs, demand and supply at both retail and farm gate levels can be represented by parallel shifts from those of the wholesale level. With this assumption, consumer and producer surplus can be measured approximately with wholesale prices (Hayami).

Empirical estimates of demand and supply elasticities vary from study to study depending on what methods and what data are used, and on the periods covered (table A2). The price elasticity of demand for beef was estimated as −.72 by Koo and Watt using the general functional form based on the Box-Cox transformation. Hwang estimated the demand elasticity as −.99 using the ordinary least squares method, and Ryu used the value of −.94 as a demand elasticity in his paper on demand and supply analysis of South Korean livestock products. Table A3 reports the complete set of own and cross-price elasticities estimated by Koo and Watt.

On the supply side, a study by Huh using the distributed lag model developed by Nerlove resulted in an estimate of a short-run elasticity of .44 and of a long-run elasticity of 1.39.[10] In addition to his demand estimates, Hwang also estimated supply elasticity by type of animal (table A2). Tyers and Anderson used the parameters −1.0 and .5 as price elasticities of demand and supply, respectively, for the South Korean beef market in their simulation model of world grain and meat markets. Anderson (1981) employed the values −.6 and .4 as demand and supply elasticities for his studies on the welfare effects of South Korea's agricultural protection policies.

[10] Most cattle-raising farms in Korea use byproducts from crop production for feed, and farmers are faced with fixed assets and few good alternative uses for them. In addition, at least a couple of years is required to raise calves and supply them for slaughter. Thus, the short-run supply elasticity for cattle may be quite low in Korea. However, as the period becomes longer, the farmers have better information and knowledge concerning adjustments to price changes, resulting in a more elastic long-run cattle supply response (Huh).

Table A1. Baseline Parameters of Prices and Quantities, 1981-84

	Unit	1981	1982	1983	1984	1981–84
Domestic Price (P_s)[a]	w/kg	5,714	6,381	6,916	6,043	6,264
Import Price (P_w)[b]	w/kg	2,362	2,387	2,659	2,414	2,456
	$/mt	2,933	2,782	2,937	2,836	2,873
P_s/P_w		2.42	2.67	2.60	2.50	2.55
P_t (= $1.25P_w$)	w/kg	2,953	2,984	3,324	3,018	3,070
Production (Q_3)	1,000 mt	69.2	61.4	66.1	90.8	71.9
Consumption (Q_4)	1,000 mt	93.9	102.9	116.3	114.8	107.0
Imports ($Q_4 - Q_3$)	1,000 mt	24.7	41.5	50.2	24.0	35.1
Self-Sufficiency Level (Q_3/Q_4)	%	73.7	59.7	56.8	79.1	67.2
Exchange rate	w/$	681.1	731.1	776.0	806.0	748.6

Source: Ministry of Agriculture, Forestry, and Fisheries; National Livestock Cooperatives Federation; and Shin.
Note: All prices are in 1985 won (w).
[a] Wholesale price in Seoul area based on boneless beef.
[b] Calculated by dividing the value of total imports by the quantity of total imports.

Table A2. Estimates of Price Elasticity of Demand and Supply for Beef in South Korea

Source	Supply Elasticity	Demand Elasticity	Period of Analysis
Koo and Watt	−0.72		1961–85
Ryu		−0.94	1967–77
Hwang	0.68 (female dairy)	−0.99	1960–82
	1.12 (male native)		
	1.15 (female native)		
	1.40 (male dairy)		
Huh	0.44		1959–78
	1.39[a]		
Anderson (1981)	0.4[b]	−0.6[b]	
Tyers and Anderson	0.5[b]	−1.0[b]	

[a] Long-run estimate.
[b] Postulated.

Table A3. Estimates of Own and Cross-Price Elasticities from Koo and Watt

	Price of		
Demand for	Beef	Pork	Poultry
Beef	−0.72	0.33	0.65
Pork	0.29	−1.13	0.03
Poultry	1.17	0.06	−0.38
Income	1.09	1.10	0.34

Table A4. Basic Data for Analysis

	Unit	1981	1982	1983	1984	1981–84
Agricultural Value Added[a]	bil. won	8,797	9,075	9,676	9,695	9,311
Per Farm Income[b]	1,000 won	2,929	3,558	3,887	3,906	3,570
Total Population	1,000	38,723	39,326	39,929	40,513	39,623
Farm Population	1,000	9,999	9,688	9,475	9,015	9,544
Number of Farms	1,000	2,030	1,996	2,000	1,974	2,000
Persons per Farm		4.93	4.85	4.74	4.57	4.77

Table A4. Continued

	Unit	1981	1982	1983	1984	1981–84
Number of Cattle-Raising Farms	1,000	876	919	1,001	1,075	968
Native	1,000	858	896	971	1,037	941
Dairy	1,000	18	23	30	38	27
Number of Cattle	1,000	1,506	1,754	2,215	2,652	2,032
Native	1,000	1,312	1,526	1,940	2,318	1,774
Dairy	1,000	194	228	275	334	258
Number of Animals Per Farm						
Raising Cattle		1.7	1.9	2.2	2.5	2.1
Of which Native		1.5	1.7	2.0	2.2	1.9
Of which Dairy		10.8	9.9	9.2	8.8	9.6
e_D						−0.99
e_S						
Case I						1.12
Case II						.44

Sources: Ministry of Agriculture, Forestry, and Fisheries; National Livestock Cooperatives Federation.
Note: Agricultural value added and per farm income are in 1985 won. In the text all data have been converted to dollars at an exchange rate of 748.6.
[a] Includes forestry and fisheries sectors.
[b] Off-farm income is not included.