DEMAND SYSTEM ANALYSIS OF THE SOUTH KOREAN BEEF MARKET WITH THE FREE TRADE DEMAND MODEL

YOUNGJAE LEE

Department of Agricultural Economics and Agribusiness
Louisiana State University AgCenter
101 Agricultural Administration Building
Baton Rouge LA 70803-5606

Phone: 225-578-2754
Fax: 225-578-2716
E-mail: ylee2@lsu.edu

P. LYNN KENNEDY

Department of Agricultural Economics and Agribusiness
Louisiana State University AgCenter
101 Agricultural Administration Building
Baton Rouge LA 70803-5606

Phone: 225-578-2726
Fax: 225-578-2716
E-mail: lkennedy@agctr.lsu.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, February 2-6, 2008

Demand System Analysis of the South Korean Beef Market with the Free Trade Demand Model

Abstract

In this study a demand system analysis for beef in South Korea is constructed. A free trade demand system was used in which the economic welfare of market participants are maximized. Recognizing implicit discrimination about non-locally sourced beef products, this study deduces market demand equations with respect to consumer preference in order to identify the marginal effect of change consumer preference has on market demand.

Introduction

Neoclassical endowment models show that price differences between importing and exporting regions provide opportunities to increase economic welfare through trade (Samuelson 1948; Bhagwati 1964). For importing parties, most trade benefits accrue to consumers as local consumers have increased choice with trade. In contrast, local producers face a more competitive market with a lower price than before the institution of trade liberalization. According to the equalization of factor prices, prices between importing and exporting regions will gradually converge into one price with increased market access where the economic welfare of both parties is maximized.

However, a price difference between local and imported products does exist in open markets. For example, price differences between locally produced beef and imported beef currently exist and have continued to grow after South Korea opened their beef market to the world economy in 2001. These price differences in the open market may reflect consumer preference for locally produced beef. However, the increasing trend of price differences seems to be unexpected in light of rational consumer behavior and enforced price competition derived from trade theory.

In fact, it is true that consumer preference can be distorted by non-economic factors such as imperfect information and/or implicit discrimination like nationalistic “buy domestic product” campaigns. Once tastes have been established, consumers persist in making purchasing decision following the established preference and require a long time to recover from these distorted preferences. Therefore, these preferences can contribute to the reason for the existence of a large price difference between locally produced beef and imported beef in South Korea and why this difference in price continues to increase following the liberalization of the South Korean beef market. In 2005, the price of imported beef was $4.68 per kilogram in the South Korean beef market while consumer price of locally produced beef was $36.11 per kilogram (exchange rate is 1034 Korean Won/$1, 2005), this is a 770% price difference in 2005 as compared to only 190% in 2001. Furthermore, concerns exist as to imperfect information related to food safety because of the occurrence of Bovine Spongiform Encephalopathy (BSE or 'mad cow disease') in the United States in 2003 caused South Korea to totally discontinue U.S. beef imports until 2007 when the U.S. and South Korea signed a Free Trade Agreement (FTA).

Following the establishment of a FTA between the United States and South Korea, some agricultural economists and some policy makers predicted a rosy prospect for U.S. beef producers because the FTA would eventually eliminate the high tariffs on U.S. beef, allowing U.S. beef to to be more competitive pricewise in the South Korean beef market relative to the beef supplied by other countries. However, even though the South Korean beef market has been open since 2001, U.S. beef producers have not benefited from increased market access. In contrast, the scare resulting from BSE restricted U.S. beef from the South Korean market. It is rational to think that price advantages for U.S. beef resulting from a FTA would result in increased competition in the South Korean beef market. However, the consumption behavior of the South Korean beef consumer would appear to be not totally dependent upon price considerations.

This study is conducted to analyze consumer behavior in the South Korean beef market. In doing this, this study will illustrate the effects of consumer preference on market demand. This study proceeds as follows: In the next section, a free trade demand system (*FTDS*) will be introduced with empirical estimation of the South Korean beef market. In section three, the role of consumer preference in the *FTDS* model will be discussed. In section four a conclusion and brief suggestions for the South Korean beef market strategy will be provided.

Free Trade Demand System

The five major source-differentiated beef suppliers in the South Korean beef market are South Korea (SK), the United States (US), Australia (AU), Canada (CA), and New Zealand (NZ). As Sarris and Freebairn (1983) illustrated by way of a political preference function (PPF) approach under non-free trade policy of an importing country, a free trade demand system simply begins with following linear demand equation:

(1) $$q_i = A_i - B_i p_i\,,\ \ i = 1,2,3,4,5\,,$$

where we assume that A_i and B_i are unconditional coefficients which can be reverted to inverse market price equation (see Houck (1965 and 1966), Huang (1994 and 1996), and Eales (1996) for more information regarding elasticities and flexibilities) as follows:

(2) $$p_i = a_i - b_i q_i\,,\ \ i = 1,2,3,4,5\,,$$

where $a_i = \frac{A_i}{B_i}$ and $b_i = \frac{1}{B_i}$. Later, in the course of this study, this unconditional assumption will be tested using empirical data. Given the inverse market price, the welfare gain of the South Korean beef consumer equates to the following:

(3) $$CS = \sum_i \left(\frac{a_i}{b_i} p_i - \frac{1}{2b_i} p_i^2 \right).$$

Similarly, the sum of welfare gain of each supplier equates to the following:

(4) $$PS = \sum_i (p_i - c_i) q_i\,,$$

where c_i is the average unit cost of beef *i* including production cost, transportation cost, and tariffs. Since market equilibrium for both price and quantity is a result of a market mechanism rather than governmental intervention under a free trade policy scenario, economic welfare of market participants is the summation of the welfare gain of both consumer and supplier and is expressed as:

$$(5) \qquad EWF = \sum_i \left(\frac{a_i}{b_i} p_i - \frac{1}{2b_i} p_i^2 \right) + \sum_i (p_i - c_i) q_i \,.$$

The economic welfare function defined in (5) can be rewritten in order to derive more easily a free trade demand system (the intent of this study) as follows:

$$(6) \qquad EWF = \alpha_0 + \sum_i \alpha_{1j} p_i + \sum_i \alpha_{2i} p_i Q + \sum_{ij} \alpha_{3i} p_i p_j + \sum_i p_i q_i - \sum_i c_i q_i \,,$$

where $Q = \sum_i q_i$ is the sum of beef supplied to the South Korean market. As implied in (6), the free trade demand system is derived from the maximizing condition of (6). In order to define the maximizing condition of (6), we differentiate *EWF* with respect to the five individual beef prices.

$$(7) \qquad \frac{\partial EWF}{\partial p_i} = \alpha_1 + \alpha_2 Q + \sum_j \alpha_3 p_j + q_i = 0 \,.$$

Then, we obtain the *FTDS* which maximizes the economic welfare of participants in the South Korean beef market as follows:

$$(8) \qquad q_i = \alpha_{1i} + \alpha_{2i} Q + \sum_j \alpha_{3j} p_j \,, \qquad i, j = 1,2,3,4,5.$$

where α_{2i} represents the marginal effect of market size on the beef coming from country *i* and α_{3j} represents own price effect $(j = i)$ and cross price effect $(j \neq i)$ on the beef *i*. Furthermore, the parameteric relationship between (3) and (8) can be defined as following:

$$(9.1)\qquad \alpha_{1i} = \frac{\sum_{j\neq i} b_j a_i}{b_i^2} - \sum_{j\neq i}\left[\frac{\sum_{j\neq i,k} b_j a_k}{b_k b_i}\right],$$

$$(9.2)\qquad \alpha_{2i} = -\frac{\sum_{j\neq i} b_j}{b_i}, \text{ and}$$

$$(9.3)\qquad \alpha_{3j} = \delta'\sum_{j\neq i}\left[\frac{\sum_{j\neq i,k} b_j}{b_i b_k}\right] - \delta\sum_{j=i}\left[\frac{\sum_{k\neq i} b_k}{b_i^2}\right],$$

where $\delta' = 1$ when $j \neq i$ and otherwise 0 and $\delta = 1$ when $j = i$ and otherwise 0. To be consistent with the maximization hypothesis of *EWF*, the second-order conditions of *EWF* require that the Hessian matrix be negative semi-definite at the optimal conditions. This condition is expressed as $-\sum_{j=i}\left[\frac{\sum_{k\neq i} b_k}{b_i^2}\right]$. The Hessian matrix, $[\alpha_3]$, should also exhibit symmetry.

Estimation of FTDS

Conventional demand system analyses of meat consumption data have generally used aggregate annual, quarterly, or monthly time series data of purchases and prices at the retail level (Kinnucan et al. 1997; Mittelhammer et al. 1996; McGuirk et al. 1995). The data used in this study consist of monthly time series observations from January 1995 to December 2004. This time period was purposely selected because 1) significant progress of liberalization was made in South Korea during this period, 2) South Korean beef imports were a little different from the scheduled level of import commitment, reflecting economic instability and consumer confidence for consumption of beef during this period, and 3) U.S. beef imports were actually banned after 2005 due to a case of mad cow disease in the

United States.

Related to liberalization of South Korean beef market, 1) a SBS system commenced at the beginning of 1995 and 2) on January 2001, beef became freely importable, at a 41.2 percent tariff without any markup payments. South Korean beef retail price data are obtained from the monthly consumer price index announced by the Korean Statistical Information Service. The study used the December 2004 nominal price as a reference price to transform the index into a ‘normalized’ price. Because retail-level prices for imported beef were not available, imported beef prices were obtained from adding tariff and markup payments to unit value import prices. The unit value import prices are obtained from the Korean Customs Services. Price data were then converted from South Korean currency, the Won, into U.S. dollars by using monthly average exchange rate data available from the Federal Reserve Bank of New York. South Korean beef consumption data was reported at the wholesale level and was obtained from Nonghyup. Data on import quantity were collected from the Korean Customs Services. The summary of sample statistics price and quantity for each source-differentiated category of beef is presented in Table 1.

In estimating the parameters of the *FTDS* model, the model had imposed upon it both homogeneity and symmetry conditions. Since the free trade demand system is composed of quantity share equations for the five source-differentiated categories of beef would induce singularity, one equation was dropped. The coefficients of the dropped equation were then calculated from the adding-up restriction. Dummy variables, reflecting seasonality in beef demand, were included in the pre-test estimation. Although some variables were significant, they were not included in the final version of the model because of the relatively small sample size and because of the subsequent problem related to degrees of freedom.

The *FTDS* model identifies the effects of own and cross price and market size on market demand of each source-differentiated beef at the point of maximizing economic welfare for market participants. Table 2 shows the marginal coefficients of variables of price and market size. Among 20 variables, 17 are significant at least at the conventional level of significance. System measure of fit is reported in the table below. The negativity condition was satisfied. For ease of interpretation, this study converts marginal values into elasticities.

Table 3 presents estimated own and cross-price elasticities, and market size elasticity at the mean of the respective variables. As expected, all own price elasticities are negative. New Zealand beef is most sensitive to own price, while South Korean and Australian beef are insensitive to own price. For South Korean and New Zealand beef, four source-differentiated beef products are shown to be substitutes. For US beef, South Korean and New Zealand beef are substitutes, while Australian and Canadian beef are complementary goods. In particular, U.S. beef is shown to be strongly substitutable for South Korean beef. For Australian beef, South Korean and New Zealand beef are substitutes, while U.S and Canadian beef are complements. For Canadian beef, South Korean and New Zealand beef are substitutes, while U.S. and Australian beef are complements. Related to growing market size, this study shows that for a 1% increase in South Korean beef market size, South Korean beef consumption increases by 0.468%, US beef 1.319%, Australian beef 0.568%, Canadian beef 1.688%, and New Zealand beef 1.276% increased, respectively. This study also shows that if U.S. beef price decreases as a result of the free trade agreement between the U.S. and South Korea (eliminating high tariffs on U.S. beef), the U.S. and South Korea free trade agreement will bring positive expectations for U.S., Australian, and Canadian beef exports, while South Korean and New Zealand beef supplies are shown to be reduced.

Role of Consumer Preference in the Free Trade Demand System

If South Korean beef consumers have different preferences for each category of source-differentiated beef, these different preferences will affect market demand for each source -differentiated beef as follows:

(10) $$\pi_i = \gamma_i p_i = \gamma_i (a_i - b_i q_i),$$

where γ_i represents a preference for each source-differentiated beef *i* and π_i represents actual market price weighted by the preference.

With different consumer preferences for each category of source-differentiated beef, welfare gains to both consumer and supplier and of the gains in economic welfare of market participants are redefined as following:

(11) $$CS^p = \sum_i \left(\frac{a_i}{b_i} \pi_i - \frac{1}{2b_i \gamma_i} \pi_i^2 \right),$$

(12) $$PS^p = \sum_i (\pi_i - c_i) q_i \ ,$$

(13) $$EWF^p = \sum_i \left(\frac{a_i}{b_i} \pi_i - \frac{1}{2b_i \gamma_i} \pi_i^2 \right) + \sum_i (\pi_i - c_i) q_i \ ,$$

where CS^p, PS^p, and EWF^p are defined in terms of actual market price, π_i, rather than true price, p_i. Finally, the preference weighted free trade demand system and parameters are redefined as following:

(14) $$q_i = \beta_{1i} + \beta_{2i} Q + \sum_j \beta_{3j} \pi_j , \qquad i, j = 1,2,3,4,5 ,$$

(15) $$\beta_{1i} = \frac{\sum_{j\neq i} b_j \gamma_j a_i}{b_i^2 \gamma_i} - \sum_{j\neq i}\left[\frac{\sum_{j\neq i,k} b_j \gamma_j a_k}{b_k b_i \gamma_i}\right],$$

(16) $$\beta_{2i} = -\frac{\sum_{j\neq i} b_j \gamma_j}{b_i \gamma_i}, \text{ and}$$

(17) $$\beta_{3j} = \delta' \sum_{j\neq i}\left[\frac{\sum_{j\neq i,k} b_j \gamma_j}{b_i \gamma_i b_k \gamma_k}\right] - \delta \sum_{j=i}\left[\frac{\sum_{k\neq i} b_k \gamma_k}{b_i^2 \gamma_i^2}\right],$$

where the Hessian matrix, $[\beta_3]$, also exhibits both symmetry and negativity. Now, to measure quantitatively these own and cross preference impacts on market demand, equation (14) can be differentiated with respect to γ_i and γ_j. Then as a result, own preference and cross preference differential equations are defined as follows:

(18) $$\frac{\partial q_i}{\partial \gamma_i} = A + \frac{\sum_{j\neq i} b_j \gamma_j}{b_i \gamma_i^2} Q + \frac{\sum_{j\neq i} b_j \gamma_j}{b_i^2 \gamma_i^3} \pi_i - \sum_{j\neq i} \frac{\sum_{k\neq i,j} b_k \gamma_k}{b_i \gamma_i^2 b_j \gamma_j} \pi_j,$$

(19) $$\frac{\partial q_i}{\partial \gamma_j} = B - \frac{b_j}{b_i \gamma_i} Q - \frac{b_j}{b_i^2 \gamma_i^2} \pi_i - \frac{\sum_{k\neq i,j} b_k \gamma_k}{b_i \gamma_i b_j \gamma_j^2} \pi_j + \frac{b_j}{b_i \gamma_i b_k \gamma_k} \pi_k .$$

where $A = -\frac{a_i \sum_{j\neq i} b_j \gamma_j}{b_i^2 \gamma_i^2} + \sum_j \frac{a_j \sum_{k\neq i,j} b_k \gamma_k}{b_i \gamma_i^2 (b_j)}$ and $B = \frac{b_j}{b_i^2 \gamma_i^2} - \sum_{k\neq i,j} \frac{b_j a_k}{b_k b_i \gamma_i^2}$.

To be consistent with preference theory, the own (cross) preference first derivative should be greater (less) than zero. However, both (18) and (19) are ambiguous as to how to determine the empirical sign of the first derivatives of both γ_i and γ_j because if one of the preferences is extremely low, own (cross) preference effect will be negative (positive). Even though both (18) and (19) cannot show globally the clear impact of preference on market demand, both equations can be used to locally determine the empirical impact of preference on market demand by normalizing preference and by using parameters estimated by econometric method, $\hat{a}_i$ and $\hat{b}_i$. Since we know actual market price and quantity of market consumption for each category of source-differentiated beef, we can determine the sign of own preference and cross preference in those equations with parameter estimates $\hat{a}_i$ and $\hat{b}_i$. Equation (18) and (19) can also be used to compare preference impacts on market demand in a variety of market sizes and market prices with equation (14).

Simulation Results

In order to simulate the South Korean beef model, this study estimated parameters, $\hat{a}_i$ and $\hat{b}_i$, using the same data set used in the previous section. Table 4 shows the statistical information of $\hat{a}_i$ and $\hat{b}_i$ all of which are statistically significant at the 1% level. The statistics show that the sign of beef prices of South Korea, U.S., Canada, and New Zealand are negative as we expected while the beef price of Australia is positive. After parameter estimation, this study replaced a_i and b_i, in (18) and (19), with that of $\hat{a}_i$ and $\hat{b}_i$ to confirm empirical sign of change in consumer preference.

Table 5 shows the impacts of changes in consumer preferences. The sign of equation (18), which represents own preference effect in empirical analysis, is shown to be positive for South Korean, U.S., and New Zealand beef, while the empirical sign of (18) is shown to be negative for Australian and Canadian beef. Related to cross preference effect, the empirical sign of equation (19) is shown to be different depending on which preference is changed. Increases in preference for South Korean beef has a negative impact on U.S. and New Zealand beef demand. Increases in preference for U.S, Canadian, and New

Zealand beef decrease South Korean beef demand, while increases in preference for Australian beef simultaneously increase South Korean and U.S. beef demand.

Conclusion

Recognizing the possibility of distortion for consumer preference for foreign sourced beef in the South Korean market, this study developed a free trade demand model to analyze South Korean beef consumer behavior. This research objective was achieved in two different steps. In the first step, this study identified the maximum condition of the economic welfare function in which market participants maximize their economic benefit from trade, hence deriving a free trade demand system without considering existing South Korean beef consumer preference. In the second step, this study analyzed preference effects on market demand of each category of source-differentiated beef using the free trade demand model weighted with consumer preference.

In undertaking these efforts, this study met serious statistical problems in performing empirical estimation under the *FTDS* framework. In order to solve the problems of biased and inconsistent estimators in the presence of misspecification errors and maintain economic consistency of *FTDS*, this study re-specified the model by the undertaking the following 1) eliminating extreme outliers, 2) arbitrarily resorting the data, and 3) using a weighted regression. Following these recommendations assures statistical validity of the *FTDS* model.

The empirical results of the *FTDS* model showed that South Korean beef consumers are shown to be negative but not sensitive to change in own price of each category of source-differentiated beef except for New Zealand beef. For South Korean beef, all four foreign beef sources are shown to be substitutes. In particular, U.S, beef is shown to be the strongest substitutable good for South Korean beef. With increasing market size, Canadian beef and U.S. beef can easily extend their South Korean market share relative to other foreign sources for beef.

Related to the role of consumer preference, the results showed that U.S. beef can extend their market share with increasing South Korean beef consumer preference for U.S. beef. In particular, this result might reflect the decrease of U.S. beef consumption after 2003 when mad cow disease was reported in the U.S. The most interesting finding related to preference analysis is that an increase in the prices of foreign sourced beef does not negatively affect market demand for this foreign sourced beef if preference for foreign sourced beef and/or market size increases and a decrease in South Korean beef price is shown not to affect market demand for foreign sourced beef.

As a result, this study suggests that marketing strategy should be focused on increasing consumer preference for the U.S. beef by providing correct information about the product and on reducing distortion of preference in order to fully succeed in the South Korean beef market.

Table 1. Summary Statistics for Source-Differentiated Beef, 1995-2004

	Mean	SD	Minimum	Maximum
q_{sk}	38318	12318	13088	74196
q_{us}	8514	5680	90	23912
q_{au}	5588	2328	785	12372
q_{ca}	647	641	1	3012
q_{nz}	1969	3527	128	38570
p_{sk}	21.87	7.28	13.08	34.12
p_{us}	5.92	1.66	3.13	10.88
p_{au}	3.68	0.90	2.56	5.74
p_{ca}	5.28	2.33	2.94	13.86
p_{nz}	3.76	0.71	2.66	5.70

Sources: Korea Customs Service and Nonghyup

q_{sk} : South Korean Beef Consumption

q_{us} : U.S. Beef Consumption

q_{au} : Australian Beef Consumption

q_{ca} : Canadian Beef Consumption

q_{nz} : New Zealand Beef Consumption

p_{sk} : South Korean Beef Price

p_{us} : U.S. Beef Price

p_{au} : Australian Beef Price

p_{ca} : Canadian Beef Price

p_{nz} : New Zealand Beef Price

Table 2. Estimated Marginal Coefficients of Prices in Free Trade Demand System

	$\hat{\alpha}_{3sk}$	$\hat{\alpha}_{3us}$	$\hat{\alpha}_{3au}$	$\hat{\alpha}_{3ca}$	$\hat{\alpha}_{3nz}$	$\hat{Q}$
q_{sk}	-697***	353***	127***	13	204***	0.582***
q_{us}		-1574***	-626**	-91	1938***	0.250***
q_{au}			-462	-396***	1356***	0.042**
q_{ca}				-98*	571***	0.027***
q_{nz}					-4070***	0.099***

System Weighted R^2 = 0.99

$\hat{\alpha}_{3i}$ is an estimated marginal coefficient of price of beef *i* sourced from country *i*.

$\hat{Q}$ is an estimated marginal coefficient of total quantity supplied into South Korean beef market.

* indicates significance at 1% level

** indicates significance at 5% level

*** indicates significance at 10% level

Table 3. Price and Quantity Elasticities at Mean Values

	p_{sk}	p_{us}	p_{au}	p_{ca}	p_{nz}	Q
q_{sk}	-0.3673	0.0300	0.0091	0.0008	0.0101	0.4683
q_{us}	0.8114	-0.7217	-0.1107	-0.0302	0.5104	1.3196
q_{au}	0.5900	-0.2660	-0.2836	-0.2285	0.5648	0.5677
q_{ca}	0.3472	-0.4629	-1.4553	-0.4071	2.0326	1.6883
q_{nz}	1.8423	3.4433	1.5852	0.8958	-4.6754	1.2758

p_i is price of beef *i* sourced from country *i*.

Q is total quantity of beef supplied into South Korean beef market.

Table 4. Statistical Information of Estimated Parameters, $\hat{a}$ and $\hat{b}$.

	$\hat{a}_i$	S.E.	t-value	$\hat{b}_i$	S.E.	t-value
q_{sk}	34.96206*	1.75002	19.98	-0.00034*	0.00004	-7.86
q_{us}	4.05512*	0.09721	41.72	-0.00005*	0.00001	-5.14
q_{au}	1.72164*	0.12643	13.62	0.00011*	0.00002	5.01
q_{ca}	3.35810*	0.12916	26.00	-0.00036*	0.00014	-2.52
q_{nz}	2.38724*	0.04387	54.41	-0.00003*	0.00001	-2.55

In order to estimate parameters, this study used system equation model because error terms are simultaneously correlated at time *t*.

* represents statistical significance at 1% level.

Table 5. Impacts of changes in consumer preference on source-differentiated beef demand

	$\hat{\gamma}_{sk}$	$\hat{\gamma}_{us}$	$\hat{\gamma}_{au}$	$\hat{\gamma}_{ca}$	$\hat{\gamma}_{nz}$
q_{sk}	+	-	+	-	-
q_{us}	-	+	+	-	-
q_{au}	+	+	-	+	+
q_{ca}	+	-	-	-	-
q_{nz}	-	-	+	+	+

$\hat{\gamma}_i$ is consumer preference for beef *i* sourced from country

References

Bhagwati, J. 1964. "The Pure Theory of International Trade: A Survey." *Economic Journal*, Vol (74-293):1-84.

Eales, J. 1996. "A Further Look at Flexibilities and Elasticities: Comment." *American Journal of Agricultural Economics* 78:1125-29.

Houk, J.P. 1965. "The relationship of Direct Price Flexibilities to Direct Price Elasticities." *Journal of Farm Economics* 47(August)301-21.

Houk, J.P. 1966. "A Look at Flexibilities and Elasticities." *Journal of Farm Economics* 48(May)225-32.

Huang, K.S. 1994. "A Further Look at Flexibilities and Elasticities." *American Journal of Agricultural Economics* 76(May)313-17.

Huang, K.S. 1996. "A Further Look at Flexibilities and Elasticities: Reply." *American Journal of Agricultural Economics* 78:1130-31.

Kinnucan, H.W., H. Xiao, C.J Hsia, and J.D. Jackson. 1997. "Effects of Health Information and Generic Advertising on U.S. Meat Demand." *American Journal of Agricultural Economics* 79:13-23.

Korean Customs Services. Statistical Database for Volume and Value of Imports. Website: http://portal.customs.go.kr/kcsipt/portal_link_index.jsp?&portalGoToLink=portals_submain_busine_08&iFrameGoToLink=/CmnPt/jsp/JDCQ000.jsp (Accessed August 2007).

Min-Kook, J., J.S. Choi., S.G. Joen., C.H. You., and D. Heo. 2002. "*Analysis of South Korean beef market and consumer behavior*." Research Report of Korean Rural Economic Institute.

McGuirk, A., P. Driscoll, J. Alwang, and H. Haung. 1995. "System Misspecification Testing and Structural Change in the Demand for Meat." *Journal of Agricultural and Resource Economics* 20(1):1-21.

Mittelhammer, R.C., H.Shi, and T.I. Wahl. 1996. "Accounting for Aggregation Bias in Almost Ideal Demand Systems." *Journal of Agricultural and Resource Economics* 21:247-62.

Nonghyup. Data on Price, Supply and Demand of Livestock Products. Internet site: http://nature.nonghyup.com/live/stock/1_main.jsp (Accessed May 2007).

Samuelson, P.A. 1948. "International Trade and the Equalization of Factor Prices." *Economic Journal*, LVIII(230), 165-84.

Sarris, A.H., and F. John. 1983. “Endogenous Price Policies and International Wheat Prices.” *American Journal of Agricultural Economics* 65(2):214-24.