

# **MODELING A FREE TRADE DEMAND SYSTEM: THE CASE OF THE S.KOREAN BEEF MARKET**

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# Motivation

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- Price difference for trade and price convergence with trade
- Why do prices diverge under free trade?
- Consumer preference

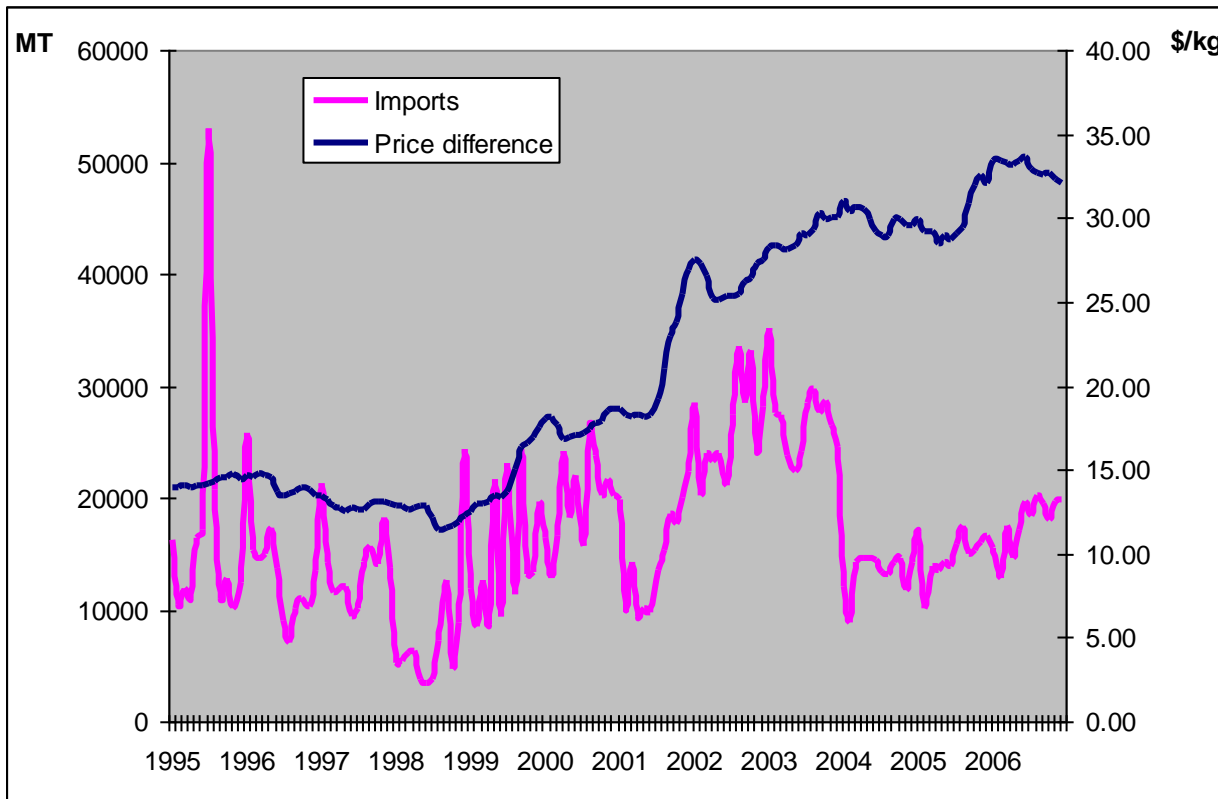


# Liberalization of S.K. Beef Market

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- A State Trading Enterprise: until 1988
- Quota: until 2000
- Liberalization: from 2001 with a 40% tariff
  - U.S./S.K. Free Trade Agreement in 2007

# Imports/Price Difference



Sources: Nonghyup

<http://livestock.nonghyup.com/common/pri/pri100.jsp>



# Objectives

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- To analyze the existing state of South Korean beef market by using a free trade demand model
- To identify price effect and consumer preference effect on beef demand in S.K. beef market



# Literature Review

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- Economic Theory
  - Arthur Lewbel (1996)
  - Asche, Salvanes, and Steen (1999)
  - Stephan von Cramon-Taubadel (1991)
- Econometric Estimation
  - McGuirk, Driscoll, Alwang, and Haung (1995)



# Free Trade Demand Model

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- Five major beef suppliers:  
S.K., U.S., Australia, Canada, and  
New Zealand
- Direct Demand Equation

$$q_i = A_i - B_i p_i$$

- Inverse Price Equation

$$p_i = a_i - b_i q_i \quad a_i = \frac{A_i}{B_i} \quad b_i = \frac{1}{B_i}$$



# Free Trade Demand Model

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- Consumer/Producer Surplus

$$CS = \sum_i \left( \frac{a_i}{b_i} p_i - \frac{1}{2b_i} p_i^2 \right) \quad PS = \sum_i (p_i - c_i) q_i$$

- Economic Welfare Function

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





# Free Trade Demand Model

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

$$\frac{\partial EWF}{\partial p_i} = \alpha_1 + \alpha_2 Q + \sum_j \alpha_3 p_j + q_i = 0$$

$$q_i = \alpha_{1i} + \alpha_{2i} Q + \sum_j \alpha_{3j} p_j$$

$$\alpha_{1i} = \frac{\sum_{j \neq i} b_j a_i}{b_i^2} - \sum_{j \neq i} \left[ \frac{\sum_{j \neq i, k} b_j a_k}{b_k b_i} \right] \quad \alpha_{2i} = -\frac{\sum_{j \neq i} b_j}{b_i} \quad \alpha_{3j} = \delta' \sum_{j \neq i} \left[ \frac{\sum_{j \neq i, k} b_j}{b_i b_k} \right] - \delta \sum_{j \neq i} \left[ \frac{\sum_{k \neq i} b_k}{b_i^2} \right]$$



# Empirical Estimation: Data

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- Monthly quantity and price data from January 1995 to December 2004
- Domestic quantity data were obtained from Nonghyup
- Imported quantity data were collected from Korean Customs Services
- South Korean beef retail price data were obtained from monthly consumer price index announced by the Korean Statistical Information Service
- The December 2004 nominal price was used as a reference price to transform the index to price
- Because retail prices for imported beef were not available, imported beef prices were obtained from adding tariff and markup payments to unit value of imports



# Empirical Estimation: Misspecification Tests

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- Equation-by-equation tests were used to test for misspecification of each equation in the free trade demand system
- In the initial tests, this study met serious violation with respect to the statistical prospective
- In order to solve the problems of bias and inconsistency of the model, this study eliminated extreme outliers, the data were rearranged without time order, and weighted regression were used
- After this remedy, a comprehensive set of misspecification can be reduced

# Empirical Estimation: Misspecification Tests

	$q_{sk}$	$q_{us}$	$q_{au}$	$q_{ca}$	$q_{nz}$
Before Model Respecification					
Normality	0.0001	0.2168	0.0279	<.0001	<.0001
Functional Form	0.2010	<.0001	0.4513	0.0001	<.0001
Heteroskedasticity	<.0001	<.0001	0.0109	0.0815	<.0001
Autocorrelation	<.0001	<.0001	0.0324	<.0001	0.8743
Parameter Stability	<.0001	<.0001	0.0671	<.0001	0.0148
After Model Respecification					
Normality	0.7048	0.2596	0.2398	0.1768	0.6094
Functional Form	0.0616	<.0001	0.3049	0.0029	0.1034
Heteroskedasticity	0.3114	0.0338	0.5450	0.2073	0.1901
Autocorrelation	0.6493	0.8679	0.3896	0.7471	0.7764
Parameter Stability	0.0073	0.0001	0.9951	0.1812	0.2819



# Empirical Estimation

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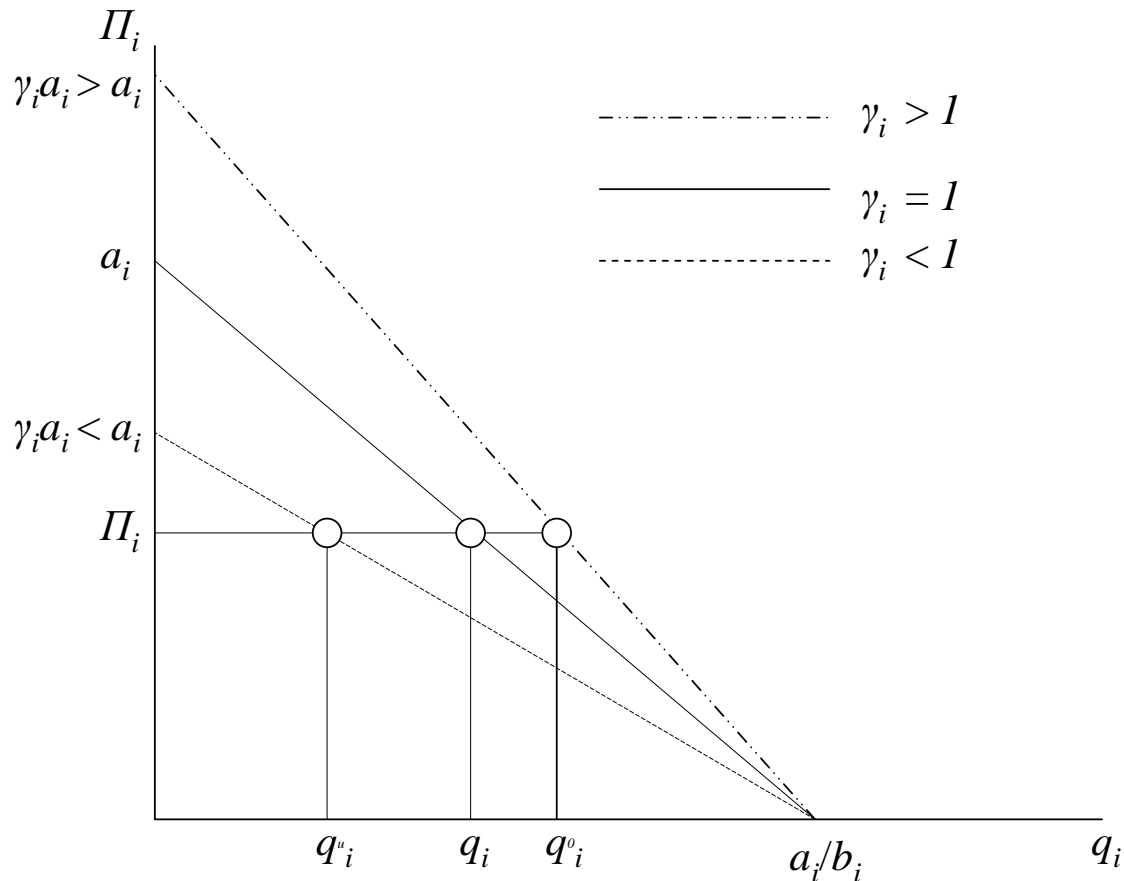
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	$p_{sk}$	$p_{us}$	$p_{au}$	$p_{ca}$	$p_{nz}$	$Q$
$q_{sk}$	-0.3673	0.0300	0.0091	0.0008	0.0101	0.4683
$q_{us}$	0.8114	-0.7217	-0.1107	-0.0302	0.5104	1.3196
$q_{au}$	0.5900	-0.2660	-0.8836	-0.2285	0.5648	0.5677
$q_{ca}$	0.3472	-0.4629	-1.4553	-0.4071	2.0326	1.6883
$q_{nz}$	1.8423	3.4433	1.5852	0.8958	-4.6754	1.2758

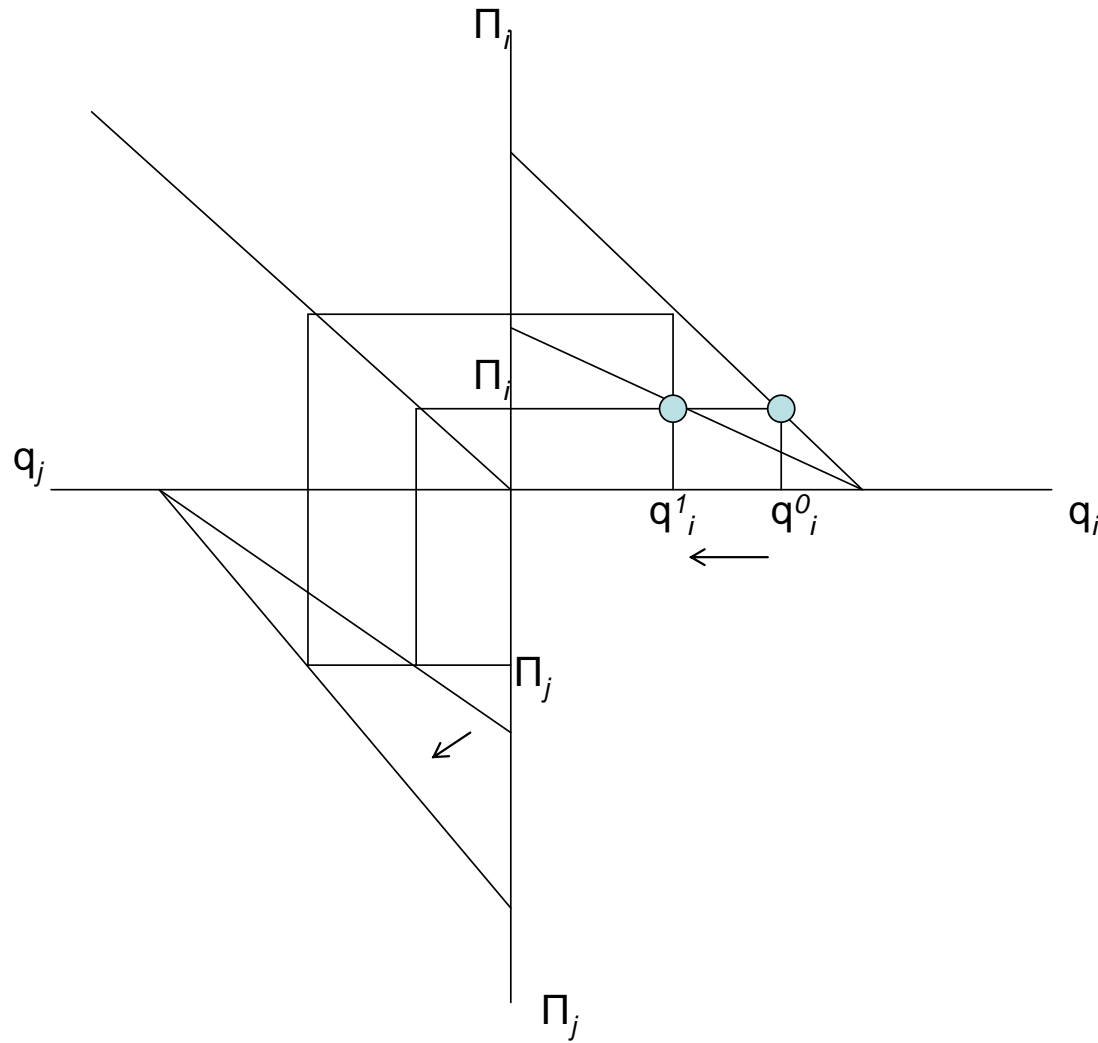
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# Role of Consumer Preference

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



# Role of Consumer Preference: Cross Preference Effect



# Role of Consumer Preference: A Weighted FTDS

$$q_i = \beta_{1i} + \beta_{2i}Q + \sum_j \beta_{3j}\pi_j$$

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

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





# Consumer Preference Effects on Market Demand

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

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

# Empirical Preference Effect on Market Demand

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

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# Conclusions

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- South Korean beef consumers are not sensitive to change in price of each source-differentiated beef except for New Zealand beef
- All four foreign sourced beef products were shown to be substitutes for South Korean beef. In particular, U.S. beef were shown to be the strongest substitutable good for South Korean beef because the cross price elasticity of U.S.beef was shown to be the largest one among four cross price elasticities
- Related to role of consumer preference, the results confirmed that U.S. beef can extend its market share with increasing South Korean beef consumer preference for U.S. beef. This result might imply that the existing consumer preference for U.S. beef was relatively underestimated, especially, because of mad cow disease reported in 2003.

Thank You!

