Competitive Forces in the Japanese Beef Market

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Japanese Beef Import Market Overview

Japan is the largest beef importing country in the world in terms of value and second (behind the U.S.) in terms of volume. In fiscal year 1999, they imported 683 thousand metric tons of beef, slightly more than they imported in fiscal 1998 (Figure 1). In 1999, Japan accounted for 13% of world beef import volume and 17% of world beef import value (United Nations). Japanese beef imports grew rapidly through 1995, but since that time they have shown little growth. The continuing financial problems there and the slow economic growth has affected beef imports.

No where in the world is the quality spectrum (where quality is measured by the degree of marbling) larger than in Japan's beef market, from low-quality grass fed beef of New Zealand and Australia to highly-marbled Japanese wagyu beef (Hayes and Longworth). The U.S. Meat Export Federation estimates that U.S. choice beef falls about midway in the quality spectrum for the Japanese market. Japanese consumers are very discriminating in their consumption patterns for beef.

Table 1 shows that Japan is an important beef market for Australia and the U.S., accounting for over 300 thousand tons of exports for each country. Australia and the U.S. have traditionally split the Japanese beef import market, each accounting for slightly less than 50% of the volume. In the early 1990s Australia had a larger market share than the U.S., but the U.S. overtook Australia in 1996 and has been the leading supplier since. In fiscal year 1999, the U.S. held a market share of 48.6% versus 46.0% for Australia (Table 2). These shares vary, though, depending on the form of imports (whether they are chilled or frozen). Australia leads in exportation of chilled beef, while the U.S. leads in

exportation of frozen beef. Canada and New Zealand are more important players in the Japanese beef market for frozen product.

Chilled U.S. beef imports typically move to the retail market, whereas frozen U.S. beef imports are processed. The USMEF estimates that 56% of US chilled beef is destined for supermarkets, 13% for specialty meat shops, 8% for other retail outlets, and 17% for food service. They estimate that 27% of US frozen beef is destined for "beef bowl" chains, 27% for processing into sausages and other deli meats, 25% for other food service, and 14% for retail sales. The U.S. and Canada are very interested in expanding their chilled beef exports because they feel this is the market with higher growth potential.

The variety and uniqueness of Japanese cooking styles and the relatively high price of beef make the market very dynamic with regard to the distribution of beef cuts imported. Japanese beef imports are almost exclusively in the form of boneless cuts. Carcasses and bone-in cuts account for less than two percent of imports currently. Chilled beef imports for fiscal year 1998 were 56% chuck, clod and round, 20% loins, and 23% ribs (ALIC). Frozen beef imports for fiscal year 1998 were 17% chuck, clod and round, 7% loins, 48% ribs, and 28% other cuts. In recent years, there has been a move toward chilled chucks and rounds away from loins due to stagnate incomes in Japan and continued high prices for imported beef.

People familiar with the Japanese beef industry say that one must analyze import patterns by cut and country of origin to make sense of this complex market. Table 3 shows Japanese imports of boneless cuts from the four major beef exporting countries for September 1999 through August 2000. Chilled chucks account for the most volume, frozen ribs are second, and chilled ribs are third. The U.S. is the leading supplier of each frozen cut, while Australia is the leading supplier of chilled chucks and loins.

Beef prices are high in Japan, as shown in Tables 4 and 5. The premium for U.S. beef relative to Australian beef varies by cut and level in the distribution system. Table 4 shows Japanese wholesale prices for four different cuts from Australia and the U.S. All prices are for chilled beef. The premium for U.S. varies from 57% for chuck roll to 162% for strip loin. Note, however, that differing definitions of cuts may not allow an exact comparison between cuts from the two countries because of different cutting styles. Much of the premium disappears, though, when the beef reaches the retail level. Table 5 shows bargain (sale) and normal prices for U.S. and Australian beef for selected cuts. U.S. beef is consistently priced higher at the retail level, but the premium is 10-25% for chuck, round, and sirloin versus 75-100% for brisket.

Few cuts from Australia are imported in chilled and frozen form -- cuts are either imported in one form or the other. When both forms are imported, the premium for chilled is small (5-12%). If the beef cut is to enter the distribution system for retail sale or food service, it will likely be chilled, but if the beef is to be used in processing, it will likely enter as frozen. There is more diversity in U.S. beef imports and the form of importation. For some cuts, the premium for chilled U.S. beef is 40-50% (Table 6), which is greater than for Australian beef, and it is great enough that some frozen U.S. beef still enters the retail distribution and food service system. While for other cuts, such as chuck eye roll and short rib, the premium for chilled beef is 15% or less.

Despite this rich diversity in demand patterns for beef cuts, there has been no analytical research which examines this facet of Japanese import patterns. This study investigates competitive relationships among beef import suppliers in the Japanese market using data by beef cut. Because of the exacting requirements and differentiated nature of beef products in Japan, exporters could have market power. A residual demand model by country for four competitors, Australia, the U.S., Canada,

and New Zealand, is specified and estimated. The analysis is disaggregated by beef cut, so that the competitive relationships can vary by beef market segment. The results are used to provide insights into pricing and marketing behavior of major beef exporters.

Conceptualization, Empirical Model and Data

For this exercise, it is assumed that beef is differentiated by country of origin, but there are substitution possibilities among beef from differing countries. For instance, Australian beef is differentiated from U.S. beef, but cross price elasticities are non-zero. Beef exporters from each country face a downward sloping demand curve, but as they change their pricing decisions, they must consider how other exporters will react to those price changes. This means that each beef exporter faces a residual demand curve that is downward sloping and they can maximize profit from that residual demand curve through their output decisions.

Specifically, consider a country's exporters selling beef in the Japanese market. Let Q_{ex} be the quantity of beef exports from the country in question, P_{ex} be the Japanese import price (in yen) of the country's beef, $P_1,\ldots, P_n$ be the yen prices of the n other competing beef exporting countries, Q_i be beef exports of country i to Japan, and Z be a vector of Japanese demand shifters. The demand functions for the exporters may be written as:

$$Q_{ex} = Q_{ex}(P_{ex}, P_j, Z) \qquad j = 1, \ldots, n \tag{1}$$

$$Q_i = Q_i\,(P_i, P_{ex}, P_j, Z) \qquad j = 1, \ldots, n \quad j \neq i \qquad (2)$$

The exporter in question maximizes profit as

Maximize $p = P_{ex} Q_{ex} - e\, C_{ex}$

where e is the exchange rate in yen per unit of the exporting country's currency and C_{ex} is cost of producing beef in the exporter's currency.

The first order condition for profit maximization is that expected marginal revenue equal marginal costs:

$$P_{ex} + Q_{ex}\left[\frac{\partial P_{ex}}{\partial Q_{ex}} + \sum_j \frac{\partial P_{ex}}{\partial P_j}\frac{\partial P_j}{\partial Q_{ex}}\right] - e\frac{dC_{ex}}{dQ_{ex}} = 0$$

$$P_{ex} = e\, MC_{ex} - Q_{ex}\left[\frac{\partial P_{ex}}{\partial Q_{ex}} + \sum_j \frac{\partial P_{ex}}{\partial P_j}\frac{\partial P_j}{\partial Q_{ex}}\right]$$

Where MC_{ex} is marginal cost. The term in brackets reflects the residual demand elasticity for the exporter and the competitive behavior among exporters, particularly how their pricing decisions are related. For our purposes, a more simplified equation suffices:

$$P_{ex} = e\, MC_{ex} + Q_{ex}\, q \qquad (3)$$

Where q contains all the terms from the bracket. In this situation, the exporter considers the demand function it faces (equation(1)) and adjusts its sales through the supply relationship in equation (3)[1]. If the exporter faces a perfectly competitive market, q will be zero and price will equal marginal cost. If the exporter exerts market power, q will be greater than zero and price will be above marginal cost.

The empirical model specified in this study includes equation (1) and (3) for each beef exporting country[2]. Beef exporters consider the residual demand function that they face, their marginal costs, and the pricing reactions of other beef exporters when they decide upon their price in the Japanese market. Because of the very specific uses for different beef cuts, Japanese demand for each beef cut is segmented from the demand for other cuts. This means the market for each cut is separable, so there is a system of equations for each beef cut. The exact empirical specification for each beef cut is in double log form for i = 1 to 4, so coefficients are elasticities:

$$\ln Q_i = a_0 + a_1 \ln P_i + \sum_{j=0}^{2} a_{2+j} \ln P_j + a_5 \ln Y$$

$$\ln P_i = b_0 + b_1 \ln e + b_2 \ln Q_i$$

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[1]We use the term "relationship" because there is no supply curve or function in this model. Exporters react to the residual demand function and decide their price and export quantity.

[2]Note that equation (1) is identical in specification to equation (2), so the model tests whether the countries face a residual demand function (equation (1)) and whether exporting countries use that demand function (and their market power) to maximize profits (equation (3)).

There is a residual demand curve and a pricing relationship for each exporting country. The demand shifter is income. The coefficient for the exchange rate in the pricing equation (b_1) measures the elasticity of price with respect to marginal costs in the exporter's currency and the coefficient for quantity exporting in the pricing equation (b_2) is Bresnahan's index of competitiveness (as b_2 moves further from zero, the market is less competitive). This model is similar to one suggested by Goldberg and Knetter, except that individual firms are not incorporated into the model. Thus, its structure is more in line with models suggested by Bresnahan.

When the model includes four exporting countries, there are eight endogenous variables (yen prices and export quantities for each country) and five predetermined variables (the four exchange rates and income) for each beef cut. There are three beef cuts analyzed: loin, chuck[3], and ribs; each cut is also analyzed on a chilled and frozen basis. The choice of beef cuts is strictly determined by data availability. The model is estimated using simultaneous equation methods because the exporting country determines price and quantity.

The model is fitted using monthly data from March 1992 to August 2000. Data on Japanese prices and imports by cut came from the Agriculture and Livestock Industries Corporation. Exchange rates came from the International Monetary Fund. Japanese personal consumption expenditures were used as the measure of income; expenditure data were chosen because they were readily available on a monthly basis. Expenditure data came from the Economic Planning Agency of Japan.

Results of Estimations

[3]For convenience we use the term "chuck" to refer to cuts from the chuck, clod, and round.

Equations (4) and (5) are estimated using three stage least squares. The results presented are for the full model presented earlier and include all data collected. We also fitted the models combining Canada and the U.S. exports (using the U.S. price), and combining Australia and New Zealand (using the Australia price). This aggregation had no substantial effect on the results. We also used a shorter data series, realizing that the last major tariff reduction in the early 1990s occurred in April 1993. We fitted the models using data beginning in January 1995 too (so that final adjustments to the lower tariff would have worked through the system). Shortening the data series also had no substantial effect on the results.

Chilled loins:

The residual demand functions for chilled loins are successfully picking up differential demand patterns by country. Own-price elasticities were significantly below zero and elastic for Canada, Australia, and New Zealand. The large magnitudes for Canada and New Zealand may surprise the reader, but one must keep in mind that chilled loin exports from those countries are small relative to exports from Australia and the U.S. (Table 3). The positive sign on own-price for the U.S. (though it is not significantly different from zero) indicates that the model is missing something that affects residual demand.

Income elasticities were significantly above zero and large for the U.S., Canada, and New Zealand, but the elasticity is negative for the leading chilled loin supplier, Australia. The income elasticity is surprisingly large for the U.S. because its chilled loin exports to Japan are substantial. These results imply that income stagnation in Japan has been a drag on U.S., Canadian, and New Zealand exports in recent years. Most cross-price elasticity estimates are positive, but only one is positive and significantly different from zero. The residual demand model does not have enough precision to pick up

all cross-price effects, if they exist. The negative (and significant) cross-price elasticities in the U.S. model lend support to the idea that the model does not sufficiently explain the demand pattern faced by U.S. loin exporters.

The supply relationships for chilled loins are presented in the bottom of Table 7. The exchange rate coefficient is positive and significantly different from zero for each country; ranging in value from 0.3 to 0.7. The U.S. and Canada have larger coefficients than Australia and New Zealand. The magnitudes indicate that marginal cost is 30-70% of the price of beef, which seems a little low. The Durbin-Watson statistics for these equations show that there is serial correlation, which is another hint that there is a misspecification.

The more disappointing results are for the coefficients on exports, which are all negative, though a positive sign was expected, and those coefficients had large t-ratios. It is clear that the exchange rate alone as an exogenous variable is insufficient to identify the estimated equation as a supply relationship. This same problem is present in nearly all the other supply results presented later. Clearly, we must add some other supply-shifters, such as cattle prices in the exporting country, to help identify the supply relationship.

Chilled chucks:

The results for chilled chucks have many similarities to the results for chilled loin. Three of the four own-price elasticities are significantly different from zero, and each is elastic. The own-price elasticity for the U.S. and Canadian chucks are especially large in absolute value, indicating that there are significant substitution possibilities with other products. Positive (and significant) cross price elasticities are obtained for Canadian and Australian chuck in the U.S. equation, for Australia in the Canadian equation, and Australian chuck in the New Zealand equation. The only significant price

coefficient in the Australian equation is the cross-price for Canadian chuck. Only the Australian income coefficient was significantly different from zero and it was a rather large negative value. Chucks are the lowest-priced of the three cuts analyzed, so a negative income elasticity is not surprising. All other estimates were positive.

The supply relationships had results similar to chilled loin in general. All of the exchange rate coefficients were significantly different from zero, ranging in value from 0.52 to 0.94. The range involved higher numbers for chuck, indicating that marginal costs accounted for 50-95% of price; a more reasonable result than for chuck. The demand results suggested that there was more competition among the countries in the chuck market and that seems to be borne out by the marginal cost results. The disappointing results, again, were for the export quantity coefficients, which were negative and had large t-ratios, except for Australia. Australia was the only equation where quantity had the expected positive sign, 0.66.

Chilled ribs:

The demand equation results for chilled rib cuts are less consistent with theory than the results for chilled loin or chuck. Only one own-price elasticity is negative and significantly different from zero (in the New Zealand equation). Many of the cross-price elasticities are negative and two are significantly different from zero; two are of the expected positive sign and significantly different from zero. It is difficult to argue that cross-price elasticities for the same beef cut from different origins would be complements. The results make it clear that income effects drive exports for the U.S., Canada, and New Zealand; each country had income elasticities greater than 10. This large income elasticity, especially for the U.S., are consistent with other results by cut, but they are surprising since the U.S. is the leading exporter of chilled ribs to Japan.

The supply relations for chilled ribs are consistent with the results for chilled loins: low but mostly significant exchange rate coefficients, but negative and significant export quantity coefficients. The lone exception to this is Canada, where the exchange rate coefficient was not significantly different from zero and the quantity coefficient was significant and positive. Again, we need to work on getting more data that reflect supply decisions. The Durbin-Watson statistic for the equation also indicates that there is less serial correlation in the Canadian equation.

Frozen cuts:

The discussion of the demand and supply relations for frozen cuts can be dispensed with fairly rapidly. For frozen loins and chucks, it is clear that the market is very competitive. The residual demand functions clearly show that prices and incomes have little bearing on demand for these cuts by country. Consumers do not differentiate among countries for these cuts when they are frozen.

The supply relations tell a similar story for frozen loins and chucks, with a few exceptions. Many of the quantity coefficients are still of the unexpected sign and significantly different from zero, especially for the frozen rib equations. The only equation that looks reasonable from a theoretical perspective is the supply relation for frozen ribs from Australia, which has positive coefficients for exchange rate and export quantity. The Durbin-Watson statistics indicate no problem with serial correlation for all of the frozen chuck equations and most of the frozen loin equations, thus omitted variables are not likely a problem.

The results for frozen ribs, the second-leading imported cut for Japan, imply that Australia and New Zealand face a down-ward sloping residual demand curve. Both demand functions are very own-price responsive, and there is a high degree of substitution between rib cuts from those two countries. Neither of the income elasticities for Oceanic countries are significantly different from zero. The results

for the U.S. and Canada show that those countries face perfectly elastic residual demand curves and their products are viewed as perfect substitutes.

The supply relationships for frozen ribs are similar to the chilled results – the exchange rate coefficients are large and significantly different from zero, while the export quantity coefficients are negative and significantly different from zero. The lone exception is Australia, where the export quantity coefficient has the expected positive sign, indicating that Australia takes advantage of its down-ward sloping residual demand curve. This result is surprising because Australia has a smaller share of the frozen rib market in Japan (only 6.4% from Table 3) than any of the other five products analyzed. Maybe specialized Australian cutting styles differentiates their rib cuts from those of other countries.

Summary and Conclusions

The results of this analysis lend insights into the competitive behavior of beef exporting countries in the Japanese market. It is clear that exporting countries face downward sloping residual demand functions for chilled cuts. Yet there is little evidence that they use that fact to their advantage through their pricing decisions.

There is definitely a need for further research in this area looking at behavior through different competitive assumptions. The simply pricing model derived here may not fully capture reactions among exporting countries as conditions change. It is clear, at a minimum, that more variables need to be used in the supply relations to identify them and refine the parameter estimates on export quantity.

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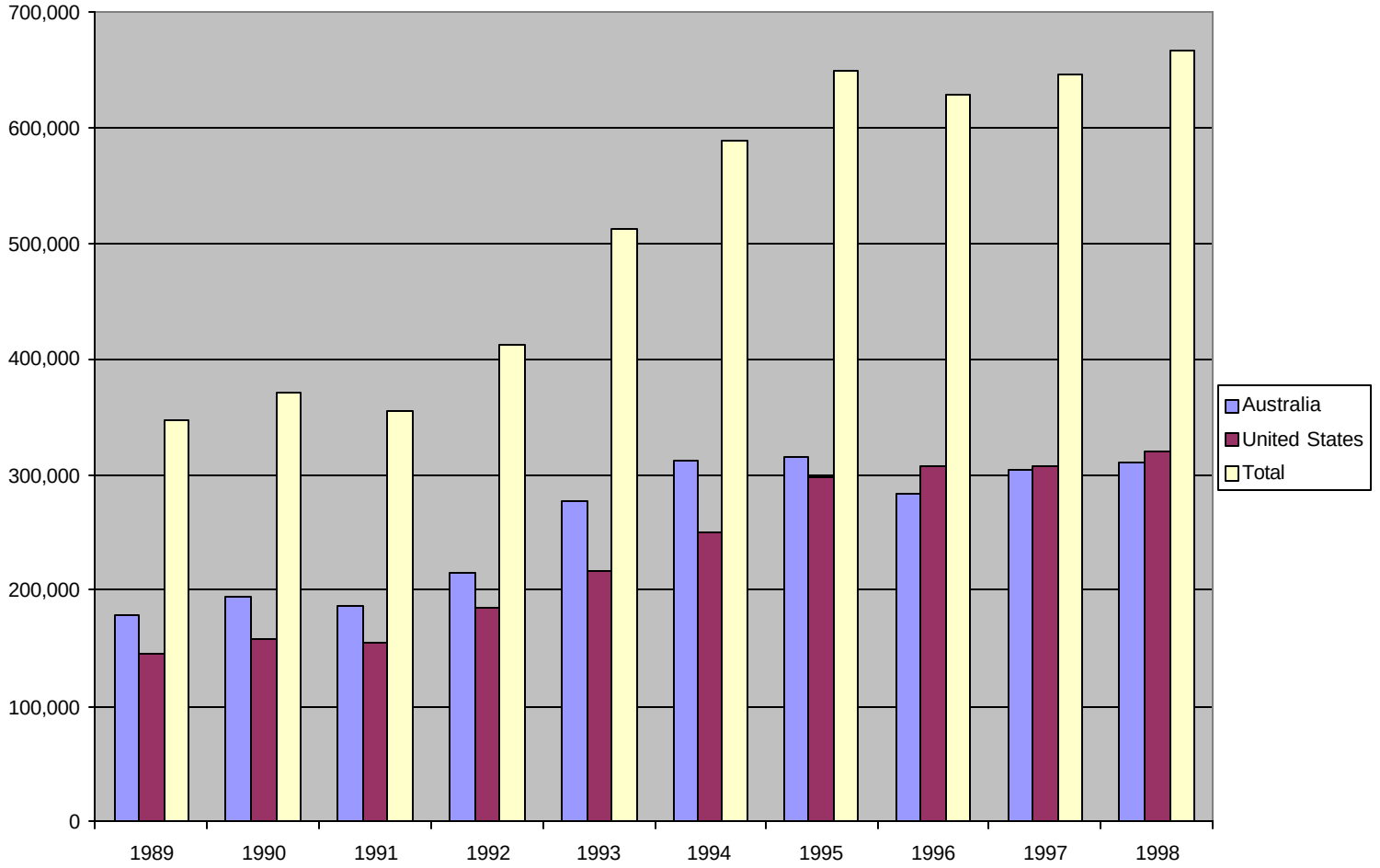
Figure 1. Japanese Beef Imports, 1989-98, in Thousand Tons



Source: United Nations

Table 1. Japanese Beef Imports in thousand metric tons, fiscal year 1999 (April 1 - March 31).

	Chilled	Frozen	Total
Australia	192.1	121.5	314.1
US	136.6	194.8	331.6
Canada	3.9	14.5	18.4
New Zealand	3.5	10.4	14.0
Total	336.2	345.2	682.6

Source: ALIC

Table 2. Share of Japanese Beef Import Market, FY 1999.

	Chilled	Frozen	Total
Australia	57.1	35.2	46.0
US	40.6	56.4	48.6
Canada	1.2	4.2	2.7
New Zealand	1.0	3.0	2.0
Total	49.2	50.8	100.0

Source: ALIC

Table 3. Japanese Imports of Boneless Cuts from the U.S., Australia, Canada, and New Zealand. September 1999 through August 2000 in metric tons.

	U.S.	Australia	Canada	N Zealand	Total of 4
Chilled Loins	25,837	37,807	641	575	64,860
Chilled Chucks	65,488	125,964	1,799	2,227	195,478
Chilled Ribs	51,549	33,199	2,540	598	87,886
Frozen Loins	11,662	7,200	875	2,156	21,893
Frozen Chucks	26,744	20,155	530	3,442	50,871
Frozen Ribs	148,184	10,978	11,718	1,634	172,514
Total	329,464	235,303	18,103	10,632	593,502

Source: ALIC

Table 4. Wholesale Prices for Australian and U.S. Beef by Selected Cuts, Mid-July 2000, in U.S. dollars per hundredweight.

Cut	Australian	U.S.	US Premium
Chuck Roll	$152	$ 238	57%
Clod	$129	$ 231	79%
Strip Loin	$317	$ 829	162%
Tenderloin	$675	$1175	74%

Source: ALIC

Table 5. Retail Prices for Imported Beef, June 2000, in U.S. dollars per hundredweight.

	U.S.		Australian	
Cut	Bargain	Normal	Bargain	Normal
Chuck	$ 599	$ 957	$ 496	$ 763
Brisket	$ 858	$1203	$ 431	$ 677
Sirloin	$1177	$1746	$1017	$1556
Round	$ 513	$ 866	$ 457	$ 750

Table 6. Wholesale Prices for U.S. Beef Cuts, Frozen vs. Chilled, July 2000, in U.S. dollars per hundredweight.

	Frozen	Chilled	Premium
Ribeye Roll	$ 622	$ 744	24%
Chuck, Shoulder Clod	$ 168	$ 231	38%
Brisket	$ 170	$ 255	50%
Strip Loin	$ 558	$ 829	49%
Tenderloin	$1017	$1177	16%
Chuck Eye Roll	$ 216	$ 239	11%
Short Rib	$ 730	$ 757	4%

Source: ALIC

Table 7. Estimates of the Demand and Supply Relations for Japanese Import of Chilled Loin.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AU}	P_{NZ}	Y	D.W.
US	-128.18**	1.87	-1.48*	2.02	-3.46**	11.95**	1.19
	(35.44)	(1.95)	(0.61)	(1.46)	(1.17)	(2.97)	
Canada	-181.68**	5.03	-9.26**	1.73	1.63	15.95**	1.29
	(56.12)	(2.97)	(0.94)	(2.20)	(1.77)	(4.62)	
Australia	24.46	0.12	-0.34	-1.38*	-0.09	-0.42	1.22
	(16.75)	(0.91)	(0.32)	(0.71)	(0.54)	(1.38)	
New Zealand	-242.22**	5.99*	-3.06**	1.31	-6.44**	21.75**	1.35
	(55.90)	(3.03)	(0.97)	(2.26)	(1.80)	(4.65)	

Supply Relation	Intercept	ER	Q	D.W.
US	3.98**	0.72**	-0.03	0.78
	(0.32)	(0.04)	(0.02)	
Canada	4.11**	0.72**	-0.05**	0.52
	(0.54)	(0.11)	(0.01)	
Australia	6.97**	0.32**	-0.20	0.55
	(1.58)	(0.12)	(0.13)	
New Zealand	5.91**	0.41**	-0.14**	0.34
	(0.45)	(0.11)	(0.03)	

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.

Table 8. Estimates of the Demand and Supply Relations for Japanese Import of Chilled Chuck.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AU}	P_{NZ}	Y	D.W.
US	4.62	-6.40**	1.57*	4.05**	0.81	0.46	1.05
	(15.89)	(1.16)	(0.63)	(1.17)	(0.43)	(1.42)	
Canada	-88.62	-9.26*	-4.34*	10.26**	2.40	8.56	1.58
	(53.01)	(3.76)	(2.07)	(3.81)	(1.38)	(4.67)	
Australia	69.25**	-0.98	0.735*	-0.77	-0.03	-4.46**	1.26
	(9.95)	(0.66)	(0.37)	(0.68)	(0.24)	(0.86)	
New Zealand	-20.92	-4.02*	1.98	5.08*	-2.66**	2.13	1.47
	(28.66)	(2.03)	(1.11)	(2.07)	(0.74)	(2.51)	

Supply Relation	Intercept	ER	Q	D.W.
US	6.97**	0.54**	-0.38**	1.02
	(0.348)	(0.07)	(0.03)	
Canada	3.61**	0.67**	-0.07**	2.04
	(0.435)	(0.10)	(0.01)	
Australia	-4.25*	0.94**	0.66**	1.50
	(2.05)	(0.14)	(0.17)	
New Zealand	6.28**	0.52**	-0.44**	1.27
	(0.36)	(0.10)	(0.04)	

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.

Table 9. Estimates of the Demand and Supply Relations for Japanese Import of Chilled Rib.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AC}	P_{NZ}	Y	D.W.
US	-111.69**	0.90	0.30	-2.67**	-0.13	10.60**	0.90
	(26.34)	(0.82)	(0.28)	(1.03)	(0.42)	(2.21)	
Canada	-349.22**	4.93*	3.25**	-11.83**	-0.46	30.67**	1.29
	(79.89)	(2.42)	(0.83)	(3.10)	(1.27)	(6.68)	
Australia	24.53	-0.11	0.15	-0.98	-0.29	-0.79	1.55
	(12.55)	(0.39)	(0.13)	(0.49)	(0.20)	(1.05)	
New Zealand	-123.83**	2.73**	0.20	1.70	-5.12**	10.77**	1.15
	(30.56)	(0.85)	(0.27)	(1.11)	(0.52)	(2.54)	

Supply	Intercept	ER	Q	D.W.
US	6.67**	0.41**	-0.23**	0.50
	(0.48)	(0.10)	(0.03)	
Canada	4.29**	0.36	0.14**	1.46
	(1.27)	(0.28)	(0.03)	
Australia	6.90**	0.30**	-0.31*	0.83
	(1.42)	(0.10)	(0.13)	
New Zealand	5.14**	0.46**	-0.27**	0.93
	(0.38)	(0.09)	(0.04)	

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.

Table 10. Estimates of the Demand and Supply Relations for Japanese Import of Frozen Loin.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AU}	P_{NZ}	Y	D.W.
US	289.33	7.18	0.45	-0.39	-4.81	-25.09	1.88
	(215.77)	(15.99)	(5.26)	(3.57)	(5.82)	(22.04)	
Canada	-886.44	-57.75	23.05	-9.80	24.17	85.86	1.99
	(1316.29)	(101.58)	(36.04)	(26.04)	(36.83)	(132.89)	
Australia	-160.70	-6.46	0.00	-0.13	3.87	15.57	1.83
	(270.49)	(25.38)	(9.62)	(7.23)	(9.22)	(27.87)	
New Zealand	51.62	-0.98	2.46	-0.76	-1.17	-3.75	1.30
	(130.39)	(8.92)	(2.71)	(1.69)	(3.26)	(13.28)	

Supply	Intercept	ER	Q	D.W.
US	7.26**	0.11	-0.12	1.90
	(1.75)	(0.28)	(0.09)	
Canada	7.11**	0.03	-0.07	1.49
	(0.96)	(0.21)	(0.04)	
Australia	10.06**	-0.07	-0.60**	1.18
	(1.46)	(0.27)	(0.11)	
New Zealand	8.00**	-0.13	-0.02	1.36
	(1.28)	(0.23)	(0.17)	

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.

Table 11. Estimates of the Demand and Supply Relations for Japanese Import of Frozen Chuck.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AU}	P_{NZ}	Y	D.W.
US	388.79	16.59	-7.07	1.19	-14.80	-29.92	1.74
	(354.99)	(14.71)	(6.41)	(12.43)	(19.57)	(28.35)	
Canada	-2520.46	-106.91	40.09	6.109	83.49	200.36	1.84
	(1822.99)	(73.52)	(32.55)	(61.61)	(95.38)	(144.83)	
Australia	388.26	16.84	-6.40	-3.14	-11.37	-29.96	1.69
	(401.66)	(16.46)	(7.21)	(14.15)	(21.83)	(32.06)	
New Zealand	166.00	7.48	-3.54	6.13	-12.20	-12.35	1.78
	(425.49)	(17.37)	(7.57)	(14.76)	(22.55)	(33.89)	

Supply Relation	Intercept	ER	Q	D.W.
US	15.24**	0.41	-1.45**	1.68
	(4.75)	(0.47)	(0.44)	
Canada	5.59**	0.28	-0.26**	1.87
	(1.63)	(0.36)	(0.04)	
Australia	-4.28**	0.68**	0.92**	1.91
	(1.56)	(0.17)	(0.17)	
New Zealand	6.38**	0.43*	-0.44**	1.66
	(0.80)	(0.18)	(0.09)	

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.

Table 12. Estimates of the Demand and Supply Relations for Japanese Import of Frozen Rib.

Demand Relation	Intercept	P_{US}	P_{CA}	P_{AU}	P_{NZ}	Y	D.W.
US	60.08	-0.94	-0.52	1.12	0.47	0.24	1.96
	(39.25)	(0.68)	(0.90)	(1.21)	(0.64)	(3.24)	
Canada	-89.64	-0.65	-5.09	2.99	3.14	7.85	1.60
	(123.80)	(2.10)	(2.86)	(3.53)	(1.88)	(10.19)	
Australia	26.45	-1.03	1.34	-3.029*	1.41*	-1.07	1.42
	(44.75	(0.74)	(1.04)	(1.34)	(0.68)	(3.66)	
New Zealand	-22.19	4.48**	-5.98**	12.73**	-8.91**	1.28	1.25
	(93.41)	(1.67)	(2.18)	(3.78)	(1.77)	(7.66)	
Supply Relation	**Intercept**	**ER**	**Q**	**D.W.**			
US	12.03**	0.86 **	-1.13**	1.25			
	(2.23)	(0.34)	(0.18)				
Canada	2.76**	0.89**	-0.19 **	1.17			
	(0.70)	(0.15)	(0.02)				
Australia	-4.22	0.97*	0.80**	1.70			
	(4.39)	(0.43)	(0.40)				
New Zealand	3.27**	0.78**	-0.24**	1.35			
	(0.81)	(0.20)	(0.04)				

Note: standard errors are in parentheses
** Significant at 1% level
* Significant at 5% level

P_{US} is US price, P_{CA} is Canadian price, P_{AU} is Australian price, P_{NZ} is New Zealand price, ER is exchange rate, Y is income, and DW is the Durbin-Watson statistic.