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Import Demand for Quality in the Japanese Beef Market

Dragan Miljkovic and Hyun Jin

The case of reduction in *ad valorem* tariffs as a trade liberalization policy is considered in this article. It is shown that the reduction leads to a higher quality of imports, *ceteris paribus*. This hypothesis was tested on the case of Japanese beef imports from the United States and Australia. U.S. beef, according to the results of Gallup surveys, is considered by Japanese consumers to be a high quality product, while Australian beef is considered to be a low quality product. Empirical results support the hypothesis. Moreover, the recent domination of U.S. beef in the Japanese market is further explained by increasingly more efficient U.S. beef production relative to Australian production and a strong income effect, where an increase in per capita income leads to more demand for higher quality products.

Key Words: *ad valorem* tariff, beef imports, Japan, quality, trade liberalization

Most literature regarding trade liberalization focuses on its benefits from an increase in international trade volume. We postulate that trade liberalization may have some additional effects that have not been sufficiently emphasized in trade theory or previously empirically addressed. The trade liberalization due to the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO) often follows the pattern of non-tariff trade barriers being converted into tariff equivalents, which are then reduced or eliminated over some period of time negotiated between participating countries. Import tariffs are considered more transparent than non-tariff measures, and because of that they have been a preferred policy instrument in multilateral trade negotiations (Clarke and Evenett 2003).

Miljkovic (2002) determined that different forms of trade liberalization (e.g., reductions in per unit versus reductions in *ad valorem* import tariffs) affect the quality of imported goods that

consumers demand. Thus, consumers may end up consuming more low-quality imported goods due to a reduction in *per unit* tariffs, or more high-quality imported goods due to a reduction in *ad valorem* tariffs. Second, the choice of a trade liberalization instrument may result in different patterns of composition of imports if different countries export differentiated-quality products. Thus, liberalizing trade does not imply an automatic increase in exports by all exporters into the liberalized market. Moreover, market shares in the import markets may shift significantly.

The objective of this study is to look into the Japanese trade liberalization policies and measure the effect they may have had on beef import markets that experienced a major shift from predominantly importing Australian beef in the 1980s, to predominantly importing American beef in the late 1990s. Other factors contributing to this shift are also analyzed. The Gallup Organization conducted several surveys in Japan during the 1990s and early 2000s examining consumers' perceptions about the quality of beef in the Japanese market. It was determined that Australian and U.S. beef are two different qualities of the same good, with U.S. beef being perceived as a higher quality product. Therefore, our article puts a special emphasis on analyzing possible implications of the reduction in import tariffs (due to GATT) on the quality of Japanese beef imports.

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Japanese Beef Market Overview

The United States is one of the world's largest producers and exporters of beef. For example, in 1996, U.S. beef exports accounted for approximately 17 percent of world beef exports. Major U.S. customers for beef have been Japan, Mexico, Canada, and South Korea (Agricultural Marketing Service 1998). While the United States is the world's largest importer of beef and live cattle combined, Japan is the world's largest importer of beef only. Japan purchased about 90 percent of its fed beef imports from the United States (the remainder from Canada and Australia) during the 1990s.¹ Most non-fed beef imports are supplied by Australia (more than 95 percent) and the rest by New Zealand. Finally, Australia exports small quantities of wagyu beef to Japan [Agriculture and Livestock Industries Corporation (ALIC), various issues]. Beef industries in the United States and Australia (both major exporting countries of beef to Japan) spent a considerable amount of money on promotional activities in order to maintain their market share. Considering the importance of Japan in the world trade of beef, it comes as little surprise that there are a large number of studies on Japanese import demand for beef. More recent studies include Reed and Saghalian (2004) and Miljkovic, Marsh, and Brester (2002), who also provide a comprehensive review of previous work in this area. However, to the best of our knowledge, the issue of the effects of trade liberalization policies on the change in quality of beef imports to Japan has never been addressed.

Overall Japanese beef imports have almost tripled since the introduction of Japan's trade liberalization policies in the late 1980s. However, imports of U.S. beef grew at a higher rate than imports of Australian beef during the same period. For instance, the U.S. beef market share was 33.4 percent of the total Japanese beef imports in 1986, while the Australian beef market share was 60.3 percent. In 2000, the U.S. beef market share grew to 48.6 percent of total Japanese beef imports, while the Australian market share fell to 45.8 percent (ALIC, various years) (Table 1).

The Gallup Organization has conducted several surveys about factors affecting consumer consumption of beef in Japan during the last several years. These surveys have been conducted on behalf of the U.S. Meat Export Federation (USMEF), and data on changes in consumer preferences used in our analysis are obtained from the USMEF. Some of the findings of the most recent (2002) Japan beef survey findings may be summarized as follows. Japanese consumers rate taste and tenderness as the most important quality attributes. Taste and tenderness of U.S. beef are perceived by Japanese consumers as superior relative to the taste and tenderness of Australian beef. Another top consideration among Japanese consumers when purchasing beef is freshness. U.S. beef has been rated slightly lower (statistically insignificant) than Australian beef in this category. Obviously, from the U.S. standpoint, in order to help this rating while increasing purchases of U.S. beef it would be desirable to educate Japanese consumers on the production process and the steps the United States takes to ensure that the product arrives fresh to the consumer. Safety of beef consumed was the last issue considered by Japanese consumers. Due to the bovine spongiform encephalopathy (BSE) outbreak in Japan in 2001, consumers have become leery of beef products in general, and beef consumption has declined overall as a result. Beef mislabeling issues may have also contributed to the decline in consumption. Japanese consumers reported significant declines in their perception of domestic beef as safe and healthy. However, there has been a significant increase in the perception that U.S. beef first and Australian beef second are safe and healthy. Note that the last Japanese beef survey was conducted before the appearance of BSE in North America, an event that may have altered consumer perceptions in Japan.²

After establishing that, based on consumers' perceptions, Australian and U.S. beef are two different qualities of the same good, factors affecting the composition (quality) of Japanese beef imports will be discussed. The first factor considered is a change in import tariffs. Until 1988, the

¹ Australian share in the imports of fed beef increased significantly after 2002, but that most recent period is not covered in the study because of the ban on imports from the United States due to bovine spongiform encephalopathy (BSE).

² Reed and Iswariyardi (2001) analyzed the Japanese import demand while differentiating for quality (measured by the degree of marbling) irrespective of the country of origin of the imported beef. That certainly is an important issue to address as well, but does not help us in answering the questions we posed.

Table 1. Japanese Beef Imports by Origin (1985–2000)

Year	Australia		United States		Total Imports
	tons	% share	tons	% share	tons
1985	97,415	61.8	49,671	31.5	157,728
1986	113,271	60.3	62,799	33.4	187,871
1987	124,498	55.7	84,611	37.8	223,606
1988	148,360	52.0	118,687	41.6	285,416
1989	189,884	52.2	151,665	41.7	363,997
1990	198,456	51.7	164,393	42.8	384,199
1991	175,976	53.8	141,529	43.3	326,923
1992	227,598	53.8	182,873	43.2	423,429
1993	301,702	53.2	243,085	42.9	566,911
1994	306,878	52.6	248,367	42.5	583,964
1995	314,544	47.8	307,936	46.8	658,365
1996	277,400	45.4	296,149	48.5	611,241
1997	307,254	46.6	315,455	47.9	658,966
1998	319,029	46.8	327,849	48.1	681,791
1999	314,140	46.0	331,564	48.6	682,596
2000	338,046	45.8	358,566	48.6	738,415

Source: Agriculture and Livestock Industries Corporation (various issues).

Japanese domestic market was highly protected by import quotas and *ad valorem* tariffs. However, beef import quotas were relaxed in 1989 and 1990. In 1991, import quotas were replaced by a 70 percent *ad valorem* tariff, which was subsequently reduced to 60 percent in 1992 and 50 percent in 1993. Under the 1994 GATT/Uruguay Round agreement, the tariff rate quota was gradually reduced to 38.5 percent by 2001. However, Japan retains the right to reinstate the higher rate under safeguard provisions, if imports of frozen or chilled beef during a fiscal quarter are greater than 17 percent of import levels for the corresponding period in the previous year. The safeguards have been employed once during the period under consideration (Miljkovic, Marsh, and Brester 2002, Dyck and Nelson 2003).

Other variables that may have affected the composition of Japanese beef imports are exchange rate, per capita GDP, relative price of U.S. to Australian beef, prices of substitutes such as pork or domestic wagyu beef, and seasonal variations in imports due to various reasons. A couple of these variables deserve extra clarification.

First, as for the exchange rate, the Australian economy was affected more adversely by the Asian economic and financial crisis than was the United States. That led to a rather significant depreciation of the Australian dollar relative to the U.S. dollar during the second part of the 1990s (International Monetary Fund 2004). The result of these changing currency values was that U.S. beef became relatively more expensive than Australian beef in the Japanese market (Miljkovic, Brester, and Marsh 2003). Second, the relative price of U.S. to Australian beef may be thought of as the relative cost of production.

Differential Quality Imports and *Ad Valorem* Import Tariffs

A Model of Quality Choice by Foreign Monopolistic Competitors

The model described here is one developed by Das and Donnenfeld (1987). On the supply side, consider a foreign monopolistic competitor. This

assumption deserves some justification. Some may be concerned that trade is not under control of governments and that trade is conducted by private firms. This is certainly true in the case of U.S. and Australian beef exports to Japan (Dyck and Nelson 2003). Some firms export only from the United States, some from Australia, and some from both countries, while the rest of the Japanese beef market is controlled by Japanese importers. Thus, there may be a fair amount of competition, although the conditions for perfect competition might not be met. Reed and Saghaian (2004, p. 116) suggest that "Treating countries as exporters is an abstraction from reality. We are forced to use country data ... due to lack of firm-level data. In such cases, the estimated parameters may be interpreted as industry averages." While the above concerns may be relevant in a different context, one also has to be careful in overstating the relevancy of private enterprises in Japanese beef trade. Even if the same firm exports from both Australia and the United States to Japan, it does not mean that the quality of meat exported from these two locations is the same. On the contrary, it is more likely that the quality is different. We believe that one can generalize and treat the U.S. and Australian industries as monopolistic competitors, each tied to a specific quality level.

On the demand side, following Das and Donnenfeld (1987), we use the approach by Shaked and Sutton (1982). This approach in modeling demand is convenient because it yields deterministic results under rather general assumptions, unlike Spence's model (1975), which is also used in trade studies. The model used in this article³ assumes that a consuming unit has a binary choice, i.e., it can buy zero or one unit of the product. It will buy the product if the utility from consuming one unit of the product, measured in money terms, exceeds its price. Further assumptions of the model are that (i) consuming units in the market have varying intensity of preferences for the product and (ii) a distribution function of preferences over the population is postulated. This implies that the aggregate quantity sold equals the number of consuming units that buy the product. And, consuming units buy the product if, and only if, doing so yields a non-negative

surplus. Another convenient feature of this model is that income does not appear in this purchase rule, which enables us to ignore the income effects in this partial equilibrium approach.

On the production side, we assume that the foreign monopolistic competitor can produce a single quality at any given point in time. Based on results of the aforementioned Gallup surveys, it is clear that Japanese consumers perceive American beef and Australian beef as two different qualities of a product. Thus, the assumption of a single quality by country at any given point in time seems to be justifiable. Further assumptions are that the marginal cost of output is an increasing function of the level of quality but is independent of the scale of output.

The assumption that the country (the United States or Australia in this case) produces a single quality (variety) deserves further elaboration.⁴ Considering the length of the production cycle in the livestock industry and the prevailing economies of scale,⁵ in the subsequent analysis we will focus on the case where the foreign monopolist provides a single quality. Also recall that the primary beef market for U.S. producers is within the United States: more than 92 percent of total beef production in 1998 was consumed domestically (Miljkovic, Marsh, and Brester 2002). Thus, the primary goal of U.S. producers is to satisfy the tastes of domestic consumers. Finally, although there are two dominant exporters to Japan, one can make the case for monopolistic competition given that there are other exporters (e.g., Canada, New Zealand) and some domestic production.

In the Das and Donnenfeld (1987) framework, the foreign monopolist chooses price, quantity, and the quality level that maximizes his profits:

$$(1) \quad \Pi = [p - c(l)]x - K,$$

⁴ "The introduction of additional qualities (varieties) requires additional investments and time. Whether the country finds it profitable to sell more than a single quality depends on the magnitude of the fixed costs associated with each variety relative to the market size, the unit cost of production, and the shape of the density function—distribution of consumers' tastes. We presume that such fixed costs are sufficiently high, so that provision of a single quality is most profitable for the foreign country" (Das and Donnenfeld 1987, p. 80).

⁵ If economies of scale were less severe and the possibility of producing several qualities were viable, the monopolistic competitor could engage in product differentiation and consumer discrimination.

³ Again, the details of the derivation and mathematical formulation of the model can be found in Das and Donnenfeld (1987).

where x denotes the quantity produced, p is the price, c is the marginal cost of output, l is quality, and K is the fixed cost. The maximization problem can be further simplified by noting that once p and l are selected, they also determine the consumer with the lowest willingness to pay who participates in the market. The relationship between the quantity sold and the marginal consumer must be negative since it reflects the fact that the higher is the lowest willingness to pay, the fewer is the number of active buyers, and hence fewer units are sold. The price then can be expressed as the function of both quantity and quality:

$$(2) \quad p = g(x) u(l).$$

Replacing p with the above expression changes our profit-maximization equation (1) into

$$(3) \quad \max_{x,l} \Pi(x, l) = [g(x) u(l) - c(l)]x - K.$$

The choice variables in this profit-maximization problem are both quantity and quality, and appropriate first-order conditions (FOC) are

$$(4) \quad \Pi_x = 0 \rightarrow [g(x) + xg'(x)] u(l) - c(l) = 0,$$

$$(5) \quad \Pi_l = 0 \rightarrow g(x) u'(l) - c'(l) = 0.$$

Equation (4) is the standard condition where marginal revenue equals marginal cost. Equation (5) states that the quality is set at the level that equalizes the marginal cost of quality with the marginal utility of quality of the marginal consumer, i.e., the customer with the lowest willingness to pay. In other words, the additional revenue induced by marginal improvement in quality matches the rise in cost. The solution to (4) and (5) is (x_0, l_0) .

In order for the FOC to be optimal, the second-order conditions are

$$(6a) \quad \Pi_{xx} = [2g'(x) + xg''(x)] u(l) < 0,$$

$$(6b) \quad \Pi_{ll} = [g(x) u''(l) - c''(l)] x < 0,$$

$$(6c) \quad \mathbf{J} \equiv \Pi_{xx} \Pi_{ll} - \Pi_{xl}^2 = x \{ u(l) [2g'(x) + xg''(x)] [g(x) u''(l) - c''(l)] - x [g'(x) u'(l)]^2 \} > 0.$$

Non-concavity of the cumulative distribution of preferences or their mild concavity, i.e., $g''(x) > 0$ but small, ensure that Π_{xx} and Π_{ll} are both negative, while for $\mathbf{J} > 0$ slightly stronger conditions are required.

Analysis of an Ad Valorem Tariff

It has been shown in the literature that there is no difference between the impact of specific and *ad valorem* tariffs on the exports of foreign firms when the product(s) is homogeneous, unless a foreign producer has monopoly power (Brander and Spencer 1984). Thus, it comes as no surprise that when the foreign monopolistic competitor controls quality in addition to quantity (price), the effects of these tariffs will also differ. We are interested here in the effects of *ad valorem* tariffs given that they were employed by Japan in beef imports.

If τ is the *ad valorem* tariff rate, we can define $T = 1 + \tau$. Equation (3) representing profits of the foreign monopolistic competitor becomes $\Pi = [g(x) u(l)/T - c(l)]x - K$. The corresponding FOCs are

$$(7a) \quad g(x)u(l) - Tc(l) + xg'(x)u(l) = 0,$$

$$(7b) \quad g(x)u'(l) - Tc'(l) = 0.$$

Comparative statics analysis of the FOC equations with respect to *ad valorem* tariff τ and evaluating at $\tau = 0$ yields⁶

$$(8) \quad dx/d\tau = x/\mathbf{J} \{ c(l)g(x)[u''(l) - c''(l)] - xg'(x)u'(l)c'(l) \},$$

$$(9) \quad dl/d\tau = xu(l)u'(l)/\mathbf{J} \{ g(x) [g'(x) + xg''(x)] - x(g'(x))^2 \}.$$

Inspection of equation (8) reveals that the overall effect of an *ad valorem* tariff on quantity of imports is ambiguous. This result implies that under the assumption of non-concave cumulative distribution of preferences, the effect on an *ad valorem* tariff on the quantity of imports is an empirical matter. However, our interest in this

⁶ Das and Donnenfeld (1987, p. 86).

article is the effect of an *ad valorem* tariff on demand for quality. Equation (9) reveals that non-concavity of the cumulative distribution of preferences, i.e., $g''(x) \leq 0$, implies that an *ad valorem* tariff lowers the quality of imports. A corollary following this would be that given that the distribution of preferences is not concave, the reduction of an *ad valorem* tariff leads to higher quality imports.

It is important to recall a few things at this point. First, a single quality good produced by the exporting country is postulated here. Also, consumer utility of buying one or zero units is assumed to be dependent on quality and price. Hence, we have consumer response in terms of demand for a given quality as an embedded part of the exporter's profit-maximization problem. Having, in this case, two exporters producing a differentiated quality product, a natural extension of the above model is to consider the import demand for quality as the changing ratio in relative quality imported measured by relative imports (quantity) of these two qualities of the product.

Empirical Specification, Data, and Tests

We previously pointed out that Japanese consumers perceive American grain-fed beef and Australian grass-fed beef as two different qualities of the same product (Gallup Organization, various years). Thus, we estimate our equation (7b), which represents the demand for quality. We measure the quality of the imported beef by Japan as the ratio of the U.S. beef to Australian beef imports. Thus, an increase in the ratio would indicate an increase in demand for the higher quality product (U.S. beef) relative to demand for the lower quality product (Australian beef).⁷ In addition to two variables derived in the theoretical model [the ratio of the Japanese import prices of the U.S. to Australian beef as the measure of the relative (marginal) cost of production, and the tariff rate on Japanese imports of beef], the set of explanatory variables is enlarged to include the following: retail prices of domestic wagyu beef and

pork meat, Japanese real GDP per capita, real U.S. dollar per Australian dollar exchange rate, quarterly dummies for seasonal effects with first quarter omitted, and the time (trend) variable. All variables are presented and described in Table 2.

Quarterly data beginning with the first quarter of 1991 through the fourth quarter of 2002 were used to estimate the changes in quality (composition) of the Japanese beef imports.⁸ Japanese import quantities of U.S. and Australian beef and corresponding import prices were obtained from the ALIC *Monthly Statistics* (ALIC, various issues). Retail Japanese prices for pork and wagyu beef were also obtained from the ALIC *Monthly Statistics*. Exchange rates were obtained from the FRED data base of the Federal Reserve Bank of Saint Louis (Federal Reserve Bank, various years). Tariff rate variables were obtained from the Organization for Economic Cooperation and Development (OECD) (various years). Seasonality was accounted for by quarterly binary variables (intercept shifts).

The quality of imports equation was subjected to various specification tests. Using ordinary least squares (OLS), they included autocorrelation (Durbin-Watson test), heteroskedasticity (White and Glejser tests), and the presence of unit roots (augmented Dickey-Fuller unit root test or ADF). Test results, although they may be sensitive to small sample size, did not indicate the presence of either autocorrelation or heteroscedasticity in the residuals. The null hypothesis of unit root residuals was rejected at the $\alpha = 0.05$ significance level.

Based on the above statistical tests, the quality of imports equation was estimated by OLS. The equation was estimated in double logs because it was assumed that variables enter the equations multiplicatively. A Koyck (or first-order) lag on the dependent variables was also tested, but the asymptotic t-ratio rejected partial adjustment (Pindyck and Rubinfeld 1998, p. 234). Finally, because of short-run (quarterly) observations, composition of import responses could be dynamic, i.e., distributed lag adjustments may exist due to

⁷ This measure of quality may be unorthodox, yet it tells us about consumers' preferences over time. Quality has many attributes and consumers express their preferences for the entire bundle of quality characteristics by buying more or less of the product with certain characteristics.

⁸ This particular time span is used because, as we mentioned earlier, it coincides with the introduction of the *ad valorem* tariff as the only protection instrument employed by the Japanese in their beef import markets. Also, the Japanese ban on U.S. beef due to the appearance of BSE in the United States clearly prevented us from extending the analysis beyond the fourth quarter of 2002.

Table 2. Definitions of Model Variables for Changes in Quality of Japanese Beef Imports

Variable Name	Variable Definition
$Q_{U.S.}/Q_{Aus}$ (dependent variable)	Japanese imports of U.S. beef / Australian beef
$(P_{U.S.}/P_{Aus})_{(t)}$	Japanese relative retail price of imported (U.S. to Australian) beef
$P_{pork(t)}$	Retail Japanese price for pork (yen/kg)
$P_{wagyu(t)}$	Retail Japanese price for wagyu beef (yen/kg)
$R_{(t)}$	Real exchange rate (U.S. dollar per Australian dollar)
$GDP_{(t)}$	Japanese real GDP per capita
$Tariff_{(t)}$	Tariff rate on Japanese imports of beef
GATT	GATT dummy (1 after first quarter of 1995, 0 before)
D2, D3, and D4	Quarterly dummies for seasonal effects, representing second, third, and fourth quarters, respectively (first quarter omitted)

uncertainty and institutional constraints. We initially estimated the equation with lag specifications for the exogenous variables. The highest order lag was t-1 based on both the Akaike information criterion (AIC) and Schwartz information criterion (SIC). This t-1 lag is also consistent with the actual trading and pricing practices of beef packers and exporters (Agricultural Marketing Service 2005). Under the mandatory price reporting rules, prices for boxed beef and cuts are required to be reported on an FOB plant basis regardless of packaging variations. Also, packers are required to specifically report all sales of beef for export by specifically indicating on the price report form that the product is intended for export. Finally, packers are required to report the delivery period for boxed beef and cuts using the delivery period code (0–21 days, 22–60 days, 61–90 days, etc.). Similar regulations exist in Australia according to the Australian Department of Agriculture, Fisheries and Forestry (2005). Thus, the import price is determined between a packer-exporter and a Japanese buyer, and the ratio of U.S. and Australian FOB plant price clearly represents the relative cost of production. Since there is normally a gap of one to two months between the contract day and actual delivery day (CIF quantity), the t-1 lag for the relative price-cost of production seems to be very reasonable. All other variables considered in contracting a purchase are contemporaneous with the price and, thus, they are also t-1 relative to the dependent variable.

Empirical Results

Table 3 gives the regression results. The statistical results show an R^2 , adjusted R^2 , and standard error of equation of 0.76, 0.66, and 0.12, respectively. Statistically significant variables, at standard significance levels of 1, 5, or 10 percent, are Japanese relative import price of U.S. to Australian beef, Japanese real GDP per capita, real exchange rate (U.S. dollar per Australian dollar), tariff rate on Japanese imports of beef, and dummy-seasonal variables for the second and third quarter. Substitute prices, i.e., retail Japanese prices for pork and wagyu beef, GATT dummy, and fourth quarter seasonal dummy are not significant. In terms of size of the coefficients, Japanese relative retail price of imported (U.S. to Australian) beef, Japanese real GDP per capita, and the tariff rate on Japanese imports of beef seem to be the major driving force in determining the composition (quality) of Japanese beef imports.

The signs of the parameter estimates for the statistically significant variables are theoretically consistent. These include the negative effect of relative retail price (relative marginal cost) of imported beef on quality (composition) of Japanese beef imports. Specifically, as the price of U.S. beef decreases by 10 percent relative to the price of Australian beef, the imports of U.S. beef increase by 16.9 percent relative to the imports of Australian beef. Also, as Japanese real GDP per capita increases, consumers are willing to in-

Table 3. Regression Results

Variable/Statistics	Estimated Coefficients
Constant	-31.21*** (-3.77)
$(P_{U.S.}/P_{Aus})_{(t-1)}$	-1.69** (-2.18)
$P_{pork(t-1)}$	0.21 (0.44)
$P_{wagyu(t-1)}$	0.14 (0.13)
$R_{(t-1)}$	-0.004** (-2.43)
$GDP_{(t-1)}$	2.11*** (3.51)
$Tariff_{(t-1)}$	-0.64** (-2.35)
GATT	0.07 (0.88)
D_2	0.14*** (3.01)
D_3	0.10* (1.87)
D_4	0.07 (1.29)
R^2	0.76
Adj R^2	0.66
Standard error	0.123
Durbin-Watson	2.08

Notes:

Numbers in parentheses are the t-values.

*, **, and *** denote statistically significant variables at 10, 5, and 1 percent, respectively. Critical t-values at the $\alpha = 0.10$, $\alpha = 0.05$, and $\alpha = 0.01$ levels are 1.69, 2.03, and 2.72, respectively (37 degrees of freedom).

R^2 is the unadjusted R-squared, while Adj R^2 is the adjusted R-squared.

Standard error is the standard error of the equation.

crease their consumption of the high quality U.S. beef relative to their consumption of the low quality Australian beef. This effect is very strong, as represented with the estimated coefficient of 2.11. Our estimate of effect of reduction in *ad valorem* tariff (estimated tariff coefficient of -0.60) is consistent with the theoretical model previously described: an *ad valorem* tariff leads to higher quality imports. Specifically, a reduction in the *ad valorem* tariff rate on Japanese imports of beef led to an increase in imports of U.S. beef relative to imports of Australian beef. The real exchange rate coefficient, although statistically significant, is very small (-0.004) and does not seem to have an impact on the quality (composition) of Japanese beef imports. Its sign, however,

is consistent with theoretical expectations: a relatively more expensive U.S. dollar would lead to more Australian beef imports relative to U.S. beef imports. Finally, estimates of the seasonal dummies for the second and third quarter are significant relative to the omitted seasonal dummy (first quarter). This is expected because the Japanese fiscal year begins on April 1st and all tariff reductions and many other legislative measures are implemented at the beginning of the fiscal year rather than the calendar year.

Implications and Conclusions

While most literature concerning trade liberalization focuses on the benefits of an obvious increase in international trade volume, we postulate that it may have some additional effects that have not been sufficiently emphasized in trade theory or previously empirically addressed. We considered the case of reduction in an *ad valorem* tariff as the trade liberalization policy. It was shown that it leads to higher quality imports, *ceteris paribus*. We tested this hypothesis on the case of Japanese beef imports from the United States and Australia. U.S. beef, according to the results of a Gallup survey, is considered by consumers in Japan to be the high quality product while Australian beef is considered to be the low quality product. Empirical results support our hypothesis. Moreover, the recent domination of U.S. beef in the Japanese market is further explained by increasingly more efficient U.S. beef production relative to Australian production, and the strong income effect where higher per capita income leads to more demand for higher quality products.

These findings are interesting for several reasons. First, it is important to understand that trade liberalization will change the composition and quality of products demanded by consumers in importing, trade-liberalizing countries. This can be primarily applied to developed nations that have a distinct demand for quality over quantity. With WTO and various regional trade agreements in full swing, understanding the implications of trade liberalization on the changing demand for quality is critically important to all exporting nations so that they can adjust, if possible, the quality of their product. Second, even if an exporter has the ability to produce multiple qualities of a

product, the knowledge of the change in demand for quality is also critical for him or her in order to adjust the mix of qualities sold in a market. Finally, as beef (and other) exporters fight for an increasing share in foreign markets, it is useful to enhance the understanding of what the factors are that determine their market share, especially when markets are saturated and may not be further developed.

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