New Aggregate and Source-Specific Pork Import Demand Elasticity for Japan: Implications to U.S. Exports

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Abstract

The common treatment of a separate import demand specification in the literature is usually motivated by product differentiation. Most studies, however, proceed further with a separability assumption between domestic and imported product for data consideration and ease in estimation. In this study, a two-stage model is used to estimate aggregate and source-specific import demand elasticities for pork in Japan. This approach allows substitution between domestic and imported product on the one hand and avoids econometric problems in generating source-specific parameters, on the other.

Pork imports into Japan are constrained by both the high protection and the strong preference of Japanese consumers for domestic pork over imported pork. Domestic pork commands a price premium of 13 to 29 percent in the retail market. Also, imported pork has a relatively low income elasticity reflecting consumer survey results of lower quality rating for imported pork compared with domestic pork. U.S. pork exports to Japan in particular have lower income elasticity than their closest competitor—Canadian pork. Japanese consumers perceive U.S. pork as inexpensive, but with food safety and quality being the main drivers of pork import demand in Japan, an “inexpensive” attribute may not be the right signal that will provide a true market advantage.

However, U.S. pork exports to Japan have performed very well in the last three years. This means either that the United States was just strategically positioned when other foreign suppliers such as Taiwan and the European Union (EU) were challenged by diseases (e.g., foot-and-mouth disease [FMD] and Classical Swine Fever [CSF]), or that U.S. exporters are getting better at understanding Japanese consumer preferences, and are delivering the products that meet them.

Keywords: Import demand, source-specific elasticity

NEW AGGREGATE AND SOURCE-SPECIFIC PORK IMPORT DEMAND ELASTICITY FOR JAPAN: IMPLICATIONS TO U.S. EXPORTS

Introduction

Japan is the biggest player in world meat trade. It is the leading importer of beef and pork, with a share of total world trade at 30 and 39 percent, respectively, and the second largest importer of broiler, following Russia, with a share of 16 percent (FAPRI 2000).

With an aging farm population and high cost of labor, Japanese domestic pork production has been declining since 1990 at an annual rate of 2.5 percent. As a consequence, pork import has substituted increasingly as an important source of supply in the Japanese pork market. In the last five years, pork imports accounted for 61 percent of production, 38 percent of consumption, and 82 percent of stocks. The mix between fresh-chilled and frozen pork imports has remained stable, with the former representing 27 percent of total imports. Whether fresh-chilled or frozen, pork imports mostly come in as boneless cuts (see Table 1).

Because major changes in the pork import market in Japan have occurred recently, driven by policy reforms and phytosanitary regulations, it is of significant importance to provide new, more precise and disaggregated supply and demand parameters that are useful both to policymakers in Japan and to foreign pork suppliers. Yang and Koo (1994) estimated a source-differentiated Almost Ideal Demand System (AIDS) model for Japanese meat import demand. But, the data they used covered the period 1973 to 1990 only, which does not capture the period when major changes in import policies and regulations were implemented. For example, the Beef Market Access Agreement (BMAA), replacing beef import quotas with tariffs, was implemented in April 1991. The General Agreement on Tariffs and Trade (GATT) reducing the tariff on beef from 93 to 50 percent, converting the variable levy in pork into specific duty, and decoupling the gate price from the stabilization price band, has been in effect only since 1995. Then in

1997, Japan imposed a complete ban of pork imports from Taiwan due to the FMD outbreak in that country.

The objective of this paper is twofold. First, it is to estimate an aggregate import demand for beef and pork and a source-specific import demand for pork. Then, the results are interpreted together with various consumer survey results to examine their implications for U.S. pork exports.

Model

There are two approaches common in the literature on the treatment of imports in commodity models. In one, under the standard trade theory assumption of homogenous products, there is no separate specification of an import demand because the excess demand function (i.e., the difference between domestic demand and supply) is the import demand function. When specified, a separate import demand function is usually motivated by product differentiation arguments both between the domestic and imported product and between various sources of the imported product. However, it is common in most of these import demand models (Yang and Koo 1994; Kilmer and Washington 2000) to further assume separability between domestic and imported products, making them incapable of investigating the interesting issue of substitution between domestic and imported products.

Yang and Koo (1994) is the only study giving elasticities by source of meat import for Japan. They used a source-differentiated AIDS model. This study departs from their study in several respects, including model specification, data, and results. First, they assumed separability between domestic and imported meats, whereas this study allows substitution between domestic and imported meats. This is accomplished by modeling the import demand in two stages. The first stage allocates consumer meat group expenditure between specific meats (e.g., beef, pork, and broiler), with domestic and imported meats disaggregated (e.g., domestic pork and imported pork) as differentiated products, thereby allowing substitution between domestic and imported meat. In the second stage, the expenditure allocated to imported meat is further allocated into source-specific imports (e.g., U.S. pork and EU pork). Second, Yang and Koo (1994) used a unit value derived

by dividing the import value by the quantity as proxy of import price, whereas this study used actual market price at the wholesale level. Third, they report negative expenditure elasticities for the U.S. and Canadian pork at -0.007 and -0.155, respectively. This last problem could probably be caused by sign reversal of parameters, which is common in estimates when multicollinearity is present. This problem also can be avoided with the two-stage approach.

The standard LA/AIDS specification is used both in the aggregate as well as in the source-specific import demand models. The advantages of using the LA/AIDS are established in the literature and include

a) flexible functional form,
b) satisfying exact aggregation across consumers,
c) non-linear Engel curves, and
d) estimation by a suitable linear approximation.

The details of the model are not repeated below. It is of the form,

$$w_{it} = \alpha_{io} + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jt} + \beta_i \ln\left(\frac{Y_t}{P_t}\right) + \varepsilon_t, \tag{1}$$

where w is budget share and the j^{th} commodity share is $w_j = (p_j q_j)/Y$; q_j is the quantity demanded of j^{th} commodity; Y is the group expenditures; p_j is the nominal price of j^{th} commodity; $ln\ P$ is the Stone price index defined as $ln\ P = \Sigma_j\ w_j\ ln\ p_j$; ε is the stochastic error term distributed as i.i.d (0, Ω); and (α, γ, β) is a vector of parameters.

Theoretical restrictions of adding-up, homogeneity, and symmetry are imposed on the parameters (Deaton and Muellbauer 1980) as follows.

Adding-up

$$\sum_{i=1}^{n} \alpha_{i0} = 1, \quad \sum_{i=1}^{n} \beta_i = 0, \quad \sum_{i=1}^{n} \gamma_{ij} = 0 \quad \forall j, \tag{2}$$

Homogeneity

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \quad \forall i, \tag{3}$$

Symmetry

$$\gamma_{ij} = \gamma_{ji} \qquad \forall i, j. \tag{4}$$

Elasticities are estimated using the formula given by Green and Alston (1990, 1991), where the expenditure elasticity is given by

$$\varepsilon_i = \left(1 + \frac{\beta_i}{w_i}\right) \tag{5}$$

marshallian price elasticity is

$$\varepsilon_{ij} = \delta_{ij} + \frac{\gamma_{ij}}{w_i} + \frac{\beta_i w_j}{w_i}, \tag{6}$$

and compensated elasticities are derived as

$$\varepsilon_{ij}^{*} = \varepsilon_{ij} + \varpi_j \varepsilon_i. \tag{7}$$

The first stage meat demand system in (1) has five commodities including domestic beef, imported beef, domestic pork, imported pork, and broiler. In stage 2, given the level of total imported pork expenditure determined in stage 1, pork import is allocated into imports from the various foreign suppliers using the same structure of the LA/AIDS model in (1). The source-specific import demand model includes pork from the United States, Canada, Denmark, Taiwan, and South Korea.

Data, Estimation, Results, and Discussion

Monthly consumption, import, and price data from 1993 to 1998 are taken from the Agriculture and Livestock Industries Corporation (*Monthly Statistics*). Additional disaggregated data were provided directly from their North American Representative Office. All estimations used Seemingly Unrelated Regression (SUR) and were conducted in SAS, release 6.12 (1993).

The result of the study has two main implications: first, that pork import into Japan is constrained both by the high protection and by the strong preference of Japanese consumers for domestic pork over imported pork; and second, that the protection structure in the Japanese pork import market makes product quality a stronger

determinant in the market share of foreign suppliers than pure competitive advantage from low price.

All the quantitative results of the study using time series data are corroborated by the qualitative results from various consumer surveys in Japan. In the first-stage model (see Table 2), imported beef has the highest income elasticity at 1.53, capturing the demand of Japanese consumers for more high-quality grain-fed beef. On the other hand, imported pork has the lowest elasticity at 0.61 compared with 1.10 for domestic pork. Various consumer surveys suggest that pork imports are driven largely by quality and safety considerations, and imported pork ranked lower compared with pork from domestic breeds in this category. This preference for domestic pork over imported pork is reflected by the price premium paid by Japanese consumers over imported pork in the retail level. Domestic pork shoulder is paid a premium of 13 percent, and domestic loin and leg have a premium of 29 percent.

The domestic support and border protection in Japan have not only restricted the entry of cheaper pork imports but, more importantly, have distorted the allocation of shares of foreign suppliers. Because Japan's "gate price" policy with specific duties still behaves like a variable levy, any advantage of low-cost foreign suppliers does not translate into a compelling factor in the import market. For example, Taiwan pork prices are 1.93 times higher than U.S. pork, but for a long period of time Taiwan dominated the pork import market in Japan in both the fresh-chilled and frozen pork import categories. At its peak in 1992, Taiwan's share was 68 percent of the fresh-chilled pork market, and 40 percent of the frozen pork market in 1995. The reason is that with border protection acting like a variable levy, imports from both high-cost (e.g., Taiwan) and low-cost (e.g., United States) foreign suppliers enter the Japanese market at the same standard import price. For the same reason, South Korea, a high-cost country with price two times higher than the U.S. price, gained a significant market share in the pork import market in Japan when Taiwan was banned because of its FMD outbreak.[1]

[1] Even before the FMD outbreak in Taiwan, South Korea already encouraged pork exports to Japan through a subsidy to farmers.

After the ban on Taiwanese pork, a substantial change in the shares of foreign suppliers occurred. The United States gained market share in the fresh-chilled pork imports, increasing from 38 percent in 1994 to 69 percent in 1998, and Denmark reversed its declining share in the frozen pork import market from 25 percent in 1996 to 39 percent in 1997 (see Table 3). Canada also gained market share in both the fresh-chilled and frozen categories, increasing its market shares from 3 to 14 percent and from 6 to 12 percent, respectively. The share of South Korea jumped from 2 to 14 percent in the fresh-chilled category and from 2 to 18 percent in frozen pork exports. In Table 3, Taiwan is grouped together with Other Countries, where its share declined from 57 to 3 percent in fresh-chilled and from 48 to 18 percent in frozen pork.

The availability of U.S. exportable pork surplus during the window of time when Japan substituted other supplies for Taiwanese pork may largely explain the significant gain in U.S. share. However, whether that gain can be maintained or further increased largely depends on how well U.S. exporters are able to deliver the products that meet Japanese consumer preference.

The source-specific AIDS model shows Denmark with the highest income elasticity of 1.19 (see Table 4). Danish exports to Japan are mostly frozen pork. Its share in the fresh-chilled category is minimal at only 0.20 percent. It is reported that domestic processors pay a significant premium for Danish pork, giving Denmark an edge in capturing more market share in the frozen pork import category. South Korea follows this at 1.16, but its improving domestic consumption may limit its exportable surplus.[2] The United Sates and Canada will be the main competitor in the fresh-chilled pork import market. The comparative ranking of Japanese consumers between U.S. and Canadian pork will determine the market share of these two competing foreign suppliers in the future. The income elasticity for pork from Canada is 1.07 compared with 0.91 for pork from the U.S.[3] Also, using the compensated cross-price elasticities as a rough measure of how Japanese consumers might substitute for pork from Taiwan, Denmark is likely to benefit the most with a cross-price elasticity of 0.986, primarily in the frozen pork import

[2] South Korea was hit by an FMD outbreak in its cattle sector in the early part of 2000.
[3] This is particularly true because Canada recently expanded its meat processing capacity to allow it to export more meat.

category. South Korea follows this with a cross-price elasticity of 0.205, then Canada at 0.198, and the United States at 0.169.

The econometric results in this study are corroborated by various consumer surveys. Japanese consumer perception is that U.S. pork is inexpensive. But with food safety and quality being the main drivers of pork import demand in Japan, an "inexpensive" attribute may not be the right signal that will provide a true market advantage.

U.S. pork exporters are faced with a double hurdle if they want to maintain and increase pork exports to Japan. The first challenge is to improve the quality perception of Japanese consumers on imported pork, in general; the second challenge is to reverse Japanese consumer attitude, particularly on U.S. pork, by positioning U.S. pork as a high-quality, safe, and low-cost product relative to the rest of foreign suppliers. This task would require a better understanding of Japanese consumers' tastes and visual preferences, on the one hand, and the ability of the U.S. pork chain to deliver pork products with characteristics that match consumer preference in Japan, on the other.

A recent survey (Miller et al. 1999) suggests that Japanese consumers expressed dislike for light-colored pork and preferred pork that is highly marbled, moist, and tender. These product characteristics need to be produced, selected, and delivered by the entire pork chain—from the farm to the processor to the exporter—and preserved until the pork reaches the retail display centers in Japan.

Finally, it should be noted that the market performance of U.S. pork exports to Japan has been excellent in the last three years with its exports increasing much faster than the growth in total pork imports in Japan. This seems to suggest that the United States is implementing with success its strategies for promoting a quality image of its pork product.

Summary and Conclusion

Japan is a large meat import market, and close to one-half (46 percent) of total pork exports from the United States was shipped to Japan in 1999. Although pork import by Japan is expected to continue to grow in the future, its growth may be constrained both by the high protection and by the preference of Japanese consumers for domestic pork

over imported pork. This is evidenced by the low income elasticity of imported pork at 0.61 compared with 1.10 for domestic pork. Moreover, domestic pork has a price premium of 13 to 29 percent over imported pork in the retail level.

Furthermore, the protection structure for pork import effectively removes any price advantage of low cost foreign suppliers. High-cost suppliers such as Taiwan and South Korea have had a significant share in this market. However, with the sanitary challenges facing Taiwan and Korea, the United States and Canada are in the best position to capture more market shares from the growth in the import market in Japan, particularly in the fresh-chilled category. Although the United States recently garnered a significant market share because of its ability to supply pork during the window of time when Taiwanese pork was banned, the question still remains whether it will be able to engage in a demand-driven expansion of market share.

Using a source-specific pork import demand model, it is shown that the United States has an income elasticity that is lower than Canada's. Moreover, it has the lowest cross-price elasticity with respect to Taiwan. Although Japanese consumers perceive U.S. pork as inexpensive, with food safety and quality being the main drivers of pork import demand in Japan, an inexpensive attribute may not be the right signal that will provide a true market advantage.

The United States is faced with a double hurdle in order to maintain and expand its market share in the Japanese pork import market: that of reversing Japanese consumer attitude on imported pork, in general, and imported pork from the United Sates, in particular. To accomplish this, the United States needs to promote and position its pork products exported to Japan as high-quality, safe, and low-cost.

The performance of U.S. exports in the Japanese pork import market has been excellent in the last three years, suggesting that U.S. pork exporters are gaining a better understanding of the preference of Japanese consumers, delivering the pork products that are demanded, and promoting their pork products with much success.

Table 1. Japanese pork supply and utilization, 1994-1998

	1994	1995	1996	1997	1998
	Thousand Metric Tons				
Production	964	910	884	902	904
Imports	503	535	663	517	546
Exports	0	0	0	0	0
Consumption	1468	1461	1482	1447	1481
Ending Stock	86	69	135	108	76
	Percent				
Share of Imports					
Imports to Production	52.19	58.78	75.00	57.38	60.37
Fresh-Chilled to Total	28.08	30.82	25.35	24.88	27.41
Boneless Cuts to Total	99.51	99.67	99.83	99.75	99.84

Table 2. Stage 1 uncompensated, compensated, and expenditure elasticity estimates

	Domestic Beef	Imported Beef	Domestic Pork	Imported Pork	Broiler	Expen-diture
Domestic	-1.108	0.178	-0.838	0.319	0.423	1.027
Beef	-0.849	0.359	-0.623	0.420	0.693	
Imported	0.173	-0.886	0.686	-0.881	-0.620	1.527
Beef	0.559	-0.617	1.006	-0.730	-0.218	
Domestic	-1.027	0.551	-0.752	0.031	0.100	1.098
Pork	-0.750	0.744	-0.522	0.140	0.389	
Imported	0.893	-1.326	0.098	-0.312	0.035	0.612
Pork	1.048	-1.218	0.226	-0.251	0.196	
Broiler	0.471	-0.188	0.111	0.001	-1.083	0.689
	0.644	-0.067	0.255	0.069	-0.902	

Note: First entry in each cell is the marshallian elasticity and the second is compensated.
Source: Fabiosa 1999.

Table 3. Market share of major foreign pork suppliers to Japan, 1994-1998

	1994	1995	1996	1997	1998
United States					
Fresh-Chilled	38.01	47.20	45.75	74.98	68.87
Frozen	5.94	8.33	13.26	13.70	15.71
Total	14.94	20.31	21.50	28.95	30.28
Canada					
Fresh-Chilled	2.54	2.95	4.65	14.03	14.21
Frozen	6.68	6.08	6.70	11.02	11.52
Total	5.52	5.11	6.18	11.77	12.26
South Korea					
Fresh-Chilled	1.67	1.94	2.73	9.79	13.50
Frozen	2.47	3.53	6.03	12.59	18.46
Total	2.25	3.04	5.19	11.90	17.10
Denmark					
Fresh-Chilled	0.40	0.09	0.04	0.33	0.14
Frozen	36.61	29.36	24.51	39.09	36.62
Total	26.44	20.34	18.30	29.45	26.62
Others (includes Taiwan)					
Fresh-Chilled	57.38	47.83	46.83	0.86	3.28
Frozen	48.31	52.70	49.50	23.59	17.69
Total	50.85	51.20	48.82	17.93	13.74

Table 4. Stage 2 uncompensated, compensated, and expenditure elasticity estimates

	Denmark	Taiwan	Canada	United States	South Korea	Expen-diture
Denmark	-1.293	1.436	-0.845	-0.188	-0.336	1.198
	-1.015	2.003	-0.777	0.038	-0.110	
Taiwan	0.785	-1.829	0.148	0.066	0.041	0.867
	0.986	-1.419	0.198	0.169	0.205	
Canada	-3.423	1.144	-0.475	1.806	-0.129	1.068
	-3.176	1.649	-0.414	2.007	0.072	
United	-1.173	0.014	0.551	-1.837	0.553	0.905
States.	0.037	0.422	0.602	-1.666	0.724	
South	-0.406	-0.043	-0.044	0.511	-1.205	1.165
Korea	-0.137	0.508	0.022	0.731	-0.985	

Note: South Korea includes other small foreign suppliers

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