THE IMPACT OF NON-PRICE PROMOTION ACTIVITIES ON UNITED STATES RED MEATS EXPORTS TO JAPAN: A MARKET SHARE ANALYSIS

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CHAPTER I

INTRODUCTION

The Cooperator and the Targeted Export Assistance (TEA) programs were created in 1955 and 1986, respectively, with the objectives of developing, maintaining and expanding foreign markets for U.S. agricultural commodities. In recent years, the level of federal resources annually invested in these programs increased to over $200 million.

Japan was the major recipient country of red meats promotion expenditures funded by the Cooperator and TEA programs. The concentration of U.S. red meats promotion activities in Japan reflects the importance of the Japanese market and its potential growth.

Japan is one of the most important and fastest growing foreign markets for U.S. red meats. The value of U.S. red meats exports to this country grew over tenfold from the early 1970s to 1988, when it reached $1.2 billion. In 1988, over 60 percent of the U.S. red meats export revenue came from Japan.

Objectives

The general objective of this study is to evaluate the effectiveness of U.S. non-price promotion programs (Cooperator program and the Targeted Export Assistance programs) on the U.S. exports of red meats to Japan.

The specific objectives of this study are to: (1) estimate the impact of non-price export promotion on the U.S. share of the Japanese imported red meats market; (2) compare the non-price promotional effectiveness between different red meat products (beef, pork, etc); (3) test whether changes in specification of the Japanese beef imports quota system has affected the U.S. market share of Japanese beef and total red meats imports.

The Cooperator and TEA Programs

Export promotion of U.S. agricultural commodities under the Cooperator program began in 1955. The Cooperator program is administrated by the the Foreign Agricultural Service (FAS). The objective of this program is to develop, maintain and expand markets for American agricultural products (GAO report, 1987). The promotion activities conducted under this program can be divided into consumer promotion (branded and generic), technical assistance, and trade servicing.

The Cooperator program is funded by the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture, private, nonprofit organizations known as Cooperators and a third participant (foreign governments or private organizations) in the importing country. Because there are three entities funding the Cooperator program, this program is also known as a three party program.

The FAS contribution, appropriated from federal funds, is awarded to the Cooperators through project agreements. The Cooperators may provide cash or goods and services as part of their contribution. The FAS guidelines encourage the Cooperators contribution to be at least equal to FAS contribution (GAO report, 1987). In 1987, over 50 Cooperators participated in the Cooperator program (GAO Report, 1987).

The Targeted Export Assistance (TEA) program was created by Section 1124 of the Food Security Act of 1985, and began its activities in the following year. Similar to the Cooperator program, the TEA also is administered by the FAS and may be funded by three participants: the FAS, cooperating domestic participants, and third parties in the importing country. The domestic participants can be either public or private organizations or private, profit-making, firms. Many of the Cooperators also participate in the TEA program and types of promotion activities are similar in both programs (GAO report, 1990).

The major difference between the Cooperator and the TEA programs is that for qualification of a commodity group to receive TEA funds, it is required that the commodity exports have been negatively affected by unfair trade practices in other countries. The focus of the program and the level of expenditures constitute other differences. The TEA program concentrates on activities of consumer promotion, where an average of three quarters of total promotion expenditures have been allocated (GAO report, 1990). The Cooperator allocates relatively more resources to trade servicing and technical assistance. The TEA program also has significantly larger funding than the Cooperator program.

The U.S. Export Promotion of Red Meats in Japan

The U.S. export promotion of red meats in Japan began under the Cooperator program in 1977, after the creation of the U.S. Meat Export Federation. In the first year, the FAS contribution to red meat promotion in Japan was slightly over $3,000. From the second year of promotion activities until 1988, the FAS contribution to the Cooperator program grew from $174,000 to $577,000.

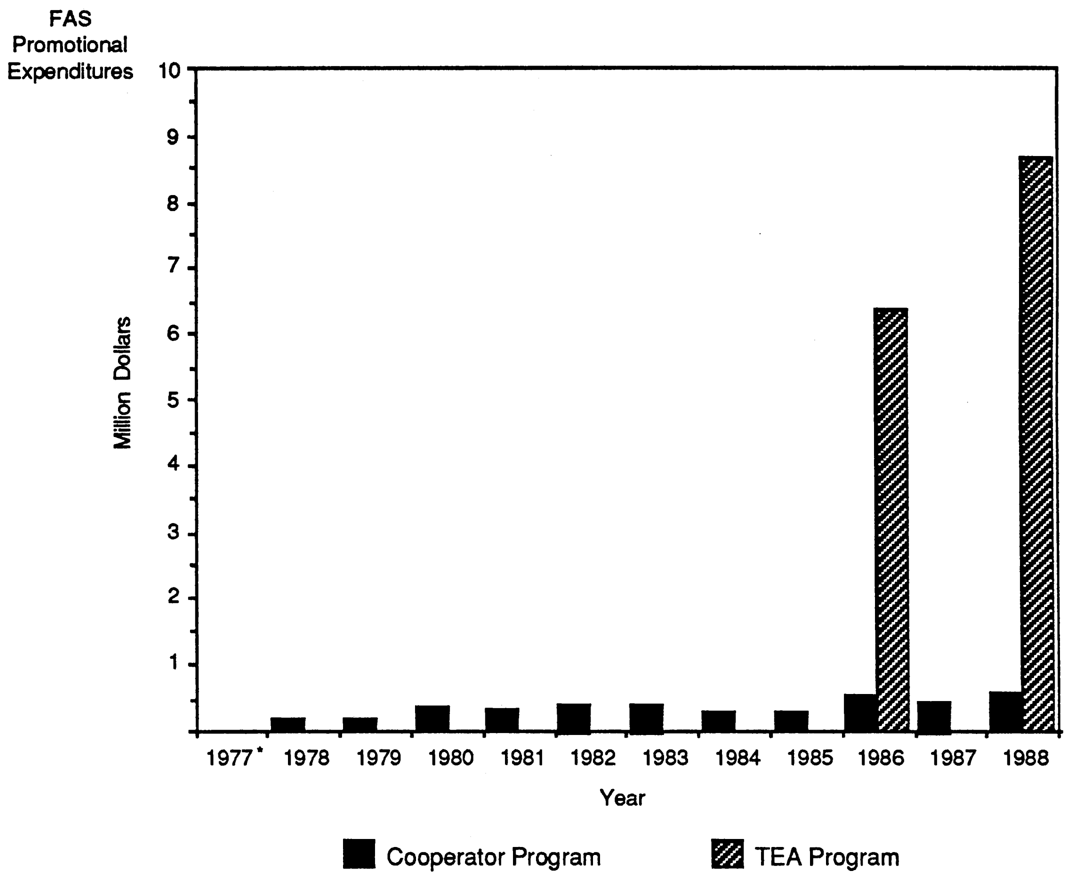
Under the TEA program, which began in 1986, red meats export promotion expenditures in Japan were at significantly higher levels compared with the Cooperator program. The FAS contribution to red meats promotion in Japan under the TEA program amounted to $6.4 million and $8.6 million in 1986 and 1988, respectively. There were no funds allocated to red meats export promotion in Japan in the year 1987. Figure 1 shows FAS contribution to this programs for red meats promotion in Japan.

In 1988, the FAS contribution to non-price promotion of red meats in Japan under the Cooperator program was divided between consumer promotion (29 percent), technical assistance (34 percent) and administrative activities (37 percent). Under the TEA program, in the same year, the FAS contribution was mainly destined to consumer promotion (93 percent). The balance was divided between technical assistance (4 percent), trade servicing (2 percent) and evaluation (1 percent) (data obtained from FAS, March 1989). The decomposition of total FAS contribution according to different types of promotion activities is not available for all years.

The limitation on FAS data concerning the market development programs was expressed in the GAO report (1990, p. 24):

> FAS officials tell us that the TEA Program is a success, but they only cite increased sales as proof. They do not have readily available, basic management data, such as total amount of TEA funding and types of activities for all commodities in a particular country; total amount of TEA funds used for branded promotion. . .

Data on the contribution of the other two participants to the Cooperator and TEA programs, the domestic participant and the third party in the foreign country, are limited at the country level. The relative contribution of each



*The FAS contribution under the Cooperator Program in 1977 was 3,152 dollars.
Source: FAS

Figure 1. FAS Contribution to Market Development Programs for Promotion of Red Meats in Japan

participant varies over the years. From 1986 to 1988, the FAS contribution under the Cooperator program to red meats promotion activities in all countries accounted for 28 percent of the total allocated funds. In the same period, the contribution of the U.S. Meat Export Federation under the Cooperator program corresponded to 13 percent of total promotion expenditures. The balance corresponded to the third party participant.

From 1986 to 1988, the FAS contribution under the TEA averaged only 15 percent of total red meats promotion expenditures in all countries. In the same period the contribution of the U.S. Meat Export Federation and the third participant were 3.4 and 81.5 percent, respectively (Henneberry, 1990).

From 1986 to 1988, over one-third of FAS contribution to red meats promotion activities under the Cooperator program went to Japan. In the same period approximately 85 percent of the FAS contribution to red meats promotion under the TEA program was spent in Japan (Henneberry, 1990). The concentration of promotion activities in Japan reflects the importance of this market for U.S. red meats exports.

U.S. Red Meats Exports

The international red meats market is segmented. The separation of the red meats market is based on sanitary regulations. In order to avoid the dissemination of threatening livestock diseases, disease free countries restrict imports of live animals or fresh meat from countries where infectious diseases prevail. Among the diseases that affect the red meats international trade flow, foot and mouth disease is one of the most important (McCoy and Sarhan, 1988, p. 520).

In terms of the presence of foot and mouth disease, the world is divided into two red meats markets. The market free of foot and mouth disease is a premium market, and prices of red meat products in countries that participate in this market are at higher levels. Exporters that are part of the free of foot and mouth disease market include Australia, Canada, Denmark, Ireland, Northern Mexico, New Zealand, Taiwan, United Kingdom and the U.S. Within the importers are Canada, Japan, South Korea, part of the European Community and the U.S. (Dewbre et al., 1986).

The bulk of U.S. red meats exports is concentrated in the market free of foot and mouth disease. The major importers of U.S. red meat products have been Japan, Canada, European Community and Mexico.

Japan is by far the most important country for U.S. red meats exports. In 1988, 41 percent of the total quantity of red meats exported by the U.S. went to Japan. When the value of exports is considered, the share of this country in U.S. exports is even larger. In the same year, 62 percent of the total U.S. red meats export value came from the Japanese market (Table I).

The share of the Japanese market in the U.S. export revenue in 1988 for beef and veal, pork and variety meats (including edible offals) was 76, 74 and 40 percent, respectively (FATUS, January-February 1990).

After this brief overview of the market development programs, red meats promotion activities in Japan and the importance of Japanese market for U.S., the following section presents the organization of the next chapters.

Organization of the Next Chapters

An overview of the Japanese red meats market is presented in Chapter II. Part of the chapter focuses on the relative importance in consumption and

TABLE I

U.S. RED MEAT EXPORTS (1988)

Red Meats	Quantity (1000 Metric Tons) Total	Japan	%	Value Million Dollars Total	Japan	%
Beef and Veal	228.6	163.1	71.3	1,109.0	840.7	75.8
Pork	63.0	39.0	62.0	249.4	185.5	74.4
Variety Meats (including edible offals)	314.7	69.5	22.1	456.8	183.3	40.1
Horse and Other Red Meats	71.6	6.8	9.4	158.2	19.3	12.2
TOTAL	677.8	278.4	41.1	1,973.5	1,228.8	62.3

Source: Foreign Agricultural Trade of the United States (January-February 1990).

imports of each commodity included in the red meats group. A comparison of the characteristics of red meats produced in different countries is also conducted. Finally, a review of the most important changes in red meats import policy in Japan is presented, with emphasis on the beef quota system.

In the third chapter a literature review of empirical work related to import demand for agricultural products is presented. Alternative approaches available for modelling import demand (single equation, demand systems and the Armington model) are discussed. A literature review of the demand models that have included promotion activities is presented. Because of the lack of empirical research in export promotion, reference is made to studies on domestic demand of agricultural products. In the last part of Chapter III, a review of empirical studies with beef in Japan is presented.

Chapter IV presents a model that is used in the study to quantify the impact of non-price promotion expenditures on U.S. market share of Japanese red meats imports. The inclusion of a variable in order to capture the impact of changes in the Japanese beef imports quota system on market shares is discussed. Changes in the quota system are hypothesized to affect market share of each competing country in the Japanese imports market. Chapter IV concludes with a description of the data procedures used in this study.

The results of estimation of the model developed in Chapter IV using the Ordinary Least Square method are presented in Chapter V. The impact of price competitiveness, promotion activities and changes in the quota system on the U.S. market share of the Japanese market was estimated for each red meats category, including the total red meats category. In the last part of this chapter, the return to U.S. promotional investment is calculated.

CHAPTER II

BACKGROUND INFORMATION

The Japanese Red Meats Market

In the last few years, consumption of red meats in Japan has significantly increased. Per capita annual consumption has increased from 21 kg. in 1976 to nearly 29 kg. in 1988 (OECD Meat Balance Sheets). In the same period, some changes occurred in red meats consumption pattern. While the beef and veal share of total red meats consumption has increased, the opposite has been observed for mutton, lamb and horse meat. Pork and edible offals relative participation in total red meats consumption has not changed significantly (Table II).

Changes in domestic red meats consumption were reflected in changes in red meat imports into Japan. Total red meats quantity imported increased over 60 percent from 1976 to 1988. In the same period, the share of total imported red meats corresponding to beef, pork and edible offals increased, while sheep, horse and other red meats share was reduced (Table III).

These changes in relative participation of each product in the total red meats market may have been caused by various factors. Among these factors are relative price changes, changes in tastes and preferences caused by promotional activities, income, trend, etc. In the following sections, the market for each red meat product will be briefly discussed.

TABLE II

JAPANESE RED MEATS ANNUAL PER CAPITA CONSUMPTION (SELECTED YEARS)

Red Meat Product Fresh, Chilled or Frozen	1976		1988	
	kilogram	%	kilogram	%
Pork	11.3	53.8	16.5	57.5
Beef and Veal	3.8	18.1	7.7	26.8
Edible Offals	2.0	9.5	3.0	10.5
Mutton, Lamb and Goat Meat	2.4	11.4	1.0	3.5
Horse and Other Red Meats	1.5	7.2	.5	1.7
TOTAL	21.0	100	28.7	100

Source: OECD Meat Balance Sheets.

TABLE III

JAPANESE RED MEATS IMPORTS
(SELECTED YEARS)

Red Meat Products	1976 metric tons	1976 %	1988 metric tons	1988 %
Pork	148.905	29.4	322,987	39.3
Bovino	92,236	18.2	263,547	32.1
Edible Offals	36,310	7.2	115,070	14.0
Sheep	135,958	26.9	77.679	9.4
Horse and Other Red Meats	92,839	18.3	42,912	5.2
TOTAL	506,248	100	822,211	100

Source: FAO Trade Yearbook.

Beef

The Japanese market is characterized by a preference for beef with extensive marbling (with intra-muscular fat). This beef property is required for the preparation of traditional dishes such as sukiyaki and shabu-shabu (Hayes, 1990, pp. 39 and 47). Extensive marbling is encountered in beef obtained from the Japanese cattle (Wagyu).

Two major factors are responsible for the extensive marbling characteristics of the beef from Wagyu. While one of the factors is genetics, the other is the feeding management (Lin, September 1990). The Wagyu cattle are

are fed with a high concentrate diet for longer periods (20-36 months) than the traditional four-five months used in the U.S. (Lin, September1990). The increase in cost due to longer high concentrate feeding periods is compensated by a large difference between prices of the Wagyu beef and beef with lower marbling. Following the Wagyu beef in preference are the beef from domestic dairy cattle (with higher marbling properties than imported beef) and the imported beef.

Pork

Pork has traditionally dominated the red meats consumption in Japan. Pork consumption has been over half of total red meats per capita consumption in the last two decades (Meat Balances in OECD Countries). Pork has also dominated the Japanese imported red meats market. Denmark and Taiwan are the most important foreign suppliers to the Japanese pork market, followed by the U.S. and Canada (Hayes, 1990, p. 23).

Japanese pork imports can be divided into cut pork (which represents more than 90 percent of total imports), carcasses, variety meats and processed pork. The U.S. has more important participation in the variety meats market, where it controls more than 50 percent, and in the processed sector. Overall, the U.S. share of Japanese pork imports has decreased mainly due to loss in price competitiveness against other suppliers in the Pacific Rim (Hayes, 1990, p. 21).

Edible Offals

According to the Japanese classification, edible offals also includes diaphragm beef (hanging tenders and outside skirts) along with liver, tongue, heart, etc. Diaphragm beef is classified by most of the other countries, including the U.S., as beef.

The increasing importance of this category in the Japanese imported red meats market has been attributed to the growth of imports of diaphragm beef (Alston et al., 1990). The portion of total imported red meats into Japan corresponding to edible offals increased from 2.3 percent in 1973 to 14.0 percent in 1988.

Mutton and Lamb and Goat Meat

While the total red meats consumption in Japan has increased over time, the sheep and goat meat consumption has declined in absolute values. The imports of this red meats category also have been reduced over time in absolute values. The imported mutton and lamb market has been traditionally dominated by Australia and New Zealand (McCoy and Sarhan, 1988, pp. 548-550).

Horse and Other Red Meats

As in the case of mutton, lamb and goat meat, the annual per capita consumption and imported quantity of horse and other red meat products declined in absolute quantity in the last two decades. The U.S. horse meat exports to Japan has not been significant.

After this review of the Japanese red meats market, the following section presents differences between products originated from different supplying countries.

Differences in Product Characteristics According to the Supplying Country

Differences in product characteristics are an important determinant of demand. Red meats produced in varied countries are different due to a diversity of factors such as genetic material, feeding management, health regulations, processing techniques, etc.

The differences in products characteristics, perceived qualities, prices and institutional factors will affect the share of each competing country in a given country imports market. The objective of this section is to identify the product characteristics that are responsible for the differentiation of the American product from other countries' products, competing in the Japanese imported red meats market. Because of lack of studies on edible offals, the focus will be on beef and pork meat.

In the Japanese imported beef market, factors related to production and processing are responsible for the differentiation of the American product. While the U.S. exports grain-fed beef to Japan, the other two main foreign suppliers to the Japanese imported beef market, Australia and New Zealand, export grass-fed beef. The American beef exported to Japan is generally in the frozen form. A significant portion of the beef imported into Japan from the other suppliers is in the chilled form.

While differences in production systems make the American beef superior when compared with the other two main suppliers in the Pacific Rim, differences in the processing methods partially off-set the U.S. beef superiority. The differences in quality are reflected in the price differences. According to Mori et al. (1986), U.S. frozen grain-fed beef is generally less expensive than even 2nd grade domestic dairy beef. It is also generally more expensive than frozen grass-fed beef and close in price to chilled grass-fed beef from Australia and New Zealand.

In the case of pork, differences in product characteristics according to the supplying country are also significant. Hayes (1990, pp. 53-55) discussed the differences in pork products from different suppliers. Differences are significant with respect to cutting methods and processing techniques adapted by different suppliers. In the use of cutting methods, Taiwan has an advantage in the Japanese imports market. In Taiwan the same cutting methods are used as those used in Japan. Therefore, pork meat from Taiwan is more suitable for processing in Japan. Denmark adapted new cutting methods in order to increase its competitiveness in the Japanese market. The importance of cutting methods in product differentiations can be better illustrated in the particular case of bellies imported for processing into bacon in the Japanese industry. For this particular purpose, bellies produced in the U.S. are unacceptable due to the currently used cutting methods in the U.S. (Hayes, 1990, p. 24).

Another characteristic that differentiates Danish imported pork meat from that from the U.S. is that the Danish packers screen for pale, soft, exudate (PSE) pork. This processing technique, avoiding accumulation of liquid in the package, makes PSE pork from Denmark more appealing to Japanese consumers (Hayes, 1990, p. 53).

Because of its proximity, Taiwan has the advantage of being able to export chilled pork with similar characteristics to the pork produced in Japan. The U.S. chilled pork exported to Japan is generally darker and "less appealing to consumers" than chilled pork from Taiwan (Hayes, 1990, p. 55).

The differences discussed above show that products from different countries are not perfect substitutes. These differences are going to affect the participation of each exporting country in the Japanese imported red meats market.

Because of the importance of policy changes in the Japanese market in determination of red meat imports, the changes in import policy will be reviewed in the next section. Emphasis will be placed in the changes in the beef imports quota system which has been, according to some authors, responsible for changes in the share of different exporters in the Japanese imports market.

Import Policy in Japan

Knowledge of some agricultural characteristics in Japan contributes to a better understanding of the policies that regulate the import of red meats. The limited land available and sizeable population turn protection of agriculture into an important concern of national security.

Another fact relevant to Japanese agriculture is the size of the farm properties. The farms are small, as mandated by the Land Law of 1952. While the farm size has little effect on the productivity of pork which is basically fed with concentrates, this does affect the beef productivity. The reduced number of animals per farm (averaging seven/farm), which is a consequence of the Law of 1952, results in loss of economies of scale in the beef sector (Coyle, 1983).

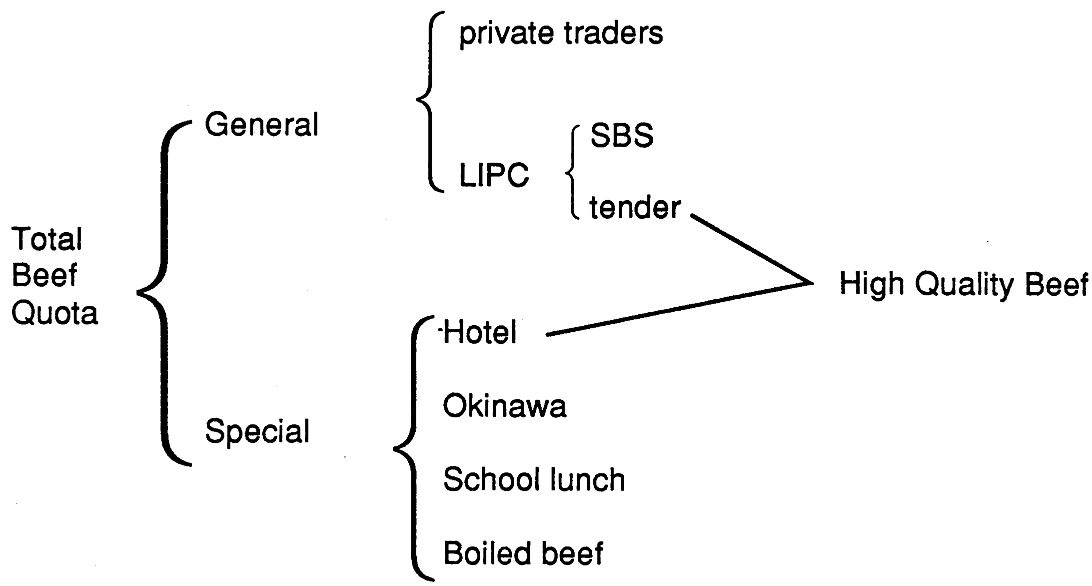
Within this context surged the government policies that significantly affected the livestock sector over the last three decades. The Livestock Industry Promotion Corporation (LIPC) was designated to coordinate these policies. In 1961, the Law of Price Stabilization of Livestock Products was approved. This law provided among other mechanisms for the use of import controls in order to stabilize domestic prices.

Because of the relative efficiency of the pork sector, the extent of government involvement in pork imports was to use a simple variable levy system in order to stabilize price. However, the levy is periodically waived. On the other hand, the beef imports were characterized by strong government involvement through the use of a 25 percent tariff and a complex quota system that has been constantly subjected to modifications. This intervention was necessary to isolate the inefficient domestic beef sector from the foreign competition. Offals, in a certain way being considered as a secondary product, was subject only to a tariff that was reduced from 25 percent to 15 percent in 1987, and have stayed at this level since.

The Beef Import Quota System

In 1964, a beef import quota was implemented for the first time. From 1965 to 1970 this quota, which was established twice a year, was divided between the LIPC and private traders. The latter increased its share over the years. Special quotas were added to this general quota over the years (boiled and canned beef - 1967, hotel - 1969, Okinawa - 1972 and school lunch - 1975) (Figure 2). Other alterations to the quota occurred with the creation of the "one touch" and the "tender" systems.

The "one touch" system was created in 1970 in order to increase efficiency in the market channel for chilled beef. This system allowed authorized importers to sell the LIPC portion of the quota directly to authorized distributors (Coyle, 1983). In 1971, a "tender" system was created. Under the tender the LIPC specified quantities of given cuts and quality for each market.



Source: Hayes (1990, p. 215) and Mori et al. (1988)

Figure 2. Japanese Beef Import Quota System (from 1985 to 1987)

After a squeeze in profitability in the beef sector in the early 1970s, a price stabilization program was created in 1975 for beef. The objective of this program was to keep the beef prices within an "historical" range.

Under a bilateral agreement between the U.S. and Japan (1978), another special quota was created, this being the High Quality Beef (HQB) quota, under the Japanese total beef import quota. Only beef classified as HQB could be imported under this special quota. The HQB is defined as beef obtained from cattle less than two years of age at slaughter and that have been fed by concentrates for at least 100 days. This specification corresponds to the definition of beef classified in the U.S. as choice or prime. A similar category does not exist in the classification systems adopted by Australia and New Zealand, the United States major competitors. These American competitors are specialized in the production of grass-fed beef (Lin, August 1990).

With the U.S.-Japan beef and citrus understanding (1984), Japan determined an annual increase of 6,900 tons in the HQB portion of the quota. The total quota would be increased by 9,000 tons annually, with a consequent increase of the HQB relative participation in the total quota. As a result of this agreement, the simultaneous/buy/sell system (SBS) was also created, which represented 10 percent of the LIPC portion of the general quota in the first years. This system allows direct negotiations between packers and Japanese buyers so that bids can be presented to the LIPC for approval (Mori et al., 1988).

As a result of increasing pressure from the U.S., Australia and New Zealand, which filed a complaint with the General Agreement on Tariffs and Trade (GATT), Japan signed a new trade agreement in 1988, Beef Market Access Agreement (BMAA). Under the BMAA, Japan agreed on the tariffication of the quota system beginning in 1988. During a quota phasing-out period from 1988 to 1990 (JFY), no preferential quota existed for HQB, the total quota increased 60,000 tons annually, and the S/B/S portion of the LIPC general quota increased progressively from 10 percent in 1987 up to 60 percent in 1990. This agreement also increased the hotel quota from 4,000 tons in 1987 to 16,000 tons in 1990 and established tariff levels in 1991-92 of 70 and 60 percent, respectively, and 50 percent thereafter. Japan also reserved the right to apply an ad valorem tariff of 25 percent if beef imports increased by more than 20 percent from the previous year (Mori et al., 1988).

CHAPTER III

LITERATURE REVIEW

The modeling of import demand will be discussed in this chapter. Inclusion of a promotion expenditures variable in demand models will also be presented. Because of the limited number of studies related to export promotion, studies on domestic promotion will be included in the review of the alternative methods of measuring the impact of promotion activities. Finally, recent empirical research on red meats demand in Japan will be discussed.

Alternative Approaches for Modeling of Import Demand

The objective of the U.S. non-price export promotion activities is to increase the demand for American products in other countries. In order to measure the impact of promotion activities on the demand for agricultural products, most researchers include a variable corresponding to promotion expenditures in the demand models. The objective of this variable is to capture shifts in the demand that are associated with promotion activities. This section presents a theoretical review of different approaches that have been used for the modeling of import demand.

Three different approaches can be used for the representation of the import demand for a commodity: (1) the single equation model that represents the total imports as the dependent variable; (2) demand systems; and (3) the Armington model. Each one of these methods has its advantages and disadvantages. The choice of using either one is based on the characteristics of the market and the objectives of the study. A review of empirical studies that have utilized these methods follows.

The Single Equation Model

The single equation model that represents total imports as the dependent variable has an advantage in flexibility. The functional form can be changed or special explanatory variables introduced if they are necessary (Deaton and Muellbauer, 1980, pg. 61).

Because there are a large number of variables such as income, foreign exchange reserves, population, prices, product quality, promotion, etc., that affect total imports, multicolinearity problems are likely to occur when this representation is used. When multicolinearity problems occur, the estimates of the coefficients of the independent variables will be inefficient. Although the model may have a high predictive power, the effect of each variable cannot be clearly isolated. This problem will become worse if few observations are available (Gujarati, 1988, pp. 283-307).

When the single equation method is used, the domestic and imported products are generally assumed to be perfect substitutes. The import demand in this specification would be considered a residual of total demand after exclusion of domestic production and taking into account changes in inventory. However, this assumption is strongly restrictive when the differences in quality likely to occur in products originating from different countries is considered.

Kargbo (1990) used a single equation model with a double logarithmic specification to estimate the beef import demand in Sierra Leone. Imported demand was estimated as a function of an average beef price, price of substitutes, real exchange rate, domestic production and quantity of beef imports lagged one period. Annual data from 1965 to 1988 was used.

All the estimated parameters had the expected signs. With the exception of the intercept term and the own price elasticity, the coefficients were statistically significant. The estimated elasticity of income was 2.84. The estimated own price and cross price elasticities were -.61 and 1.03, respectively.

Konandreas et al. (1978) specified a linear model in order to test for income, price and exchange rate effects on U.S. wheat exports for five world regions. Annual data were used. Besides income, price, and production variables, the model included one year lagged quantity of imports from U.S. and concessional wheat exports of U.S. as independent variables. The use of ordinary least square method for estimation of the model produced unexpected signs for the income parameter. To improve the results, available estimates of income elasticity were included in the model, and conditional least square was used to estimate the parameters.

Results indicated that exchange rate changes had a substantial effect on U.S. wheat exports. The coefficient for lagged imports was between 0 and 1 for Latin America and Asia and negative (not significant) for other regions. The estimated coefficient of U.S. concessional wheat exports was approximately -.5 for Latin America and developed countries. Results showed an unexpected positive relation between domestic production and U.S. wheat exports for Asia and USSR/Eastern Europe. According to the authors, this problem was due to the partial nature of the analysis.

In order to estimate the import demand for sweet cherries in Japan, McCracken et al. (1989) used the single equation representation. Imported and domestic products were assumed to be imperfect substitutes, and the impact of domestic production on imports was only indirectly taken into consideration through the cross-price effect. Because cherries are a highly perishable commodity providing a relatively fixed supply volume in each period, a price-dependent variable was specified. The cherry price deflated by the Japanese Consumer Price Index was used as dependent variable. Models were built for the estimation of the Japanese and U.S. product demand separately.

Dummy variables for each ten day observation periods (six) were included in the model to account for seasonality. A seasonal dummy-quantity interaction variable was also introduced for the first season. The objective of this slope shifter variable was to capture a hypothesized possible novelty factor in the product demand.

The researchers used a linear form. They included income deflated by the consumer price index and substitute product (watermelon) quantity as independent variables. However, these variables were canceled from the American model because their coefficients were not significant. The resultant seasonal own price flexibilities (the inverse of the elasticity) at the sample mean values from the Japanese model ranged from -.5483 to -.0423.

Ward and Tang (1978) measured the growth in the U.S. fresh grapefruit exports to Canada, Europe and Japan. They also verified the potential economic impact of Japanese trade restrictions. Using quarterly data beginning immediately after June 1971 when the quota on grapefruit imports to Japan was lifted, the model allowed for dynamic adjustment in price elasticity. As the market matured after elimination of restrictions, the price elasticity was assumed to converge to a stable value.

A double-log specification was used and the competitor's (Israeli) price variable was assumed to affect European demand only. Israel is the major supplier for this market. In the period studied, the U.S. supplied nearly all grapefruit consumed in the other regions studied (U.S., Canada and Japan). U.S. domestic price elasticity of domestic demand was -.74, while Japanese and Canadian price elasticities of imports of American fresh grapefruit converged to -3.58 and -1.26, respectively. Effects of different levels of Japanese embargo on exports, price and revenue were simulated.

In many studies a system of equations was used to improve the quality of the estimates. Estimating import demand for U.S. burley tobacco in European markets, Reed and Schnepf (1982) used a three-equation recursive system. In the first equation used, domestic per capita production is a function of per capita GNP. In the second equation, total domestic production is obtained from domestic per capita production and population size. Finally, imports of unmanufactured burley tobacco from the U.S. is determined by the relative price of the American product and domestic production in the importing country.

The supply and demand system of equations can also be used with the objective of improving the estimation. Because of the importance of this system for the large country case, this special case of the single equation model is presented in the next section in more detail.

The Large Country Case. A country is considered large in terms of international trade if changes in its import demand are capable of affecting the world price equilibrium. In the large country case, not only is the rest of the world price of a commodity expected to affect the imported quantity of this commodity, but the large country import demand for the commodity is expected to affect the rest of the world price. The world price is determined simultaneously in the point of equilibrium between rest of the world supply and import demand for the large country.

Because there is a two directions causality effect, it can be shown that the use of the Ordinary Least Square method for estimation of either one of the equations (demand or supply) separately will not be consistent. This problem is known as the simultaneous-equation bias (Gujarati, 1988, p. 566). In order to avoid this bias, the demand and supply schedule must be estimated simultaneously. Methods such as the two stages and three stages least square are frequently used in this cases.

Using annual data, Pagoulatus et al. (1978) provided an estimate of the impact of the European Community's Common Agricultural Policy (CAP) on production, consumption, and intra European Economic Community (EEC) and world trade. The system of equations used included domestic supply, market demand, export to non-EEC countries and intra-EEC import equations. Imports from non-EEC countries were incorporated into the model through the use of an identity where this variable correspond to the residual of trade intra-EEC, exports, consumption, production and stock variation.

The results indicated that extra-EEC meat imports under free-trade conditions in 1972 would have been approximately 180 percent higher than actual imports of meat. However, this approximation was overestimated since it was based on the assumption that world prices would not be affected even under free-trade conditions.

Haniotis et al. (1988) used a system of equations in order to: (1) estimate the income and price elasticity of demand and the price elasticity of supply for U.S. exports of corn, soybean and wheat; and (2) evaluate dynamic properties of export supply and import demand for these commodities. In this study a partial adjustment model was used to represent supply of exports. The desired export supply is a function of relative prices and an index of domestic exporting capacity. Wheat prices of Argentina, Australia and Canada were used to obtain average competitor's price. For corn and soybean, the coefficient of adjustment was not higher than one. Therefore, stability was verified. Stability was not confirmed in the wheat market.

When the interest of the researcher is focused on the participation of a specific supplier in the import market, comparing it with the competitors, the single equation method is not the most suitable method. When the single equation is not adequate, the researcher has the option of using demand systems or the Armington model.

Demand Systems

These models were initially developed to deal with a broad group of commodities. In recent years, their applications have been extended for the representation of import demand. An advantage of the demand systems over the single equation estimation is that they allow for testing restrictions of demand theory such as symmetry or homogeneity conditions (Deaton and Muellbauer, 1980, pg. 61).

In the demand system's specification, the allocation problem is separated in different levels. In the first level, the total country's disposable income is allocated across different commodities. At a lower hierarchy level of decision, the total expenditures designated for each commodity are allocated for purchase of the product from different sources. The allocation may occur in two or more stages. The domestic product may be included in the representation at a lower hierarchy level of decision or at higher levels (Seale et al., 1991).

At lower stages, only the variables that are expected to affect allocation across different country suppliers are included. Many variables that are expected to affect only total expenditures are not included in the lower decision level specification. This allows in the lower hierarchy levels representation the inclusion of higher number of variables representing the competitors' prices, when compared with the single equation model.

Seale et al. (1991) used the Rotterdam model, a demand system, to represent the Japanese import demand for citrus juices and the United Kingdon's demand for fresh apples. The domestic and imported goods were assumed to interact at higher levels. In the estimation of the import demand at lower levels, domestic prices were not included. In the Japanese model, five different suppliers were included, the four major and other suppliers that were aggregated in the category rest of the world (ROW). In the U.K. model, four different suppliers were considered, including the ROW category.

In this study, annual data from 1973 to 1986 were used for estimation of the Japanese model, while for the U.K. model, quarterly data from 1978 to 1987 were used. All the estimated marginal share for exporters were consistent with economic theory. Only one of these parameters was not statistically significant. All own price parameters had the expected signs.

The Rotterdam model was also used by Sparks et al. (1990) to estimate the demand for imported apples in four different countries (Canada, Hong Kong, Singapura and the United Kingdom). A dummy variable was included in the model to test whether the entrance of Chile into the market affected the conditional elasticity of income.

Results indicated that the U.S. would increase its share slightly in Hong Kong and the U.K. as the market grows. In Canada and Singapura the U.S. market share would not be significantly affected by changes in market size. The growth of Chile position as supplier has not affected the U.S. market share.

The demand system's applicability is generally restricted to cases where there are only few major suppliers in the market. When there are many suppliers in the market, the large number of prices and in the case of promotional studies promotion expenditures, parameters are likely to result in significant multicolinearity problems.

The Armington Model

In the Armington model, products are differentiated according to type and according to the country where they are produced. In this model, the participation of each competing country in the market is determined in a second stage. In this second stage, the inclusion of domestic product will depend on the characteristic of the market or data availability. More details about this model will be presented in the next chapter.

In order to estimate the demand for U.S. wheat in eight Latin America countries, Shalaby (1988) uses the Armington model. In the representation used, the U.S. share of wheat imports is dependent on the ratio U.S./world wheat prices and the dependent variable lagged one period. The price ratio was expressed in the form of a two-year moving average in order to capture lagged adjustment. Annual data were used, and wheat was defined as commercial wheat and wheat flour in wheat equivalent.

From the results, the long-run price elasticities of the U.S. share of the import demand were larger than the short-run elasticities as expected. The U.S. market share was elastic in relation to the price ratio in the short-run for Chile, Colombia and Peru. Besides these countries, Venezuela also had long-run elasticity higher than one, though for Peru this coefficient was not significant at 5 percent. For Colombia, the coefficient of adjustment was excessive and not statistically significant. This parameter was higher than one for three other countries (from a total of eight) implying erratic reaction to price changes.

This review does not intend to exhaust all options that are available to the researcher in modelling import demand. The objective of this section was to summarize empirical studies on import demand where different methods were used. The knowledge of the market, objective of the study and creativity of the researcher opens possibilities for the use of new methods.

Promotion Activities

The different types of promotion activities (consumer promotion, technical assistance and trade servicing) are expected to have different impacts on demand. The most studied type of non-price promotion activities, consumer promotion, is unanimously believed to allow diminishing returns as the level of activities increases.

The different types of promotion activities are believed to have different impacts on demand (Henneberry and Ackerman, 1990). However, in most empirical research in promotion activities, differences in response pattern that are likely to occur depending on the promotion expenditures composition were neglected. Because of data restriction, only the overall response to total promotion activities have been considered.

The impact of promotion activities is frequently measured by including a variable that represents promotional efforts in the demand model. In order to represent promotion activities, most researchers used promotion expenditures. As example of alternative variables that can be used are advertising space in newspapers, time of commercials on TV or even dummy variables (Lee et al., 1988).

The dummy variable is generally used to test whether there was a structural change on demand after the beginning of a promotional campaign.

Using the promotion expenditures variable has the advantage of having direct economic meaning. The dummy variable method is undoubtedly the most limited because it cannot handle diminishing marginal returns to promotion activities. With the dummy variable method, only the average impact of promotion activities can be obtained.

Because of the limited research on export promotion and considering the similarities between domestic and import demand models, studies on domestic promotion will be also included in this section review.

In order to analyze the effect of foreign market promotional programs for apples, poultry and tobacco, Rosson et al. (1986) used the single equation model with linear specification. In this study, total export promotion expenditures under the Cooperator Program was used to represent the level of promotion activities. For apples, the French price was used as the competitor's price and the relative price model generated the best result when compared with the specification where own-price and competitor's price were separated terms. In the tobacco model, the contribution of the competitor's price variable was not significant.

The coefficient of the promotion expenditures variable was significant for the apples and tobacco equations only. The own-price elasticity for U.S. poultry exports was inconsistent with economic theory. Apples and tobacco price elasticity at sample mean values were -.29 and -.43, respectively. On average over the period studied, export sales increased $60 and $31 for apples and tobacco, respectively, for each dollar invested.

In order to measure the impact of the Cooperator Market Development Program on European demand for orange juice, Lee and Brown (1986) adapted a specification which represents imports as an exponential function of promotion expenditures. Because of the lack of information on the competitor's

(Brazilian) prices for each country, average Brazilian prices for orange juice imported into the U.S. was used. Since the Netherlands acted as a trans-shipment point for other European countries, the benefits from Cooperator Program may have been over-estimated for this country while under-estimated for others.

According to the results, the aggregate returns for each dollar of promotion expenditures ranged from $2.4 to $7.81. The benefit cost ratio was correlated with per capita promotion expenditures. Promotion activities were more effective than price cuts in maintaining or increasing levels of exports, except for Finland, U.K., Austria and Italy (out of 13 countries).

The Potential Use of Demand Systems in Export Promotion Studies

The above reviewed studies illustrate applications of the single equation import demand model for measurement of the effectiveness of export promotion activities. The other models discussed in this chapter can also be used with the same objective. However, demand systems have not been used for the purpose of measuring the effectiveness of export promotion activities.

The lack of studies using demand systems for measurement of export promotion activities is most likely to be attributed to its data requirements. Demand systems require data on all exporters' promotion activities in order to measure the impact of each export promotional program. Theoretical restrictions of demand theory cannot be imposed in the model for estimation purposes if data on promotion expenditures of competing countries is not available. In most of the cases, information on promotion activities conducted by all major countries that compete in a market is not available. This problem is likely to be the reason for the lack of studies on export promotion using this method. The two studies on domestic demand presented below illustrate the possibilities of using demand systems for purposes of measuring the impact of promotional programs.

Lee et al. (1988) used a demand system modeling the U.S orange juice market. In this study the author intended to: (1) determine whether there was an impact on total commodity demand after the implementation of the Brand Advertising Rebate program (BAR); and (2) evaluate the impact of advertising programs on the demand for brand and private label orange juice. A modified Rotterdam model was used to capture the impact of different kinds of advertising on the demand for the three major brands of orange juice, other brands of orange juice, private label orange juice and other fruit juices. Bimonthly data was used.

As a result, all own-advertising expenditure elasticities were statistically different than zero at 10 percent level, and generic advertising expenditure positively affected the sales of private label orange juice. All cross-advertising expenditure elasticities were negative when statistically different than zero. Generic advertising expenditures had a large positive effect on the total sales of orange juice. In order to address objective 1., a single equation was estimated.

In a study on domestic promotion, Green et al. (1990) discussed the inclusion of the promotion expenditures in the AIDS model in order to maintain the restriction of demand theory. A double log single equation model and two modified AIDS models were used to measure the impact of promotion expenditures on the demand for dried fruits.

Annual data from 1957 to 1986 were used for estimation. The homogeneity and symmetry conditions were rejected by the results. Results of the AIDS model indicated that the overall impact of promotion expenditures on demand of dried fruits was not statistically significant. These results disagreed with the results obtained using the double log model. Results of the double log specification showed a negative effect of promotion activities on demand for fig and prunes while a positive effect on demand for raisins.

Promotion Expenditures Carry Over Effect

Promotion activities are also believed to have a lagged impact on demand. This means that the positive impact of promotion activities would be observed beyond the period when the activities occur. In empirical studies, the determination of the lag structure has been based on theoretical assumptions, prior studies and/or testing the data. Two different lag structures, the geometric lag and the Almon polynomial distributed lag, have been more frequently used.

Geometric Lag. The geometric lag is based on the "good will stock" concept. In this representation, the highest effect of promotion activities would be observed in the current period. The carry over impact would then geometrically decline until it becomes negligible. However, the always decreasing impact of promotion activities over time that the geometric lag imposes in many cases is not appropriate. The peak of promotional impact may be delayed (Kinnucan, 1985).

With the objective of measuring the impact of advertising on total cigarette sales in the U.K., Radfar (1985) used the geometric structure to represent the promotion expenditures carry over effect. Based on prior research, nine lag observation periods (months) were used.

Dummy variables were used to represent health publicity. These variables were assumed to interact with cigarette advertising and divided the whole period studied into pre- and post- Royal College of Physicians' reports (1961, 1971 and 1977). The impact of this health variable was considered as having a permanent effect because it signalled for persistent government publicity that would alert for smoking hazards. In the resultant equation, only the coefficient of disposable income was not significant. All the other variables, including the promotion variable, had coefficients that were consistent with economic theory and statistically significant different from zero.

In this study, poster advertising, point of sale advertising, coupons, sponsorships and other activities were excluded from the model because cigarette manufacturers, facing the possibility of advertising prohibition, were reluctant to give an independent researcher access to these data.

In order to overcome a limitation of the geometric lag structure, Kinnucan (1987) chose a hybrid lag structure when evaluating the impact of advertising on domestic milk sales and comparing different advertising approaches. The hybrid lag used allowed the peak of the promotional impact not to occur in the current period, which in many cases is more appropriate. The lag structure adapted after preliminary analysis had independent coefficients for current and one lag period advertising expenditures and geometric structure from the second to the sixth periods.

In this study, harmonic variables where used to represent seasonality. Harmonic variables have the advantage over dummy variables of saving degrees of freedom. Based on t-test and individual net contribution, six harmonics were eliminated from the model. With the logarithmic form used, the income elasticity was .35, and price elasticity was -.73. Cross-price elasticity of the substitute product used (cola) was .51. The long run estimated advertising elasticity was .121. The results indicated that prices should fall 31.3 units for each unitary reduction in advertising expenditures.

Polynomial Distributed Lag. The alternative structure mostly used to represent the promotion expenditures, the Almon polynomial distributed lag (PDL), has in its flexibility the major advantage over the geometric lag. In this lag structure the peak of the promotional impact does not need to occur in the current period. The use of the Almon lag structure for representation of promotion activities carry over effect is reviewed below.

Working with milk advertising, Thompson and Eiler (1977) assumed a polynomial distributed lag. In this structure, after declining in the first period (month) advertising effectiveness begins increasing to reach its maximum in the fourth lagged period. In the fifth/last period, the advertising impact falls again.

In another study with the same commodity and observation period, Ward (1986) used a second order polynomial structure. Preliminary tests suggested that advertising effectiveness last up to 12 months. The advertising peak effect in this case occurred in the fifth and sixth months after actual expenditures.

For estimation of the returns to promotion activities, the author used two assumptions. First, it was assumed that the increase in fluid milk quantity consumed, stimulated by advertising, is matched by a reduction in the quantity used for food manufacturing. The second assumption used is that the opportunity cost of advertising is zero. According to the results, the optimal advertising expenditures level for 1983 should be about 75 percent higher than the actual level. The rate of return of the advertising investment calculated for same the year was 1.6629.

Lee (1981) used the Almon lagged structure to estimate the impact of generic advertising and FOB price adjustment on the FOB revenue of Florida grapefruit juice industry. The square-root form was used to represent the advertising effect, implying diminishing marginal returns. A system of equations combining variables in the supply and demand side through a set of six equations was used to represent the the vertical integration of the market. Data were adjusted for increases in the cost of advertising.

Grapefruit juice was found to be price elastic and would be considered an inferior good because of its negative income elasticity (-3.25). Orange juice and grapefruit juice showed high elasticity of substitution at retail level. The long run net return to advertising at FOB level was estimated to be $10.44 per dollar spent.

Empirical Studies with Beef in Japan

Because of the importance of the beef import quota for the present study, two studies analyzing the impact of changes in the import quota will be reviewed. The first study analyzes the impact of the elimination of the quota on the Japanese meat demand. The other studies the impact of changes in the beef imports quota system on share of foreign suppliers to the Japanese beef imports market.

In order to analyze the possible outcome of two alternative policies in Japan, the Beef Market Access Agreement (BMAA) and total liberalization of beef imports, Wahl et al. (1991) used a livestock industry model with 51 equations. For representation of the Japanese meat demand, the linear approximation of the AIDS model was used. In the AIDS model, the Wagyu beef, "import-quality beef" (aggregate of imported beef and domestic dairy beef), pork, chicken and fish were included. Net substitutability was imposed in the demand system using a Bayesian procedure.

Simulation results indicated that Japanese beef imports under the BMAA would increase to over 650,000 metric tons (mt) per year by the year 1991 as a result of the change from the quota to tariff. Annual beef imports were estimated to reach 1.2 million mt by 1997 under this alternative policy. According to the simulation results, under complete trade liberalization Japanese beef annual imports would have reached the level of approximately 1,500,000 mt in 1988. Total beef imports would be over two million mt by the year 1997.

Lin et al. (1988) estimated the effect of political manipulation and price competition on market shares of different suppliers in the Japanese beef imports market. Three equations were used to represent the major suppliers (U.S., Australia, and New Zealand) of the Japanese beef imports market. In the model used, the market share of each competing country is affected by own price, price of the competitors (weighted average price of the other two suppliers), a quota variable and one period lagged market share.

The quota variable corresponds to the percentage of the total beef quota corresponding to the high quality beef (HQB) quota. This variable was included to test whether manipulation of the quota system would affect market share of different competitors. If the U.S. had a comparative advantage in supplying HQB, increases in the HQB relative participation in the total beef quota would benefit the U.S. Annual data from 1973 to 1986 were used in this study. The seemingly unrelated regressions (SUR) method was used for estimation of the equations.

Results indicated that increases in the relative participation of the HQB in the total quota had a positive impact on the U.S. share of the Japanese beef imports market. The estimated elasticity of the U.S. market share with respect to the HQB variable was .113.

In this study the total demand for imported beef at retail level was also estimated using a double log specification. Because retail price of imported beef was not available, the wholesale price was used. Quarterly import beef prices were derived using the prices of eleven different frozen primal cuts and two full sets of aged beef and chilled beef.

The demand of imported beef at retail level was represented as being a function of own-price, competitors' prices, consumption expenditures, quarterly consumption lagged four periods and a seasonal dummy. Because there was high correlation between Wagyu beef and dairy beef prices and between pork and broiler prices, Wagyu beef and broiler prices were excluded from the model.

For the estimation of the total imported beef demand, quarterly data from 1978 to 1987 were used. Only the forth quarter seasonal dummy had a significant impact on demand. Using OLS, only the coefficient of the price of fish variable had the sign inconsistent with economic theory. Although the income and own price parameters estimated by OLS had the correct signs, they were significantly different from other estimates obtained in prior studies.

The researchers then restricted the income parameter to be an approximation of coefficients obtained in other studies. The results of the restricted model were not rejected at 5 percent level. In the restricted model, only the price of fish coefficient did not had the expected sign. All coefficients except the fish price were statistically significant different from zero.

CHAPTER IV

MODEL AND DATA PROCEDURES

The Model

In this study, an Armington model was used to measure the impact of the U.S. non-price promotion expenditures on the U.S. market share of the Japanese red meats import market. The Armington model differentiates products according to the type and according to the region where they are produced.

The Armington Model

In the Armington model, the products are assumed to be differentiated according to the source. The assumption is appropriate for this study as red meats produced by different countries are considered imperfect substitutes. For example, grain-fed beef produced in the U.S. is of different quality than grass-fed beef produced in Australia and New Zealand. The pork meat processing techniques adapted in the U.S. are also different from those adapted in Denmark and Taiwan, etc. This will result in different product characteristics.

According to the Armington model, if there are n product types and m supplying countries, in each country there will be n * m demands, one for each differentiated product. The demand for each product can be interpreted as the combination of prices and quantities for which utility is maximized, under the constraint of the limited income.

For a given country, the aggregate utility (U) can be specified as a function of the quantity of the different products (X_{ij}).

$$U = U(X_{11},X_{12},...,X_{1m},X_{21},X_{22},...,X_{2m},...,X_{n1},X_{n2},...,X_{nm}) \quad (1)$$

Where Xij = the quantity demanded of product type i from country j.

Given the products prices (P_{ij}), the demand for each product can be obtained by maximizing the utility function, subject to the budget constraint, income (I).

$$X_{ij} = X_{ij}(I,P_{11},P_{12},...,P_{1m},P_{21},P_{22},...,P_{2m},...,P_{n1},P_{n2},...,P_{nm}) \quad (2)$$

Where, Pij = price of the product type i from supplying country j.

However, the demand specified in such a way does not have significance for empirical work because of the excessive number of variables. Starting with the Hicksian demand function, Armington uses a sequence of progressively more restrictive assumptions in order to simplify the model to allow estimation (Armington, 1969).

The first simplification used in the Armington model is based on the assumption of weak-separability. Weak-separability states that the marginal rate of substitution between any pair of products (i.e. red meats from the U.S. versus red meats from Australia) that belong to one group (i.e. red meats imported by Japan) is not affected by the quantity of any other product that belongs to a different group (i.e. poultry meat imported by Japan) (Hassan and Johnson, 1976). This assumption can be represented using the derivative concept:

$$\frac{d\,\frac{(dU/dX_{ij})}{dU/dX_{ik}}}{dX_{gh}} = 0$$

Where,

d is the operator symbol for derivation

i and g are different groups of products

j and k are different products in group i

h is a product in group g

Using the assumption of weak-separability, the utility function can be represented as:

$$U = U'(X_1, X_2, \ldots, X_n) \quad (3)$$

Where, X_i is specified by a quantity index function (ϕ) of products from different countries that belong to the group i (i.e. red meats imported into Japan). This quantity index function can be represented as follows:

$$X_i = \phi_i (X_{i1}, X_{i2}, \ldots, X_{im}) \quad (4)$$

The Armington model can be viewed as a two-stage budget allocation. In the first stage, the size of the market (i.e. imported red meats) is determined by income and the prices of various goods (i.e. imported red meats, poultry meat, etc.). In the second stage the price of products competing in the same market (i.e. red meats from U.S. against red meats from Australia in the Japanese red meats import market) and the size of the market will determine the imports from each country (Figure 3).

The demand specified in two-stage (simplified demand) will be appropriate if the determination of the quantity demanded for each product in the two-stage representation corresponds to the quantity that would be determined by the representation of the demand function where all prices are included (Armington, 1969). This condition will be fulfilled if:

$$P_i = P_{i1} / \left(\frac{d\phi}{dX_{i1}}\right) = P_{i2} / \left(\frac{d\phi}{dX_{i2}}\right) = \ldots = P_{im} / \left(\frac{d\phi}{dX_{im}}\right) \quad (5)$$

$$\text{for } i = 1, 2, \ldots, n$$

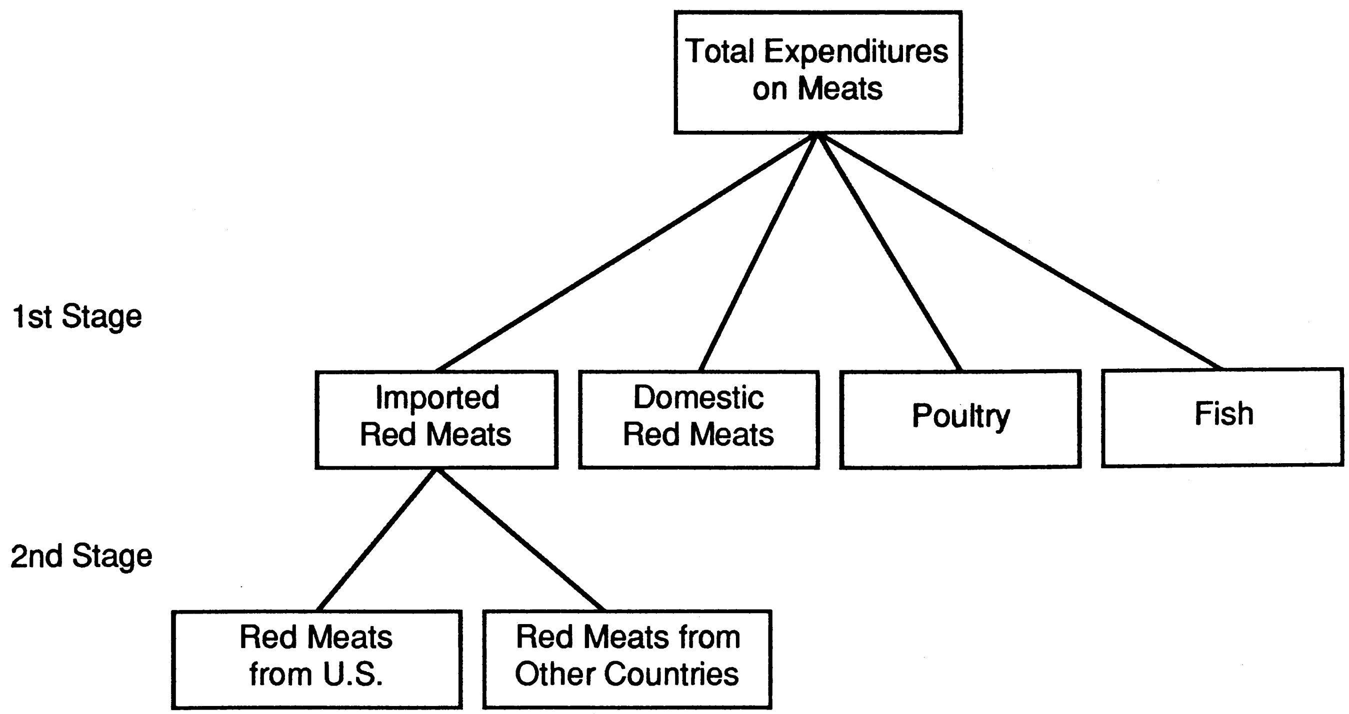


Figure 3. Representation of Japanese Demand for Meats

This condition implies the following:

$$\frac{P_{i1}}{P_{i2}} = \frac{(d\phi_i/dX_{i1})}{(d\phi_i/dX_{i2})} \quad , \quad \frac{P_{i2}}{P_{i3}} = \frac{(d\phi_i/dX_{i2})}{(d\phi_i/dX_{i3})}, \text{ etc.} \ldots \tag{6}$$

for $i = 1,2, \ldots, n$

Equation 6 corresponds to the first order conditions for minimization of the cost of purchasing the quantity X_i with given prices ($P_{i1}, P_{i2}, \ldots, P_{im}$) (Armington, 1969).

To assure that P_i does not depend on X_i,it must be assumed that ϕ_i is linearly homogeneous. "This second restriction means that the market share . . . must not depend on the size of the market itself" (Armington, 1969, p. 165). The assumption that ϕ_i is linearly homogenous means that if each of the independent terms X_{ij}'s are multiplied by a constant r, the quantity X_i (Equation 4) will also be multiplied by r. This assumption does not necessary imply that ϕ_i is a linear function (Chiang, 1984, p. 411).

Using the assumption of independence and the assumption that the quantity function is linearly homogenous, it can be shown that the demand for product X_{ij} will be determined by the market size X_i and the ratios of the price of product X_{ij} (P_{ij}) and price of other products that belong to the same market (P_{ik} for .... $k = 1, \ldots m$).

$$X_{ij} = X_{ij}\left(X_i, \frac{P_{ij}}{P_{i1}}, \frac{P_{ij}}{P_{i2}}, \ldots, \frac{P_{ij}}{P_{im}}\right) \tag{7}$$

In order to simplify the model to allow estimation, Armington uses two restrictions. First, the elasticity of substitution between the same product from different sources competing in a market is taken as constant. In other words, it does not depend on market share.

The second restriction is that "the elasticity of substitution between any two products (from different sources) competing in a market is the same as that between any other pair of products competing in the same market" (Armington, 1969, p. 167). This last assumption allows for the use of a single price parameter in the estimation.

After the incorporation of these two restrictions, equation (7) will have the form of (8):

$$X_{ij} = A\, X_i \left(\frac{P_{ij}}{P_i}\right)^B \qquad (8)$$

or

$$\frac{X_{ij}}{X_i} = A \left(\frac{P_{ij}}{P_i}\right)^B \qquad (9)$$

Where,

X_i = the total quantity demanded of product type i

X_{ij} = the quantity demanded of product type i from country j

P_i = average price of the product type i

P_{ij} = price of the product type i from country j

A and B are constants

Defining (X_{ij}/X_i) as W_{ij}, equation (9) can be written as:

$$W_{ij} = A \left(\frac{P_{ij}}{P_i}\right)^B \qquad (10)$$

The two restrictions of Armington model described above imply the functional specification used in Equation (10). Equation (10) can be transformed in the double logarithmic specification for estimation purposes.

Variables were added to this basic structure to capture the effect of promotion activities, quota specification and time trend. These variables were assumed to modify the constant term A. The modified model was used for estimation of the Japanese demand for red meats from the U.S.

Non-Price Promotion Expenditures

To the basic Armington model, a variable representing non-price promotion expenditures was added. Because the U.S. promotional efforts target increasing the perceived qualities of the American product, the U.S. share of the Japanese red meats import market is expected to increase as promotion activities occur.

Like the U.S., other countries have also invested in promotion activities (Denmark - pork, Australia - beef) (Hayes, 1990). A negative impact is expected to occur on the U.S. red meats market share as a result of the promotion activities conducted by U.S. competitors. This is under the assumption that other countries' promotional efforts are effective in increasing the perceived qualities of U.S. competing products.

A variable should then be included in the model for representation of other countries' promotion activities. However, data on other countries' promotion activities are not available. Therefore, in the model used in this study, other countries' promotion activities were not included. The exclusion of other countries market development expenditures from the model would not have affected the coefficient of U.S. promotion expenditures if these two variables were not correlated (Wallace and Silver, 1988, p. 163).

After the inclusion of the variable that represents the U.S. promotion expenditures, the model can be represented as:

$$W_{ij} = e^{B_0} E^{B_1} \left(\frac{P_{ij}}{P_i}\right)^{B_2} \qquad (11)$$

where,

E = U.S. promotion expenditures

B_k = parameters for k = 0,1,2,...

e = the base of the natural log

In this model, the marginal return to promotion activities will be decreasing, constant or increasing if B_1 is smaller than, equal to, or larger than one.

Institutional Factors

The beef quota system has played an important role in determining market share in the Japanese imports market according to Lin et al. (1988), Alston et al. (1990), and Davis and Rosson (1990).

From 1983 to 1987, there was a percentage increase in the portion of the total beef quota corresponding to high quality beef (HQB) which was larger than the percentage increase in the total beef quota. HQB is defined as beef obtained from cattle not older than two years at slaughter that have been fed with a high concentrate ration for at least 100 days.

A variable representing the HQB portion of the total beef quota is added to the model to represent changes in this institutional factor, which is hypothesized to affect market share.

The rationality of the use of this variable is that an increase in the HQB share of total beef import quota would favor the U.S., where a high concentrate ration is generally used in livestock production. The use of a high concentrate ration is required for production of the HQB. The U.S. main competitors, Australia and New Zealand, specialize in producing grass-fed beef.

Because the HQB share of the total beef quota will affect the beef and veal market share only, its importance is expected to be reduced when a broader commodity category is considered. That is, the impact of this variable on the beef market share is expected to be higher than its impact on the red meats market share.

With the inclusion of the quota variable, the model can be represented as:

$$W_{ij} = e^{B_0} E^{B_1} HQBS^{B_2} \left(\frac{P_{ij}}{P_i}\right)^{B_3} \qquad (12)$$

Where,

HQBS = ratio of the high quality beef over the total beef imports quota

Time Trend

A time trend variable was included in the model to represent changes in demographic factors that are associated with lifestyle and may possibly affect red meats demand and consequently imports. Within the demographic factors that may affect red meats consumption are the age composition of the population, the percentage of the population living in urban areas, average size of the family, participation of the women in the work force, etc. (Hayes, 1990, p. 38).

Changes in these demographic factors are associated with changes in lifestyle such as an increasing search for convenience (which means an increase in demand for canned or frozen products), increase in consumption of food away from home, etc. These changes in habits are likely to affect red meats demand and consequently imports.

In this study, a trend variable was used to represent changes in demographic factors that are likely to be associated with changes in red meats demand. After adding the trend variable (T), the model becomes:

$$W_{ij} = e^{B_0} E^{B_1} HQBS^{B_2} T^{B_3} \left(\frac{P_{ij}}{P_i}\right)^{B_4} \qquad (13)$$

Partial Adjustment Model

In order to allow for dynamic adjustment, the partial adjustment form was used. In this form, it is assumed that there is an optimal combination of imports from different sources. This combination is determined by prices and perceived quality differences of the commodity between different sources, etc., based on the importing country's utility function. The perceived quality is affected by promotion expenditures. Using the double log specification:

$$\log W^*_{ijt} = B_0 + B_1 \log E_t + B_2 \log HQBS_t + B_3 \log T_t + B_4 \log \left(\frac{P_{if}}{P_i}\right)_t \qquad (14)$$

where,

W^*_{ij} = optimal j country share in the market i

P_{ij}/P_i = relative price of the commodity from country j in the market i

E = promotion expenditures

HQBS = share of total beef imports quota corresponding to HQB

T = time trend

t = observation period

Because of rigidities originated from contracts and other reasons, the importing country does not completely adjust to changes in the determinants of demand immediately. In this model the market share is adjusted in each period by a percentage of the difference between desirable market share and lagged one period market share.

$$\log W_{ijt} - \log W_{ijt-1} = \lambda (\log W^*_{ijt} - \log W_{ijt-1}) \qquad (15)$$

where,

W_{ij} = actual country j share of the market i

λ = coefficient of adjustment

If the term with W^*_{ij} in equation (15) is separated in the left hand side, equation (16) is obtained.

$$\lambda \log W^*_{ijt} = \log W_{ijt} - (1-\lambda) \log W_{ijt-1} \tag{16}$$

Multiplying equation (14) by λ, equation (17) is obtained.

$$\lambda \log W^*_{ijt} = \lambda B_0 + \lambda B_1 \log E_t + \lambda B_2 \log HQBS_t + \lambda B_3 \log T_t + \lambda B_4 \log \left(\frac{P_{ij}}{P_i}\right)_t \tag{17}$$

Combining equations (16) and (17), we obtain:

$$\log W_{ijt} = \lambda B_0 + \lambda B_1 \log E_t + \lambda B_2 \log HQBS_t + \lambda B_3 \log T_t + \lambda B_4 \log \left(\frac{P_{ij}}{P_i}\right)_t + (1-\lambda) \log W_{ijt-1} \tag{18}$$

Defining $\lambda B_k = \beta_k$ (for k = 0,1,...,4), and $(1 - \lambda) = \beta_5$, equation (18) can be written as:

$$\log W_{ijt} = \beta_0 + \beta_1 \log E_t + \beta_2 \log HQBS_t + \beta_3 \log T_t + \beta_4 \log \left(\frac{P_{if}}{P_i}\right)_t + \beta_5 \log W_{ijt-1} \tag{19}$$

Equation (19) can be estimated with the ordinary least square method. For the non-price promotion expenditures variable, the short run effect will be the coefficient $\beta 1$ in equation (19) or λB_1 in equation (18). The promotion expenditures effect in the long run will correspond to $\beta 1 / (1-\beta_5)$, which corresponds to the coefficient of promotion expenditures in the equation (14) (B_1).

The higher the coefficient of adjustment (λ), the smaller (β_5) will be. This means that the smaller will be the difference between the long and short run effect of the promotion expenditures. If the importing country adjusts immediately to changes in price and quality, etc., λ will be equal to 1, and the long run and short run effects will be the same. In this case, the impact of all promotion expenditures would occur in the current period.

Red Meats Categories

Besides knowing the impact of promotion expenditures on total red meats market share, one may be interested in the impact on different commodity groups (beef, pork, etc.). However, data on U.S. overseas non-price promotion activities are reported only as aggregated data.

Data on promotion expenditures were not disaggregated for each red meat product (beef, pork, etc.). However, the impact of promotion expenditures on U.S. share of each red meat product market can be estimated if it is assumed that promotion expenditure on each red meat product is a constant portion of total red meats promotion expenditures over the period under the study.

If this assumption holds, the use of total promotion expenditures in the equation for each red meat product will be equivalent to a change in the units contained in a variable. Change in the units of a variable per se in the double log specification will not affect the coefficient of any independent variables nor the t-values. Transformation of units contained in a variable in the double logarithmic specification will affect only the intercept term.

Use beef as an example. If it is assumed that promotion expenditures on beef are equal to a constant portion of total promotion expenditures on red meats, total promotion expenditures on red meats can be used to represent promotion expenditures on beef. In the estimated beef equation, only the intercept term will be biased. This allows us to obtain the elasticity of the U.S. market share on the Japanese beef market with respect to promotion expenditures, even though the correct expenditure on beef promotion is unknown. However, this perfect linear relationship between beef and total red meats promotion expenditures need not exist. If there is no perfect linear relationship, bias will be originated in the coefficients.

Data Sources

This study used data for the period from 1973 through 1988. The year 1973 was chosen as a starting period because the U.S. did not export any beef offals to Japan in 1972. Price data used in this study are derived from quantity and value numbers. The absence of exports made the derivation of the U.S. price for the year 1972 impossible.

Data on prices were obtained by dividing the total value by total quantity (unity price). Data on total red meats and pork imports into Japan were collected from the Food and Agricultural Organization (FAO) trade yearbook (various issues). Pork numbers correspond to the FAO category pork meat fresh, chilled or frozen (011.3). Red meats data were obtained by subtracting the numbers in the category poultry meats fresh, chilled or frozen (011.4) from the numbers in the broader category of fresh, chilled or frozen meats (011).

For total red meats and pork, the U.S. exports to Japan data were collected from Foreign Agricultural Trade of the U.S. (FATUS). The red meats data correspond to the category of meat and meat products which excludes poultry meats. The pork numbers correspond to the pork fresh and frozen category.

This data procedure was not used for the beef category ("beef and veal" and "beef" are used thereafter interchangeably). For the use of two data sources in the market share model, there must be a correspondence between the classifications adapted in these two sources. While this is true for red meats and pork, the same does not hold for beef.

While the U.S. includes diaphragm beef in the beef category, Japan includes diaphragm beef in the offals category or, more specifically, beef offals. The Japanese classification was adapted in this study because of the impossibility of obtaining the average price of Japanese imports in the American classification.

Data on beef and beef offals were obtained from Japan Exports and Imports: Commodity by Country (various December issues). The beef category used in this study corresponds to the Japanese categories beef and veal, fresh chilled or frozen (2.01 - 111, 119, 121, 129). The category beef offals includes internal organs and tongues of bovines, fresh chilled or frozen (2.01 - 131).

The U.S. market share is expected to be affected by total U.S. promotion expenditures. However, because of data restrictions, only FAS contribution to the market development programs was used in place of total promotion expenditures. Data on the FAS contribution to the Cooperator and TEA Programs were furnished by the FAS.

Because changes in the U.S. market share are believed to be caused by changes in technology, trade practices or consumer preferences that have occurred in Japan, promotion expenditures were transformed from the U.S. dollar to real yen.

Promotion expenditures were first transformed from nominal dollar to nominal yen using the nominal exchange rate (yen/dollar). Promotion expenditures in nominal yen were then divided by the Japanese Consumer Price Index in order to obtain the promotion expenditures in real yen.

Data on Japanese consumer price index (base year 1985) and the foreign exchange rate yen/dollar were obtained from Japan Statistical Yearbook.

Changes that occur in Japan are expected to be related with promotion expenditures transformed in Japanese real currency. The use of promotion expenditures in real dollar in the model would originate error in measurement and consequently bias the estimation of promotion activities impact.

The promotion activities of the U.S. competing countries in the Japanese red meats market were not included in the model because of the lack of data. The omission of this variable from the model would not have affected the other estimated coefficients if this variable was not correlated with the other variables. However, if the promotion expenditures of other countries are, for example, positively correlated with the U.S. promotion expenditures, the omission of this variable from the model would introduce downward bias in the coefficient of the American promotion expenditures.

Data on the variable used in this study to capture changes in the Japanese beef imports quota system were obtained by dividing the High Quality Beef quota by total beef imports quota. The period corresponding to data on the quota variable is based on the Japanese fiscal year (April to March) because the Japanese beef import quota was determined twice a year (April and October). Therefore, there is no exact correspondence between the period of data on this variable and the period of the data on other variables used in this study, which correspond to the calendar year (January to December).

CHAPTER V

RESULTS

The Armington model was used to estimate the impact of U.S. export promotional activities on the U.S. share of the Japanese red meats import market. The model discussed in the prior chapter, account for changes in prices, the beef import quota specification and demographic factors (which are assumed to be associated with changes in lifestyle). In order to represent changes in demographic factors, a time trend variable was used.

The current expenditure values were used to represent promotion expenditure variables in the estimated equation (Equation 19, Chapter IV). In preliminary trials a moving average of two and three years and a polynomial distributed lag were used in order to verify whether there was a promotion carry-over effect. However, the results were not improved (see Appendix A).

The ordinary least square method was used for estimation of the coefficients. When there were autocorrelation problems, a two-stage least square procedure was used in the estimation. This procedure is described in the next section.

Results for each category are presented below. The return for each dollar invested on promotion of the American red meats in Japan is calculated in the last section. Return to promotion of activities on each commodity (beef, pork, etc) can not be calculated separately because the exact portion of total promotional expenditures on red meats allocated for each commodity is unknown.

Total Red Meats

In the equation representing the U.S. share of the Japanese red meats import market (equation 19 in Chapter IV) estimated by the ordinary least square method, the R^2 was 86%, meaning that this percentage of the variability of the dependent variable was explained by the independent variables. Only the intercept term and the time trend coefficient were statistically significant at five percent level. The promotional expenditures coefficient was equal to .019 and was not statistically significant (Table IV).

In the estimation of this equation, two problems were observed, autocorrelation and multicollinearity. The consequence of autocorrelation, when there is a lagged dependent variable in the equation, is bias and inconsistency of the ordinary least square estimators. The consequence of multicollinearity is large variance of the coefficients, wider confidence intervals and small t values. The estimators of the model where multicollinearity is present are the best linear unbiased estimators (Gujarati, 1988, pg. 290-292).

When there is a lagged dependent variable included in the model as a regressor, the Durbin Watson d statistic is not appropriate for testing for autocorrelation problems. For this type of model, the h statistic can be used for testing for the presence of autocorrelation (Durbin, 1970).

$$h = (1-\frac{d}{2}) \sqrt{\frac{T}{1-[T\ (VAR\ BY_{t-1})]}}$$

Where,

d = Durbin Watson d statistic

T = sample size

$[VAR\ BY_{t-1}]$ = variance of the lagged dependent variable coefficient

TABLE IV

ESTIMATED TOTAL RED MEATS EQUATION USING THE ORDINARY LEAST SQUARE METHOD

	β_0	β_1	β_2	β_3^*	β_4	β_5	R^2
Unrestricted	-4.78**	.019	.002	.10**	.17	-.52	.858
Model	(3.20)	(1.27)	(.14)	(2.65)	(.20)	(1.43)	
Restricted Model	-4.85**	.020**	0	.10**	.20	-.53	.858
(B2 = 0)	(3.58)	(1.79)		(2.86)	(.26)	(1.56)	

**Significant at 5% level.

In the absence of autocorrelation, the h statistic will be normally distributed with mean zero and variance equal to one. If the h value is statistically significant different from zero, autocorrelation will be considered as a problem. However, when the quantity under the radical sign is negative, this test is not applicable. In this case an alternative two steps method can be used for testing for autocorrelation problems.

In the first step the model is estimated by the ordinary least square method, and the residuals e_t of this estimation are saved. In the second step, e_t is

---

*β_3 is the coefficient of the regressor time trend. The results of estimation of Equation 19 would change according to the starting value of the time trend variable. With the exception of the intercept term and the coefficient of the time trend, all coefficients converge to asymptotic values as the starting value of the time trend becomes sufficiently large.

These asymptotic values of the coefficients can also be obtained if the regressor log T is replaced by T. When T is used in place of log T, the starting value of the time trend will not affect the results. In all results presented in this study, the variable log T was replaced by T.

regressed on e_{t-1}, Y_{t-1} and the X_t's. If the coefficient of the variable e_{t-1} in the second step is statistically significant (based on the t test), the null hypothesis of absence of autocorrelation should be rejected (Durbin, 1970).

In the equation representing the U.S. share of the Japanese red meats import market, the h statistic was not defined because the quantity under the radical sign was negative. The two-step method described above in order to test for the presence of serial correlation was then used. This test indicated that there were autocorrelation problems in the equation.

The high R^2 obtained in the estimation, associated with non-statistically significant coefficients suggests that there were multicollinearity problems. In order to verify the presence of multicollinearity, the Klein test was used. In the Klein test, each regressor is regressed on the remaining regressors, and for each one of this auxiliary regressions is kept the R^2_i (where i refers to the dependent variable (X_i) of these auxiliary regressions). If the R^2 of the original model is smaller than the R^2_i of one of these auxiliary regressions, multicollinearity would be considered as a problem (Gujarati, 1988, pg. 300).

Table V shows the R^2_i of the regression of each regressor (X_i) in the remaining regressors. The R^2_i of three auxiliary regressions were higher than the R^2 of the original model (.858). This indicates that multicollinearity is a significant problem in the data sample used.

First, the autocorrelation problem was corrected without taking into account multicollinearity problems. When there is autocorrelation problems in a model where a lagged dependent variable appears as independent variable, the Cochrane-Orcutt method cannot be used for estimation of the serial correlation coefficient (Wallace and Silver, 1988, P. 298).

In the case where there is a lagged dependent variable as a regressor, estimators with the desirable asymptotic properties can be obtained in a two-stage estimation procedure. In the first stage, the lagged dependent variable (Y_{t-1}) is regressed on variables (instruments) that are correlated with Y_{t-1}, but are not expected to be correlated with the error term of the original model. The

TABLE V

AUXILIARY REGRESSION R^2_i FOR DETECTION OF MULTICOLLINEARITY PROBLEMS

Regressor X_i	R^2_i
Log E_t	.860
Log $HQBS_t$	.617
Log T_e	.917
Log $(\frac{P_{ij}}{P_i})_t$	.696
Log W_{ijt-1}	.910

predicted value of Y_{t-1} in this first stage ($\hat{Y}_{t-1}$) will substitute the actual value of Y_{t-1} in the original equation that will be estimated in a second-stage (Johnston, 1988, p. 363 and Gujarati, 1988, p. 524).

Liviatan (1963) suggested the use of other regressors X_{t-1} as instruments for Y_{t-1}. Gujarati (1988, pg. 525) discussed the problems resulting from the use of this technique. Because X_t and X_{t-1} are commonly correlated in time series data, multicollinearity problems are likely to be originated, when this technique is used.

In order to avoid worsening the multicollinearity problems already present in the original model, the presence of correlation between each X_t variable and its lagged value (X_{t-1}) was verified (Table VI). Because of the high correlation coefficient between current and lagged values for the promotional expenditures

TABLE VI

CORRELATION COEFFICIENTS BETWEEN EACH REGRESSOR AND ITS LAGGED ONE PERIOD VALUE

X_i	COR Xit • Xit-1
Log E	.903
Log HQRS	.735
Log T	1
Log $(\frac{P_{ij}}{P_i})$	.452

regressor, and obviously the time trend regressor, only the relative price and quota variables lagged one period and an intercept term were used as instruments for Y_{t-1}. The estimated equation where Y_{t-1} is replaced by $\hat{Y}_{t-1}$ is presented below.

$$\log W_{ijt} = \underset{(1.21)}{-1.41} + \underset{(.54)}{.007} \log E_t + \underset{(.48)}{.005} \log HQBS_t + \underset{(.71)}{.025} \log T_t -$$

$$- \underset{(.97)}{.73} \log \left(\frac{P_{ij}}{P_i}\right)_t + \underset{(1.35)}{.37} \log W_{ijt-1} \qquad R^2 = 86$$

Where the numbers within parenthesis correspond to t statistic the R^2 did not change significantly. The relative price, promotion expenditures, quota and lagged dependent variable coefficients had the expected signs. Results of the two-step procedure indicated that autocorrelation was not a significant problem. However, all the coefficients were not statistically significant. This reflects the high multicollinearity problems in the data sample.

Because the coefficient of the variable representing the beef import quota specification was not statistically significant in the total red meats and beef equations (next section), this variable was excluded from the model.

When the ordinary least square method was used for estimation of the restricted model ($\beta_2 = 0$), serial correlation problem was detected. The estimated equation is presented in Table IV. The same procedure for correction of autocorrelation that was used for estimation of the unrestricted model was used for the restricted model.

The R^2 and coefficients of the time trend, relative price, lagged dependent variable and the intercept term did not change significantly when compared with the unrestricted model. The lagged dependent variable coefficient became statistically significant at ten percent level (one tail test). The time trend coefficient and intercept term were not statistically significant. The promotion expenditures coefficient increased from .007, in the unrestricted model, to .010, but it was statistically non-significant.

$$\log W_{ijt} = \underset{(1.35)}{-1.50} + \underset{(1.09)}{.010 \log E_t} + \underset{(.74)}{.025 \log T_t} -$$

$$- \underset{(.93)}{.67 \log \left(\frac{P_{ij}}{P_i}\right)_t} + \underset{(1.39)}{.37 \log W_{ijt-1}} \qquad R^2 = .85$$

Based on the coefficients of this equation is calculated the return to each dollar invested in promotion activities. The procedure used for calculation of the return to investment in promotion activities is described in the last section of this chapter.

In the partial adjustment representation used, the coefficients of the variables correspond to the short run elasticities. The long run elasticity can be obtained dividing the short run elasticity by the coefficient of adjustment, which can be obtained subtracting the coefficient of the lagged dependent variable from one. The long run promotion expenditures elasticity was equal to .016.

The small t values in this equation reflect high multicollinearity in the sample. In order to increase the t values, variables such as time trend, that were not statistically significant different from zero could be excluded from the model (see Appendix B).

However, results from the beef and pork equations indicate that the time trend variable (representing changes in life style) had a significant impact on U.S. share of the Japanese red meats market. The exclusion of this variable from the model would result in bias of the coefficients of the remaining variables in the model that are correlated with time trend (Gujarati, 1988, pg. 304). In the case of promotion expenditures coefficient, because promotion expenditures is positively correlated with time trend, the direction of the bias would be upward.

Beef

In the beef equation the Durbin h statistic showed that autocorrelation was not a problem. The estimated equation presented good fitness, with R^2 equal to 98%. The estimated equation is presented below.

$$\log W_{ijt} = \underset{(5.41)}{-7.08} + \underset{(3.07)}{.019} \log E_t + \underset{(1.04)}{.0061} \log HQBS_t + \underset{(5.25)}{.079} \log T_t -$$

$$- \underset{(5.45)}{1.03} \log \left(\frac{P_{ij}}{P_i}\right)_t + \underset{(2.86)}{.183} \log W_{ijt-1} \qquad R^2 = .98$$

All coefficients in the beef equation, with the exception of the quota variable, were statistically significant. However, the promotion expenditures coefficient had negative sign, which is inconsistent with prior expectations. A negative sign of the coefficient of U.S. promotional expenditures would imply that as promotional expenditures increase, the U.S. market share of the Japanese beef import market would decrease.

This result is likely to be caused by exclusion from the model of other factors that are important to the determination of market share. Within these factors is promotion activities conducted by competitors of the American product in the Japanese beef import market (Australia). This factor was not included in the model because of the lack of data.

The Australian promotional expenditures are expected to have a negative impact on the U.S. market share. If this variable is not correlated with the variables included in the model, the omission of this variable from the model will not affect the remaining estimated coefficients. However, if for example the Australian promotion expenditures are positively correlated with the U.S. promotional expenditures, the omission of this variable from the model would result in a downward bias in the coefficient of the U.S. promotional expenditures. This may be a reason for the negative and significant coefficient in the beef equation.

When the quota variable was excluded from the model, the results did not improved. The estimated equation with the coefficient of the quota variable (HQBS) restricted to be equal to zero is present below.

$$\log W_{ijt} = -6.81 - .016 \log E_t + .075 \log T_t -$$
$$(5.28) \quad (2.99) \quad (5.13)$$
$$- 1.09 \log \left(\frac{P_{ij}}{P_i}\right)_t + .19 \log W_{ijt-1}$$
$$(6.04) \quad (3.04) \quad R^2 = .98$$

Because the sign of the coefficient of the promotion expenditures variable was inconsistent with prior expectations, this coefficient was restricted to be equal to zero. The model was re-estimated to verify whether the coefficient of the quota variable would become significant. The results did not change significantly, but the sign of the quota variable coefficient became negative.

$$\log W_{ijt} = -6.02 + .004 \log HQBS_t + .062 \log T_t -$$
$$(3.58) \quad (.60) \quad (3.33)$$
$$- .97 \log \left(\frac{P_{ij}}{P_i}\right)_t + .162 \log W_{ijt-1}$$
$$(3.90) \quad (1.91) \quad R^2 = .96$$

Beef Offals

According to Hayes (1990, p. 16), diaphragm beef (which belongs to the category beef offals) qualities are affected by feeding management. If U.S. market development activities are effective in changing Japanese consumer tastes in favor to diaphragm beef obtained from grain-fed cattle, it will result in an increase on U.S. share of Japanese beef offals imports, ceteris paribus.

For beef offals the estimated equation presented good fitness with R^2 equal to 99%. The h statistic was non-statistically significant different from zero, meaning that autocorrelation should not be considered as a problem. All the signs of the estimated coefficients were consistent with economic theory. With the exception of the intercept term and the trend variable coefficient, all coefficients were statistically significant at 5% level.

$$\log W_{ijt} = \underset{(1.17)}{-.257} + \underset{(2.61)}{.015} \log E_t + \underset{(.97)}{.0002} \log T_t - \underset{(2.94)}{1.99} \log \left(\frac{P_{ij}}{P_i}\right)_t + \underset{(2.34)}{.31} \log W_{ijt-1} \qquad R^2 = .99$$

When the trend variable was excluded from the model, the R^2, h statistic and remaining coefficients did not change significantly. However, the intercept term became statistically significant different from zero. The coefficient of the promotion expenditures variable was equal to .015. The estimated equation is presented below.

$$\log W_{ijt} = \underset{(2.90)}{-2.65} + \underset{(2.98)}{.015} \log E_t \underset{(3.09)}{-1.99} \log \left(\frac{P_{if}}{P_i}\right)_t + \underset{(2.89)}{.31} \log W_{ijt-1} \qquad R^2 = .99$$

Pork

When the ordinary least square method was used for estimation of the equation representing the pork sector, only the coefficient of the lagged dependent variable was statistically significant. The relative price and promotional expenditures coefficients had the sign inconsistent with economic theory. The h statistic was not defined. The two-step method fail to reject the null hypothesis of absence of autocorrelation at ten percent level.

Different restrictions were imposed in the model in order to verify whether results would improve. The coefficients of the trend variable, lagged dependent variable or both were restricted to be equal to zero. The model was estimated with and without correction for autocorrelation problems, which occurred when the lagged dependent variable was excluded from the model.

The intercept, relative price and promotion expenditures coefficients were never statistically significant. The sign of the relative price coefficient was always inconsistent with economic theory.

Return to Non-price Promotional Activities

The return of promotion activities can be divided into two parts. One corresponds to the increase in the U.S. export revenue due to an increase in the U.S. market share. The second corresponds to the increase in the U.S. export revenue due to an expansion of the Japanese imports market. Because the scope of this study was restricted to market share analysis, the estimated return considered here corresponds only to the first part of the total effect.

Because the double log form was used, the estimated coefficient of promotional expenditures corresponds to the elasticity of the U.S. market share (W_{US}) with respect to promotional expenditures transformed in real yen value (E). This coefficient then corresponds to the percentage change in the U.S. market share for each percentage change in promotion expenditures in real yen. Using the derivative representation,

$$B_1 = \frac{(dW_{US})}{W_{US}} / \frac{dE}{E} \qquad (20)$$

Equation (20) can also be written as:

$$\frac{(dW_{US})}{dE} = B_1 \cdot \frac{W_{US}}{E} \tag{21}$$

or

$$d\left(\frac{X_{US}}{X}\right)/dE = B_1 \cdot \left(\frac{X_{US}}{X}\right)/E \tag{22}$$

Where,

X_{US} = the quantity of American red meats exported to Japan

X = the quantity of red meats imported by Japan from all sources

Since only the impact on market share is being considered in this study, total Japanese imports are assumed to be pre-determined. Therefore, equation (23) can be represented as:

$$\frac{dX_{US}}{dE} = B_1 \cdot \frac{X_{US}}{E} \tag{23}$$

Multiplying both sides by the U.S. commodity price in dollars (P_{US}), the equation (24) can be obtained.

$$\left(\frac{dX_{US}}{dE}\right) \cdot P_{US} = \frac{dTR_{US}}{dE} = B1 \left(\frac{X_{US} \cdot P_{US}}{E}\right) \tag{24}$$

Where TR_{US} is equal to total U.S. red meats export revenue in dollars.

The price of the U.S. red meats is transformed in real dollar value using 1982-1984 as base years. In order to obtain the U.S. price in real value, the nominal price of the American product was first divided by the U.S. CPI (1982 - 1984 as base years). In the next step, all adjusted prices were multiplied by 100. At the mean values, equation (25) can be written as:

$$\frac{dTR_{US}}{dE} = B1 \cdot \frac{(\bar{X}_{US} \cdot \bar{P}_{US})}{\bar{E}} \tag{25}$$

Where P_{US} is the U.S. average price of red meats exported to Japan. The bars over the variables represent the simple mean of the respective variables over the period under the study.

Equation (26) will give us the average return in dollars for each yen invested on promotional activities. In order to obtain the return in dollar for each dollar invested in promotion activities, promotion expenditures is converted in dollar using the average real exchange rate (RER) between Japanese and U.S. currencies, in the period under the study.

$$\frac{dTR_{US}}{dE} = B1 \frac{(\bar{X}_{US} \cdot \bar{P}_{US})}{(\overline{E} / \overline{RER})} \tag{26}$$

Using the coefficient from the equation without the quota variable and the mean values in the sample period,

$$\frac{dTR_{US}}{dE} = .0158 \frac{116{,}984{,}000 \cdot 3.8586}{1{,}811{,}779 / 2.15} = 8.46$$

This calculated value corresponds to the return to investment in promotion activities in the long run. Using the coefficient β_1 in place of B1, the return to each dollar invested in promotion activities in the short run can be calculated. This value corresponds to 5.36 dollars.

Because only the FAS contribution to the Cooperator and TEA Programs was used, the return per dollar here estimated is an overestimation of the true coefficient. The return per each dollar invested in promotion activities, considering the market share effect, can be approximated if it is assumed that FAS contribution corresponds to one third of total promotion expenditures. The remaining two thirds would correspond to the contribution of the cooperator and the third participant in the country where the promotion activities occurred.

If actual promotional expenditures correspond to three times the FAS contribution, the return per each dollar of the total promotional expenditures will be one third of the return per dollar of the FAS contribution. The return to each dollar invested in promotion activities in the long run and short run would correspond to \$2.82 and \$1.78, respectively, assuming that the FAS contribution is only one-third of total promotion expenditures.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study used an Armington model to estimate the impact of U.S. government assisted promotion activities on U.S. exports of red meats. In the Armington model, products are assumed to be differentiated according to the supplying region or country.

Results of estimation of the Armington model indicated that U.S. non-price promotion activities had a positive but not statistically significant impact on the U.S. share of the Japanese imports of total red meats. The calculated long run and short run elasticities of the U.S. market share with respect to promotion expenditures were equal to .016 and .010, respectively.

A specific objective of this study was to compare the impact of promotion expenditures on different red meat products (beef, beef offals and pork meat) market share. In order to achieve this objective, the model was used to estimate the impact of promotion activities on U.S. share of the Japanese beef, beef offals and pork meat import markets.

Results of estimation of the Armington model, indicated that U.S. non-price promotion activities had a positive and statistically significant impact on the U.S. share of the Japanese imports of beef offals. According to results of the Armington model, promotion activities did not positively affect U.S. share of the beef and pork Japanese imports.

In the beef equation, all coefficients, with the exception of the quota variable, were statistically significant. However, the promotion expenditures coefficient had the sign inconsistent with economic theory.

The beef offals equation presented good fitness (R^2 = 99%) and all coefficients, with the exception of the intercept term and the trend variable coefficient were statistically significant. The estimated short run elasticity of U.S. market share with respect to promotion expenditures was equal to .015, while the long run elasticity was equal to .022.

In the equation representing the Japanese pork meat import market, the intercept, price and promotion expenditures coefficients were not statistically significant. The signs of the coefficient of the relative price variable was inconsistent with economic theory.

Other specific objective of the present study was to test whether changes in the Japanese beef import quota system had affected the U.S. share of the total red meats and beef import market. For testing the impact of changes in the Japanese beef import quota system, a variable was introduced in the model representing the share of the total beef import quota corresponding to high quality beef quota.

The impact of changes in the beef quota system on the U.S. share of Japanese imports of beef or total red meats was not statistically significantly different from zero. When this variable was removed from the equations and the equations re-estimated the remaining coefficients, R^2 and Durbin h statistic did not change substantially.

Based on the results of the estimation of the Armington model, the return in the long run to each FAS dollar invested in red meats promotion activities in Japan, assuming FAS takes credit for all revenue generated, was estimated to be equal to 8.46 dollars. Sixty three percent of this return would be observed in the short run. Assuming that the FAS contribution corresponded to one third of total U.S. red meats promotion expenditures in Japan, the return in the long run and short run to each dollar invested in promotion activities are estimated to be equal to $2.80 and $1.80, respectively.

Model Limitations

Limitations related with the assumptions of the model used and data restrictions should be kept in mind before inferences from the results can be made. Because of the nature of the model used in this study, Armington model, only the return to promotion expenditures due to an increase in U.S. market share was considered.

The impact of promotion activities on total red meat imports was not estimated because of lack of data on price of substitutes of imported red meats in Japan prior to the beginning of promotion activities.

One limitation of this study is related with the assumption that market shares are not affected by the size of the market. This is one restriction of the Armington model. The independence between market share and market size has not been tested in the Japanese red meats import market. If Japanese red meats import market size affects market share, this effect could have been significant in the period study, when the quantity of red meats imported increased nearly 70 percent.

Data Limitations

Limitation of data restricted the analysis. Other countries promotion activities were not considered in the analysis because of lack of data. Because of data restrictions, only the FAS contribution to the market development programs was used in place of total promotion expenditures. The exclusion of other countries promotion efforts from the analysis and the exclusion of other participants contributions to the Cooperator and TEA Programs are potential sources of bias.

The exclusion of other countries export promotion activities from the model used in this study would not have affected the results if the promotion expenditures of competing countries was not correlated with U.S. promotion expenditures.

In this study only the FAS contribution to the Cooperator and TEA Programs was used in the estimation because of lack of data on the other participants contribution. The use of FAS contribution to represent total promotion expenditures introduces measurement error. Error in measurement will result in bias of the coefficients.

If the ratio between FAS contribution and the contribution of other participants to the market development programs were constant over time, the bias would be zero. The use of FAS contribution to represent total promotion expenditures would be equivalent to change in the units contained in a variable. In the double logarithmic specification used, this would not affect the promotion expenditure coefficient. If this constant proportionality does not hold, the coefficient of promotion expenditures will be bias. The direction of the bias cannot be identified.

The non significance of the variable used in this study to represent Japanese beef import quota may be due to data problems. There was no exact correspondence between the period of data on this variable, which corresponds to Japanese fiscal year (from April to March), and the period of the data on other variables used in the model which, corresponds to calendar year (from January to December). This lack of correspondence was due to data restrictions.

In the equations representing individual red meat commodities (beef, beef offals and pork meat), results are limited in accuracy because total promotion expenditures on red meats was used to represent promotion activities in each commodity.

Suggestion for Future Research

There is a need for testing whether market share is affected by changes in the Japanese red meats import market size. Demand systems such as Rotterdam or AIDS can be used with this purpose.

Demand systems can also be thought as alternative models for measurement of U.S. red meats export promotion effectiveness. A disadvantage of demand systems, when compared with the Armington model, is that demand systems have higher data requirements. In order to cope with data limitations, theoretical restrictions such as homogeneity or symmetry conditions can be imposed for estimation of demand systems. This procedure will be inappropriate if data on other countries promotion activities is not available.

More detailed studies are lacking on Japanese red meats demand. Most studies on demand for meats in Japan did not included sheep and horse meats or edible offals. The share of Japanese red meat imports corresponding to these products has been changed significantly in recent years. Future research is needed to analyze the impact of changes in income, lifestyle, promotion activities or prices on the imports of each of these products.

A demand and supply system should be used to measure the impact of promotion activities on total Japanese red meat imports. Because Japan is a major importer of red meats, shifts in Japanese demand are likely to affect world prices. The estimation of the Japanese red meats import demand separately from world supply is likely to be associated with bias and inconsistency of the estimators because of the bias of the simultaneous equation.

The U.S. export promotion activities have been effective in increasing U.S. market share of Japanese beef offals imports. Because of the importance of this policy alternative for increasing U.S. red meats export revenue, more detailed research should be directed to the Cooperator and TEA programs, and their activities.

The Japanese red meats market has been increased significantly in recent years. After the end of the Japanese quota on beef imports, which occurred in April 01, 1991, significantly changes are expected to occur in the Japanese red meats import market. Research on this major foreign market for U.S. red meats is essential for elaboration of policies that target at increasing the U.S. red meats exports.

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APPENDIXES

APPENDIX A

PRELIMINARY TRIALS USING ALTERNATIVE SPECIFICATIONS FOR REPRESENTATION OF THE PROMOTION ACTIVITIES CARRY-OVER EFFECT

This appendix summarizes the estimation results assuming various lag structures to represent carryover effects of promotion expenditures in the equation measuring U.S. market share of Japanese total red meats imports. The polynomial distributed lag specification and moving average (two and three years) were used in preliminary estimates to capture the promotion expenditures carry-over effect. When these representations were used, the coefficient of adjustment (λ) was assumed to be equal to one (which means that the coefficient of the lagged dependent variable is equal to zero).

First to third degree polynomials were used with different number of lags (from one to five). However, for every category tested, the various polynomial distributed lag structures tested showed results inconsistent with economic theory. Either there was a negative coefficient for the promotion expenditures variable or the coefficient of the price variable was positive. In most of the forms tested, the intercept term was not significant. Results also changed substantially with the elimination of only one observation. That is, changing the number of lags of the promotion variable changes the results substantially.

Tables VII, VIII, IX, and X show results of estimation of the model using different variables to represent promotion expenditures. In each of these tables, for representation of the promotion expenditures variables the following were used: 1) current value, 2) current and lagged one period promotion expenditures simultaneously, 3) lagged one period value, 4) two years moving average (the simple mean of current and one-lagged promotion variable), and 5) three years moving average (the simple mean of current, one-lagged, and two-lagged promotion variable).

In Table VII, only the coefficient of the lagged dependent variable (β_5) was restricted to be equal to zero. In Table VIII, the coefficient of the variable representing changes in the beef import quota system (β_2) and β_5 were

TABLE VII

ESTIMATION RESULTS OF THE MODEL USING DIFFERENT LAG STRUCTURES TO REPRESENT THE IMPACTS OF PROMOTION EXPENDITURES ON U.S. RED MEATS MARKET SHARE WHEN $\beta_5 = 0$

Value Used to Represent Promotion Expenditures	Coefficients[2]					
	β_0	β_1	β_2	β_3	β_4	R^2
E_t[1]	-2.80** (4.91)	.007 (.53)	.005 (.45)	.059** (2.36)	-.46 (.61)	.83
E_t and E_{t-1}	2.73** (4.51)	.004 .012 (.26) (.52)	.003 (.13)	.049 (1.59)	-.43 (.55)	83
E_{t-1}	-2.75** (4.79)	.015 (.71)	-.002 (.12)	.051 (1.75)	-.42 (.56)	.83
$\frac{(E_t + E_{t-1})}{2}$	-2.81** (4.89)	.006 (.45)	.005 (.43)	.059** (2.30)	-.45 (.59)	.83
$\frac{(E_t + E_{t-1} + E_{t-2})}{3}$	-2.79** (4.84)	.007 (.48)	.005 (.41)	.058** (2.23)	-.45 (.60)	.83

*Significant at 10% level.
**Significant at 5% level.
[1]Subscript "t" corresponds to current value while "t-1" represents lagged value of promotion expenditures (E).
[2]The coefficients relate to equation 19 in Chapter IV.

TABLE VIII

ESTIMATION RESULTS OF THE MODEL USING DIFFERENT LAG STRUCTURES TO REPRESENT THE IMPACTS OF PROMOTION EXPENDITURES ON U.S. RED MEATS MARKET SHARE WHEN $\beta_2 = \beta_5 = 0$

Value Used to Represent Promotion Expenditures	Coefficients[2]					
	β_0	β_1	β_2	β_3	β_4	R^2
E_t[1]	-2.88**	.010	0	.059**	-.40	.83
	(5.49)	(1.04)		(2.75)	(.55)	
E_t and E_{t-1}	-2.73**	.004 .010	0	.051*	-.45	.83
	(4.73)	(.27) (.69)		(1.91)	(.61)	
E_{t-1}	-2.75**	.012	0	.053*	-.44	.83
	(5.00)	(1.25)		(2.09)	(.63)	
$\frac{(E_t + E_{t-1})}{2}$	-2.87**	.010	0	.058**	-.38	.83
	(5.39)	(1.00)		(2.36)	(.54)	
$\frac{(E_t + E_{t-1} + E_{t-2})}{3}$	-2.85**	.011	0	.057**	-.39	
	(5.30)	(1.02)		(2.29)	(.55)	

*Significant at 10% level.
**Significant at 5% level.
[1]Subscript "t" corresponds to current value while "t_{-1}" represents lagged value of promotion expenditures (E).
[2]The coefficients relate to equation 19 in Chapter IV.

TABLE IX

ESTIMATION RESULTS OF THE MODEL USING DIFFERENT LAG STRUCTURES TO REPRESENT THE IMPACTS OF PROMOTION EXPENDITURES ON U.S.RED MEATS MARKET SHARE WHEN

$\beta_2 = \beta_5 = 0$ $\beta_3 = \beta_5 = 0$

Value Used to Represent Promotion Expenditures	Coefficients[2]					
	β_0	β_1	β_2	β_3	β_4	R^2
E_t[1]	-1.56**	.024**	.006	0	-1.53**	.74
	(5.92)	(1.94)	(.41)		(2.19)	
E_t and E_{t-1}	-1.90**	.008 .033*	-.016	0	-1.00	.79
	(5.84)	(.56) (1.61)	(.84)		(1.36)	
E_{t-1}	-1.88**	.041**	-.016	0	-1.03*	.79
	(5.98)	(2.63)	(.91)		(1.45)	
$\frac{(E_t + E_{t-1})}{2}$	1.61**	.026**	.004	0	-1.44**	.74
	(5.72)	(1.98)	(.25)		(1.99)	
$\frac{(E_t + E_{t-1} + E_{t-2})}{3}$	1.62**	.027**	.003	0	-1.40**	.75
	(5.86)	(2.07)	(.21)		(1.96)	

*Significant at 10% level.
**Significant at 5% level.
[1]Subscript "t" corresponds to current value while "t_{-1}" represents lagged value of promotion expenditures (E).
[2]The coefficients relate to equation 19 in Chapter IV.

TABLE X

ESTIMATION RESULTS OF THE MODEL USING DIFFERENT LAG STRUCTURES TO REPRESENT THE IMPACTS OF PROMOTION EXPENDITURES ON U.S.RED MEATS MARKET SHARE WHEN

$\beta_2 = \beta_3 = \beta_5 = 0$

Value Used to Represent Promotion Expenditures	Coefficients[2]					
	β_0	β_1	β_2	β_3	β_4	R^2
E_t[1]	-1.64** (9.80)	.028** (3.49)	0	0	-1.47** (2.23)	.74
E_t and E_{t-1}	-1.66** (10.29)	.009 .021* (.62) (1.45)	0	0	-1.29** (1.99)	.78
E_{t-1}	-1.63** (10.90)	.028** (3.96)	0	0	-1.33** (2.12)	.77
$\frac{(E_t + E_{t-1})}{2}$	-1.66** 9.80	.028** (3.55)	0	0	-1.39** 2.08	.74
$\frac{(E_t + E_{t-1} + E_{t-2})}{3}$	1.67** (9.95)	.029** (3.64)	0	0	-1.36** (2.06)	.75

*Significant at 10% level.
**Significant at 5% level.
[1]Subscript "t" corresponds to current value while "t_{-1}" represents lagged value of promotion expenditures (E).
[2]The coefficients relate to equation 19 in Chapter IV.

restricted to be equal zero. The coefficient of the trend variable (β_3) and β_5 were restricted to be equal zero in Table IX. Finally, in Table X, β_2, β_3, and β_5 are restricted to be equal to zero.

In Tables VII through X, results of estimation of the model using current promotion expenditures and moving average were very similar. In Tables VII and VIII, all the coefficients of the promotion expenditures variable were statistically non-significant.

In Table IX, where only the one period lagged promotion expenditures or lagged and current promotion expenditures simultaneously were used, the coefficient of this variable or the summation of the two coefficients of promotion expenditures (when current and one-lagged were used simultaneously in the same equation) were higher than in the other three specifications. The R^2 in these two specifications were also higher than in the other forms. However, the coefficient of the variable representing HQBS had the sign inconsistent with prior expectations.

In Table X, in both specifications using current or lagged promotion expenditures, the results were very similar. When current and lagged promotion expenditures were used simultaneously, the summation of the coefficients were approximately the same as the coefficient of the promotion expenditures variable in the equations in which were used only one variable for promotion lagged or current or moving average. Therefore, none of the alternative forms tested were superior to the one in which only current promotion expenditure was used.

APPENDIX B

ESTIMATION OF THE EQUATION REPRESENTING JAPANESE TOTAL RED MEATS IMPORTS WITH THE TIME TREND COEFFICIENT RESTRICTED TO BE EQUAL TO ZERO

Appendix B presents the estimation of the equation 19 for total red meats with the coefficient of the time trend variable restricted to be equal zero (Table XI). The first equation corresponds to the equation on page 62, while the second equation corresponds to the equation on page 63.

TABLE XI

ESTIMATION OF THE MODEL REPRESENTING JAPANESE RED MEATS IMPORTS ASSUMING THE COEFFICIENT OF THE TIME TREND VARIABLE IS EQUAL TO ZERO

Restriction	β_0	β_1	β_2	β_4	β_5	R^2
$\beta_3 = 0$	-.64	.010	.006	-1.05*	.51**	.85
	(1.62)	(.91)	(.51)	(1.78)	(2.77)	
$\beta_2 = \beta_3 = 0$	-.72*	.014*	0	-.99*	.51**	.85
	(2.06)	(1.73)		(1.77)	(2.86)	

*Significant at 10% level.
**Significant at 5% level.
[1]The coefficients relate to equation 19 in Chapter IV.

When the coefficient of the time trend variable was restricted to be equal to zero, the intercept term was reduced in absolute value. All other coefficients increased in absolute value when compared with the correspondent equation in which the time trend variable was included.

The t values increased as was expected. In the equation where the coefficients of the HQBS and time trend variable were restricted to be equal zero, the coefficient of the lagged dependent variable was statistically significant at 5% level, while the remaining coefficients were statistically significant at 10% level.

If the time trend is in fact associated with other variables which are responsible for changes in the market share and that were not included in the model (demographic factors, changes in lifestyle, etc.), the omission of this variable from the model would originate specification bias.

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