COMPETITIVENESS OF U.S. PROCESSED MEAT INDUSTRIES IN THE PACIFIC RIM

By

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PREFACE

Current goal for the U. S. meat industry is to supply a larger share of the international market for consumer-oriented meats than its current market share. This study addresses the topic by focusing on prepared/preserved red meats and poultry (PPM) in the Pacific Rim in two articles. The first article is descriptive and focuses on identifying factors that impact trade in the Pacific Rim countries of Hong Kong, Japan, South Korea and Singapore. Per capita income, economic growth rate, tariffs and nontariff trade barriers are important factors that can impede trade. In the second article, an econometric analysis is performed using the Almost Ideal Demand System (AIDS) model. The AIDS model is applied to three prepared/preserved meats based on Standard International Trade Classification (SITC) codes, in estimating import demand systems for Hong Kong, Japan, and Singapore. Goods in the model are differentiated by source of origin and the models are estimated with the assumption of block substitutability among goods. The model used with these conditions is referred to as restricted source differentiated AIDS (RSDAIDS) model.

Previous research on Pacific Rim meat import demand has normally assumed product aggregation and has concentrated on demand for fresh, chilled, and frozen meats. This is the first study that applies the source differentiated AIDS model to the analysis of prepared/preserved red meats and poultry in the Pacific Rim. This study should provide

timely information about the competitiveness of U.S. processed meat industries in the Pacific Rim.

At this time, I with to acknowledge a few of the many people who have contributed to me being able to complete this dissertation. Foremost, I wish to thank my adviser, Dr. Shida Henneberry, for her guidance throughout the completion of the dissertation. Also, special thanks to the members of my advisory committee, Dr. Darrel Kletke, Dr. Derrell Peel, and Dr. Stephen Damron, for their input and suggestions in the dissertation process. In addition, I wish to express appreciation to the following people for their help and encouragement: my sister Vergie Talley, Brothers Joe T. Mixon, Chester Mixon and wife Jerdene, and my good friends Alvin D. Ferguson and wife Evelyn. Thanks to my father, Joe Mixon, who served as a source of strength for me to attain the Ph.D. degree. Last, but not least, thanks to Gracie Teague for being able to interpret my handwriting so she could type this interesting document.

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PAPER I

AN OVERVIEW OF INCOME GROWTH OF SELECTED IMPORTERS IN THE PACIFIC RIM.

Introduction

The U.S. is a major supplier of red meats and poultry meat to the international market. During the decade of the 1980s, over 90 percent of U.S. meat exports was classified as value-added (Ellison). The value-added meat category refers to fresh, chilled, frozen, and prepared/preserved meats as an aggregate group. However, most of the U.S. value-added meat exports are fresh, chilled, and frozen; with only a small percentage classified as prepared/preserved meats. For example, during the 1990 through 1994 period, the percent of U.S. meat exports categorized as prepared/preserved average 2.8, 15.5, and 4.7 percent of volume, respectively, for beef/veal, pork, and poultry. Given the current interest in expanding U.S. processed meat exports, the Pacific Rim was chosen for analysis as a potential market for prepared/preserved meats (PPM). Exporting processed products are considered to generate greater business activity, more jobs, higher incomes and greater tax revenue than trading in bulk commodities (Schluter and Edmondson).

Four Pacific Rim countries: Hong Kong, Japan, South Korea, and Singapore were selected to be studied as markets for U.S. processed red meats and poultry meat. These countries are considered to be growth markets for consumer-oriented products because of rapid income growth and increasing number of two income couples during the past decade

and relatively high per-capita GDP (Dwyer). Countries that attain high per-capita incomes normally change their diet from grains to consumption of more meat products (Halliburton, 1993). Each of the selected Pacific Rim countries is considered to offer great potential for marketing of U.S. further processed meats (Dwyer). Some of the selected countries averaged more than 10 percent growth in GDP over the 10 year period 1983 through 1992.

The three countries of Hong Kong, South Korea, and Singapore are newly industrialized and experienced much greater income growth than Japan during the 1983-92 period. Two countries, Hong Kong and South Korea, had average annual GDP growth rates for the decade of 14.9 and 15.5 percent, respectively. Japan and Singapore growth rates were less than 10 percent for the decade with percentages of 5.7 and 8.4, respectively. Even though Japan had the smallest growth rate, it is still a large market for processed products because of its high per-capita income and large population. Per-capita gross domestic product in Japan was $26,971 in 1991 and was much higher than the $14,581 per-capita income in Singapore; the next highest per-capita income of the selected Pacific Rim countries for this study. The other two countries, Hong Kong and South Korea, had per-capita incomes of $12,173 and $6,498, respectively, in 1991.

Market Structure for U.S. Processed Meat Exports

U.S. Department of Commerce, Bureau of the Census (Bureau of the Census) data were used in this study to give a global view of U.S. trade in processed meats. Figure 1 shows six classes of PPM exported by the U.S. for a total value of $385 million in 1994. Two classes, poultry and sausages/bologna, represented 68 percent of trade with

percentages of 37.1 and 30.6, respectively. The other classes of PPM, beef/veal, pork, ham/shoulders, and bacon were 13.7, 6.1, 5.9 and 6.6 percent, respectively, of 1994 total trade for the six products. From a regional perspective, the two markets of North America (Canada and Mexico) and Japan accounted for 75 percent of six U.S. processed meat exports in 1994, with percentages of 55 and 20, respectively (Figure 2). Other regional markets include the Republics of former USSR, 4 Tigers of Asia (Hong Kong, South Korea, Taiwan, Singapore) and Rest-of-World (ROW), which had import percentages of 7.4, 6.6, and 11, respectively, of 1994 U.S. export value of six (PPM).

Table I shows the top three import countries for each of the six categories of U.S. PPM for 1994. Canada, Japan, and Mexico accounted for over 65 percent of trade for five PPM, beef/veal, pork, hams/shoulders, poultry, and sausages/bologna. Mexico, Colombia, and Hong Kong accounted for 65 percent of U.S. bacon exports in 1994. The summed percentage of each type of PPM exported to the top three markets ranged from a low 65 percent for bacon to a high 89.5 percent for beef/veal (Table I).

U.S. exports of PPM basically went to the same destinations (Figures 2, 3). For a regional comparison, figure 2 shows that 89 percent of processed red meats went to four regions: North America, Japan, Republics of former USSR, and the 4 Tigers of Asia. Figure 3 shows 91 percent of processed poultry went to three regions, North America, Japan, and the 4 Tigers of Asia.

From a country perspective, U.S. red meats and poultry PPM exports go to the same countries, Canada, Mexico, and Japan. Eighty-five percent of poultry went to these countries with percentages of 44.5, 28.2, and 12.1, respectively (Table I). In the case of

red meats (as aggregate good), 75 percent went to these countries with percentages of 29, 25.8, and 20.2, respectively.

U.S. Department of Commerce, Bureau of the Census data were used to profile major export markets for U.S. processed meats. However, to profile major exporters of processed meats to the Pacific Rim countries, Bureau of Census data are inadequate because they do not include all exporters to the selected countries in this study. Therefore, United Nations data, which include all major exporters, are used to analyze PPM imports by source of origin for Hong Kong, Japan, South Korea, and Singapore.

United Nations data on International trade of agricultural commodities are reported in terms of Standard International Trade Classification (SITC) codes. Table III provides four commodities (bacon, offals, sausages, and other PPM) and their definitions based on revision II of the SITC codes. Time series data on four SITC codes of meats covering years 1971 through 1992 will be the basis for comparison of Pacific Rim countries imports of PPM by source of origin for the two periods 1983-87 and 1988-92. The four SITC codes of PPM are bacon (0121), offals (0129), sausages (0134), and other PPM (0138).

Table IV lists the changes in value, volume, and unit value for the periods 1983-87 to 1988-92 for the meat categories. An important observation for bacon is that value of imports showed a decrease in Hong Kong from 1983-87 to 1988-92 period of 7.7 percent. Hong Kong and Singapore showed volume of bacon decreased by 34.1 and 28.4 percent, respectively, for the period. Sausages from South Korea showed unit value decreased 5.9 percent from the 1983-87 to 1988-92 period (Table IV).

Pacific Rim Countries Imports of PPM by Source of Origin

In this section, a comparison is made of top exporters of PPM to the Pacific Rim market for the years 1982 and 1992 (Tables I, V). This allows an assessment of the stability of suppliers to this market to be made. Table I shows the U.S. exports of red meats (aggregate good), 5 disaggregated red meats, and poultry to major markets for 1994. In Table V the major exporters of PPM to the Hong Kong market, using United Nations data, are shown for years 1982 and 1992. A major supplier is a country that supplies at least 10 percent of a country's imports of a particular type meat during a year. Top supply countries to the Hong Kong market (Table V) are the same for the two year comparison with the exception of Vietnam being a major supplier in 1982 and not 1992. Switzerland was not a major supplier in 1982 but achieved the status of major supplier in 1992. Another important observation in Table V is that the U.S. was a major supplier of sausages and other PPM in 1992 but was not a major supplier of any PPM to the Hong Kong market in 1982. The overall average market share of combined total value of the four PPM in this market supplied by the U.S. was 3.2 in 1982 and 18.5 in 1992, an increase of 472 percent.

Japan is the largest market for U.S. agricultural exports and is a major importer of PPM (Reynolds). Table VI shows the top exporters of PPM to Japan for the four SITC meat categories for the years 1982 and 1992. Each meat category had a country that was a major supplier in 1992 that did not supply a significant amount of PPM in 1982. Switzerland was a new supplier for bacon, New Zealand and Taiwan were new suppliers for offals, Taiwan was a new supplier for sausages, and Thailand and Taiwan were new

suppliers for other PPM. The U.S. was a major supplier of each product in both years in the Japanese market. Overall market share of combined total value of the four PPM supplied by the U.S. to Japan was 34.6 percent in 1982 and 39.6 percent in 1992, a 14.5 percent increase.

The South Korean market does not seem to be very competitive as indicated by the percentage of imports supplied by a few export countries (Table VII). For bacons, offals, and sausages one or two countries supplied 90 percent to 100 percent of each type meat during the years 1982 and 1992. Another interesting point of the Korean market was that the major supplier of bacon changed from 1982 to 1992. Austria was the sole supplier for bacon in 1992 in contrast to the U.S. being the sole supplier in 1982. Major suppliers were the same in both years for sausages. For other PPM, two major suppliers in 1982, Japan and Australia, did not achieve major supply status in 1992. The U.S. was a major supplier of all PPM to the South Korean market in 1982 and a major supplier of all PPM in 1992, except for bacon, when Austria was the sole supplier. Overall average U.S. market share of combined total value of four PPM in this market was 61 percent in 1982 and 54.5 percent in 1992, a decrease of 10.7 percent. This was the only Pacific Rim country in the study where overall average U.S. market share in 1992 was less than average market share in 1982 (Table VII).

Table VIII shows the major suppliers to the Singapore market for the years 1982 and 1992. Three meats had a major supplier in 1992 that was not a significant supplier in 1982. New suppliers were Sweden, China and the U.S. for bacon, sausages, and other PPM, respectively. The U.S. was a major supplier of sausages and bacon in 1982 and a major supplier of all meats, except offals, in 1992. Average market share for the U.S. of

combined total value of the four PPM in the Singapore market was 13.5 percent in 1982 and 21.6 percent in 1992, a 60 percent increase in market share.

Based on market share and the number of markets in which a country is a major supplier of PPM; three countries, China, EC, and U.S. have historically supplied most of the processed meats to the four selected Pacific Rim countries (Tables V-VIII).

Market Share Analysis of U.S. PPM in Four Selected Pacific Rim Countries

This section covers a year to year market share analysis of U.S. PPM trade in the Pacific Rim which differs from the previous section analysis which was based on two years, 1982 and 1992. The emphasis here is to show more detail information on U.S. market share changes in contrast to the comparison made in the two years' analysis. U.S. market shares for four PPM exported to the Pacific Rim depict the wide fluctuations in trade in this market. In some years the U.S. market share for an individual product is zero and other years the U.S. market share for the same product is above 50 percent.

In Hong Kong, the U.S. did not supply a major portion of any of the four PPM until 1984 when it became a major supplier of sausages and continued a significant supplier through 1992 (Table IX). Other individual products whose market share achieved major supplier status were bacon in 1990 and other PPM in 1992, when over 10 percent of each commodity was supplied by the U.S. The U.S. had a market share of over 30 percent for one meat, sausages, in the Hong Kong market which began in 1986 and remained over 30 percent each year through 1992 (Table IX).

For the Japanese market, the U. S. was a major supplier of all four PPM (Table X) and for many years during the study period supplied over 30 percent of each type meat.

Japan is the largest processed meat market for the U.S. and since 1977 never imported less than 10 percent of each of the four PPM from the U. S. during each year of the study period (Table X).

The trading pattern of U.S. processed meat exports has been rather unusual in the South Korean market compared to the other selected Pacific Rim countries. For example, the percent of a particular type of meat supplied by the U.S. ranged from 100 percent in one year to zero percent for the same commodity in several years (Table XI). Nevertheless, South Korea was the only market where the U.S. had a market share of over 60 percent for a commodity for more than one year. In addition, in some years the market share for a particular type of meat was over 90 percent (Table XI).

Singapore offers the most diverse historical trading pattern for U.S. PPM. For offals, the U.S. never gained over 1 percent of the market share during any year of the study period (Table XII). For the other three commodities, the U.S. supplied over 10 percent of the market in some years. Supply from the U.S. accounted for over 20 percent of the market for sausages during many years of the study period (Table XII). Overall, it seems that the U.S. had less success in the Singapore market, based on market share, than in any other Pacific Rim country. In no other market did the U. S. receive less than a 1 percent market share for a product during each year of the study period. From the small market penetration of U.S. processed meats in some markets, such as Singapore, it appears that a concentrated effort is needed to make the U.S. competitive in these markets.

U.S. Competitiveness in International Processed Meat Trade

Production systems for red meats and poultry are considered efficient in the U.S. and are believed to give the U.S. a comparative advantage in production of these commodities. The historical trading pattern of the U.S. has been bulk meat products with increased emphasis on value-added meats for exports in recent years. Bulk meat products refer to carcasses and carcass portions that have not been designed ready for consumer use. Value-added meats include fresh, chilled, frozen and prepared/preserved meats as an aggregate good with more emphasis on portion size ready for consumer use. Value-added U.S. meat exports comprised over 90 percent of U.S. meat trade in the 1980s (Elleson). The U.S. has emphasized more processing for meat exports in recent years. For this reason, export of prepared/preserved meats (PPM) which do not include fresh, chilled, and frozen products is the focus of this study.

Some factors that point to the U.S. ability to be competitive in the international market for processed meats are (Elleson):

1. Plentiful supply of high-quality low priced inputs.
2. Efficient processing facilities
3. U.S. government emphasis on promoting exports of more consumer-oriented products.

However, for labor intensive processing, the U.S. may be at a disadvantage with low wage countries.

Impediments of International Trade in Selected Pacific Rim Countries

Many countries use tariffs and nontariff barriers to distort free trade and the extent to which these measures are used determines their trading status. A tariff may be defined as a tax on imports. Nontariff barriers are measures used to affect trade that can be in several forms ranging from quotas to direct ban on importing products. Both tariff and nontariff measures can effectively distort trade with nontariff affects on trade being harder to quantify.

Countries with low or no tariff and without nontariff barriers are considered free trade areas. Based on this definition, two Pacific Rim countries selected for study, Hong Kong and Singapore, qualify as free traders for most products. However, the other two selected countries, Japan and South Korea, have high tariffs and several nontariff barriers and are not free traders. The cumulative affect of barriers to trade can negate the comparative advantage of a country in production of a commodity and encourage consumption of domestic products instead of cheaper imports that could be obtained in the absence of trade barriers. Examples of nontariff measures directly affecting fresh, chilled, and frozen meats include sanitary requirements, phytosanitary requirements, and grades. Nontariff measures affecting export of these products as well as further-processed meat include standards, quotas, license arrangements, and government trading institutions. Barriers used by selected Pacific Rim countries are discussed in this section to assess the U.S. ability to supply processed meats to these markets.

Table XIII lists tariff and commonly used nontariff barriers impacting meat imports into Hong Kong, Japan, South Korea, and Singapore. Since Hong Kong and Singapore are free traders, barriers to trade will focus on Japan and South Korea.

U.S. exports to Hong Kong enter duty free in contrast to approximately 25 percent of Hong Kong exports to the U.S. (U.S. Trade Representative Staff). Nontariff barriers are not considered a problem for exports to Hong Kong. Some factors that have affected Hong Kong production of red meats and poultry are outbreak of foot and mouth disease and stringent anti-pollution measures that shrunk poultry production. In the pork industry, production declined from a self-sufficiency of 47 percent in 1990 to 24 percent in 1992. An implication for international trade from these occurrences is increased demand for red meats and poultry must be supplied by imports.

Singapore is open to world trade and investment and is a free trade country. Approximately 96 percent of imports enter Singapore duty free. Those that do not enter duty free are luxury goods on which an excise tax is imposed, but equivalent levies are imposed on similar domestic products (U.S. Trade Representative Staff). Singapore also has few quotas and license requirements. One key concern about Singapore is the production, sale, and export of counterfeit goods. Singapore has responded to this concern by initiating measures to strengthen its intellectual property right (IPR) laws.

Japan is considered a very restrictive market to export as evidenced by high tariffs and several nontariff trade barriers. Japan also is a large market for processed meats with approximately 50 percent of the processed meat market being for pork sausages (McNeill). Sausages have a 10 percent tariff, boneless chicken meat 14 percent tariff, and other pork products are imported with a 25 percent tariff.

Nontariff measures impacting fresh, chilled, and frozen meat imports into Japan include sanitary requirements, phytosanitary requirements, and grades. Sanitary and phytosanitary measures are enacted to provide consumers a wholesome supply of meat

and prevent the spread of harmful diseases (Hillman). When these measures are based on scientific facts, they are not considered nontariff barriers. However, in some instances, these measures may not be based on facts. Grades can become effective restraints to trade when the criteria which determine grades are applied differently to individual supply countries.

Some nontariff barriers directly impacting PPM exports to Japan are standards, quotas, and a complex distribution system that is difficult for exporters to grasp. A quota limits the amount of a product that can be exported to a country for a specified period of time. Standards are especially significant when exporting to Japan because many U.S. products have to be modified to meet the unique requirements of the Japanese consumer. In addition, the complex distribution system becomes a major export barrier because many potential exporters are not willing to commit the time and resources necessary to gain access to this potentially profitable market (Reynolds). Factors affecting Japanese production of red meats and poultry are environmental concerns and waste treatment problems. As a result of increased waste treatment cost to meet more stringent environmental standards, the pork and poultry industries have been negatively impacted. Also, the reluctance of the younger generation to enter production agriculture could increase the Japanese demand for imported meats.

South Korea is another very restrictive trade market for imports because of high tariffs and several nontariff barriers. High tariffs can be used to distort trade as evidenced by the 1990 emergency tariff rate increase from 30 to 50 percent on canned pork. This measure was deemed necessary to protect the domestic pork industry. However, Korea is projected to decrease the levy on pork sausages from 30 to 18 percent by 2004.

Several nontariff measures are imposed against imports. In addition to sanitary requirements, phytosanitary requirements, and grades that establish standards for fresh, chilled, and frozen meats, Korea imposes a ban on fresh, chilled, and frozen poultry products but imports other poultry products freely. Quotas and license arrangements are other barriers impacting imports into Korea. Two recent developments projected to affect future Korean's production of red meats and poultry are the high production costs and new waste disposal methods required by the government. These developments will reduce domestic production and increase dependency on meat imports.

Summary and Implications

This paper focused on 4 selected Pacific Rim countries, Hong Kong, Japan, South Korea and Singapore, as potential export markets for U.S. prepared/preserved red meats and poultry. These countries were selected because of rapid economic growth during the 1980s and early 1990s and their relatively high per capita incomes. Other than Japan, these countries are classified as newly industrialized and have higher income growth rates than Japan. Hong Kong and South Korea had average annual income growth rates of 14.9 and 15.5 percent, respectively. Respective growth rates for Singapore and Japan were 8.4 and 5.7 percent. However, Japan had the highest per capita income of $26,971 in 1991. Per capita incomes for Singapore, Hong Kong and South Korea were $14,581, $12,173, and $6,498, respectively. Other factors that make Hong Kong and Singapore attractive markets are low or no tariffs and the absence of nontariff barriers to trade.

In 1994, on a regional basis, North America and Japan accounted for 75 percent of U.S. prepared/preserved red meats (as aggregate good) exports with respective

percentages of 55 and 20. For prepared poultry, 73 percent went to North America and 12 percent to Japan. On a per country basis, Canada, Japan, Mexico and Hong Kong are major export markets for U.S. PPM. From a historical perspective, China, Australia, U.S., EC, and Switzerland have been the major suppliers of PPM to the selected Pacific Rim countries. The U.S. has had varying degrees of success in supplying the four selected categories of prepared meats to the Pacific Rim countries.

In the Hong Kong market, the U.S. did not become a major supplier of any of the four PPM until 1984 when it became a major supplier of sausages and continued a major supplier through 1992. It had limited success in supplying other PPM to this market. However, it did supply over 10 percent of other PPM in 1992 and over 10 percent of bacon in both 1979 and 1990.

The U.S. supplied the largest percent market share of PPM for most years in the Japanese market. It was a major supplier of all four PPM to this market during most years of the study period. Since 1977; Japan never imported less than 15 percent of its market share of any of the four PPM from the U.S. during each year of the study period. In fact, for sausages and other PPM, market share from the U.S. was above 30 percent for many years after 1977.

South Korea's market displays wide variations in U.S. market share of the four PPM over the study period. During several years of the study period, U.S. market share was zero for bacon and offals. In other years, U.S. share ranged from 100 percent for offals in 1977 to 0.77 percent in 1987. For sausages and other PPM, U.S. market share was above 20 percent most years of the study period.

In the Singapore market, U.S. share of offals never reached 1 percent during the study period. But for the other three goods, the U.S. did become a major supplier during some years of the study period. For sausages, the U.S. supplied over 20 percent of the market share to Singapore during many years of the study period.

Tariff and nontariff barriers can impede trade in the Pacific Rim market. However, because of low to no tariffs and absence of nontariff barriers, Hong Kong and Singapore are considered freer-trade areas. Japan and South Korea are considered restricted trade countries because of high tariff rates and the existence of several nontariff trade barriers. But Japan and South Korea are moving toward more liberalized trade. As the world is moving toward free-trade, environmental considerations are becoming increasingly important. Higher poultry and pork environmental standards adopted by Hong Kong are believed to have decreased poultry and pork production, causing most of the meat demand to be served by imports. Likewise, stricter Korean environmental standards are considered to have reduced domestic meat production and increased meat import demand.

Results from this study have several important policy implications for the U.S. meat industries and local and national policy makers. One implication is that the growth in demand for processed meats seems to offer the greatest opportunity for the U.S. to expand its international meat trade because as countries experience economic growth consumers demand more further-processed meats. In addition, exports of processed meats create more jobs and generate greater economic activity than trade in bulk commodities. A second policy implication concerns the economics of transporting processed products versus bulk commodities. Processed products are less troublesome to transport because they can be shipped at room temperature and do not require the

refrigeration needed when transporting fresh, chilled, and frozen meats; processed products have a higher per unit value; and processed products offer a greater degree of product differentiation than exists in bulk commodities.

Hong Kong and Singapore are currently considered free-trade areas because of little or no tariffs and the absence of nontariff barriers to trade. A third policy implication from this study is the uncertain future trading status of Hong Kong when the People's Republic of China gain control of Hong Kong on 1 July 1997. A fourth policy implication is that results from this study should aid in identifying countries to aim marketing strategies and suggest that the U.S. processed meats are high quality and that marketing strategies should emphasize the quality of U.S. processed meats rather than focus on price.

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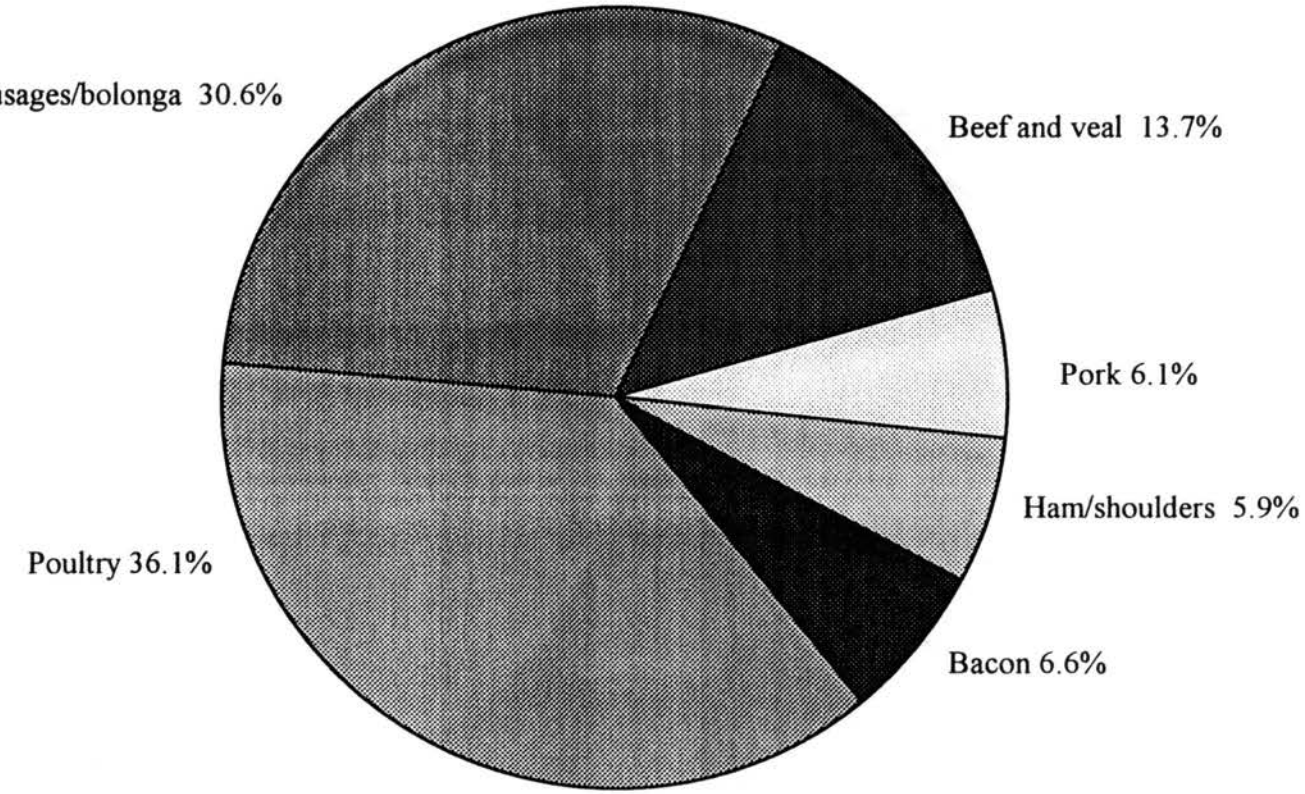
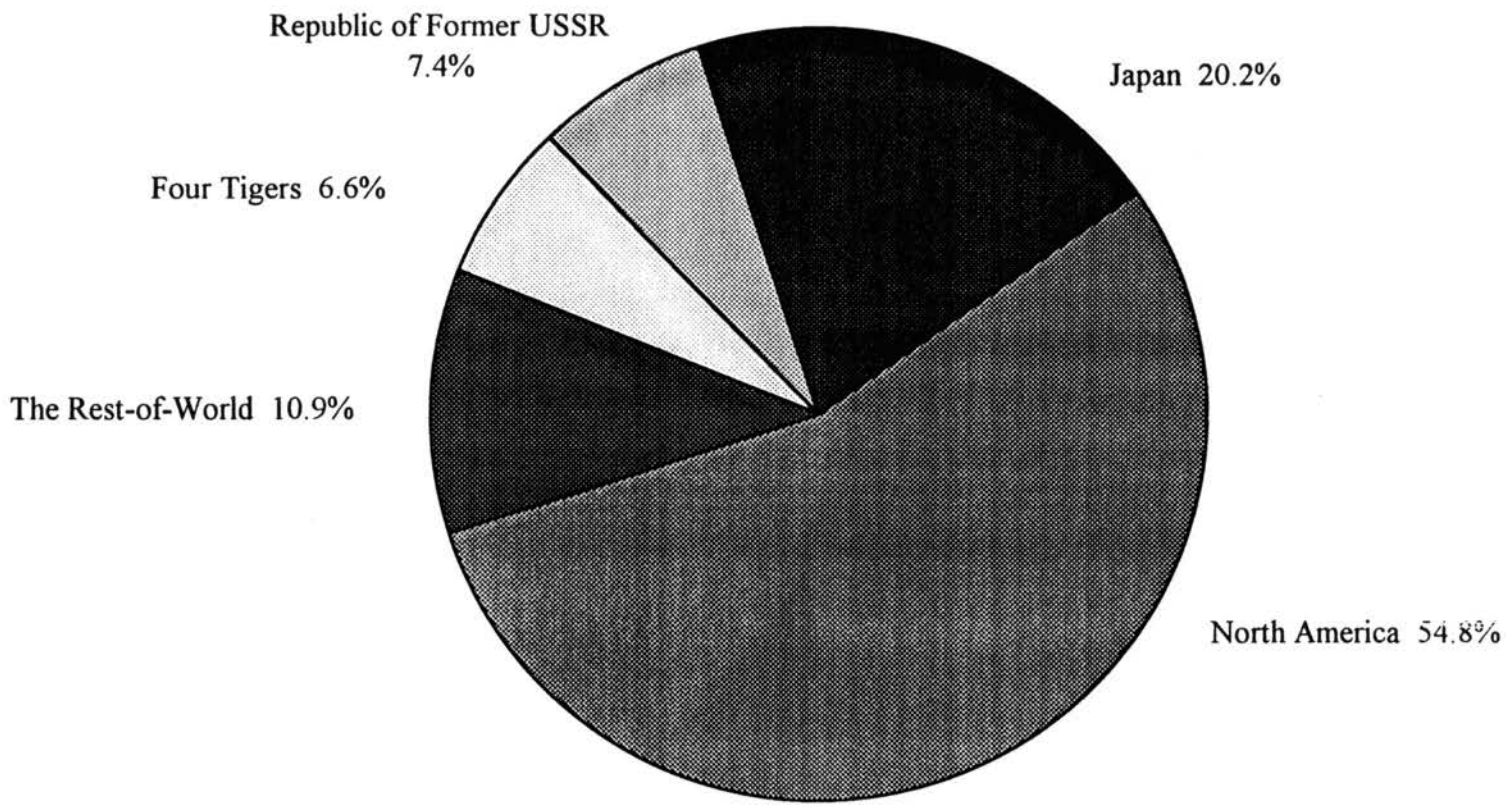
Figure 1. U.S. Exports of Prepared/Preserved Meats by Type Commodity as Percentage of Total Value of Six Processed Meat Exports in 1994.



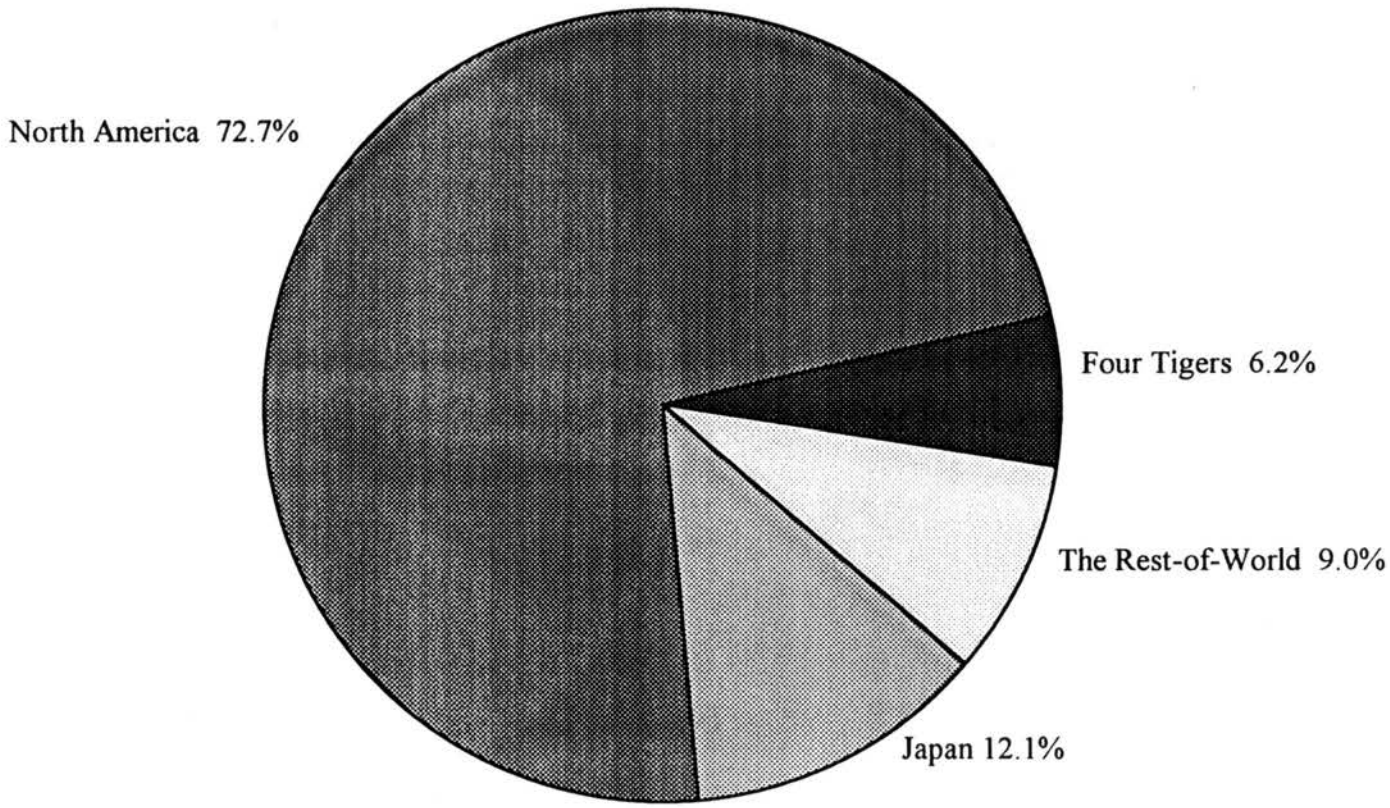
Source: U.S. Department of Commerce, Bureau of the Census, 1994
Processed Meats refer to meats that have undergone processing beyond fresh, chilled, and frozen; include sausages, ham/shoulders, bacon etc.

Figure 2. U.S. Exports of Prepared/Preserved Red Meats (Aggregate Good) to Top Five Regional Markets in 1994.



Source: U.S. Department of Commerce, Bureau of the Census, 1994.
Four Tigers (Hong Kong, Singapore, South Korea, Taiwan)

Figure 3. U.S. Exports of Prepared/Preserved Poultry to Top Four Regional Markets in 1994.



Source: U.S. Department of Commerce, Bureau of Census, 1994.
Four Tigers (Hong Kong, Singapore, South Korea, Taiwan)
*Prepared/preserved poultry refers to poultry meat that has undergone processing beyond fresh, chilled, and frozen; includes chicken nuggets, breaded chicken patties, etc.

Table I. Top Three Import Countries for U.S. Prepared/Preserved Meats in 1994.

Commodity	Top Three Countries			Share of Three Countries of U.S. Total Export
Beef/veal	Canada	Japan	Mexico	
	54.7	25.2	9.6	89.5
Pork	Canada	Mexico	Japan	
	36.3	23.2	7.1	66.6
Hams/shoulders	Mexico	Canada	Japan	
	15.4	11.9	55.2	82.5
Bacon	Mexico	Colombia	Hong Kong	
	48.2	5.9	11.2	65.3
Poultry	Canada	Mexico	Japan	
	44.5	28.2	12.1	84.8
Sausages/	Mexico	Canada	Japan	
bologna	31.4	26.5	15.1	73
Red meat	Mexico	Canada	Japan	
(aggregate good)	29	25.8	20.2	75

Source: U.S. Department of Commerce, Bureau of the Census, 1994.
*Figure below country name is the percentage of U.S. exports of a particular type meat exported to that country in 1994.

Table II Top Three Regional Import Markets for U.S. Prepared/Preserved Meats in 1994.

Commodity	Top Three Countries			Share of Three Markets of U.S. Total Export
Beef/veal	North America 64.3	Japan 25.2	4 Tigers 2.3	91.8
Pork	North America 59.5	Japan 7.1	4 Tigers 14.6	81.2
Hams/shoulders	North America 27.4	Caribbean Islands 8.1	Japan 55.2	90.7
Bacon	North America 53	South America 11.8	4 Tigers 16.6	81.4
Poultry	North America 72.7	Japan 12.1	4 Tigers 6.2	91
Sausages/ bologna	North America 57.9	Japan 15.1	4 Tigers 6.6	79.6

Source: U.S. Department of Commerce, Bureau of the Census, 1994.
*Figure below country name is the percentage of U.S. exports of a particular type meat exported to that country in 1994.

Table III. Definition of Four SITC Codes of Meats Exported to the Pacific Rim.

SITC Code:	Definition of Prepared/Preserved Meat	* Text Reference
0121	bacon, ham, other dried, salted, smoked	bacon
0129	Prepared/Preserved Meats: edible meat offal, nes, dried, salted, smoked	offals
0134	sausages and the like of meat	sausages
0138	Other prepared and preserved meats	other PPM

SITC = Standard International Trade Classification

Definition of meat products is based on revision II of the meat categories (bacon, offals, sausages, other PPM).

Nes = Prepared/Preserved meats not elsewhere stated in any SITC category.

* Text reference refers to the name used to represent each meat category (SITC Code). For example, offals is used to represent the offals meat category.

Source: United Nations data

Table IV. Value, Volume, and Unit Value, Prepared/preserved Meat Imports From all Sources, Hong Kong, Japan, South Korea, and Singapore.

		Value ($1,000)			Volume (metric tons)			Unit Value $U.S.		
Meat Category	Country	1983-8	1988-9	% Chang	1983-8	1988-9	%Chang	1983-8	1988-9	% Chang
Bacon:										
	Hong Kong	13479	12441	-7.7	6255	4121	-34.1	2155	3019	40
	Japan	1080	3342	209	176	266	51.1	6136	12564	105
	S. Korea	40	*NA		65	NA		NA	NA	
	Singapore	2078	3206	54.3	1263	904	-28.4	1645	3546	116
Offal:										
	Hong Kong	7722	NA		3081	NA		2506	NA	
	Japan	16179	NA		2609	NA		6201	NA	
	S. Korea	773	NA		339	NA		2280	NA	
	Singapore	5033	NA		930	NA		5412	NA	
Sausages:										
	Hong Kong	18080	31345	73.4	10542	16867	60	1715	1858	8.3
	Japan	4603	17740	285	1566	4319	176	2939	4107	39.7
	S. Korea	24.2	292.9	12003	10	1286	12760	2420	2278	-5.9
	Singapore	3022	5570	84.3	1618	2696	66.6	1868	2066	10.6
Other Meats:										
	Hong Kong	35408	54382	53.6	25807	30722	19	1372	1770	29
	Japan	46502	187510		28164	55441	96.9	2716	3382	24.5
	S. Korea	687	6340	823	329	2433	640	2088	2606	24.8
	Singapore	21963	38022	145	13409	18374	37	1638	2069	26.3

Source: United Nations Trade data.

* NA means data are not available.

See table 3 for definitions of meat categories (bacon, offals, sausages, other PPM).

Table V. Major Exporters of PPM to Hong Kong, 1982 and 1992.

Meat Category:	Top Export Countries 1982				Market Share of Top Countries
Bacon	China	EC	U.S.		
	34.4	57.6	5.4		97.4
Offals	China	Macau	U.S.	Vietnam	
	79.7	3.54	.04	11.2	94.5
Sausages	China	EC	U.S.		
	74.4	15.1	4.5		94
Other PPM	China	EC	U.S.		
	86.1	5.6	3.0		94.7

Overall U.S. Average (simple mean) Market Share 3.2 percent

Meat Category:	Top Export Countries 1992				Market Share of Top Countries
Bacon	China	EC	U.S.		
	56.1	20.7	6.4		83.2
Offals	China	*Switzerland	U.S.	*EC	
	17.7	37.2	3.5	20.6	79
Sausages	China	EC	*U.S.	Japan	
	3.2	9.2	51.8	5.8	98.8
Other PPM	China	EC	*U.S.	Brazil	
	72.4	5.9	12.4	1.8	92.5

Overall U.S. Average (simple mean) Market Share 18.5 percent

Source: United Nations Trade data
Figures below countries indicate market share.
* Indicates a major supplier of a type of meat in 1992 but not 1982.
See Table III for definitions of meat categories (bacon, offals, sausages, other PPM).

Table VI. Major Exporters of PPM to Japan, 1982 and 1992.

Meat Category:	Top Export Countries 1982				Market Share of Top Countries
Bacon	EC 54. 3	U.S. 36.3	Canada 6.74		97.3
Offals	Australia 65.3	New Zealand 4.4	U.S. 28.5		98.2
Sausages	EC 35.3	U.S. 41	New Zealand 12.1	Australia 8.8	97.2
Other PPM	EC 21.6	Australia 32.3	China 5.4	U.S. 32.7	92

Overall U.S. Average (simple mean) Market Share 34.6 percent

Meat Category:	Top Export Countries 1992				Market Share of Top Countries
Bacon	EC 31.8	U.S. 26.1	*Switzerland 36.9	Canada 4.6	83.2
Offals	Australia 25	*New Zealand 35.3	U.S. 27.5	*Taiwan 12.3	100
Sausages	EC 21.9	U.S. 60.1	*Taiwan 10.6	Australia 3.7	96.3
Other PPM	EC 9.9	*Thailand 16	*Taiwan. 10	U.S. 44.8	80.7

Overall U.S. Average Market Share 39.6 percent

Source: United Nations Trade data
Figure below countries indicates market share.
* Indicates a major supplier of a type of meat in 1992 but not 1982.

Table VII. Major Exporters of PPM to South Korea, 1982 and 1992.

Meat Category:	Top Export Countries 1982				Market Share of Top Countries
Bacon	U.S.				
	100				100
Offals	Japan	U.S.			
	59.4	40.6			100
Sausages	U.S.	EC			
	87.4	7.9			95.3
Other PPM	EC	Japan	U.S.	Australia	
	46.9	19.8	16.4	16.1	99.2

Overall U.S. Average (simple mean) Market Share 61.1 percent

Meat Category:	Top Export Countries 1992				Market Share of Top Countries
Bacon	*Austria				
	100				100
Offals	U.S.	*Hong Kong			
	86.6	13.4			100
Sausages	U.S.	Australia			
	97	2.4			99.4
Other PPM	EC	U.S.	China	Japan	
	39.3	34.2	9.2	6.2	88.9

Overall Average Market Share 54.5 percent

Source: United Nations Trade data
Figure below countries indicate market share.
* Indicates a major supplier of a type of meat in 1992 but not 1982.
See Table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table VIII. Major Exporters of PPM to Singapore, 1982 and 1992.

Meat Category:	Top Export Countries 1982				Market share of Top Countries
Bacon	EC	U.S.	Sweden		
	71.9	14.3	9.8		96
Offals	China	EC	Switzerland		
	66.9	8.3	5.6		80.8
Sausages	EC	U.S.	Australia	China	
	40.9	34.1	13.2	7.5	95.7
Other PPM	China	EC	U.S.	Australia	
	69.2	11.2	5.4	6.4	92.2

Overall U.S. Average (simple mean) Market Share 13.5 percent

Meat Category:	Top Export Countries 1992				Market share of Top Countries
Bacon	EC	U.S.	*Sweden	Switzerland	
	64.4	13.6	14.7	6	98.7
Offals[+]	China	Hong Kong			
Sausages	EC	U.S.	*China		
	45.6	34.4	12.7		92.7
Other PPM	China	EC	*U.S.		
	61.6	10.0	16.9		88.5

Overall U.S. Average (simple mean) Market Share 21.6 percent

Source: United Nations Trade data
Figure below countries indicate market share.
* Indicates a major supplier of a type of meat in 1992 but not 1982.
[+] data not available for offals in year 1992.
See Table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table IX. U.S. Market Share of Four PPM in percentages, Hong Kong, 1971-1992.

	Meat Category			
Year	Bacon	Offals	Sausages	Other PPM
71	.50	1.34	4.69	.35
72	.36	1.98	3.95	.51
73	6.64	3.33	4.67	.71
74	1.12	1.74	4.55	1.00
75	.90	.12	3.46	2.01
76	.95	.21	7.93	2.29
77	.59	.14	8.87	1.20
78	1.13	.12	9.21	.78
79	1316	1.04	6.53	1.46
80	1.66	.27	6.13	1.37
81	4.41	.16	5.56	1.23
82	5.41	.04	4.50	3.05
83	4.10	.09	5.21	1.64
84	5.25	.11	19.55	1.98
85	5.64	.64	24.29	2.68
86	5.03	.02	32.01	2.87
87	7.08	1.01	41.65	4.25
88	7.19	.62	43.18	2.53
89	7.73	.47	49.58	3.49
90	11.53	4.40	54.10	8.98
91	9.88	1.93	48.41	8.39
92	6.35	3.53	51.79	12.40

Source: United Nations Trade Data
See Table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table X. U.S. Market Share of Four PPM in percentages, Japan, 1971-1992.

	Meat Category			
Year	Bacon	Offals	Sausages	Other PPM
71	15.22	0.00	21.31	11.15
72	12.09	.50	38.64	4.05
73	7.15	6.14	37.44	6.40
74	5.37	9.81	37.58	6.41
75	5.85	14.09	38.25	8.41
76	7.13	35.22	35.84	15.25
77	11.35	24.43	41.06	14.60
78	22.43	31.79	53.74	19.67
79	25.93	29.60	41.35	17.56
80	23.92	19.49	25.7	20.40
81	35.72	22.88	28.5	24.44
82	36.34	28.47	41.0	32.74
83	21.4	28.05	47.53	34.38
84	36.61	32.74	37.01	47.82
85	20.15	23.90	37.25	43.14
86	18.78	23.20	32.21	36.54
87	17.07	18.55	29.04	37.35
88	21.23	38.19	43.97	39.28
89	32.52	29.70	35.32	45.26
90	35.50	26.58	58.44	50.99
91	18.05	16.82	45.15	44.39
92	26.14	27.54	60.09	44.83

Source: United Nations Trade Data
See Table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table XI. U.S. Market Share of Four PPM in percentages, South Korea, 1971-1992.

	Meat Category			
Year	Bacon	Offals	Sausages	Other PPM
71	54.07	79.3	20.4	23.9
72	37.16	8.0	8.8	12.0
73	99.69	16.4	1.2	4.2
74	0	81.8	12.0	27.4
75	0	42.7	25.6	13.3
76	.05	16.4	7.3	38.5
77	11.35	100	62.9	8.8
78	22.43	80.7	12.5	71.8
79	25.93	82.5	78.3	20.1
80	23.92	0	75.8	54.7
81	35.72	0	23.8	36.2
82	36.34	40.6	87.4	16.4
83	21.40	0	80.5	23.0
84	36.61	0	85.3	9.0
85	23.83	14.5	12.3	1.9
86	7.04	96.2	55.3	3.5
87	67.43	.77	60.7	25.1
88	0	0	69.3	21.2
89	0	1.22	76.0	55.1
90	0	0	97.9	35.8
91	0	0	99.2	44.5
92	0	86.6	97.1	34.2

Source: United Nations Trade Data
See Table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table XII. U.S. Market Share of Four PPM in percentages, Singapore, 1971-1992.

	Meat Category			
Year	Bacon	Offals	Sausages	Other PPM
71	3.6	.2	7.2	4.5
72	5.2	.96	13.6	3.5
73	4.0	0	13.5	2.5
74	3.6	.97	8.3	2.3
75	5.5	0	15.2	3.1
76	7.2	.47	15.0	1.5
77	8.1	0	22.9	2.9
78	9.4	0	22.0	2.3
79	5.8	0	22.9	2.5
80	9.0	0	17.9	1.6
81	8.7	0	26.3	2.3
82	14.3	0	34.1	5.4
83	7.7	0	27.4	7.4
84	10.4	0	26.	12.8
85	13.1	0	29.2	12.6
86	8.6	0	28.3	9.6
87	8.6	0	22.6	8.4
88	10.3	0	25.9	13.9
89	8.1	0	31.7	16.5
90	12.3	0	32.5	18.8
91	11.6	0	31.9	16.0
92	13.6	0	34.4	16.9

Source: United Nations Trade Data
See table III for definitions of meat categories (bacon, offals, sausages, and other PPM).

Table XIII. Trade Barriers of Selected Pacific Rim Countries.

Barrier	Country			
	Hong Kong	Japan	Singapore	South Korea
Trf		X		X
LA		X		X
Qts		X		X
Stnds		X		X
SPhyt		X		X
LDI		X		X
IPF		X		X
IPR	—	—	—	—
IB		X		X
GD		X		
GTI		X		
SL		X		

X means barrier restricts imports into the country
— means Intellectual property rights protection needs improvement.

Source: Hillman, J. S., Technical Barriers to Agricultural Trade, 1991.

Definition of abbreviations:

Trf = Tariff
LA = Licensing Arrangements
Qts = Quotas
Stnds = Standards
SPhyt = Sanitary-Phytosanitary
LDI = Limit Direct Investment
IPF = Import Processing Fee
IPR = Intellectual Property Rights
IB = Import Ban
GD = Grading Differentiation
GTI = Gov. Trading Institutions
SL = Special Labeling

PAPER II

ECONOMETRIC ANALYSIS OF PREPARED/PRESERVED RED MEAT AND POULTRY (PPM) IN 3 SELECTED PACIFIC RIM COUNTRIES.

Introduction

Consumer-oriented products like further-processed meats are gaining in popularity as consumer incomes increase. These trends, coupled with the U.S. goal of increasing market share in the international processed meat market, create a need for demand studies for prepared/preserved red meats and poultry (PPM). The Pacific Rim is considered an attractive market for processed meat products because of relatively high per capita incomes and fast growing economies. In addition, processed products generate more business activity, more jobs, and greater tax revenue than bulk commodities (Schluter and Edmondson).

The three countries of Hong Kong, Japan, and Singapore were selected for econometric analysis of import demand for PPM. Two of the countries, Hong Kong and Singapore, had growth rates of 14.9 and 8.4 percent, respectively, during the 1980s and are considered newly industrialized economies. Even though Japan had a much smaller growth rate at 5.7 percent, it is still a large market for processed meats because of its high per-capita income and large population. Per-capita gross domestic product for Japan was $26,971 in 1991 compared to $14,581 in Singapore and $12,173 in Hong Kong.

Market Structure for U.S. Processed Meat Exports

From a regional perspective, two markets (North America and Japan) accounted for 81 percent of the $191 million value of six PPM (beef/veal, pork, hams/shoulders, bacon, poultry, sausage/bologna) exported by the U. S. for the 1990-94 period (Figure 2) with percentages of 56 and 25, respectively. Other regional markets during the 1990-94 period included the Republics of former USSR, 4 Tigers of Asia (Hong Kong, South Korea, Taiwan, Singapore) and Rest-of-World (ROW), which had import percentages of 3.5, 9.4, and 6.4, respectively, of U.S. export value of six PPM for the 1990-94 period.

Table I shows the top three import countries for six U.S. PPM for the 1990-94 period. Canada, Japan, and Mexico accounted for over 70 percent of trade for three PPM (U.S. Department of commerce, Bureau of the Census data) beef/veal, pork and sausages/bologna. Mexico, Colombia, and Hong Kong accounted for 52 percent of U.S. bacon exports. For red meats as an aggregate good, Canada, Japan, and Mexico accounted for 81 percent of value for the period (Table I). The summed percentage of each type of PPM exported to the top three markets ranged from a low 52 percent for bacon to a high 87.4 percent for beef/veal (Table I). Two classes, poultry and sausages/bologna, represented 68 percent of trade with percentages of 40 and 28, respectively (Figure 1). U.S. exports of red meats and poultry meat (as aggregate groups) basically went to the same destinations (Figures 2, 3). For a regional comparison, Figure 2 and Table II show that 90 percent of U.S. processed red meats went to three markets, North America, Japan, and the 4 Tigers of Asia. Figure 3 shows that 96 percent of processed poultry went to the three markets of North America, Japan, and the Rest-of-World.

From a country perspective, U.S. red meats and poultry PPM exports go to the same countries, Canada, Mexico, and Japan. Eighty-five percent of poultry went to these countries and 81 percent of red meats (as aggregate good) went to these countries (Table I).

Import values of PPM have increased over time in the Pacific Rim and China, EC, and U.S. have historically supplied most of the processed meats to the selected Pacific Rim countries. Even though rapid growth has occurred in import value and volume of PPM in the Pacific Rim, econometric models have not focused on the PPM import trade, especially for highly processed meats. For this reason, import demand elasticities for U.S. and other competitors would be valuable information to use in making decisions to expand exports of PPM to the Pacific Rim market.

Model Specifications and Related Literature

Several studies (Hayes, et al.; Capps, et al.; Lee, 1989; and Seleka and Henneberry) have focused on demand for red meats and poultry in selected Pacific Rim countries. However, these studies have assumed product aggregation and have concentrated on red meats and poultry that are not considered highly processed. This study disaggregates goods by source of origin and concentrates on highly processed meats. Disaggregation is important in demand models because of perceived quality differences by source of origin. Demand for PPM is important because the potential to expand international meat trade is considered to be in processed meats (Schluter and Clayton).

Armington's trade model, Deaton and Muellbauer's AIDS model, and the Rotterdam model have been used to estimate import demands. Two weaknesses of the Armington's model are homotheticity and single constant elasticity of substitution (Alston, et al.; and Winters). Empirical application of AIDS and Rotterdam models in meat import demand normally assume product aggregation in which goods are not differentiated by source or block separability among goods which allows the model to consist only of share equations for a good from different origins (Yang and Koo). To overcome the shortcomings of these models, Yang and Koo (1994) applied a source differentiated AIDS model to represent Japanese import demand for red meats and poultry.

The overall objective of this study is to analyze import demand for U.S. PPM in selected countries of Hong Kong, Japan, South Korea and Singapore. Specific objectives are:

1. To analyze changes in market share of the U.S. and other major suppliers of PPM in these markets as importer total expenditures on PPM change.
2. To determine the responsiveness of quantity of imports from the U.S. and other suppliers with respect to price changes in the studied import markets (price elasticities of import demands).
3. To quantify cross-commodity effects in import demand models.

The model used in this study is the source differentiated AIDS model with block substitutability* as a maintained hypothesis. This model is referred to as restricted source differentiated AIDS (RSDAIDS) model and is specified as given in Yang and Koo:

$$W_{ih} = \alpha_{ih} + \sum_{k} \gamma_{ihk} \ln(p_{ik}) + \sum_{j \neq i} \gamma_{ihj} \ln(p_j) + \beta_{ih} \ln\left(\frac{E}{P}\right)$$

where W_{ih} is the value share of good i from source h; i, j denote goods; h, k denote products; α, γ, β are parameters; $\ln(p_j) = \sum_{k} W_{jkt-1} \ln(p_{jk})$; E is the total expenditures on goods i and j by an importing country; and P is the Stone's index defined by $\sum_{i} \sum_{h} W_{iht-1} \ln(p_{ih})$. In general, the RSDAIDS model has M + (N-1) + 2 parameters to be estimated in each equation with M being the number of origins, N being the number of goods, plus the constant, and the expenditure parameter (Yang and Koo).

The Marshallian and Hicksian elasticities of the RSDAIDS model are:

$$\varepsilon_{ihih} = -1 + \frac{\gamma_{ihh}}{w_{ih}} - \beta_{ih} \qquad \delta_{ihih} = -1 + \frac{\gamma_{ihh}}{w_{ih}} + w_i$$

$$\varepsilon_{ihik} = \frac{\gamma_{ihk}}{w_{ih}} - \beta_{ih}\left(\frac{w_{ik}}{w_{ih}}\right) \qquad \delta_{ihik} = -1 + \frac{\gamma_{ihk}}{w_{ih}} + w_k$$

$$\varepsilon_{ihj} = \frac{\gamma_{ihk}}{w_{ih}} - \beta_{ih}\left(\frac{w_j}{w_{ih}}\right) \qquad \delta_{ihj} = -1 + \frac{\gamma_{ihj}}{w_{ih}} + w_j$$

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* The block substitutability assumption means the cross-price effects with regard to demand for any good in i will be the same with respect to the price of good j from different origins.

Where ε denotes Marshallian elasticities and δ denotes the Hicksian or income compensated elasticities.

Expenditure elasticity is:

$$\eta_{ih} = 1 + \frac{\beta_{ih}}{w_{ih}}$$

The general demand conditions are specified as:

Adding-up: $\sum_i \sum_h \alpha_{ih} = 1$; $\sum_h \gamma_{ihk} = 0$; $\sum_i \sum_h \gamma_{ihj} = 0$; $\sum_i \sum_h \beta_{ih} = 0$;

Homogeneity: $\sum_k \gamma_{ihk} + \sum_{j \neq i} \gamma_{ihj} = 0$

Symmetry: $\gamma_{ihk} = \gamma_{ikh}$

Separability among goods will be tested by examining whether the following holds, using the coefficients from a RSDAIDS model.

$$\gamma_{ihj} = w_{ih}\, \gamma_{ij}\,; \qquad \forall_j \neq i$$

Where γ_{ij} is the cross-price parameter between groups i and j, estimated from an aggregate AIDS model (where sources are not differentiated). The Wald Test will be used in testing the separability and aggregation hypotheses. The following equalities are examined in testing for product aggregation:

$$\alpha_{ih} = \alpha_i, \qquad \forall\, h \,\varepsilon\, i,$$

$$\gamma_{ihjk} = \gamma_{ij}, \qquad \forall\, h,k \,\varepsilon\, i,j,$$

$$\beta_{ih} = \beta_i \qquad \forall\, h \,\varepsilon\, i.$$

Data

Two data sources, U.S. Department of Commerce, Bureau of Census and United Nations trade data, provided information on PPM. U.S. Department of Commerce, Bureau of the Census data were used to profile current export markets and type PPM exported by the U.S. United Nations data for three SITC classes of meats, bacon (0121), sausages (0134), and other PPM (0138) as described in Table III were used in the econometric analysis Time series data for years 1971 through 1992 were used to develop import demand models for PPM in selected Pacific Rim countries of Hong Kong, Japan, and Singapore. Import quantity (metric tons) and value (U.S. dollars) for the three SITC classes of meats by source of origin were obtained from United Nations trade data for each selected Pacific Rim country. Exchange rates, GDP, and price indices for Japan and Singapore were obtained from the International Monetary Fund Financial Statistics Yearbook. Exchange rate, GDP, and the price index for Hong Kong were obtained from the Statistical Yearbook for Asia and the Pacific. Populations for the countries were obtained from USDA published sources (Urban and Nightingale).

During most years of the study period a few countries, China, European Community, Australia, and U.S. supplied most of the PPM to the selected Pacific Rim countries. However, during the 1980s, Brazil, Argentina, Taiwan and other countries became major suppliers of PPM to the Pacific Rim market. But, because of the limited number of years in which they were major suppliers, these countries were grouped into the ROW category for model estimation.

Estimation Procedure

The import demand model for each selected Pacific Rim country include 3 goods (bacon, sausages, other PPM) with different numbers of origins. In the model for the Hong Kong market, the number of origins was 4 for each SITC class of meat. The Japan model number of origins was 3, 4, and 5 for the respective SITC classes. Singapore's model number of origins was 3, 5, and 4 for the respective classes of meats. The major suppliers of each good to the Pacific Rim countries determined the number of origins. Major supplier was defined as a country that supplied at least 10 percent of the import market for a good during a one year time period. Countries that supplied less than a 10 percent market share were grouped into (ROW) category. However, the U.S. was included in each model whether or not it was a major supplier of a product because of the focus on U.S. PPM trade in the Pacific Rim market.

The model for each country has twelve equations. However, only eleven equations are estimated in each model to avoid the singularity problem due to the adding up condition. In each model, equation for bacon from ROW is omitted and parameters for the omitted equation are obtained by imposing the restrictions of adding up condition to each model. The other equations are estimated by Seemingly Unrelated Regression (SUR). All models were estimated with homogeneity, symmetry, and block substitutability among goods imposed.

Import value (U.S. dollars) was converted into each import country's currency by multiplying U.S. dollars value times the exchange rate for each selected Pacific Rim country. Unit value determined by dividing value of imports by quantity was used as a proxy for price. Market share was determined by dividing value of imports from a supply

country for a particular product by the total import expenditures for a product group (PPM) by the import country. Stone's index in the source differentiated AIDS model equals the sum of the lagged weights multiplied by the prices for the products in the model. Prices used for the block substitutability assumption, (p_j), equals the sum of lagged weights times price of a good from different origins.

Statistics for Expenditure Shares: Hong Kong, Japan and Singapore, 1971 - 92.

Table IV presents mean expenditure share summaries for PPM products for Hong Kong, Japan, and Singapore. In each of the three markets, other PPM had the largest mean expenditure share. Expenditure shares for other PPM were 50, 85, and 78 percent for the respective markets of Hong Kong, Japan, and Singapore. This shows that at least 50 percent of import value for the three goods was for other PPM in each selected country. In Hong Kong, 41 percent of import value of other PPM was supplied by China. Japan had 4 major suppliers that accounted for 80 percent of other PPM import value with expenditure percent shares of 22, 18, 25, and 15, respectively, for EC, Australia, U.S. and ROW.

The respective expenditure shares for sausages were 22, 8, and 13 percent for Hong Kong, Japan, and Singapore. China and the U.S. accounted for 75 percent of Hong Kong's import value of sausages with percentages of 47 and 28, respectively (Table IV). In Japan, the EC and U.S. accounted for 71 percent of the import value of sausages with percentages of 30 and 41, respectively. The EC and U.S. accounted for 69 percent of Singapore's import value of sausages with percentages of 47 and 22, respectively.

Respective expenditure shares for bacon were 28, 7, and 9 percent for Hong Kong, Japan and Singapore (Table IV). The EC and China comprised 88 percent of Hong Kong's import value of bacon with percentages of 38 and 50, respectively. For Japan, the EC comprised 81 percent of import value of bacon. In Singapore, the EC accounted for 82 percent of import expenditures on bacon (Table IV).

Endogeneity Test

The expenditure explanatory variable may be endogenous when estimating the AIDS model because expenditures are used to compute the dependent variable (Attified, 1985; LaFrance, 1991). Correlation of the expenditure variable with the error term causes estimates to be biased and inconsistent. Most previous literature assumes the simultaneity is small and ignores the problem (Lee, 1993). The procedure in this paper follows Blundell (1987) and uses the Wu-Hausman test to determine if expenditure can be treated as exogenous.

To test the exogeneity assumption of expenditures the equation for ln(E/P) in the RSDAIDS model is approximated (using a single equation OLS model) by:

$$\ln(E/P) = a_{ih} + \sum_i \sum_h P_{ih} \ln P_{jkt} + g_{ih} \ln(E/P)_{t-1} + h_{ih} \ln Y_t + V_{iht}$$

where t = time, Y is total income (GDP is used in this paper), E is total import expenditures on the three goods (bacon, sausages, and other PPM), P is Stone's index, and V_{iht} is a random error term. The residual V_{iht} from the single equation OLS model was included in each of the RSDAIDS equations. RSDAIDS models were run to determine the random error effect on total import expenditures. Wald Chi-Square statistic was used to complete the exogeneity test. Based on Wald Chi-Squares of 7.05, 5.58, and 12.34 with 11 degrees of freedom for Hong Kong, Japan, and Singapore, respectively, the Wu-

Hausman test cannot reject the hypothesis in which expenditures in the RSDAIDS models are not correlated with the error terms. This implies that expenditures in the models can be treated as exogenous.

Hong Kong Import Market for PPM

Table V presents the Wald Chi-Square test results for the null hypotheses for block separability and production aggregation for the PPM import demand model for Hong Kong using a RSDAIDS model. At a 1 percent significance level, block separability was rejected based on an Chi-Square of 81.82 with 22 degrees of freedom. The Chi-Square for rejecting product aggregation was 2584.26 with 48 degrees of freedom. Rejection of the null hypothesis for block separability implies that demand for the three meats should be estimated in a single demand system and not as a separate demand system for each meat. Rejection of the null hypothesis for product aggregation implies that the three meat products should be differentiated by source of origins.

Table VI and VIa include the Marshallian and Hicksian demand elasticities for Hong Kong PPM import demand using a RSDAIDS model. Marshallian demand elasticities refer the percentage change in quantity demanded for a product due to a 1 percent price change when demand is expressed as a function of prices and income. Hicksian demand elasticities are derived as the percentage change in quantity demanded because of a 1 percent price change of a product when demand for a product is expressed as a function of prices and utility (the level of utility is held constant). The system R^2 for the model is .818. Many of the expenditure elasticities have the expected sign. An exception is the negative expenditure elasticity for the EC and China for bacon. China's negative expenditure elasticity of -0.704 is also significant, this implies bacon from China

to be an inferior good. Positive expenditure elasticities that are significant include the EC and ROW for sausages with elasticities of 2.814 and 2.678, respectively (Tables VI and VIa). These two countries seem to be in a favorable trading position in this market because their market share would increase with an increase in expenditures on sausages in Hong Kong. Because most of the increase in import expenditures would be spent on sausages from the EC and ROW than on sausages from other sources. Only China has a significant expenditure elasticity for other PPM in this market (Tables VI and VIa), and it would benefit from an increase in expenditures on other PPM. The U.S. had a significant expenditure elasticity for bacon in the Hong Kong market.

Cross-price elasticities reveal the type relationships among suppliers. A significant positive cross-price elasticity between suppliers of a product indicates a competitive relationship. This implies that an increase in the price of one supplier's product will result in an increase in demand for the product from the other supplier. A complementary relationship exists between suppliers with a significant negative cross-price elasticity. This means that an increase in price by one competitor will result in a decrease in demand for the product of the other supplier. Bacon from the U.S. has a competitive relationship with bacon supplied by ROW based on a significant positive cross-price elasticity of 1.298 and a complimentary relationship with bacon from China based on a negative elasticity of -3.891. Also, a competitive relationship exists with bacon supplied by the EC and bacon from China according to a cross-price elasticity of 0.521 (Tables VI and VIa). Sausages from the U.S. has a competitive relationship with sausages supplied by the EC based on a cross-price elasticity of 1.050. The cross-price elasticity of other PPM from the U.S. and other PPM supplied by China (elasticity 4.402) indicates a competitive relationship and the

negative cross-price elasticity with other PPM from ROW (elasticity -1.635) suggests a complimentary relationship (Table VI) in the Hong Kong market.

The type of relationships among the three meats determine the degree of substitutability and complimentarity. Bacon from the EC is a substitute for other PPM (elasticity .632) and bacon from China substitutes for both sausages and other PPM based on elasticities of .345 and .817, respectively (Table VI). The negative cross-price elasticities of suppliers of sausages with bacon and other PPM indicate complimentary relationships. The positive significant cross-price elasticities with sausages imply substitutes (Table VI). All the negative own-price Marshallian elasticities were significantly different from zero at a 5 percent significance level (Table VI). However, neither of the two positive own-price elasticities, for bacon from U.S. (.870) and sausages from China (.282) was significantly different from zero at the 5 percent significance level (Table VI).

Japan Import Market for PPM

Table VII presents the Wald Chi-Square test results for the null hypotheses for block separability and product aggregation for the PPM import demand model for Japan using a RSDAIDS model. At a 1 percent significance level, block separability was rejected based on an Chi-Square of 242.31 with 22 degrees of freedom. The Chi-Square for rejecting product aggregation was 2486.53 with 51 degrees of freedom.

Tables VIII and VIIIa include the Marshallian and Hicksian elasticities for Japan PPM import demand using a RSDAIDS model. The system R^2 for the model is .981. Expenditure elasticity for U.S. bacon did not have the expected positive sign. But the

negative expenditure elasticity was not significant at a 5 percent significance level. Bacon did not have a significant expenditure elasticity in the Japanese market. All expenditure elasticities for suppliers of sausages and other PPM are significant (Tables VIII and VIIIa). Expenditure elasticities for the U.S. and ROW for sausages were slightly greater than 1 at 1.27 and 1.19. However, they are not significantly greater than 1. This implies that the U.S. and ROW market shares would mostly remain constant from an increase in import expenditures on this product by Japan. For other PPM the U.S. and ROW have elastic expenditure elasticities of 1.42 and 1.94, respectively (Tables VIII and VIIIa). These two countries' market shares would increase rapidly with an increase in import expenditures in Japan for other PPM.

The positive cross-price elasticity between bacon supplied by the U.S. and EC (4.814) implies a competitive relationship. A complimentary relationship exists between bacon supplied by the U.S. and bacon from ROW according to an elasticity of -2.735 (Table VIII). For sausages, the elasticity between the U.S. and Australia (-0.606) suggests a complimentary relationship. A competitive relationship exists between sausages from ROW and sausages from Australia, elasticity 1.50. The relationships among suppliers of other PPM are mostly competitive as indicated by positive significant cross-price elasticities (Table VIII). The exception is the complimentary relationship between ROW and Australia (-2.029).

The degree of substitutability and complimentarity is determined by the cross-price elasticities among the three goods. Bacon supplied by the U.S. is a substitute for other PPM (1.268). Sausages from the U.S. is a compliment to bacon (-0.452) and compliment to other PPM (-0.823). Other PPM from EC is a substitute for bacon (0.113), other PPM

from China is a substitute for bacon (0.151) and compliment to sausages (-0.5143); other PPM from the U.S. compliments bacon (-0.201) and sausages (-0.362), and other PPM from ROW serves as a substitute for sausages (0.700) and compliment to bacon (-0.162).

The own-price elasticities have the expected negative sign, except for sausages supplied by the U.S. (0.492) and other PPM from Australia (0.677). However, neither of the two positive Own-price elasticities is significantly different from zero (Table VIII). Most negative own-price elasticities are significantly different from zero with exceptions being EC bacon and Australia's sausages (Table VIII).

Singapore's Import Market for PPM

Table IX presents the Wald Chi-Square results for the null hypotheses for block separability and product aggregation for the PPM import demand model for Singapore using a RSDAIDS model. At a 1 percent significance level, block separability was rejected based on an Chi-Square of 44.02 with 22 degrees of freedom. The Chi-Square for rejecting product aggregation was 982 with 51 degrees of freedom.

Elasticities for Singapore's PPM import demand using a RSAIDS model are shown in Table X and Xa. The system R^2 for the model is .939. All expenditure elasticities are positive and all are significant, except ROW insignificant elasticity for sausages. Only two expenditure elasticities, for other PPM from China and the U.S., were greater than 1. However, the U.S. expenditure elasticity of 2.5 was the only one significantly greater than 1. This indicates an elastic expenditure elasticity for U.S. other PPM in the Singapore market. The implication for the U.S. is that its market share would increase rapidly with an increase in import expenditures by Singapore for other PPM. The U.S. had a

significant expenditure elasticity for each product it supplied to the Singapore market (Tables X, Xa).

The cross-price elasticity between bacon supplied by the U.S. and bacon from the EC (0.995) indicate they are competitive in the Singapore market. Sausages supplied by the U.S. competes with sausages from Australia (0.204) and sausages from the EC (0.149) based on significant positive cross-price elasticities (Table X). Also, sausages supplied by the EC and China are competitive. The other significant elasticities imply complementary relationships among sausages suppliers. Other PPM supplied by the U.S. is complementary with other PPM supplied by the EC (-1.33).

Cross-price elasticities among the goods show bacon from the U.S. is a compliment for sausages (-0.691) and has a competitive relationship with other PPM (0.535). Sausages from the U.S. complements bacon (-0.279) and serves as a substitute for other PPM (0.415). Other PPM from ROW serves as a compliment to sausages (-0.741). In the Singapore market, all own-price elasticities are significantly different from zero except ROW other PPM (-0.468) and the elasticity for sausages from Australia (-0.546).

Summary and Conclusion

Results from the RSDAIDS models for the three selected Pacific Rim countries of Hong Kong, Japan, and Singapore provide valuable information about the PPM import trade. In developing econometric models the null hypotheses of block separability and product aggregation were rejected in each market at a 5 percent significance level. Inference here is that the three SITC commodities should not be estimated as separate

models with only budget shares of a good from different origins. Furthermore, rejection of the null hypothesis of product aggregation implies differentiating by source of origin is appropriate for the PPM models.

A country was considered to have a favorable competitive position to increase market share when expenditure is elastic and own price is inelastic. Based on this criterion the U.S. was competitive for bacon in the Hong Kong market. In addition, both U.S. sausages and other PPM were competitive in the Japanese market. In Singapore, U.S. other PPM was very competitive with an elastic expenditure elasticity of 2.5.

All expenditure elasticities were positive as expected except for negative elasticities for EC and China for bacon in the Hong Kong market and for the U.S. bacon in the Japanese market. Furthermore, China's negative expenditure elasticity was also significantly different from zero. This implies that bacon imported into Hong Kong from China is an inferior good.

The intensity of competition among the suppliers of PPM can be determined by the magnitude of cross-price elasticities among suppliers of the products. In the Hong Kong market, the most intense competition for bacon was between EC and China (1.492) and between EC and U.S. (1.477) for sausages. Competition between the U.S. and China (4.402) was the most intense for other PPM in the Hong Kong market. In the Japanese market, intense competition existed between the U.S. and EC (4.814) for bacon and between the ROW and Australia (1.500) for sausages (Table VIII). For other PPM, the most intense competition was between China and ROW (1.552). In Singapore, competition was the most intense between China and EC (1.326) for sausages and between China and EC (1.100) for other PPM (Table X).

All own-price elasticities were negative as expected with the exceptions of two cases each in Hong Kong and Japan. In Hong Kong, the U.S. and China had positive own-price elasticities for bacon and sausages, respectively (Table VI). In the Japanese market, the U.S. had a positive own-price elasticity for sausages and Australia had a positive own-price elasticity for other PPM (Table VIII). However, in neither case was the elasticity significantly different from zero.

The degree of substitutability and complimentarity can be observed by the cross-price elasticities among the three goods. Most of the relationships are substitutes based on significant positive cross-price elasticities, especially in the Hong Kong market. Also, in the Japanese market, relationships are substitutes except for the complimentary relationship between other PPM from China and U.S. sausages. In Singapore, U.S. sausages compliments bacon. All the other significant relationships are substitutes.

Policy Implications

Results from this study have several important policy implications for the U.S. meat industries and local and national policy makers. One implication is that the growth in demand for processed meats seems to offer the greatest opportunity for the U.S. to expand its international meat trade because as countries experience economic growth consumers demand more further-processed meats. In addition, exports of processed meats create more jobs and generate greater economic activity than trade in bulk commodities. A second policy implication concerns the economics of transporting processed products versus bulk commodities. Processed products are less troublesome to transport because they can be shipped at room temperature and do not require the

refrigeration needed when transporting fresh, chilled, and frozen meats; processed products have a higher per unit value; and processed products offer a greater degree of product differentiation than exists in bulk commodities.

Hong Kong and Singapore are currently considered free-trade areas because of little or no tariffs and the absence of nontariff barriers to trade. A third policy implication from this study is the uncertain future trading status of Hong Kong when the People's Republic of China gain control of Hong Kong on 1 July 1997. A fourth policy implication is that results from this study should aid in identifying countries to aim marketing strategies and suggest that the U.S. processed meats are high quality and that marketing strategies should emphasize the quality of U.S. processed meats rather than focus on price. The expenditure elasticities show which U.S. products that would experience an increase in demand when import expenditures increase in the selected Pacific Rim countries. Cross-price elasticities show the intensity of competition among the suppliers of processed meats to the selected Pacific Rim countries and identify how competitors pricing policies could affect U.S. processed meat exports.

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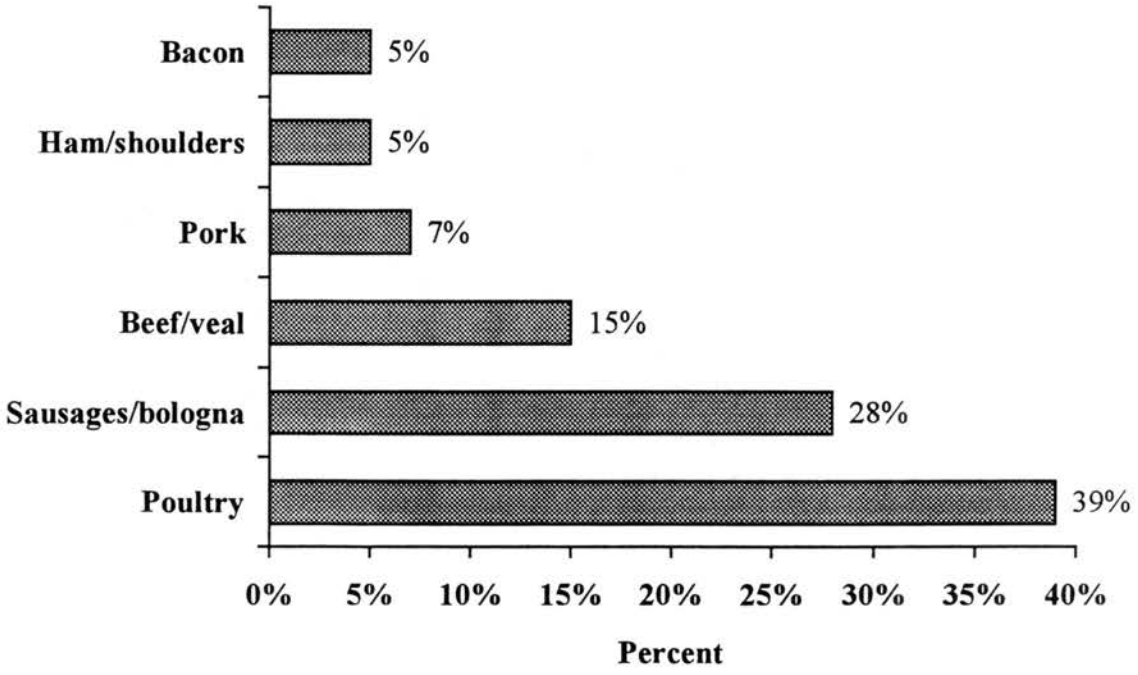
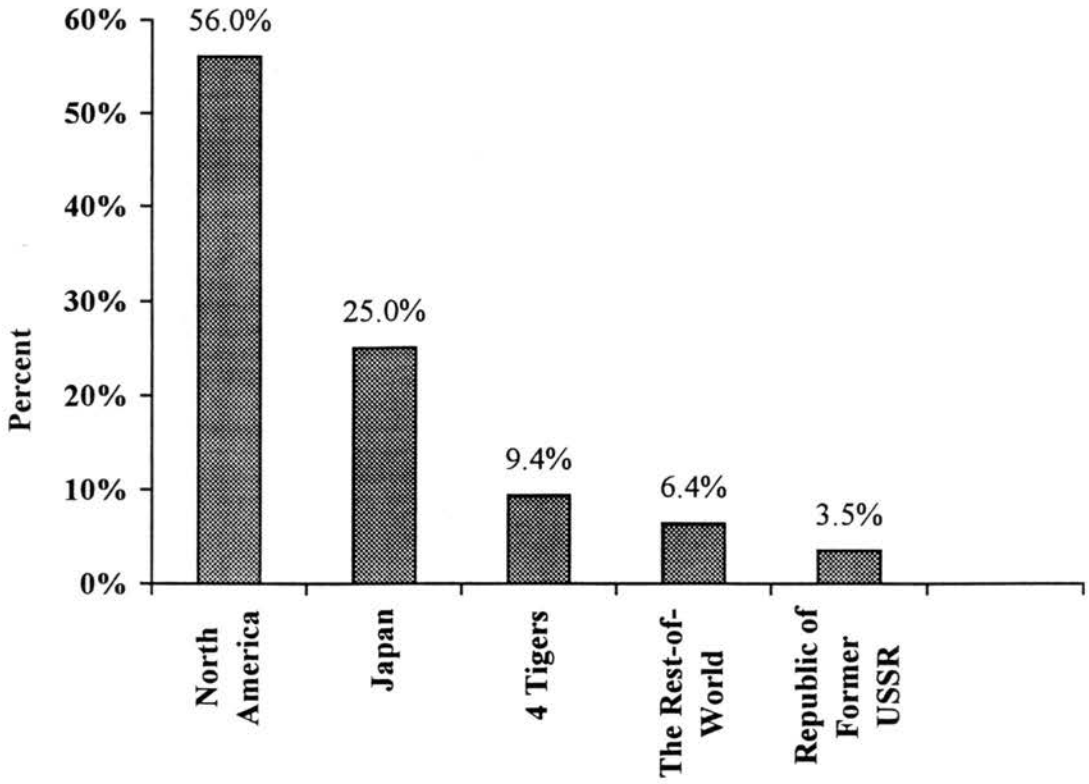
Figure 1. U.S. Exports of Prepared/Preserved Meats by Type Commodity as Percentage of Total Value of Six Processed Meat Exports, 1990-94.



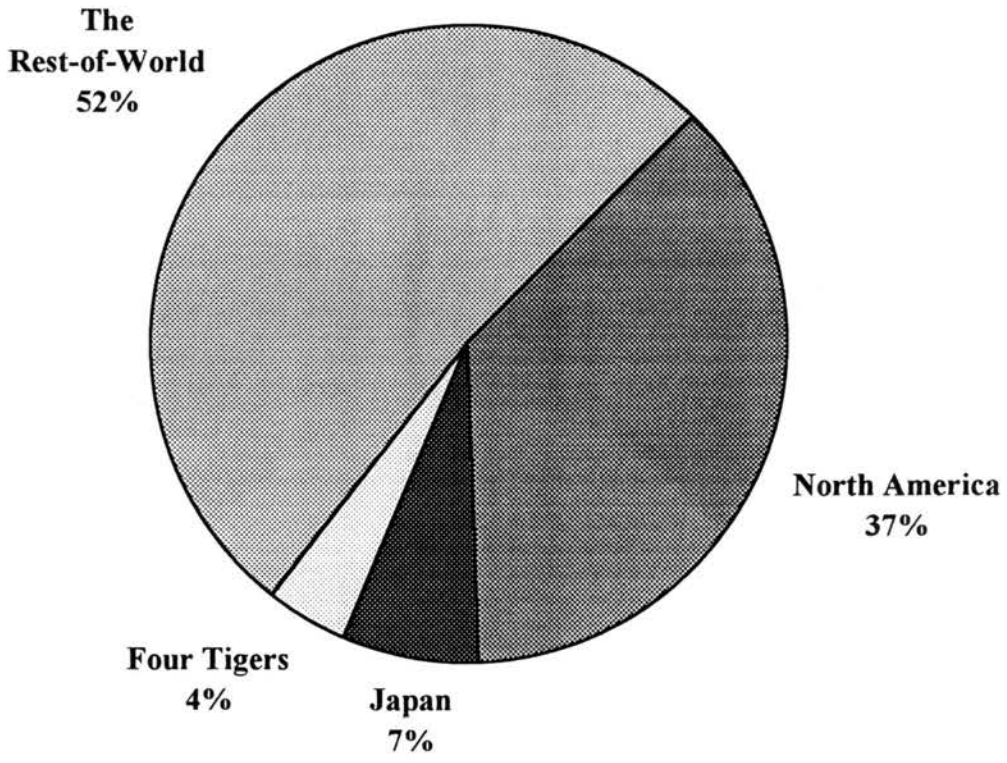
Source: U.S. Department of Commerce, Bureau of the Census, 1994.
Processed Meats refer to meats that have undergone processing beyond fresh, chilled, and frozen; include sausages, ham/shoulders, bacon etc.

Figure 2. U.S. Export of Prepared/Preserved Red Meats (Aggregate Good) to Top Five Regional Markets in 1990-94.



Source: U.S. Department of Commerce, Bureau of the Census, 1994.
4 Tigers (Hong Kong, Singapore, South Korea, Taiwan)

Figure 3. U.S. Export of Prepared/Preserved Poultry to Top Four Regional Markets in 1990-94.



Source: U.S. Department of Commerce, Bureau of the Census, 1994.
4 Tigers (Hong Kong, Singapore, South Korea, Taiwan)
* Prepared/preserved poultry refers to poultry meat that has undergone processing beyond fresh chilled, and frozen; includes chicken nuggets, breaded chicken patties, etc.

Table I. Top Three Import Countries for U.S. Prepared/Preserved Meats, 1990-94.

Commodity	Top Three Countries			Share of Three Countries of U.S. Total Export
Beef/veal	Canada 55.3	Japan 25.2	Mexico 6.9	87.4
Pork	Canada 44.9	Mexico 18.5	Japan 10.3	73.7
Hams/shoulders	Mexico 21.5	Canada 12.9	Japan 23.2	57.6
Bacon	Mexico 42.5	Colombia 4.3	Hong Kong 4.7	51.5
Poultry	Canada 48.1	Mexico 23.3	Japan 13.4	84.8
Sausages/ bologna	Mexico 26.3	Canada 27.3	Japan 22.1	75.7
Red meat (aggregate good)	Mexico 22.8	Canada 33.5	Japan 24.4	80.7

Source: U.S. Department of Commerce, Bureau of the Census, 1994
*Figure below country name is the percentage of U.S. exports of a particular type meat exported to that county in 1994.

Table II. Top Three Regional Import Markets for U.S. Prepared/preserved Meats, 1990-94.

Commodity	Top Three Countries			Share of Three Markets of U.S. Total Export
Beef/veal	North America	Japan	4 Tigers	
	62.3	25.2	2.8	90.3
Pork	North America	Japan	4 Tigers	
	63.4	12.0	9.3	84.7
Hams/shoulders	North America	Caribbean Islands	Japan	
	34.3	17.6	23.2	75.1
Bacon	North America	South America	4 Tigers	
	49	11.5	8	68.5
Poultry	North America	Japan	4 Tigers	
	71.5	13.4	7.7	92.6
Sausages/	North America	Japan	4 Tigers	
bologna	53.7	22	11	87

Source: U.S. Department of commerce, Bureau of the Census, 1994.
Figure below country indicates market share.

Table III. Definition of Four SITC Codes of Meats Exported to the Pacific Rim.

SITC Code	Definition of Prepared/Preserved Meat	*Text Reference
0121	bacon, ham, other dried, salted, smoked	bacon
0129	Prepared/Preserved Meats: edible meat offal, nes, dried, salted, smoked	offals
0134	sausages and the like of meat	sausages
0138	Other prepared and preserved meats	other PPM

SITC = Standard International Trade Classification

Definition of meat products is based on revision two of the meat categories (bacon, offals, sausages, other PPM).

Nes = Prepared/Preserved meats not elsewhere stated in any SITC category.

* Text reference refers to the name used to represent each meat category (SITC Code). For example, offals is used to represent the offals meat category.

Source: United Nations data

Table IV Summary Statistics for Expenditures Shares; Hong Kong, Japan, and Singapore, 1971 - 1992.

	Hong Kong		Japan		Singapore	
	Supplier	*Mean share	Supplier	Mean share	Supplier	Mean share
Commodity category						
bacon		**.277**		**.070**		**.093**
	EC	.105	EC	.057	EC	.074
	China	.139	U.S.	.008	U.S.	.008
	U.S.	.008	ROW	.005	ROW	.011
	ROW	.026				
Sausages		**.221**		**.082**		**.125**
	EC	.039	EC	.024	EC	.061
	China	.104	Australia	.013	China	.016
	U.S.	.060	U.S.	.033	Australia	.014
	ROW	.020	ROW	.012	U.S.	.029
					ROW	.005
Other PPM		**.502**		**.848**		**.782**
	EC	.039	EC	.219	EC	.113
	China	.409	Australia	.185	China	.500
	U.S.	.016	China	.040	U.S.	.062
	ROW	.039	U.S.	.253	ROW	.108
			ROW	.157		
Total Percent		**100**		**100**		**100**

Source: United Nations Trade Data

*Mean share is defined as the average share of a SITC commodity supplied by a country as a percentage of total import value of the three commodity categories.

The bold number in front of each code is the aggregate share of import expenditures for the commodity. Under the meat categories (bacon, offals, sausages, other PPM) are the export countries and their contribution to the aggregate percentage.

For definition of SITC codes covered under these categories, refer to Table III.

EC = European Community, U.S. = United States, and ROW = Rest-of-World.

Table V. Wald Chi-Square Results for Block Separability and Product Aggregation, Hong Kong, 1971-1992.

Block Separability:

Ho: Bacon is separable from all other meats.
Chi-Square = 19.29**
+df: 6

Ho: Sausages is separable from all other meats.
Chi-Square = 18.54*
df: 8

Ho: Other PPM is separable from all other meats.
Chi-Square = 43.99**
df: 8

Ho: All of the above.
Chi-Square = 81.82**
df: 22

Product Aggregation:

Ho: Bacon can be aggregated.
Chi-Square = 138.14**
df: 12

Ho: Sausages can be aggregated.
Chi-Square = 269.05**
df: 18

Ho: Other PPM can be aggregated.
Chi-Square = 2177.07**
df: 18

Ho: All of the above.
Chi-Square = 2584.26**
df: 48

+df = degrees of freedom
Single and double asterisks (*) denote significance at the 5% and 1% levels, respectively.

Table VI. Marshallian Own-price, Cross-price, and Expenditure Elasticities for PPM in Hong Kong Using RSDAIDS Model.

	Bacon				Sausages				Other PPM			
	EC	CN	US	ROW[b]	EC	CN	US	ROW	EC	CN	US	ROW
PbEC	-1.597**	.464*	1.492**	.908								
	(.249)[a]	(.224)	(.557)									
PbCN	.521*	-.521	-3.891**	-.384								
	(.213)	(.335)	(.639)									
PbUS	.125	-.205	.870	.543								
	(.207)	(.253)	(.902)									
PbROW	.147	-.196	1.298*	-.048								
	(.260)	(.317)	(.724)									
PfEC					-2.80**	-.838**	1.050**	-.378				
					(.393)	(.150)	(.204)	(.326)				
PfCN					-2.460**	.282	.137	.125				
					(.440)	(.289)	(.293)	(.454)				
PfUS					1.477**	.080	-1.999**	.948**				
					(.304)	(.153)	(.312)	(.350)				
PfROW					-.188	.060	.343	-1.631**				
					(.368)	(.176)	(.266)	(.541)				
PeEC									-1.825**	-.053	.819	.521**
									(.502)	(.099)	(.952)	(.212)
PeCN									-.205	-1.181**	4.402**	.655*
									(.562)	(.182)	(1.414)	(.342)
PeUS									.387	.199*	-5.577**	-.660**
									(.391)	(.105)	(1.386)	(.219)
PeROW									.539*	.041	-1.635*	-1.734**
									(.308)	(.079)	(.780)	(.257)
PB					-.185**	-.352**	-.273*	-.553**	-.051	-.073*	-.867**	-.084
					(.166)	(.078)	(.136)	(.180)	(.132)	(.034)	(.323)	(.090)
PF	.186	.345	-1.053	-1.195					.751**	.227**	.181	.552**
	(.232)	(.241)	(.660)						(.311)	(.075)	(.762)	(.212)
PE	.632**	.817**	-.190	-1.465	-1.177*	.053	-.004	-1.190*				
	(.295)	(.321)	(.836)		(.641)	(.260)	(.460)	(.616)				
Y	-.014	-.704*	1.473*	1.641	2.814**	.715*	.746	2.678**	.405	1.294**	2.677	.752*
	(.322)	(.346)	(.872)		(1.147)	(.487)	(.756)	(1.147)	(.849)	(.202)	(2.110)	(.544)

System $R^2 = 0.818$

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.597) is the own-price elasticity for bacon in the EC equation.

Table VIa. Hicksian Own-price, Cross-price, and Expenditure Elasticities for PPM in Hong Kong Using RSDAIDS Model.

	Bacon				Sausages				Other PPM			
	EC	CN	US	ROW	EC	CN	US	ROW	EC	CN	US	ROW
PbEC	-1.58**	.391	1.646**	1.079								
	(.255)	(.228)	(.567)									
PbCN	.519*	-.619*	-3.686**	-.156								
	(.210)	(.337)	(.638)									
PbUS	.125	-.211	.881	.556								
	(.207)	(.253)	(.901)									
PbROW	.146	-.214	1.336*	-.006								
	(.263)	(.320)	(.733)									
PfEC					-.170	-.810**	1.079**	-.274				
					(.384)	(.151)	(.200)	(.327)				
PfCN					-2.169**	.356	.214	.403				
					(.390)	(.263)	(.261)	(.405)				
PfUS					1.644**	.122	-1.954**	1.106**				
					(.306)	(.155)	(.319)	(.361)				
PfROW					-.135	.074	.357	-1.580**				
					(.360)	(.172)	(.260)	(.529)				
PeEC									-1.809**	-.004	.922	.550*
									(.491)	(.098)	(.938)	(.206)
PeCN									-.039	-.652**	5.496**	.962**
									(.411)	(.149)	(1.064)	(.225)
PeUS									.393	.221**	-5.533**	-.648**
									(.388)	(.104)	(1.372)	(.216)
PeROW									.554*	.091	-1.531*	-1.706**
									(.311)	(.080)	(.790)	(.259)
PB					.594*	-.154	-.066	.189	.061	.285**	-.126	.124
					(.248)	(.123)	(.169)	(.244)	(.203)	(.052)	(.508)	(.131)
PF	.183	.189	-.728	-.833					.840**	.058	.772	.718**
	(.188)	(.196)	(.561)						(.285)	(.069)	(.718)	(.184)
PE	.625**	.464*	.550	-.640	.263	.412*	.371	.156				
	(.193)	(.213)	(.586)		(.355)	(.169)	(.266)	(.361)				
Y	-.014	-.704*	1.473	1.641	2.814*	.715	.746	2.678**	.405	1.294**	2.677	.752
	(.322)	(.346)	(.872)		(1.147)	(.487)	(.756)	(1.150)	(.849)	(.202)	(2.110)	(.544)

System $R^2 = 0.818$

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.58) is the own-price elasticity for bacon in the EC equation.

Table VII. Wald Chi-Square Results for Block Separability and Product Aggregation, Japan.

Block Separability:

Ho: Bacon is separable from all other meats.
Chi-Square = 12.27*
+df: 4

Ho: Sausages is separable from all other meats.
Chi-Square = 85**
df: 8

Ho: Other PPM is separable from all other meats.
Chi-Square = 144.98**
df: 10

Ho: All of the above.
Chi-Square = 242.31**
df: 22

Product Aggregation:

Ho: Bacon can be aggregated.
Chi-Square = 80.1**
df: 5

Ho: Sausages can be aggregated.
Chi-Square = 203.7**
df: 18

Ho: Other PPM can be aggregated.
Chi-Square = 22.02
df: 28

Ho: All of the above.
Chi-Square = 2486.53**
df: 51

+df = degrees of freedom
Single and double asterisks (*) denote significance at the 5% and 1% levels, respectively.

Table VIII. Marshallian Own-price, Cross-price, and Expenditure Elasticities for PPM in Japan Using RSDAIDS Model.

	Bacon			Sausages				Other PPM				
	EC	US	ROW	EC	AU	US	ROW	EC	AU	CN	US	ROW
PbEC	-1.108**	4.814**	.246									
	(.510)	(.792)										
PbUS	.644	-2.44**	1.120									
	(.644)	(.960)										
PbROW	-.002	-2.735**	-1.882									
	(.729)	(.858)										
PfEC				-1.00**	.926*	.158	-.241					
				(.299)	(.630)	(.349)	(.568)					
PfAU				.475**	-1.048	-.606*	1.500**					
				(.196)	(.802)	(.342)	(.549)					
PfUS				.228	-1.587**	.492	-.107					
				(.228)	(.722)	(.520)	(.602)					
PfROW				-.116	1.459**	-.040	-2.181**					
				(.195)	(.610)	(.317)	(.741)					
PeEC								-.959**	-.092	-.364	-.104	.011
								(.208)	(.328)	(.602)	(.212)	(.290)
PeAU								-.033	.677*	-.795	.177	-2.029**
								(.162)	(.481)	(.604)	(.252)	(.300)
PeCN								-.055	-.170	-1.549**	.085	.371
								(.170)	(.349)	(.779)	(.212)	(.292)
PeUS								.105	.405**	.677**	-1.225**	.222
								(.086)	(.212)	(.311)	(.178)	(.179)
PeROW								.219*	-1.475**	1.552**	.211	-1.049**
								(.132)	(.279)	(.467)	(.200)	(.383)
PB				-.140	-.534	-.452*	-.028	.113**	.091*	.151*	-.201**	-.162**
				(.158)	(.444)	(.255)	(.413)	(.031)	(.064)	(.105)	(.057)	(.065)
PF	.230	-.500	-.385					.080	-.207*	-.514**	-.362**	.700**
	(.455)	(.546)						(.069)	(.142)	(.239)	(.124)	(.170)
PE	-.242	1.268**	-.383	-.325**	-.028	.823**	-.133					
	(.395)	(.440)		(.147)	(.453)	(.227)	(.435)					
Y	.477	-.407	1.284	.879**	.813**	1.271**	1.190**	.530**	.772**	.842**	1.421**	1.935**
	(.424)	(.472)		(.086)	(.267)	(.129)	(.256)	(.073)	(.163)	(.261)	(.147)	(.169)

System R^2 = 0.981

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.108) is the own-price elasticity for bacon in the EC equation.

Table VIIIa. Hicksian Own-price, Cross-price, and Expenditure Elasticities for PPM in Japan Using RSDAIDS Model.

	Bacon			Sausages				Other PPM				
	EC	US	ROW	EC	AU	US	ROW	EC	AU	CN	US	ROW
PbEC	-1.080	4.791**	.319									
	(.897)[a]	(.781)										
PbUS	.648	-2.443*	1.130									
	(.645)	(.960)										
PbROW	.001	-2.733**	-1.875									
	(.730)	(.858)										
PfEC				-.980**	.945	.189	-.212					
				(.299)	(.629)	(.349)	(.567)					
PfAU				.487*	-1.038	-.590	1.515**					
				(.196)	(.803)	(.343)	(.549)					
PfUS				.257	-1.560*	.534	-.068					
				(.229)	(.722)	(.520)	(.602)					
PfROW				-.106	1.469*	-.025	-2.167**					
				(.196)	(.611)	(.318)	(.742)					
PeEC								-.843**	.077	-.180	.207	.434
								(.205)	(.328)	(.595)	(.203)	(.287)
PeAU								.065	.820	-.639	.440*	-1.671**
								(.157)	(.466)	(.585)	(.239)	(.291)
PeCN								-.033	-.139	-1.515*	.142	.450
								(.171)	(.351)	(.779)	(.212)	(.292)
PeUS								.239*	.600*	.890*	-.866**	.712**
								(.099)	(.244)	(.360)	(.206)	(.209)
PeROW								.299*	-1.359**	1.678**	.425*	-.758*
								(.127)	(.268)	(.449)	(.189)	(.369)
PB				-.078	-.477	-.363	.056	.150**	.145*	.210*	-.102	-.026
				(.158)	(.442)	(.225)	(.410)	(.033)	(.068)	(.114)	(.063)	(.071)
PF	.270	-.534	-.279					.123	-.144	-.445*	-.245	.860**
	(.478)	(.568)						(.071)	(.147)	(.247)	(.180)	(.177)
PE	.162	.923**	.705	.421**	.661*	.255	.845*					
	(.194)	(.237)		(.122)	(.350)	(.183)	(.323)					
Y	.477	-.407	1.284	.879**	.813**	1.271**	1.190**	.530**	.772**	.842**	1.421**	1.935**
	(.424)	(.473)		(.086)	(.267)	(.129)	(.256)	(.073)	(.163)	(.261)	(.149)	(.169)

System $R^2 = 0.981$

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.080) is the own-price elasticity for bacon in the EC equation.

Table IX. Wald Chi-Square Results for Block Separability and Product Aggregation, Singapore.

Block Separability:

Ho: Bacon is separable from all other meats.
Chi-Square = 10.08*
+df: 4

Ho: Sausages is separable from all other meats.
Chi-Square = 26.07**
df: 10

Ho: Other PPM is separable from all other meats.
Chi-Square = 7.87
df: 8

Ho: All of the above.
Chi-Square = 44.02**
df: 22

Product Aggregation:

Ho: Bacon can be aggregated.
Chi-Square = 99**
df: 5

Ho: Sausages can be aggregated.
Chi-Square = 343**
df: 28

Ho: Other PPM can be aggregated.
Chi-Square = 539**
df: 18

Ho: All of the above.
Chi-Square = 982**
df: 51

+df = degrees of freedom
Single and double asterisks (*) denote significance at the 5% and 1% levels, respectively.

Table X. Marshallian Own-price, Cross-price, and Expenditure Elasticities for PPM in Singapore Using RSDAIDS Model.

	Bacon			Sausages					Other PPM			
	EC	US	ROW	EC	CN	AU	US	ROW	EC	CN	US	ROW
PbEC	-1.81**	.995**	.967									
	(.402)	(.330)										
PbUS	.104	-1.219**	-.541									
	(.287)	(.377)										
PbROW	.054	-.251	-1.335									
	(.169)	(.154)										
PfEC				-1.127**	1.326**	-.223	.149**	-2.341**				
				(.222)	(.355)	(.315)	(.049)	(.535)				
PfCN				.356**	-1.400**	.079	.049	.219				
				(.125)	(.402)	(.239)	(.041)	(.474)				
PfAU				-.052	.066	-.546	.204**	-.464				
				(.166)	(.357)	(.446)	(.056)	(.551)				
PfUS				-.067*	.083	-.426**	-.786**	.083				
				(.042)	(.107)	(.092)	(.038)	(.191)				
PfROW				-.202*	.067	-.174	.013	-1.544**				
				(.102)	(.259)	(.202)	(.040)	(.597)				
PeEC									-1.202**	.181	-1.33**	.060
									(.248)	(.167)	(.522)	(.180)
PeCN									1.100**	-1.33**	.955*	.020
									(.210)	(.279)	(.692)	(.392)
PeUS									-.607**	.206	-1.720**	-.103
									(.149)	(.159)	(.608)	(.287)
PeROW									.093	-.025	-.363	-.468
									(.176)	(.165)	(.526)	(.467)
PB				.028	-.499	.396	-.279**	1.649**	.190	-.137	-.324	.413
				(.194)	(.455)	(.330)	(.087)	(.652)	(.168)	(.131)	(.575)	(.318)
PF	.353	-.691**	.144						-.065	.205	.282	-.741*
	(.229)	(.283)							(.234)	(.190)	(.790)	(.454)
PE	.306	.535*	-.813	.137	-.485	.156	.415**	2.122**				
	(.270)	(.314)		(.218)	(.505)	(.374)	(.164)	(.903)				
Y	.363*	.631**	1.593	.793**	.842**	.739**	.643**	.274	.494**	1.09**	2.502**	.819**
	(.179)	(.205)		(.144)	(.375)	(.285)	(.136)	(.660)	(.104)	(.087)	(.373)	(.210)

System $R^2 = 0.939$

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.81) is the own-price elasticity for bacon in the EC equation.

Table Xa. Hicksian Own-price, Cross-price, and Expenditure Elasticities for PPM in Singapore Using RSDAIDS Model.

	Bacon			Sausages					Other PPM			
	EC	US	ROW	EC	CN	AU	US	ROW	EC	CN	US	ROW
PbEC	-1.154**	1.041**	-1.083									
	(.400)	(.329)										
PbUS	.107	-1.214**	-.529									
	(.287)	(.376)										
PbROW	.058	-.245	.344									
	(.169)	(.155)										
PfEC				-1.078**	1.378**	-.179	.188**	-2.324**				
				(.226)	(.362)	(.322)	(.049)	(.542)				
PfCN				.369**	-1.386**	.091	.060	.224				
				(.126)	(.404)	(.241)	(.092)	(.477)				
PfAU				-.041	.078	-.536	-.195**	-.460				
				(.165)	(.356)	(.444)	(.055)	(.548)				
PfUS				.090*	.108	-.405**	-.768**	-.093				
				(.042)	(.104)	(.093)	(.036)	(.184)				
PfROW				-.198*	.071	-.170	.017	-1.542**				
				(.102)	(.259)	(.201)	(.040)	(.597)				
PeEC									-1.147**	.304*	-1.050*	.153
									(.249)	(.166)	(.522)	(.334)
PeCN									1.345**	-.791**	2.204**	.429
									(.211)	(.291)	(.702)	(.399)
PeUS									-.577**	.274	-1.565**	-.053
									(.147)	(.156)	(.598)	(.284)
PeROW									.146	.093	-.092	-.379
									(.172)	(.162)	(.517)	(.458)
PB				.101	-.422	.464	-.220	1.674**	.235	-.036	.093	.488
				(.192)	(.453)	(.322)	(.092)	(.644)	(.172)	(.134)	(.588)	(.326)
PF	.399	-.611*	.346						-.004	.157	.596	-.638
	(.239)	(.294)							(.233)	(.189)	(.786)	(.455)
PE	.590	1.029**	.432	.758**	.173	.734**	.918**	2.337**				
	(.164)	(.196)		(.167)	(.376)	(.319)	(.101)	(.716)				
Y	.363*	.631	1.593	.793**	.842**	.739**	.643	.274	.494**	1.088**	2.502	.819**
	(.179)	(.205)		(.144)	(.376)	(.285)	(.136)	(.660)	(.104)	(.87)	(.373)	(.210)

System $R^2 = 0.939$

[a] Standard errors are in parentheses. Single and double asterisk (*) denote significance at the 5% and 1% levels, respectively.

[b] Standard errors are not reported for bacon parameters from ROW. These parameters are recovered from the adding up condition.

Notes: For definition of meat categories, refer to Table III.

Abbreviations: P = price, Y = import expenditures, b = bacon, f = sausage, e = other PPM.

PB is the price of bacon on an aggregate basis regardless of origin (assuming block substitutability).

PF is the price of sausages on an aggregate basis regardless of origin (assuming block substitutability).

PE is the price of other PPM on an aggregate basis regardless of origin (assuming block substitutability).

EC = European Community, CN = China, US = United States, ROW = Rest of World.

The columns in the table represent the 12 equations in the RSDAIDS model and the rows represent variables. For example, in column 1, the elasticity (-1.154) is the own-price elasticity for bacon in the EC equation.

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Doctor of Philosophy

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