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The competitiveness of the NAFTA countries members in the imports demand of Japanese meat market

La competitividad de los países miembros del TLCAN en la demanda de carne de importación en el mercado japones

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Abstract

Japan is one of the largest importers of meat products. The United States of America has provided a large proportion of these products during the last decade, but Canada and Mexico have steadily increased their share of these imports. NAFTA countries furnished a large proportion of these imports, namely, 60% of the swine meat and 40% of the bovine meat imported by Japan in 2016. In this article we apply a Source Differentiated Almost Ideal Demand System to estimate the pork and beef meat demands of Japan from the NAFTA countries during the 2006-2016 period. Both block separability and aggregation over product sources hypothesis were rejected at the conventional levels of significance. Hence, the data support differentiating by sources both individually and as a whole. Empirical results suggest that in order to increase their exports, all NAFTA countries must produce beef and swine more efficiently and be more competitive with the international market.

Japan, NAFTA, SDAIDS, Swine, Bovine

Resumen

Japón es una de los principales importadores de carne a nivel mundial. Los Estados Unidos de América ha sido tradicionalmente uno de sus principales proveedores, pero recientemente Canadá y México han incrementado constantemente su presencia en este mercado. Los países del TLCAN concentraron el 60% de las importaciones japonesas de carne de cerdo así como el 40% de las de carne de res durante la década 2006-2016. En este trabajo se aplica un Sistema de Demanda Casi Ideal con Orígenes Diferenciados (*Source Differentiated Ideal Demand System*) para estimar las demandas de carne de puerco y de res durante el periodo 2006-2016. Se rechazaron las hipótesis de separabilidad en bloques y de agregación a los niveles de significancia convencionales. Por lo tanto, los datos se ajustan a la distinción de orígenes tanto de manera individual como global. Los resultados sugieren que para incrementar sus exportaciones los países del TLCAN deben producir las carnes de res y puerco de forma más eficiente para ser competitivos con el mercado internacional.

Japón, TLCAN, SDCIOD, Puerco, Res

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Introduction

International meat trade has a long history, but recent decades have seen fast growth of trade volume and value. One of the main reasons for this increase is undoubtedly associated to global reductions on protectionism. Associated with the reduced protectionism, either as casual factors or as consequences of liberalized trade, are important changes in diets, distribution technology, and multinational business structures. (Dyck J. H. and Nelson K. N., 2003: 12).

Meat trade flows among countries and world regions are determined largely by differences among countries in their resource base, preferences for meat types and cuts, the extent and character of barriers to trade, and the industry structure. Poultry meat, beef, and swine are the three most important meats in world trade. (DYCK J. H. AND NELSON K. N., 2003: III).

Back in 1994 Yang and Koo found that USA, Canada, Australia, Taiwan, and a group for European countries were the most important supplier countries of meat to Japan (YANG AND KOO, 1994). However, due to the policies mentioned above, nowadays USA, Canada and Australia continue be important suppliers, but a group of new countries from Europe (Italy, Spain, France, Hungary and Denmark), Asia (Philippines, New Zealand and Taiwan) and from Latin America (Argentina, Brazil, Chile and Mexico) have a significant share of the meat imports to Japan. (See tables 1 and 2).

Year	Total Q	NAFTA	Can	Usa	Mex
2006	460614	3.40%	0.45%	1.59%	1.36%
2007	473651	9.45%	0.71%	7.21%	1.53%
2008	458017	14.88%	1.03%	11.81%	2.04%
2009	481133	18.15%	1.77%	14.38%	2.00%
2010	499529	23.32%	2.59%	18.34%	2.39%
2011	517233	28.71%	1.97%	23.38%	3.37%
2012	514186	31.86%	2.23%	25.66%	3.98%
2013	534256	40.86%	2.38%	34.83%	3.66%
2014	518707	41.09%	2.72%	36.37%	2.00%
2015	493980	37.90%	2.01%	33.49%	2.40%
2016	503232	42.31%	2.67%	38,18%	1.46%

Table 1 Proportional participation of the NAFTA countries in the imports of bovine meat by Japan. Total imports expressed in metric tons
Source: Japan Trade Statistics, Ministry of Finance, www.customs.go.jp/toukei/srch/indexe.htm

It is apparent from Table 1 the dramatic increase in the share of NAFTA countries the imports of bovine meat where the total imports have expanded from 3.4% to 42.3% in just 10 years. This is due to the authorization of imports of bovine meat to Japan from the USA and Canada once the spongiform encephalopathy (mad cows) disease was over. However, Mexico is the only NAFTA country whose share in the market has been steady in this period.

Year	Total Q	NAFTA	Can	Usa	Mex
2006	724797	61.29%	20.92%	34.80%	5.57%
2007	760273	63.73%	21.77%	35.59%	6.36%
2008	817619	69.49%	21.36%	41.21%	6.92%
2009	702887	71.80%	24.52%	41.07%	6.21%
2010	752967	68.77%	23.72%	39.62%	5.43%
2011	793046	67.96%	21.94%	40.82%	5.20%
2012	778762	68.32%	22.16%	40.30%	5.86%
2013	738417	65.37%	19.26%	38.07%	8.04%
2014	829366	58:73%	17.84%	33.28%	7.60%
2015	790622	62.60%	20.97%	32.82%	8.81%
2016	861156	60.13%	20.74%	30.66%	8.73%

Table 2 Proportional participation of NAFTA countries in the imports of swine meat by Japan. Total imports expressed in metric tons Meat of Swine
Source: Japan Trade Statistics, Ministry of Finance, www.customs.go.jp/toukei/srch/indexe.htm

It is interesting to observe that the share of the imports of swine meat from the NAFTA countries have also increased in the past 7 years, even though the imports of swine meat have not been banned recently. East Asian countries (Japan, South Korea and Taiwan) form the world’s largest meat-importing region. The region is densely populated, with mountains and forests that limit the land available for agriculture, so that large-scale feed production is relatively expensive. Furthermore, the region has relatively high labor costs. (DYCK J. H. AND NELSON K. N., 2003: 1).

Japan is the third largest economy in the world, with a GDP of US$4383,076 millions, a population size of almost 127 million people, and a per capita income of US$38,840 (WORLD BANK, 2015). Expenditure on food products accounts in average for 20 percent of households budgets. Sea food and meat make up the largest share of the food budget at 21 percent.

This increased disposable household income, over the past half century, has changed dramatically the food consumption patterns of Japanese consumers. Consumption of rice as the staple item has declined while the consumption of livestock products, oils and fats, and beverages has increased.

There is in fact a marked change in dietary habits towards Western style foods, partly due to strong marketing efforts, notably by major exporters as the US and Australia (VEEMAN M. M., VEEMAN T.S., ADILU S., 2002: 4).

Increases in expenditure for food are mainly due to qualitative rather than quantitative changes in the Japanese diet. Food consumption in Japan is mature and saturated for the hotel, restaurant and institution sector, and in the retail sector, for non- grain crops, livestock, meat and dairy products, as well as processed foods (VEEMAN M.M., VEEMAN T. S., ADILU S., 2002: 4).

Agricultural production including cereals, rice, beef, swine, fruits and vegetables has been steadily contracting in Japan, though Japan still maintains price and income supports and some protective measures on imported commodities in favor of its agriculture producers. These measures include tariffs, quotas and non-tariff barriers such as sanitary and phytosanitary requirements and administered prices on various commodities and products. Most domestically produced commodities, including rice, beef, swine, and dairy products, are affected by one or more of these measures (VEEMAN M.M., VEEMAN T.S., ADILU S., 2002: 4 AND 5).

Japan's domestic beef production is predominantly a byproduct of diary production with nearly 60 percent of total cattle slaughter coming from dairy breeds. Though beef production has increased in Japan, its self-sufficiency in beef has dropped over the years. (VEEMAN M.M., VEEMAN T.S., ADILU S., 2002: 5 AND 6).

Major reasons for increased Japanese beef consumption have been the rise in disposable household income, population growth and changes in relative prices. The rise in beef imports in the first half of the 1990's is also attributable to tariff reductions and appreciation of the yen (VEEMAN M.M., VEEMAN T.S., ADILU S., 2002: 6).

Domestic pig meat production, accounting for 8 percent of total agricultural output, is the second most important agricultural output (after rice) in Japan. Domestically produced swine is mainly sold fresh and chilled for table use. Hence, the decline in local production has resulted in a significant increase in fresh and chilled imports (VEEMAN M.M., VEEMAN T.S., ADILU S., 2002: 7).

Japan is one of the largest net importers of agriculture products of the world; it meets 50 percent of domestic food requirements through imports. The gain from Japanese food imports have been mainly captured by the United States, which accounts for about 37 per cent of this food import market. In fact, Japan is the largest importer of US beef (FIELDS, K.H., *ET.AL*., 2018:18). Canada, the fifth largest supplier, possesses about 5 per cent of the Japanese agri-food market. For Canada, Japan is the second largest agri-food export market. Financial crises in 1997-98 affected Japan's economy but the effects in agricultural trade were very small (VEEMAN M.M., VEEMAN T.S., ADILU S., 2002: 5).

Japan's largest meat firms produce meat both in Japan and in exporting countries (such as the United States, China and Australia) for shipment to Japan as well as to other markets. Importing lower cost meat produced in foreign markets allows the Japanese firms to offer competitive prices in Japan while controlling cutting specifications to use those best suited for Japanese consumers. (DYCK J. H. AND NELSON K. N., 2003: 18).

There are thus good reasons to analyze Japan's import meat market. The primary objective of this study is to estimate a meat demand system for Japan, differentiating meats by type and by source of origin from the North America Free Trade Agreement (NAFTA) countries.

We present first a review of the meat trade policies in the last thirty years of countries of the North America Free Trade Agreement (NAFTA). In the next section the Source Differentiated Almost Demand System (SDAIDS) model for imports is introduced. Data and estimation procedures are explained in the fourth section, followed by a presentation and analysis of empirical results. Conclusions are presented in the final section.

International meat trade policy

Most international trade models are based on the classical theory of comparative advantage developed by David Ricardo at the beginning of the nineteenth century. He showed that, in a free market, if two countries capable of producing two commodities exchange products, then both countries will increase its overall consumption by exporting the good for which it has a comparative advantage while importing the other good (BAUMOL AND BINDER, 2009:50).

Canada and USA had been open economies for a long period and both signed the original GATT (General Agreement on Tariffs and Trade) agreement back in 1947. Hence, both countries acquired experience in import and export goods and the internal prices of their production were the same as the international prices. On the other hand, the case of Mexico was totally different until 1986 when signed the agreement. As a result, Mexico reduced considerably trade barriers among GATT members. Japan assigned to Mexico the same tariffs as to any developing country. Later in 1994, Mexico opened more dramatically its economy by signing NAFTA agreement (North America Free Trade Agreement) with Canada and the USA As a consequence, all the tariffs and barriers for meat between these countries were eliminated.

After the discovery of the first cases of Bovine Spongiform Encephalopathy (BSE) in the USA and Canada in 2003, Japan interrupted the imports of beef from Canada was in May, and later on from USA in December. Two years later Japan once again allowed imports of USA beef provided the animals were under 20 months and without brain and spine (WTO, bulletin 21620063). It should be also pointed out that when President Obama was running for his first presidency term, he said that he would demand to Japan an increase of the beef meat quota. (The Japan Times On Line. may 18 2008). Just a few months later after Japan opened its beef meat imports to USA and Canada, Mexico signed a trade agreement with Japan increasing the quotas for the Mexican meat. Table 3 shows the special quotas of beef and swine allowed in the agreement.

Meat	Free quotas (Tons)	2016 Mexican imports
Swine	80,000	75,143
Beef	6,000	7,352

Table 3 Free quotas of Mexican Meat to Japan
Source: Secretaria de Economia. www.secretariadeeconomia.gob.mx, (Accessed March 2017), and Japan Trade Statistics, Ministry of Finance, www.customs.go.jp/toukei/srch/indexe.htm,

Mexican livestock producers face considerable problems to export their product. Amongst these difficulties one should point out:

1. There are only 113 abattoirs in the whole country certified to handle the meat with international standards (Sagarpa, 20013).
2. Mexico imports a great proportion of the feed grain needed for the production of meat. As a result, the meat production in Mexico is expensive. In fact, retail prices tend to be higher than the prices of imported meat from the USA. Moreover, this difference in price increases due to the existence of a substantial illegal importation of meat (Mutondo, 2007: 72).
3. The lack of the design of adequate policies to mitigate these problems.

For these reasons, Mexico needs to find alternative markets for its high quality meat production.

Related studies

In 1994 Yang and Koo introduced the *Source Differentiated Almost Ideal Demand System* (SDAIDS) model to estimate the demands of similar goods produced in different countries. In fact, they analyzed the Japanese meat import demands from the European Community and as well as some countries from Asia and America during the 1973-1990 period. For this study they selected the countries that were Japan's most important meat suppliers.

After Yang and Koo seminal work, the SDAIDS model has been used extensively to study the demands of import markets. In the case of meat markets related either to Japan or the NAFTA countries we should mention (Veeman et.al., 2002) where the prospects for Canadian meat exports to Asian countries is analyzed as well as the two works of Henneberry and Mutondo from 2007 and 2009 where both imports and exports of the U.S. meat market is taken into a careful consideration.

The Source Differentiated AIDS Model

As previously mentioned, the *Source Differentiated AIDS* model (SDAIDS) was first introduced by Yang and Koo (Yang and Koo, 1994). It is an ingenious generalization of the original AIDS model of Deaton and Muellbauer (Deaton and Muellbauer, 1980). In the SDAIDS model imports from different sources are treated as if they were totally different goods. In this section we will recall some of its main properties.

In what follows, we shall denote the imported goods (beef or swine meats) by the subindices *i* and *j*, while the origins (countries or regions) will be denoted by the subindices *h* and *k*. In this manner, the subdindex *ih* is associated to the good *i* imported from *k*. If *E* represents the total expenditure of the imported goods, *u* denotes an utility level and *p* a system of prices, then the SDAIDS model assumes that

$$\ln(E(u,p) = (1-u)\ln\big(a(p)\big) + uln(b(p)) \qquad (1)$$

where:

$$\ln\big(a(p)\big) = \alpha_0 + \sum_{ih}\alpha_{ih}\ln(p_{ih}) + \tfrac{1}{2}\sum_{ih,jk}\gamma^*_{ihjk}\ln(p_{ih})\ln(p_{jk}) \qquad (2)$$

and

$$\ln\big(b(p)\big) = \ln\big(a(p)\big) + \beta_0\prod_{ih} p_{ih}^{\beta_{ih}} \qquad (3)$$

In this expression the α's, β's and $\gamma^{*\prime}$s are parameters, while $a(p)$ and $b(p)$ can be regarded as the costs of subsistence and bliss. Thus,

$$\ln\big(E(p,u)\big) = \alpha_0 + \sum_j \alpha_{ih}\ln(p_{ih}) + \tfrac{1}{2}\sum_{j,k}\gamma^*_{ihjk}\ln(p_{ih})\ln(p_{jk}) + u\beta_0\prod_{ih}p_{ih}^{\beta_{ih}}. \qquad (4)$$

The budget share of the good *ih* can be obtained by differentiating the above expression with respect to $\ln(p_{ih})$ and applying the Shephard's lemma, since

$$\frac{\partial\ln(E)}{\partial\ln(p_{ih})} = \frac{\frac{\partial\ln(E)}{\partial p_{ih}}}{\frac{\partial\ln(p_{ih})}{\partial p_{ih}}} \qquad (5)$$

$$= \frac{\frac{\partial E/\partial p_{ih}}{E}}{\frac{1}{p_{ih}}} \qquad (6)$$

$$= \frac{p_{ih}x_{ih}}{E} \qquad (7)$$

$$= w_{ih}, \qquad (8)$$

where x_{ih} represents the imports of *ih* and w_{ih} the proportion of the budget associated to *ih*. Thus,

$$w_{ih} = \alpha_{ih} + \sum_{jk}\tfrac{1}{2}\gamma^*_{ihjk}\ln\big(p_{jk}\big) + \sum_j\tfrac{1}{2}\gamma^*_{jk\,ih}\ln\big(p_{jk}\big) + \beta_0\beta_{ih}\,u\prod_{jk}p_{jk}^{\beta_{jk}}. \qquad (9)$$

If we define $\gamma_{kj} = \frac{1}{2}\big(\gamma^*_{kj} + \gamma^*_{jk}\big)$, the expression reduces to

$$w_{ih} = \alpha_{ih} + \sum_{jk}\tfrac{1}{2}\gamma_{ihjk}\ln\big(p_{jk}\big) + \beta_0\beta_{ih}\,u\prod_{jk}p_{jk}^{\beta_{jk}} \qquad (10)$$

Solving the equation (*) for *u* and substituting in the previous equation produces

$$w_{ih} = \alpha_{ih} + \sum_{jk}\gamma_{ihjk}\ln\big(p_{jk}\big) + \beta_{ih}\ln(E/P^*) \qquad (11)$$

where

$$\ln(P^*) = \alpha_0 + \sum_{jk}\alpha_{jk}\ln\big(p_{jk}\big) + \tfrac{1}{2}\sum_{jk,ih}\gamma^*_{jk\,ih}\ln\big(p_{jk}\big)\ln(p_{ih}). \qquad (12)$$

In order to simplify the estimation of the parameters of the model, the Price index P^* is replaced by the Stone price index *P* given by

$$\ln(P) = \sum_{jk} w_{jk}\ln\big(p_{jk}\big), \qquad (13)$$

so that

$$w_{ih} = \alpha_{ih} + \sum_{jk}\gamma_{ihjk}\ln\big(p_{jk}\big) + \beta_{ih}\ln(E/P). \qquad (14)$$

Properties of the compensated demands

$$x_{ih} = \frac{w_{ih}}{p_{ih}}E \qquad (15)$$

impose some algebraic conditions. Namely,

Additivity: $\sum_{ih}\alpha_{ih} = 1,\ \ \sum_{ih}\gamma_{ihjk} = 0,\ \ \sum_{ih}\beta_{ih} = 0.$ (16)

Homogeneity: $\sum_{jk}\gamma_{ihjk} = 0.$ (17)

Symmetry: $\gamma_{ihjk} = \gamma_{jkih}.$ (18)

Marshallian elasticities can be derived in the following manner.

$$\varepsilon_{ihjk} = \frac{\partial\ln(x_{ih})}{\partial\ln\big(p_{jk}\big)} \qquad (19)$$

$$= \frac{\partial\ln(w_{ih}E/p_{ih})}{\partial\ln(p_{jk})} \qquad (20)$$

$$= \frac{\partial\ln(w_{ih})}{\partial\ln(p_{jk})} - \frac{\partial\ln(p_{ih})}{\partial\ln(p_{jk})} + \frac{\partial\ln(E)}{\partial\ln(p_{jk})} \qquad (21)$$

$$= \frac{\frac{\partial w_{ih}}{\partial\ln(p_{jh})}}{w_{ih}} - \delta_{ihjk} + 0, \qquad (22)$$

where the last term is zero since the expenditure remains constant for Marshallian demands. From (**) we see that

$$\frac{\partial w_{ih}}{\partial\ln(p_{jk})} = \gamma_{ihjk} - \beta_i\frac{\partial\ln(P)}{\partial\ln(p_{jk})} \qquad (22)$$

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$$= \gamma_{ihjk} - \beta_{ih} w_{jk}, \quad (23)$$

producing finally

$$\varepsilon_{ihjk} = -\delta_{ihjk} + \frac{\gamma_{ihjk}}{w_{ih}} - \frac{\beta_{ih} w_{jk}}{w_{ih}}. \quad (24)$$

The expenditure elasticities can be obtained in an analogous manner. The formula reduces to

$$\varepsilon_{ihE} = \frac{\beta_{ih}}{w_{ih}} + 1. \quad (25)$$

The restricted SDAIDS Model

In the source-differentiated model it is assumed that buyers discriminate every good by the origin. This means in our study that Japanese buyers discriminate say between swine meat from Canada or from the USA, and so on. This assumption has the inconvenience of a degrees of freedom problem. To reduce the number of parameters it is assumed that the cross price effects of different goods are independent of the countries of origin. Following Yang and Koo (Yang and Koo, 1994), we will refer to this assumption as *block substitutability* and has to be tested. For example, this assumption says that Japanese demand for USA beef exhibits the same cross-price response to swine from either Mexico, Canada, or from the Rest of the World. The corresponding model under block substitutability is known as *restricted source differentiated AIDS* model (RSDAIDS).

In the SDAIDS model cross price effects are parametrized by the coefficients γ_{ihjk}, with $i \neq j$. The block substitutability imposes some conditions on these γ_{ihjk}. Clearly the effect on changes in p_{jk} and p_{jm} on the demand of say x_{ih} depend on the sizes of the corresponding markets, i.e., the sizes of w_{jk} and w_{jm}. It is assumed then that the parameter γ_{ihjk} is proportional to w_{jk}. More precisely, we define first weights u_{jk} by first setting

$$w_j = \sum_k w_{jk}, \quad (26)$$

and then,

$$u_{jk} = w_{jk}/w_j. \quad (27)$$

So, for the RSDAIDS model there is a common value $\gamma_{ih\,j}$ such that for all origins k

$$\gamma_{ihjk} = u_{jk}\gamma_{ih\,j}. \quad (28)$$

It is convenient also to replace prices by the corresponding weighted mean, that is, to replace $\ln(p_{jk})$ by $\ln(p_j)$ for all origins k, where

$$\ln(p_j) = \sum_k u_{jk} \ln(p_{jk}). \quad (29)$$

Moreover, in order to simplify the notation the parameters $\gamma_{ih\,ik}$ will be simply denoted by $\gamma_{i\,hk}$. Expenditure proportions are now given by

$$w_{ih} = \alpha_{ih} + \sum_k \gamma_{i\,hk} \ln(p_{ik}) + \sum_{\substack{jk \\ (j \neq i)}} u_{jk}\gamma_{ih\,j} \ln(p_{jk}) + \beta_{ih} \ln\left(\frac{E}{P}\right) \quad (30)$$

$$= \alpha_{ih} + \sum_k \gamma_{i\,hk} \ln(p_{ik}) + \sum_{\substack{j \\ (j \neq i)}} \gamma_{ih\,j} \ln(p_j) + \beta_{ih} \ln\left(\frac{E}{P}\right) \quad (31)$$

Block substitutability conditions are very restrictive and some of the conditions on the parameters for the SDAIDS model are no longer applicable. For the RSDAIDS model the following conditions are imposed:

Additivity: $\sum_{ih} \alpha_{ih} = 1, \quad \sum_{ih} \beta_{ih} = 0$ (32)

Homogeneity: $\sum_h \gamma_{i\,hk} + \sum_{\substack{jk \\ (j \neq i)}} \gamma_{ih\,j} = 0$ (33)

Symmetry: $\gamma_{ih\,k} = \gamma_{ik\,h}$

The expressions for the Marshallian elasticities are now

$$\varepsilon_{ih\,j} = \frac{\gamma_{ih\,j}}{w_{ih}} - \frac{\beta_{ih} w_j}{w_{ih}} \quad (34)$$

for $i \neq j$, and

$$\varepsilon_{i\,hk} = \frac{\gamma_{i\,hk}}{w_{ih}} - \delta_{hk} - \frac{\beta_{ih} w_{ik}}{w_{ih}} \quad (35)$$

The formulas for the expenditure elasticities do not change in the restricted case.

The block separable SDAIDS Model

A further reduction on the number of parameters to be considered comes from assuming that if $i \neq j$, then

$$\gamma_{ih\,j} = u_{ih}\gamma_{ij}, \quad (36)$$

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Where

$$u_{ih} = w_{ih}/w_i \quad (37)$$

As above, and γ_{ij} is the cross-price parameter between groups i and j. Thus, sources are not differentiated when $i \neq j$. If we set

$$\beta_i = \sum_h \beta_{ih}, \quad (38)$$

It is not difficult to establish the following formula for the Marshallian elasticities for $i \neq j$ under the block separability assumption:

$$\varepsilon_{ij} = \sum_h u_{ih}\, \varepsilon_{ih\,j} \quad (39)$$

$$= \frac{1}{w_i}\left(\gamma_{ij} - \beta_i w_j\right) \quad (40)$$

Data and estimation procedures

Monthly data from August 2006 through September 2016 were used for the analysis. We considered two goods, beef and swine, being imported from four different origins, USA, Canada and Mexico (the members of NAFTA) as well as the imports coming from elsewhere. All data come from the Japan Trade Statistics, Ministry of Finance of Japan, and can be obtained from the website www.customs.go.jp/toukei/srch/indexe.htm

Due to the large number of observations, 122 in total for the above mentioned period, we were able to estimate the linear SDAIDS model under three different assumptions, namely, a complete SDAIDS model, a restricted RSDAIS model, and finally a RSDAIDS model assuming further block separability. In order to estimate all the parameters we used the SAS Syslin Iterated seemingly unrelated regression procedure with homogeneity and symmetry conditions imposed.

Estimated results

Hypothesis of product aggregation and block separability are both tested with the Wald F-test with the necessary parameters obtained by means of the Ordinary least squares estimation procedure. The corresponding results are presented in Table 4. Both product aggregation and block separability hypothesis are rejected at the significance level of 1%. Thus, the data support differentiating by sources both individually and as a whole.

The estimated Marshallian elasticities based on AIDS models with three different assumptions (block separability, block substitutability or RSDAIDS, complete SDAIDS) are presented in tables 5, 6 and 7, respectively.

Expenditure elasticities are all positive as theory asserts. However, they are not significant except for the case of the Mexican swine (0.667) in the restricted SDAIDS model. As expenditures on both beef and swine imports increase, most Japanese imports from NAFTA countries increase proportionally to their market sizes, as all expenditure elasticities are relatively close to 1.

Block Separability	Ho: Beef is separable from all other meats. $F = 44.26^{**}$ df: 1 for numerator and 115 for denominator
	Ho: Swine is separable from all other meats. $F = 960.25^{**}$ df: 1 for numerator and 115 for denominator
	Ho: All of the above. $F = 968.2^{**}$ df: 2 for numerator and 117 for denominator
Product Aggregation	Ho: Beef can be aggregated. $F = 33.8^{**}$ df: 4 for numerator and 116 for denominator
	Ho: Swine can be aggregated. $F = 26.48^{**}$ df: 4 for numerator and 116 for denominator
	Ho: All of the above $F = 7.42^{**}$ df: 8 for numerator and 107 for denominator

Note: Single and double asterisks (*) denote significance at the 5% and 1% levels, respectively.

All own-price significant elasticities for individual meats from different origins are negative, as it should be expected, except for the Mexican swine (3.806) in the separable case. The only elastic significant market corresponds to the Mexican beef in the three models: -2.351, -2.246 and -2.059, for the complete, restricted and separable SDAIDS models, respectively.

Cross price elasticities reflect competitiveness among certain products. Particularly, between the US and Mexican beef with 1.684 and 1.482 in the block separable model, 0.129, 1.462 in the restricted SDAIDS model and, 0.141, 1.600 in the complete SDAIDS model.

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Competition between Canadian and Mexican beef is also strong, where all elasticities are positive and significant in the three models: 0.707, 0.538 in the separable case, 0.980, 0.743 in the restricted case, and 0.812, 0.616 in the complete case.

It is interesting to observe that cross price elasticities between the US and Canadian beef are significantly negative in the restricted (-0.108 and -1.608) and in the complete (-0.139 and -0.617). Even in the separable case the elasticities remain negative (-0.039 and -0.617), even though these are not significant. This numbers reflect some complementary relationship contrary to what theory predicts. This may be related to the fact that both US and Canada suffered from the Bovine Spongiform Encephalopathy (BSE) between 2003 and 2005, and somehow Japanese consumers identify the two products as a single one.

	ub	*cb*	*mb*	*rb*	*us*	*cs*	*ms*	*rs*
pub	-1.339	-2.083**	1.600**	0.126	0.121	-0.281	0.127	0.020
pcb	-0.139**	-1.672	0.616**	0.005	0.031	0.331**	-0.157	-0.159*
pmb	0.141**	0.812**	-2.351**	-0.019	-0.125*	0.152	0.486	-0.068
prb	0.353	0.192	-0.494	-0.579**	-0.464**	-0.623**	-0.058**	0.268*
pus	0.258	1.064	-3.414*	-0.484**	-0.783	0.189	-1.046	0.421
pcs	-0.408	6.789**	2.372	-0.358**	0.109	-1.337	-2.306	0.871*
pms	0.041	-1.056	2.418**	-0.028	-0.199	-0.746	0.709	0.296
prs	0.072	-5.182**	-1.625	0.233*	0.439	1.436*	1.565*	-2.799
Y	1.022	1.135	0.879	1.102	0.871	0.881	0.681	1.150
R^2 = 0.675								
1% = ** 5%=*								

Table 5 Marshallian Elasticities of Japanese Meat Import Demand Using the SDAIDS Model

	ub	*cb*	*mb*	*rb*	*us*	*cs*	*ms*	*rs*
pub	-1.358	-1.608**	1.462**	0.135*				
pcb	-0.108**	-1.705*	0.743**	-0.005				
pmb	0.129**	0.980**	-2.246**	-0.021				
prb	0.372*	-0.213	-0.591	-0.604**				
pus					-0.898	0.185	-0.684	0.548
pcs					0.103	-0.934	-2.252	0.592
pms					-0.133	-0.729	1.499*	0.044
prs					0.559	113.000	0.324	-2.076
$\varepsilon_{ih\ j}$	-0.067	1.453**	-0.324	-0.602**	-0.500**	-0.382**	0.444**	-0.281
Y	1.031	1.093	0.957	1.098	0.869	0.854	0.670*	1.172
R^2 = 0.656								
1% = ** 5%=*								

Table 6 Marshallian Elasticities of Japanese Meat Import Demand Using the Restricted SDAIDS Model

The SDAIDS models allow us to analyze the relationship between the different beef and swine products. In the complete case the strongest substitute relationship is given between Canadian beef and Canadian swine whose elasticities are 6.789 and 0.331. The Mexican beef and Mexican swine also show a substitute behavior as the elasticities are now 2.418 and 0.486 in the complete case, and 1.4531 and 0.444, in the restricted case.

	ub	*cb*	*mb*	*rb*	*us*	*cs*	*ms*	*rs*
pub	-1.131	-0.617	1.684**	0.172**				
pcb	-0.039	-1.529	0.538**	0.022				
pmb	0.148**	0.707**	-2.059**	-0.022				
prb	0.449**	0.789	-0.622	-0.677**				
pus					-2.096	0.564	1.647	1.549**
pcs					0.321	-0.837	-4.432**	1.008**
pms					0.281	-1.437**	3.806**	-0.203
prs					1.456	1.655	-0.851	-2.592
$\varepsilon_{i\ j}$	-0.581				-0.835			
Y	1.110	1.448	0.969	1.099	0.875	0.870	0.433	1.154
R^2 = 0.657								
1% = ** 5%=*								

Table 7 Marshallian Elasticities of Japanese Meat Import Demand Using the Block Separable Restricted SDAIDS Model

Summary and Conclusions

The Source Differentiated AIDS model was applied to analyze the Japanese imports of beef and swine from the NAFTA countries. Both block separability and aggregation over product sources hypothesis were rejected at the conventional levels of significance (See Table IV). Hence, the data support differentiating by sources both individually and as a whole. The complete and the restricted SDAIDS models provide a more accurate description about the beef and swine Japanese imports from NAFTA.

As Yang and Koo (Yang and Koo, 1994: 407) point out, a country is regarded as having strong export potential in an import market if demands are for the product is insensitive to price change, but increases with import expenditure. The three NAFTA countries satisfy the second condition (large positive *Y* expenditure elasticities), but none satisfy the first one (due to large own price elasticities). Thus, in order to increase their exports all NAFTA countries must produce beef and swine more efficiently and be more competitive with the international market.

In the case of Mexico it is imperative to encourage the production of feed grain in order to make the production of Mexican meat more competitive in prices. This market is too important to be left aside. Mexican government should design policies to encourage the meat production and should provide the basic structure for the preservation and transportation of the meat exports in airports and ports of the country.

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References

Baumol, W J. and Binder, A.S., 'Economics: Principles and Policy', South-Western Cengage Learning, 11rd edition (2009), Marson, OH, USA, p. 50.

Cadena Carnica Bovina. Internet site: www.cadenacarnicabovina.org (Accessed September 2009).

Deaton, A., and Muellbauer, J. An Almost Ideal Demand System. Amer. Econ. Rev. 70(1980):312-326.

Dyck J.H. and Nelson K.E. Structure of the Global Markets for Meat. Agriculture Information Bulletin. Number 785. USA 2007.

Fields, K.H., Therrien, D.A., Halstrom, D., Haggard, J. and Clayton, P., International beef trade: a value proposition, Animal Frontiers, 8(3)(2018), 16-22.

Henneberry S. R. and Hwang S. H. Meat Demand in South Korea: An Application of the Restricted Source-Differentiated Almost Ideal Demand System Model. Journal of Agricultural and Applied Economics. 39, 1(April 2007):47-60. 2007 Southern Agricultural Economics Association

Henneberry S. R, and Mutondo J. E., Agricultural Trade Among NAFTA Countries: A Case Study of U.S. Meat Exports, Review of Agricultural Economics 31 (2009), 424-445.

Instituto Nacional de Estadística y Geografia (INEGI).

Internet site: http://www.inegi.gob.mx (Accessed in April 2009).

International Monetary Found. Financial Statistics Year Book

Internet site: www.imf.org/external/index.htm (Accessed August 2009).

Japan Animal Quarantine Service. Internet site : www.maff.go.ja/aqs/english/product/import.html (Accessed October 2009).

Jetro.Internet site: http://www.jetro.org.jp (Accessed April 2009).

Mutondo, J. E. Global demand for United States meats. Pro Quest Dissertations and Theses 2007. Vol. 0503, Iss.0664; p. n/a

OECD Statistics: Economic Outlook No. 85: Annual and quarterly data. Internet site: http://oecdstats.ingenta.com/OECD/TableViewer/tableView.aspx (Accessed in August 2009).

The Japan Times on Line. Obama calls for Japan to drop limits on beef. (05-18-2008).

Trades statistics of Japan, Ministry of Finance, www.customs.go.jp/toukei/srch/indexe.htm.

Veeman M. M., Veeman T. S., Adilu S. Analysis of East Asian Meat Import Demand: Market Prospects for Alberta and Canada. Project Report 02-04, AARI Project#990030. RURAL ECONOMY. Project Report. Department of Rural Economy. Faculty of Agriculture & Forestry and Home Economics. University of Alberta. Edmonton, Canada. 2002

WTO Bulletin Internet site: www.mre.gov.py/paginas/..../boletin 21620063.asp (Accessed in September 2009).

Yang S. R. and Koo W. W. Japanese Meat Import Demand Estimation with the Source AIDS Model. Journal of agricultural and Resource Economics, 19(2): 396-408 Copyright 1994 Western Agricultural Economics Association.