Effects of Tariffs and Technical Barriers on High- and Low-Value Poultry Trade*

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ABSTRACT

A perfectly competitive spatial partial equilibrium model is constructed to evaluate some of the policy effects on world poultry trade. The model simulates the trade flows among six key exporting and importing countries and two aggregate rest-of-world regions. Effects of removal of restrictions based on tariffs, tariff-rate quotas (TRQs) and sanitary regulations are evaluated maintaining a distinction between "high-value" (mostly white meat) and "low-value" (mostly dark meat) poultry products. Results suggest that removal of sanitary barriers alone has relatively little effect compared to removal of tariffs and TRQs, but has more effect if sanitary and other barriers are removed simultaneously. Imposition of new sanitary barriers against US products by Russia would also shift trade flows, with production rising in Brazil.

World poultry markets are one of the most rapidly growing sectors of the food industry. Poultry production rose six-fold between 1965 and 2000 to over 65 million tons. Consumption increases have exceeded population growth, with world per capita supplies of poultry meat tripling from 3.3 kg in 1965 to more than 10 kg in 2000. International trade has more than kept pace with this industry growth. World exports of poultry meat rose from 375,000 tons in 1965 to over 6.5 million tons in 2000. Thus, trade now accounts for about 10 percent of world consumption.

The objective of this paper is to evaluate the effects of sanitary barriers to trade related to avian and human health in the context of the broader set of economic factors and policy decisions that determine product flows in international poultry markets. Poultry flocks are susceptible to diseases that can spread domestically and across borders. Microbial contamination of poultry for human consumption is also a serious problem in the sector, as with other meats, and is addressed by health regulations in exporting and importing countries. In addition, intensive poultry production can cause local environmental problems through pollution of groundwater, and the conditions under which chickens are kept have been subject to criticism from health and animal-welfare advocates. Thus, poultry markets are subject to a complex mix of national and trade regulations, together with traditional (nontechnical) tariff and nontariff barriers. The 1995 Uruguay Round Agreements on Agriculture and on the Application of Sanitary and Phytosanitary (SPS) Measures have, to some extent, affected this mix, reducing or freezing levels of producer support while tightening the rules for sanitary measures.

To evaluate some of the policy effects on world poultry trade, a perfectly competitive spatial partial equilibrium model is constructed to simulate the trade flows among six key exporting and importing countries and two aggregate rest-of-world regions. We model the production, consumption, trade, and price outcomes maintaining a distinction between "high-value" poultry products, going into Japan the EU and elsewhere, and "low-value" poultry products, which are imported primarily into China, Russia, and other countries. Effects are evaluated from removal of restrictions based on tariffs and tariff-rate quotas (TRQs), sanitary regulations, or both types of barriers.

Model

A perfectly competitive spatial partial equilibrium model is used to represent the global poultry sector.[1] There are eight regions in the model: United States (US), Brazil, European Union (EU), Japan, China, Russia, a rest-of-world poultry exporting region (ROWE), and a rest-of-world poultry importing region (ROWM). The non-composite regions were chosen because

[1] The analysis developed herein builds on discussion of the global poultry industry, trade policies, and very preliminary assessment of policy impacts presented by Orden, Josling and Roberts in "Product Differentiation, Sanitary Barriers, and Arbitrage in World Poultry Markets" (chapter 8 of Global Food Trade and Consumer Demand for Quality (Barry Krissoff, Mary Bohman and Julie A. Caswell, editors), New York, Kluwer Academic /Plenum Publishers, 2002, pp. 147-164.

they account for a significant portion of world poultry production (approximately 70 percent) and poultry trade (approximately 90 percent of all exports and 75 percent of all imports).

Poultry Sector

All production, processing, and distribution activities within each region are aggregated into one industry. This level of aggregation is a simplifying assumption and reflects that for some regions, such as the United States, the production and processing activities are vertically integrated.

Because a wide range of poultry products is traded, two distinct poultry products are included in the model: high-value and low-value poultry products. The high-value poultry product includes white meat (breasts and wings) of chicken and turkey along with de-boned meat and specialty items. Low-value poultry is comprised of mainly dark meat (drumsticks and thighs) of chicken and turkey. This distinction is a reflection that certain countries, such as the United States, mainly export (or import) dark (or white) meat due to the preferences of domestic consumers. Because white and dark meats are produced in fixed amounts per bird, they are treated as jointly produced goods in the model.

All poultry firms are assumed to employ constant returns to scale technology.[2] This assumption is necessary in order for all firms to earn zero economic profits. For a perfectly competitive firm, the first-order condition for profit maximization states that price must equal marginal cost. Only in the case where marginal cost equals average cost will requirements of profit maximization and zero profits occur. Poultry firms are also assumed to use two aggregate inputs: an input that is specific to the sector and a non-sector specific input. The non-sector specific factor may be thought to consist of feed, fuel, and certain types of labor and capital that

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[2] The assumption that all firms employ constant returns to scale technology also permits aggregation across firms and an industry cost function will exist.

are not specific to the poultry sector.[3] The sector specific input may be thought to include physical and human capital, such as poultry houses or processing equipment that have little or no use outside of the poultry sector and management with specific knowledge about the poultry sector. Because the poultry sector is assumed to be a relatively small user of feed, fuel, etc., changes in the level of poultry production will not affect the price of the non-sector specific input. This implies that the supply of this input to the poultry sector is perfectly elastic. Conversely, in order to build more production or processing facilities or train new managers, the poultry sector must bid that capital away from other uses within the economy. Thus, the supply of the sector specific input is assumed to be upward sloping. This implies that to expand poultry output, the sector must use more of the specific input and pay a higher factor price, thereby increasing both marginal and average cost,[4] yielding an upward sloping poultry output supply function.

Consumer Demand

Consumer demand for poultry products in each region is represented by a four-level nested Constant Elasticity of Substitution (CES) demand system (see figure 1). At the bottom level, consumers choose among imported high-value poultry products or low-value poultry products. We have chosen to use an Armington specification for two reasons. First, within the high or low-value product categories, there is some variation across countries in the specific types of high or low-value products being exported. Thus, the low-value poultry being exported from the US is not exactly the same products as the low-value poultry from Brazil. Second, because it should cost the same to transport either low-value or high-value between two regions,

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[3] For example, lower skill workers employed in the production or processing activities of the sector.

[4] Only in the special case of all inputs being perfect substitutes would average and marginal cost not increase. Given the definition of the aggregate inputs used in the model, they are not viewed as perfect substitutes.

it is not possible to replicate the benchmark high-value and low-value trade flows assuming low-value and high-value poultry products are homogeneous.

In the second-level of the nested CES demand system, consumers choose between a domestically produced and an aggregate imported low-value or high-value poultry product. So if imports become more expensive relative to domestically produced poultry, consumers will substitute away from imports. At the third-level, consumers choose between aggregate high-value and low-value poultry products. If the aggregate price of high-value poultry, which is a function of the f.o.b. price of imports and the domestic price of high-value poultry, increases relative to the aggregate price of low-value poultry, consumers will increase their consumption of low-value poultry and decrease their consumption of high-value poultry. At the top-level of the demand system, consumers choose between an aggregate poultry product and all other products. This allows for consumers to increase or decrease their overall consumption of poultry products as the aggregate relative price of poultry changes.

Government Policies

The base year of the model is 1998. During that year, all non-composite regions imposed tariffs on imported poultry products. Table 1 summarizes the tariff levels imposed by these regions. The Japanese import market has the lowest tariffs of all of the non-composite regions. This in part reflects the Japanese government's encouragement of foreign investment by Japanese poultry firms in Brazil, Thailand, and China. China and Russia both have state trading structures that have survived economic reforms. This may allow these countries to direct trade towards particular exporters. Also, both China and Russia have contiguous countries (Hong Kong in the case of China, and the Baltic countries in the case of Russia) with lower or zero tariffs where trade may enter. In the past, poultry products have entered China through Hong

Kong, due to zero tariffs, good port facilities, and regulations discouraging direct sales to China.[5] In the case of Russia, transshipments of poultry products through the Baltic countries are being discouraged.

The EU has established tariff rate quotas (TRQ) that are allocated to Brazil, countries in Central and Eastern Europe who have quota-restricted preferential access under the Europe Agreements, Canada, and Mexico. Both the US and Brazil using use tariffs to protect their poultry markets.

Because poultry flocks are susceptible to diseases, particularly when they are kept in intensive production facilities, and microbial contamination of poultry meat is a serious problem, many countries have sanitary regulations that impose restrictions on exports from one or several countries. Table 2 summarizes whether there are binding sanitary (SPS) barriers between the six non-composite regions in the model. One might expect that these countries would divide into two groups, those free of highly infectious poultry diseases and those that are not free of disease, and trade would occur within each group. However, this is not the case. The major importers of poultry products, China, Japan, and Russia, accept imports from all exporting regions in the model. The two major exporters, the US and Brazil, do not accept imports from each other and also ban imports from China, given recurrent outbreaks of Newcastle Disease. The EU also bans imports from the US and from China.

The main point of disagreement between the US and the EU focuses on the use of end-of-line chlorine decontamination in US processing facilities. The EU does not consider this to be equivalent to trisodiummonophosphate or lactic acid decontamination, and therefore bans poultry imports from the US. Imports of poultry from Brazil into the US are banned based on

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[5] A recent US-China agreement has dealt with some of these problems and thus direct sales to China from the US are likely to increase.

intermittent outbreaks of poultry diseases in Brazil. It is interesting to note that the EU does not find Brazil's disease problem a reason to block imports. Finally, Brazil's SPS barrier against imports from the US is based on the decision that the inspection system for poultry processing plants in the US is not equivalent to its own.

Data

The benchmark bilateral trade flows are obtained from the United Nation's trade database.[6] The UN trade data distinguishes six, five-digit SITC categories for trade in poultry products. These SITC categories separate poultry into whole birds, cuts, and livers, as well as between fresh or chilled and frozen. The dominant SITC category is 01235, "Poultry cuts and offal (other than livers) frozen," which accounts for nearly 70 percent of world (excluding intra-EU) poultry trade. The next largest category is SITC 01232, "Poultry not cut in pieces, frozen," which accounts for approximately 20 percent of world poultry trade.

The UN trade database contains information on the quantity, in metric tons, and the value of poultry trade in each category. The bilateral trade flows were assigned to either the high-value or low-value category based on the computed unit value. For example, the computed unit values of US poultry exports to Japan is nearly twice of the computed unit value of US exports to China and Russia (see Table 3). Thus, all US poultry exports to China and Russia are assumed to be low-value products while all US exports to Japan are assumed to be high-value products. Table 4 shows all of the benchmark high-value and low-value bilateral trade flows. It is interesting to note that Japan is an importer of high-value products while China and Russia are importers of low-value products. The US and the EU are exporters primarily of low-value poultry products while China is an exporter of high-value products. Brazil exports both high- and low-value products.

[6] Access to the UN data was provided by Mark Gehlhar, ERS/USDA.

The level of poultry production for each region is given in the first column of Table 4. It is the 1998 estimate of poultry meat production obtained from the Food and Agriculture Organization (FAO) of the United Nations FAOSTAT database. Poultry production for the two composite rest-of-world regions is obtained by subtracting the quantity of poultry meat produced in China, the EU, Brazil, Japan, Russia, and the US from world poultry production. That estimate is then equally divided between the poultry importing rest-of-world composite region (ROWM) and the poultry exporting rest-of-world (ROWE) region.

Data on prices of high and low-value poultry products by region were not available. We estimated the overall magnitude of these prices based on the reported unit trade values and estimated transportation costs. Prices for each region were determined as part of model calibration process that is described in the next section.

Calibration

To implement the model, the parameters of the CES demand functions for poultry products, the supply functions for the poultry sector specific input, and poultry sector industry cost function must be chosen in order to replicate the benchmark data in Table 4. We will begin by describing the calibration procedures for the CES demand functions.

The CES utility and sub-utility functions for each level of the demand system in figure 1 can be expressed as:

$$U = \left\{ \sum_{j=1}^{n} \alpha_j^{1/\sigma} x_j^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}}, \ \sum_{j=1}^{n} \alpha_j = 1, \tag{1}$$

where α_j is a shift parameter to be determined during calibration, x_j is the quantity of good j consumed, n is the number of goods consumed, and σ is the elasticity of substitution for that level in the nested CES demand structure. The resulting demand function and true cost-of-living price index for each level are then:

$$x_j = \frac{\alpha_j p_j^{-\sigma} I}{\sum_j \alpha_j p_j^{(1-\sigma)}} \text{ and} \tag{2}$$

$$P_M = \left\{ \sum_{j=1}^{n} \alpha_j p_j^{(1-\sigma)} \right\}^{\frac{1}{(1-\sigma)}}, \tag{3}$$

where *I* is total or group expenditures, p_j is the price of good *j*, and P_M is the price index.

The calibration process for the CES demand system begins at high and low-value import sub-utility functions because it is the only level where both initial quantities and expenditure are observed. Because removing trade barriers could alter the observed pattern of trade, assuming that $\alpha_j = \alpha$, allows α_j to be eliminate from equations (2) and (3).[7] Otherwise, if region *i* did not import from region *j* in the benchmark, the only way for x_j to equal zero is for α_j to equal zero. But this would imply that corner solution represented by consumers in region *i* not purchasing imports from region *j* would be due to preferences only, excluding the possibility that a lower price would induce consumption. Clearly, this is not an appropriate assumption. The implication of assuming $\alpha_j = \alpha$ is that all imports will be consumed in equal amounts if all import prices are the same.

Using equation (2), the prices of imported high-value or low-value poultry products are determined to match the benchmark trade flows and expenditures. Because imported poultry products are likely considered good substitutes, an elasticity of substitution equal to 10 is used for all high-value and low-value imports. For example, consider the imports of high-value

[7] This is due to the ordinal properties of all utility functions. If all α's are equal in equation (1), then a monotonic transformation will allow them to be removed without altering the preference structure of the utility function.

poultry into Japan. In the benchmark, four regions, the US, Brazil, China, and ROWE export 461,000 mt. of high-value poultry to Japan at a value of $844.1 million. A system of four equations, representing the quantity of high-value poultry imported from each region, in four unknowns, the import prices, is then solved.[8] The resulting import prices are tariff inclusive f.o.b. prices. Thus, dividing the calibrated import price by the tariff rate and then subtracting the estimated transportation cost determines the domestic price for each of the exporting countries. Continuing with the Japan example, the calibrated import prices per mt. are $2,232 for the US, $2,262 for Brazil, $2,033 for China, and $2,124 for ROWE. Dividing by the assumed 10 percent tariff rate and subtracting the transportation costs given in Table 5 yields the domestic prices listed in Table 4 for these regions.[9] The domestic price of high-value poultry in Japan is estimated to approximately equal the average import price.

The same procedure is used to determine the import prices in all importing regions. The calibrated import prices of high-value poultry to the EU are not used to determine domestic prices in Brazil and ROWE because they contain TRQ rents. Also, the calibrated import prices for ROWM for high-value and low-value poultry are not used to determine domestic prices because an aggregate tariff rate is not available.

Once all domestic prices for all products have been determined, the parameters in the remaining CES utility and sub-utility functions are determined. However, since all remaining groups in the nested CES have only two goods, equation (2) is modified to:

$$x_j = \frac{\alpha p_j^{-\sigma} I}{\alpha p_j^{(1-\sigma)} + (1-\alpha) p_k^{(1-\sigma)}}. \tag{4}$$

8 The system of nonlinear equations is solved using the CNS solver in GAMS.
9 The transportation costs were adjusted slightly in order to round the poultry prices to the nearest $10/mt.

For example, consider the sub-utility functions that govern the substitution between domestic and import poultry products. Then x_j is the quantity of the high-value (low-value) domestic poultry product consumed, p_j is the domestic price, p_k is the import price index, determined using equation (3), σ is the elasticity of substitution, and *I* is expenditure on high-value (low-value) poultry products. Assuming elasticities of substitution of 8 between domestic and imported poultry products in the base case, only the parameter α is unknown in equation (4). Similarly, for the sub-utility function that governs substitution between high-value and low-value poultry, x_j is the aggregate quantity of high-value poultry consumed, p_j and p_k are the price indices for high-value and low-value poultry, σ is the elasticity of substitution between high-value and low-value poultry products (assumed to equal 0.5 in the base case), and *I* is total expenditure on poultry. Finally, at the top-level of the nested CES utility function, x_j is the aggregate quantity of poultry consumed, p_j and p_k are the price indices for poultry and all other products (which is assumed to be constant and equal to one), σ is the elasticity of substitution between poultry products and all other products (assumed to equal 0.25 in the base case), and *I* is GDP for the region.

The poultry supply elasticity in each region is derived from the zero profit condition, the demand for the specific factor, and the specific factor supply equation. Formally, the supply elasticity can be expressed as:

$$\eta_p^s = \frac{\eta_s + c_v \sigma_{vz}}{c_z}, \qquad (5)$$

where η_p^s is the poultry supply elasticity, η_s is the supply elasticity of the specific factor, c_v and c_z are cost shares of non-specific and specific factors, and σ_{vz} is the elasticity of substitution between the non-specific and specific factors in poultry production. Assuming that $\sigma_{vz} = 0$, the poultry supply elasticity depends on the specific factor supply elasticity and its cost share.

Results

The model developed in the previous section is used to analyze the impacts on the global poultry sector of four alternative policy scenarios. First, we remove all tariffs and TRQ's but leave any SPS barriers in place. Second, we remove only the SPS barriers. Third, we remove all trade barriers, a true free trade scenario. The final policy scenario is from current events, a Russian ban on low-value imports from the United States.

Removal of All Tariffs and Quotas

The removal of all tariffs and tariff rate quotas results in a 2.1 million mt, or 60.9 percent, increase in poultry trade (see table 6). Because the removal of all tariffs results in the reduction in the relative price of imported poultry products, exports of both high-value and low-value poultry products from the three main exporting regions, the US, Brazil, and ROWE increase. Conversely, imports of poultry products increase for the three main importing regions: Japan, Russia, and ROWM. To accommodate the increase in export demand, poultry production in the three main exporting regions increase while the increase in import competition leads to a reduction in poultry production in the three main importing regions. However, there are some interesting differences that occur within the main exporting and importing regions.

While the US is the largest exporter of low-value poultry in the base case, it is a relatively small exporter of high-value poultry. Thus, the US experiences about a ten times larger increase in low-value exports (530,000 mt.) compared to its increase in high-value exports (57,000 mt.). Since high-value and low-value poultry products are assumed to be produced jointly in fixed proportions, the increase in US poultry production required to meet the increase in the export demand for low-value products will result in more high-value poultry being produced than is necessary to meet the increase in high-value export demand. Thus, the US price of high-value poultry decreases by 2.6 percent in order to induce an increase in domestic consumption, while the US price of low-value poultry increases by 15.8 percent. This highlights the importance of the joint product assumption. In contrast, because Brazil and ROWE experience relatively similar increases in high-value and low-value export sales, the prices of high-value and low-value poultry both increase in these regions.

A similar situation occurs in Japan and Russia. Because Japan is an importer of high-value poultry only, any displacement of domestically produced high-value poultry by imported poultry will also result in a reduction in domestically produced low-value poultry. High-value imports to Japan increase by 40,000 metric tons while total consumption of high-value poultry only increases by 20,000 mt. Thus, some domestic high-value production is displaced, leading a reduction in domestic low-value production as well. Thus, the price of Japanese high-value poultry decreases in the face of import competition while the price of Japanese low-value poultry increases due to the joint reduction in Japanese poultry production. In Russia, who is an importer of low-value products only, the opposite situation occurs. Russian low-value poultry products are displaced by imported low-value poultry, leading to a reduction in Russia poultry production and an increase in the Russian price of high-value poultry.

While the EU and China are major exporters of low-value and high-value poultry products respectively, they are also major importers of high-value and low-value poultry respectively. The removal of the TRQ's in the EU results in a 670,000 mt increase in high-value imports into the EU. As was the case in Japan and Russia, this increase in high-value imports displaces a portion of the domestic high-value production in the EU, leading to a 9.3 percent decline in total poultry production in the EU. Because less low-value poultry is now produced in the EU, it can not take advantage of any increase in export demand due to the trade liberalization. As a result, low-value poultry exports from the EU declines slightly (4.3 percent). A similar situation occurs in China. The removal of Chinese tariffs on low-value poultry results in a 922,000 mt (103.6 percent) increase in low-value imports. This substantial increase in low-value imports displaces some Chinese low-value poultry production, resulting in a decline in Chinese high-value production as well. Thus, the Chinese are not able to respond to an increase in high-value poultry export demand, and their high-value exports drop by 60,000 mt or 25 percent.

Removal of SPS Barriers

In this scenario, all of the SPS barriers listed in table 2 are removed.[10] However, because the EU's TRQ is still in place, removal of the SPS barriers on US and Chinese imports is moot because these countries do not have quota rights. Thus, only the US's ban on Brazilian and Chinese poultry products and Brazil's ban on US and Chinese poultry products are removed. Since the US is a large exporter of low-value poultry, it is only likely that Brazil or China would export high-value poultry products to the US. But given the size of the US poultry sector and the differences in the bases prices plus transportation costs, it is unlikely that the lifting of the US sanctions would generate a significant amount of export sales. The same is true for US or Chinese exports to Brazil. Thus, because removing these barriers alone does not really improve the potential for increased trade, there is little change between the base case the results for this scenario.

[10] This does not necessarily imply that all such regulations are unnecessary or protectionist in intent. Full risk-based evaluation of the impact of alternative sanitary regulations and the consequences of their modification are needed to complete judgments about whether a particular regulatory barrier is an efficient and effective way of controlling health dangers. Here, we limit our analysis to the effects of removing these barriers between our aggregated regions, without providing a full assessment of whether doing so would raise sanitary risks among these trading partners.

Free Trade

Removing all trade barriers simultaneously, in particular all SPS barriers and the EU's TRQ, has a greater impact on world poultry industry than just the sum of removing the barriers individually. The important difference in the results between this scenario and when all tariffs and TRQ's were removed is that now the US and Chinese producers have access to the EU high-value poultry market. This leads to substantial increases in high-value export for both the US and China (470,000 mt. and 310,000 mt respectively), which displaces a greater amount of EU poultry production than in the tariff and TRQ removal case.

Russian Ban on US Low-Value Poultry Imports

An import ban on the US by Russia has the effect of lowering the demand for US low-value poultry products while increasing the demand for US competitors, namely Brazil and the EU. Consequently, the price of US low-value poultry falls while the price of low-value poultry from Brazil and the EU increases. These relative price changes cause a shift in the trade patterns in other regions as well. The US increases exports of low-value poultry to China by 232,000 mt and to the ROWM by 205,000 mt while Brazil and the EU experience lower export sales to these regions. The lower price of low-value poultry also spurs an increase in domestic consumption in the US by 190,000 mt. Overall, US poultry production declines by 110,000 mt or 0.7 percent and the US low-value price declines about 6 percent. However, the decline in the low-value price is at least partly offset by a one percent increase in the US high-value poultry price, due to a smaller supply being available. Thus, the impact of the Russian embargo on US poultry producers is softened, with the factor price of the poultry specific factor declining by only two percent.

Summary and Conclusions

Using a perfectly competitive, spatial equilibrium model, we show that the removal of tariff and technical barriers can substantially increase trade in poultry products. However, the removal of sanitary barriers alone has relatively little effect compared to removal of tariffs and TRQs, but has more effect if sanitary and other barriers are removed simultaneously. For example, elimination of the sanitary barriers against US poultry imports into the EU will not have any effect as long as the EU's TRQs are still in place. Imposition of new sanitary barriers against US low-value poultry products by Russia would also shift trade flows, but does not have as large impacts on US poultry producers as might by expected given the relative large initial US export sales to Russia.

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Table 1. Summary of Tariffs Rates Imposed by Non-Composite Regions

Region	Tariff Rates	Average Rate
US	Tariffs bound at $0.088/kg for whole chicken and $0.176/kg for parts (18-36 percent ad valorem).	25%
Brazil	Tariffs bound in the WTO at 35 percent on all poultry products.	35%
China	Tariffs of 45 percent on all poultry products.	45%
EU	Tariff of 299 ECU/mt. on whole chicken and 358 ECU/mt. on parts (18-60 percent ad valorem). Tariff-rate quotas established with quantities allocated to Brazil and Central and Eastern European countries.	20%
Japan	Tariffs of 11.9 percent on whole chicken and 8.5 percent on parts.	10%
Russia	Tariffs of 30 percent on chicken and 15 percent on turkey. Trade agreement with EU gives no special access to European imports. Restrictions on transshipments through Baltic countries.	22.5%

Source: USITC, USDA, and WTO Schedules

Table 2. Bilateral SPS Barriers to Poultry Trade

	Importers					
Exporters	US	Brazil	EU	China	Japan	Russia
US	--	Banned	Banned	Allowed	Allowed	Allowed
Brazil	Banned	--	Allowed	Allowed	Allowed	Allowed
EU	Allowed	Allowed	--	Allowed	Allowed	Allowed
China	Banned	Banned	Banned	--	Allowed	Allowed

Table 3. Unit Value of 1998 World Poultry Trade, SITC Code 01235, US Dollars per Metric Ton

	Importers							
							All Others	
Exporters	US	Brazil	EU	China	Japan	Russia	High-Value	Low-Value
US	--	--	--	647	1112	719	1555	808
Brazil	--	--	2505	717	1940	558	1774	476
EU	--	--	--	936	3358	712	1500	710
China	--	--	--	--	1890	--	1563	--
All Others								
High-Value	--	--	3264	--	2060	--	--	--
Low-Value	--	--	--	798	--	885	--	--

Source:

The UN trade data contained very small quantities of exports from Brazil to Russia, China to Russia, Japan to China, the EU to Japan, and All Others to the US, Brazil, and the EU. Because of their small magnitude, they are dropped from the benchmark trade flows.

Table 4. Benchmark Data

			Domestic Consumption (+), Exports (+), or Imports (-)								
Country	Production	Price	US	Brazil	ROWE	EU	China	Japan	Russia	ROWM	Net Trade
High-Value	(Million MT)	$/MT					(Million MT)				
US	7.589	1850	7.513					0.076			0.076
Brazil	2.485	1820		2.328		0.043		0.067		0.047	0.157
ROWE	4.885	1800			4.699	0.062		0.125			0.187
EU	4.379	2950		-0.043	-0.062	4.484					-0.105
China	5.675	1700					5.427	0.194		0.054	0.247
Japan	0.606	2150	-0.076	-0.067	-0.125		-0.194	1.067			-0.461
Russia	0.340	2250							0.340		0.000
ROWM	4.885	2150		-0.047			-0.054			4.986	-0.101
Total HV	30.844										
Low-Value											
US	7.589	500	5.627				0.491		0.683	0.789	1.962
Brazil	2.485	545		2.349			0.136				0.136
ROWE	4.885	600			4.750		0.126		0.010		0.135
EU	4.379	600				3.803	0.139		0.145	0.292	0.576
China	5.675	1090	-0.491	-0.136	-0.126	-0.139	6.565				-0.891
Japan	0.606	650						0.606			0.000
Russia	0.340	925	-0.683			-0.145			1.168		-0.827
ROWM	4.885	1040	-0.789			-0.292				5.966	-1.081
Total LV	30.844										
Total	61.688										

Table 5. Transportation Costs

	US	Brazil	EU	China	Japan	Russia	ROWE	ROWM
				Dollars per mt.				
US	--	190	180	181	179	195	250	260
Brazil	190	--	190	230	236	200	250	355
EU	180	190	--	173	235	212	250	239
China	181	230	173	--	148	240	181	448
Japan	179	236	235	148	--	235	131	250
Russia	195	200	212	240	235	--	464	250
ROWE	250	250	250	181	131	464	--	350
ROWM	260	355	239	448	250	250	350	--

Table 6. Model Results

Variable	Base Case	Remove Tariffs,TRQ	Remove SPS	Free Trade	Russian Ban
Total Poultry Production			(Million MT)		
US	15.18	15.53	14.98	15.94	15.07
Brazil	4.97	5.65	4.95	5.50	5.12
ROWE	9.77	10.37	9.77	10.20	9.77
EU	8.76	7.94	8.76	7.45	8.78
China	11.35	10.82	11.48	11.28	11.31
Japan	1.21	1.16	1.21	1.17	1.21
Russia	0.68	0.66	0.68	0.66	0.70
ROWM	9.77	9.54	9.79	9.45	9.71
Total	61.69	61.67	61.63	61.65	61.68
High-Value Price			($1,000/MT)		
US	1.85	1.80	1.83	1.84	1.87
Brazil	1.82	1.91	1.83	1.87	1.77
ROWE	1.80	1.86	1.80	1.83	1.80
EU	2.95	2.71	2.95	2.60	2.93
China	1.70	1.81	1.72	1.88	1.70
Japan	2.15	2.05	2.16	2.06	2.15
Russia	2.25	2.31	2.25	2.31	2.18
ROWM	2.15	2.24	2.15	2.22	2.16
Low-Value Price					
US	0.50	0.58	0.51	0.57	0.47
Brazil	0.55	0.65	0.53	0.65	0.64
ROWE	0.60	0.63	0.60	0.63	0.60
EU	0.60	0.72	0.60	0.75	0.62
China	1.09	0.92	1.08	0.90	1.08
Japan	0.65	0.70	0.65	0.69	0.65
Russia	0.93	0.83	0.93	0.83	1.04
ROWM	1.04	0.92	1.04	0.93	1.02
Total High-Value Exports			(Million MT)		
US	0.08	0.14	0.11	0.55	0.07
Brazil	0.16	0.51	0.20	0.47	0.19
ROWE	0.19	0.54	0.24	0.36	0.25
China	0.25	0.19	0.29	0.56	0.18
Total	0.67	1.38	0.84	1.95	0.68

Table 7. Continued

Variable	Base Case	Remove Tariffs,TRQ	Remove SPS	Free Trade	Russian Ban
Total Low-Value Exports			(Million MT)		
US	1.96	2.53	1.91	2.69	1.72
Brazil	0.14	0.63	0.16	0.61	0.38
ROWE	0.14	0.51	0.13	0.44	0.14
EU	0.58	0.55	0.58	0.40	0.65
Total	2.81	4.22	2.78	4.14	2.90
Total High-Value Imports					
US	0.00	0.00	0.14	0.14	0.00
Brazil	0.00	0.00	0.04	0.04	0.00
EU	0.11	0.78	0.11	1.11	0.11
Japan	0.46	0.51	0.46	0.50	0.46
Russia	0.00	0.00	0.00	0.00	0.00
ROWM	0.10	0.09	0.10	0.15	0.11
Total Low-Value Imports					
Brazil	0.00	0.00	0.05	0.04	0.00
China	0.89	1.81	0.84	1.65	0.97
Russia	0.84	0.86	0.83	0.87	0.75
ROWM	1.08	1.54	1.06	1.58	1.18
High-Value Consumption					
US	7.51	7.62	7.52	7.56	7.47
Brazil	2.33	2.32	2.31	2.33	2.37
ROWE	4.70	4.67	4.70	4.69	4.70
EU	4.48	4.75	4.49	4.84	4.50
China	5.43	5.20	5.40	5.13	5.42
Japan	1.07	1.09	1.06	1.08	1.07
Russia	0.34	0.33	0.34	0.33	0.35
ROWM	4.99	4.86	4.99	4.88	4.97
Low-Value Consumption					
US	5.63	5.23	5.58	5.28	5.82
Brazil	2.35	2.20	2.37	2.19	2.18
ROWE	4.75	4.68	4.75	4.66	4.74
EU	3.80	3.42	3.80	3.33	3.74
China	6.57	7.22	6.58	7.29	6.63
Japan	0.61	0.58	0.61	0.58	0.61
Russia	1.18	1.19	1.17	1.20	1.10
ROWM	5.97	6.31	5.95	6.31	6.04