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Impact of Sanitary and Phyto-Sanitary Agreements on World Trade of Poultry and Poultry Products

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Introduction

Rapid changes in information technology have been instrumental in stimulating consumers' awareness of diseases, food-borne diseases, infections, and health care at the national and international levels. As the volume of foods (both fresh and processed) traded in world markets has increased, consumers have called on international organizations to find efficient and effective ways to control disease transmission and outbreaks and minimize health risk. Outbreaks of food-borne disease vary in scale from limited or localized to large-scale, rapidly spreading events to many countries via international trade in affected commodities. According to World Health Organization (WHO) statistics, 2.2 million children die every year from diarrhea caused mostly by food (and water) contaminated by microbiological organisms in developing countries [14]. The situation becomes gloomier if we include casualties from food contaminated with chemicals; for example, the Dioxin incident that contaminated animal feed and other food products in some European countries in January 1999.

Food safety became highly publicized following the spread of Bovine Spongiform Encephalopathy (BSE) in cattle, which was found in England in 1986, and in other places in Europe, Japan, and Canada in May 2003, and the United States in December 2003. BSE (better known as mad cow disease) is suspected of causing variant Creutzfeld-Jacob disease (vCJD) in

humans. VCJD has a relatively low infection rate, but is always fatal, causing over 140 deaths worldwide since 1996.

Another food safety issue is the widespread use of antibiotics to cure diseases in animal and poultry husbandry that could potentially elevate the levels of antibiotic-resistant bacteria in humans. There are many other food safety issues, ranging from hard cheese made from non-pasteurized milk, representing a health hazard due to the possible presence of E-coli, to poultry and egg products infected with *Salmonella,* or *Campylobacter*, to storage requirements for perishable fresh and canned food products.

Since its inception in 1995, the World Trade Organization (WTO) has continued to promote multilateral trade negotiations toward reforming trade rules started by its predecessor, the Uruguay Round (UR) of the General Agreement on Tariffs and Trade (GATT), and other earlier rounds. While the GATT dealt with trade in goods only, the WTO established new trade rules directly related to health and health policies. Among others, the Sanitary and Phyto-Sanitary (SPS) Agreement is probably the most important. Implementing SPS measures has affected the flow of agricultural commodities, processed foods, and, in particular, poultry, shell-eggs, and processed egg products. Potential linkages between SPS Agreements and health-related issues could be direct when a disease together with a traded good crosses a border, or indirect when it comes to other national health protection and policies [12].

Food safety issues have become major issues in international and domestic markets of poultry meat, other processed poultry products, shell-eggs, and processed egg products for the following reasons:

- Food safety affects numerous components of the industry: feed manufacturing, live birds, handling and treatment of slaughtered carcasses, and many processed food items,
- Food safety affects many countries: currently these issues are considered to be a fast-rising health phenomenon affecting all trading nations,
- Food safety issues are not discrete short-lived events; their effect could extend for years,
- Food safety information is not directly linked to trade and other available data in a way that is useful for research studies, and
- Many aspects of food safety are not well supported by scientific evidence recognized by a consensus of poultry and egg producers and processors.

The major objectives of this paper are: 1) to identify major producers, exporters, and importers of poultry, shell eggs, and egg products; and 2) assess the effect of the 1995- introduced SPS measures on the flows of trade in world markets, comparing the pre- and post-SPS exports and export-shares of poultry, shell eggs, and processed egg products. First, some background on SPS agreements on health-related issues is presented.

Agricultural Trade and SPS Agreements

During the Uruguay Round Negotiations, some members were concerned that countries might increase allegations of human, animal, or plant health risks as non-tariff barriers to control or restrict imports that otherwise would be rising as a result of agreed-upon reductions of agricultural tariffs and subsidies. Consequently, near the end of the Uruguay Round, Members negotiated and approved the SPS to prevent such actions. The Sanitary and Phyto-Sanitary (SPS) Agreements specifically deal with rules on health risks related directly to agricultural commodity trade, which ensure food safety and the protection of human life from plant and/or animal-born diseases that can affect humans (zoonoses). It is important to emphasize that GATT 1947 Article XX (b) had already provided many general rules and measures to protect human, animal, and

plant life or health. These are also known as Codex Alimentarius Commission (CODEX), literally interpreted as "food code" and are a collection of internationally adopted food standards [8, 12].

The SPS Agreement of 1995 extended these rules and provided precise measures to avoid any temptation for their misuse. While it recognized Members' rights to determine the appropriate level of health protection, it ensures that the imposed SPS requirement "does not represent an unnecessary, arbitrary, scientifically unjustifiable, or disguised restriction on international trade." [12]. In other words, the SPS Agreement emphasized measures used to achieve high levels of health protection, or encouraged Members to use all measures "aimed at health concerns for which international standards do not exist, providing that they are scientifically justified."[12].

SPS measures are applied only to the extent necessary to protect human, animal, or plant life or health, and should be supported by scientific evidence to carry out assessments of risk to human health, animal, or plant life. The SPS Agreement applies to a certain range of health protection measures and is based on scientific justification. Different countries would address their national health policies differently. Therefore, health and trade policies can create synergistic actions in some cases, or create tensions in others, resulting in serious implications to world trade.

Unlike GATT, the SPS Agreement emphasizes how countries actually respond in the event of the sudden appearance of a health hazard-- more specifically, how governments could pursue national health objectives by imposing temporary trade restrictions. This may be why many disputes on SPS measures have been raised by several countries concerning trade in poultry, eggs, and products. For example, in July 1997, Venezuela banned the importation of U.S.

poultry and products following the detection of non-pathogenic Avian Influenza in some northeastern states. However, the import-ban was lifted in June 2000, when the disease was completely eradicated. Another notification was filed by Thailand in September 1998, protesting poultry imports by the Czech Republic, due to their relatively higher levels of arsenic acid that exceeded the acceptable Czech limits. Following a visit to Thailand by Czech experts, all restricting measures were lifted in October 1999.

Some disputes are still under investigation, including a complaint filed by the United States in September 1998, which expressed concerns about Swiss regulations on meat from animals treated with hormones, antibiotics, and similar products. Another unresolved notification was filed by Costa Rica in March 2002, complaining that Honduras imposed import restrictions on poultry meat due to avian influenza, avian infectious laryngotracheitis, Newcastle disease, and avian Salmonellas. Costa Rica claimed that there is no scientific evidence that these diseases could be transmitted through poultry meat. In the event that there is a lack of an International Office of Epizootics (OIE) standard for poultry meat for these diseases, the OIE is obliged to establish scientific proofs. This issue is still unresolved.

Notifications concerning eggs and egg products were filed by the United States in November 1998, indicating that Chile banned imports of eggs and egg products from birds raised in battery cages under Tariff Trade Quotes (TRQ), but imposed prohibitively high duties and strict labeling on imports outside the TRQ. The United States was concerned that the measures were not based on scientific evidence or on any risk assessment. Another unresolved issue was raised by the European Union in November 1998, querying whether U.S. measures on

refrigeration and labeling requirements for shell eggs are based on a risk assessment. In March 2002, Colombia stated that Venezuela banned imports of fertile eggs and day-old chicks due to an outbreak of avian flu in Colombia, but the ban was successfully lifted in March 2003.

Major Differences between SPS and TBT Agreements

In some cases, it is not easy to determine whether the introduced technical barriers are classified as Technical Barriers to Trade TBT or as SPS measures. Both have the goal of protecting life and health, but each entails different rights and obligations. To minimize confusion, WTO recognized only four categories as valid under the SPS Agreements. These are organized according to the object(s) they intend to protect:

- Protect human life or animal life from hazards caused by additives, contaminants, toxins or disease-causing organisms in their food, beverages and/or foodstuffs,
- Protect human life from the risks of plant- or animal-carried diseases (zoonoses),
- Protect animal or plant life from pests, diseases, or disease-causing organisms, and
- Protect a country from damage caused by the entry, establishment, or spread of pests (including invasive species).

If the protective measures do not fit the objectives of these four categories, they are considered TBT measures. In general, the TBT Agreement supports the following objectives under its jurisdiction. These include safeguarding national security, the prevention of deceptive practices, protection of human health or safety, and protection of the environment. The scope or responsibilities of both the TBT and SPS agreements seem at first to be overlapping. However, in reality sometimes the same government regulation contains both SPS and TBT measures. For example, a regulation on labeling may address safety issues and information about the content. In this case, notifications should be sent to both SPS regarding the safety issue, and to TBT regarding the content element. Other examples of overlap include the requirement that animals and their products come from disease-free areas, inspection of products for microbiological

contaminants, fumigation for products, and setting maximum allowable levels of pesticide residues in food [10].

Diseases Related to Poultry and Egg Trade

Major bacteria affecting poultry and eggs include *Salmonella, Campylobacter jejuni, Listeria monocytogenes,* and *Staphylococcus aureus*. *Salmonella enteritidis* (SE) and *Salmonella typhimuriam* (ST) are the most common strains in the United States. However, *Salmonella* is the most contentious in terms of trade disputes [3]. In addition, there are other important diseases that are transmitted by viruses, including the Exotic Newcastle Disease, and Avian Influenzas. Infected birds or eggs may not always have any apparent symptoms when they are alive. However, because infected birds harbor the bacteria in their intestinal traces, slaughtering and processing procedures can contaminate end products.

Most food safety issues are solved without actually having been raised at the SPS Committee meeting itself. WTO complaints referencing poultry products accounted for 8 percent of total WTO filed notifications during the first 5 years of the SPS Agreements [6].

Global Trade of Poultry, Shell-eggs, and Egg Products

World Production and Trade of Poultry

Between 1985 and 2001, per capita poultry meat consumption grew faster than pork, bovine (beef and water buffalo), lambs, goat, and other meat. World poultry meat output increased from 32.2 million tons in 1985 to 71.6 million tons in 2001, ranking second after pig-meat's 91.2 million tons and exceeding bovine meat's 59.2 million tons in 2001. To meet the generally

rising demand for all meats, poultry production rose the fastest by 129 percent, followed by pork (52 percent), sheep and goat meat (39 percent), and bovine meat (15 percent). In 2001, the major poultry producers were the United States with 23.5 percent of world production, followed by the EU (18 percent), China (12.6 percent), Brazil (8.9 percent), Mexico (2.7 percent), and Thailand (1.9 percent).

Major Poultry Meat Exporters

Worldwide, the poultry and egg sectors have developed dramatically since the 1980s, fueled by changes in technology, improved genetics, and economic reforms in several countries. World exports of poultry increased by 374 percent, from 1.7 million tons in 1985 to 9.6 million tons in 2001. In comparison, exports of pork rose by 106 percent, bovine by 52 percent, and sheep and goat meat by 5 percent. In 2001, the United States was the world largest exporter of poultry meat, accounting for 33.1 percent of the world total. In value terms, total U.S. exports of all fresh meats (poultry, bovine, pig-meat, sheep and goat) amounted to $6.2 billion in 2001. Due to higher beef and pig-meat prices compared with poultry, the export value of beef and veal ranked first at $2.6 billion, followed by poultry ($2.3 billion) and pig-meat ($1.3 billion) [11].

Poultry meat is exported in fresh, chilled, frozen, prepared, or preserved states. It also is shipped as whole birds, parts (white/dark meat), mechanically de-boned meat (MDM), livers, giblets, or chicken paws. Approximately 88 percent of poultry meat is exported in parts or whole as fresh, chilled, or frozen. This paper's analysis will concentrate on major exporters of fresh, chilled or frozen poultry meat, as categorized according to the UN database during 1989 to 2001[8]. Data indicated that nearly 72 percent of world poultry exports were shipped frozen (parts or whole)

and the remaining 28 percent is fresh or chilled. Exports of chicken parts made up 72 percent of total frozen exports and 67 percent of total fresh/chilled exports in 2001.

The majority of frozen poultry parts exports were from the United States (48 percent) followed by the EU (22 percent), Brazil (13 percent), and China and Thailand at about 6 percent each. In the whole-bird frozen poultry market, Brazil was the largest exporter, accounting for 49 percent, followed by the EU at 34 percent, and the United States at 6 percent in 2001 (table 1). Aggregating frozen parts and frozen whole birds into a single category, the United States was the world's largest exporter, accounting for 41 percent of total frozen poultry exports, followed by EU (24 percent), Brazil (19 percent), China (5.4 percent), and Thailand (4.8 percent).

In the export market for fresh/chilled poultry meat, the EU captured the major share, followed by the United States, Hungary, and China. The EU exported 76 percent of the whole bird world total, followed by the United States (12.5 percent) and China (5.5 percent). Likewise, the EU was the major shipper of fresh/chilled parts, followed again by the United States, Hungary, and China (table 2).

Major Poultry Meat Importers

The largest share of frozen poultry exports (parts and whole) were received by Russia, accounting alone for almost one-quarter of the world total in 2001. Hong Kong and China together account for another quarter of frozen poultry, followed by the EU, Japan, Saudi Arabia, and Mexico. Surprisingly, the Middle East countries were the world's largest importers of whole frozen poultry birds: with Saudi Arabia, Kuwait, Oman, Qatar, and Bahrain receiving almost half

of all imports. Major importers of frozen poultry parts were Russia, followed by Hong Kong, China, the EU, Japan, and Mexico.

Major importers of fresh/chilled parts were the EU, receiving 2/3 of world totals, followed by Mexico, Canada, and Japan. Fifty-eight percent of total whole bird imports were received by the EU. Within the EU, 27 percent of total fresh poultry meat (whole and parts) was imported by Germany, 16 percent by the United Kingdom, 15 percent by Belgium-Luxembourg, 11 percent by France, and 9 percent by the Netherlands in 2001. Likewise, Germany imported 22 percent of total EU frozen poultry, followed by the Netherlands, the United Kingdom, France, and Spain.

World Production and Trade of Eggs

Worldwide, there are two kinds of eggs produced-- primary or hen eggs, and other eggs (excluding hens). Hen egg production is the most significant, amounting to 93 percent of the world total. World egg production increased from 32.5 million tons in 1985 to 57.1 million tons in 2001, and grew at an annual growth rate of 3.7 percent. The major egg producers are China, accounting for 42 percent of the world production, followed by the EU, and the United States. China's egg production has steadily increased, by tripling from 1985 to 2001, while that of the United States has increased by 27 percent, and Japan by 17 percent. EU production has actually decreased by 3 percent during the same period.

Eggs are exported as eggs in the shell for direct consumption or hatching purposes (shell eggs), or as processed egg products such as yolk, egg white (albumen), and various mixtures, in liquid or dried forms. Worldwide total exports of shell eggs and processed eggs converted into shell

egg equivalent increased from 1.6 million tons in 1985 to 2.3 million in 2001. These exports were divided about evenly between shell eggs and all processed egg products. In the exports of shell eggs, the Netherlands is the main exporter, accounting for one third of the world total. Other shell egg exporters are Belgium-Luxembourg, Germany, the United Sates, and China. In the processed egg market, the Netherlands also scored about 20 percent of the world total, followed by Belgium-Luxembourg at 14 percent, France at 12 percent, and Germany at 11 percent. The EU is the major exporter of an aggregate of shell eggs and processed egg products, accounting for 62 percent of the world total. Other exporters include the United States, Malaysia, India, and Canada.

In value terms, U.S. exports of shell-eggs and processed egg products rose from $61.4 million in 1985 to $201 million in 2001. This amount accounted for 12 percent of world total export value, up from 6.1 percent in 1985.

The main importer of aggregate shell eggs and processed egg products was the EU, accounting for 60 percent. Other non-EU importing countries were Japan, Switzerland, and the United States. Likewise, the major importer of processed egg products was the EU, accounting for 63 percent of aggregate shell eggs and processed egg products in 2001. Japan ranked second at 14 percent of world total imports, followed by Switzerland and the United States.

Analysis of Export-shares of Poultry, Shell-eggs, and Processed Egg Products

Data Source

FAO was the major source of data on production, consumption, exports, and imports, among others. Available data on individual countries extended from 1961 to 2001. In addition, United Nations (UN) trade data on poultry were presented in several categories, including parts and whole--fresh, chilled, or frozen, livers, and offal's. However, UN trade data were available only for a relatively shorter period, extending from 1989 to 2002. Both sources of data were used along with other minor sources [10, 12].

Methodology

Multivariate regression models were used to estimate world export demand for poultry, eggs, and processed egg products. The models identified major variables such as prices and income, that have impact on trade flows. Further, a dummy variable attached to the time variable was added to the regression models to pick up change in global exports after the inception of the SPS Agreements in 1995. This approach assumes that SPS measures constitute the main constraint to the flow of trade that affects world exports in global markets. A new series of regression models were run, using the export shares, instead of total exports, as the dependent variable and maintaining the same specification and exogenous variables identified before. The new regression equations extended over 1986-2002, representing equal number of years before and after the inception of the SPS Agreement.

Specifically, world export demand is hypothesized to respond inversely to own-prices and directly to substitute prices, percentage growth rate of GDP, and a time trend that capture the

effect of technological changes in output. The two models are indicated in the following.

$$\mathbf{Ln\,(XQ)_t = \alpha + \beta\,Ln\,(P)i_t + \gamma Ln\,(P^*)j_t + \delta Ln\,(G)_t + \theta Ln\,(T)_t + \zeta\,D_t + \varepsilon_t}$$

$$\mathbf{Ln\,(SXQ)_t = \alpha + \beta Ln\,(P)i_t + \gamma Ln\,(P^*)j_t + \delta Ln\,(G)_t + \theta Ln\,(T)_t + \zeta\,D_t + \varepsilon_t}$$

Where $(XQ)_t$ and $(SXQ)_t$ represent total world exports and share-of-export (total exports divided by total production) in metric tons, respectively, in year t; $(P)i_t$ and $(P^*)j_t$ are export prices of commodity and prices for the close substitute in year t, respectively; $(G)_t$ is global GDP growth rate in year t; $(T)_t$ is a time variable; D is a dummy variable that assumes 0 from 1971 to 1994 and one from 1995 to 2002; ε_t is an error term; and α, β, γ, δ, θ, ζ are parameters to be estimated in the log functional form, representing intercept, own-price, cross-price, GDP growth rate, and time-trend elasticities, respectively. All prices were measured in real 2000 U.S. dollar terms and were deflated by a developed world consumer price index (CPI).

Statistical Results

Results of world export demand models using the Ordinary Least Squares (OLS) regression procedure are presented in table 1. As expected, the response of world total exports of poultry to its own-price is significant (at the 5-percent level) or highly significant (at the 1-percent level) in all models. The estimated model indicated that the elasticity of export demand and export shares for poultry meat, eggs, and each of the processed egg products were negative with respect to their own-prices. In the total export models (Table 4), where dried egg yolk and albumen were estimated using a shell-egg price as a substitute price, cross-price elasticities were positive and

inelastic, but statistically insignificant at the 5-percent level. In the export-share models, the cross-price elasticity of all eggs and processed products were positive, inelastic, and highly significant (at the 1 percent level) using poultry prices as the price of substitutes. In the shell-egg model, however, it was insignificant.

GDP growth rate was negatively correlated in all export models (except poultry), indicating that rising income, in real terms, is associated with decreasing export demand for eggs, and products. This inverse-relationship is in accordance with economic theory, indicating the inferiority of eggs and products in the ladder of consumer preferences for animal proteins. As income rises, consumers follow a general pattern to upgrade their protein diet from eggs toward poultry, beef, pork and mutton.

Dummy-variable coefficients (D) were highly significant and positive in all export models, except the shell-egg model that was negative and insignificant. The dummies indicate rising total export volume in post-SPS era (Table 3). D-coefficients showed different results in the export-share models; negative in egg models (shell eggs, processed egg products, and all eggs), but positive in poultry models. These coefficients were statistically significant and could indicate declining export-shares for the egg models and rising export- shares for poultry.

However, a more scrutinized residual analysis was run, using the error sum squares (ESS) of the restricted and unrestricted models to test for significance of the dummy variable as a systematic explanatory variable. ESS analysis will also determine whether the dummy variable represents a systematic variable that ought to be explicitly included in the regression models [3, 7]. F-value

for the ESS differences between the unrestricted model (without a dummy) and the restricted model (with a dummy) are significant at the 1-percent level in poultry, processed eggs, and dried yolk models. Similarly, F-tests are significant at the 5-percent in all eggs and dried liquids models, but insignificant in all other export models (Table 3). In export-share models, ESS differences in shell egg and all egg models were significant at the 5 percent level, and insignificant in processed eggs. They have negative signs, indicating declining export-shares since 1995 (Table 4). F-value for the ESS differences in the poultry model was positive and significant at 5-percent level, indicating a rising trend since 1995.

These latter results for all eggs and shell-eggs (negative and highly significant) and for processed egg product (insignificant) in export-shares were confirmed using a paired-difference t-test [5].

Discussions and Implications

The study shows that total exports as well export-shares of poultry meats have been increasing since 1995, suggesting that the SPS agreements which assume the quality of eggs and poultry have been positively contributing to rising global trade of poultry while addressing global food safety concerns. Safeguarding health is an unquestionable objective in the context of the SPS Agreements. The United States, the EU, and Brazil were the world largest exporters, abiding by SPS measures to ensure the safety of their products. In order to participate in the global economy, major poultry diseases were regionalized in few countries and poultry exports were quickly banned for a few months or years, until diseases were eradicated. During that time, other disease-free regions/countries increase production to fill the export-gap in world markets. Production cycles are shorter in poultry (7 weeks for broilers) compared with other meat and thus poultry is cheaper to produce. Consequently, the export shares of poultry rose the fastest

from 5.3 to 12.9 percent, preceding all other meat such as beef and pork, which rose from 8.4 to 12.4 percent and from 5.7 to 8.2 percent, respectively during 1985-2002. Mutton and lamb export shares actually declined from 13.2 to 10.9 percent during the same period.

The study also shows that the world total aggregate export shares of all eggs (shell-eggs and processed egg products) have been declining during the same period. However, by disaggregating, shell eggs were significantly lower than the pre-SPS era, while processed eggs were insignificant, implying that their shares stayed unchanged. The decrease in shell egg export-shares was strong enough to pull down all egg export-shares below their pre-SPS levels (see figure 2).

Shell eggs are more risky because they are important carriers of *Salmonella* and other diseases if the shells are not properly disinfected or fumigated. Shell eggs are alive, constituting a fertile media for disease-dissemination, especially when used for hatchery purposes. Consequently, many countries restrict imports to protect their domestic poultry flocks and their citizens' health. Human infection with *Salmonella* has been on the rise since the start of large-scale production operations and processing plants that make poultry and shell eggs an inexpensive and affordable source of protein. Consequently, the poultry and eggs industries, especially in developed countries, carried out intensive research to reduce *Salmonella* at all stages of production from the hatchery to dressed and chilled carcasses. In developed countries, the poultry and egg industries introduced substantial changes to control the rising *Salmonella*'s infection in eggs. In addition, several improvements were achieved to elevate hygienic conditions in farms, layer houses, egg-collection plants, packing operations, and transporting vehicles. For example, controlling

Salmonella infection in broilers includes crate cleaning, disinfection, and hygiene, starting with disinfection in the feed mills [1, 2]. Other recommendations include the use of peroxygen disinfectant to clean transportation crates, the fumigation of eggs for hatching, and vaccination of breeding and laying flocks. All of these measures were successfully implemented in developed countries, but were less common in most developing countries, except a few such as Brazil, Mexico, China, and Thailand.

Over the last few years, some poultry exporters alleged that non-tariff-barriers are quietly being used as instruments to restrict the flow of trade under the SPS umbrella, especially by the United States and the European Union. Many developing countries consider that food safety quality standards are set too high. As a result, they are deprived of a fair share of international trade. Allegation is sometimes difficult to justify on health grounds, but countries contend that it should not matter where unsafe poultry or eggs come from. If these products contain any hazardous contaminants, they should be equally unwelcome regardless of origin.

Developing countries will need to elevate or improve their sanitary standards, but will need substantial investments to achieve that goal. This issue has been recognized by Article 9 of the SPS Agreement, which recommends technical assistance to developing countries to build, improve, or complete their structure building. Currently, the WHO together with Food and Agriculture Organization (FAO) provides technical assistance to countries to help them conform to SPS requirements to improve food safety control systems by strengthening National Codex Committees, providing training in risk analysis, surveillance, and control of food-borne diseases.

Concluding summary

Multivariate regression models were developed to estimate world export demand for poultry, eggs, and processed egg products. Major variables included own-price, substitute price, GDP annual growth rate, and a time trend to capture technological advancements in output. The GDP variable was negatively correlated with exports in shell eggs, and some processed egg products, indicating egg inferiority in the ladder of consumer preference for animal proteins. In the poultry export-share model, GDP variable was positive but insignificant. Residual analysis of the error sum squares of unrestricted and restricted equations after the inclusion of dummy variables, indicated that poultry exports rose in the post-SPS, as showed by the significance of the F-test. Similarly, total exports rose in post-SPS era in all eggs, processed egg products, and in dried yolk and liquids.

Regression analysis of pre-SPS and post-SPS export shares of poultry was positive, indicating a significant rise in poultry export-shares since the inception of the SPS Agreements in 1995. In all eggs, shell eggs, and processed egg products the coefficients were negative and significant, indicating a declining export shares. However, analysis of ESS was a stronger methodology, showing that post-SPS export-shares were significant only in all egg and shell egg export-shares models, but insignificant for processed egg products. Processed egg products are considered less than a health-hazard compared with shell eggs because they are cautiously handled and prepared during manufacture.

The paper suggests that the SPS Agreements, among other factors, were instrumental in expanding world trade of poultry meat by addressing global food safety measures in providing a high quality of poultry exports. Declining export-shares of shell eggs is mainly due to precautionary measures undertaken by importing countries to protect their poultry flocks and the health of their citizens. Shell eggs are important carriers of *Salmonella*, the most contentious in terms of trade dispute, as well as other diseases on the shells, if not properly disinfected or fumigated. Industrial countries introduced several measures to control *Salmonella*'s infection in eggs, but not in many developing countries, except a few such as Brazil, China, Mexico, and Thailand.

Allegations that SPS measures serve as non-tariff-barriers to restrict the flow of world trade are difficult to justify on health grounds. But the role of SPS Agreements in restricting unsafe trade of poultry or eggs in world markets is considered successful and reassuring to many poultry and egg importing countries.

References

1. Corry, J.E.L. and V.M. Allen. "Sources of Salmonella on Broiler carcasses during transportation and processing: modes of contamination and method of control." *The Society of Applied Microbiology*, 2002.

2. Hope, B.K., et al., "An Overview of the Salmonella Enteritidis Risk Assessment for Shell Eggs and Egg Products." *Risk Analysis*, Vol. 22, No. 2, 2002

3. Maddala, G.S., *Econometrics*, McGraw-Hill Book Company, New York, 1977.

4. Mathews, K.H. Jr, J. Bernstein, and J.C. Buzby. "International Trade of Meat/Poultry Products and Food Safety Issues," Chapter 4 in "*International Trade and Food Safety, Economic Theory and Case Studies,"* by J.C. Buzby, editor, *Economic Research Service, UDSA, Agriculture*; Economic Report Number 828, Washington, DC, 2003.

5. McClave, J.T., F.H. Dietrich, II. "*Statistics,"* Delten Publishing Company, San Francisco, 1979, pp. 681.

6. Orden, D., T. Josling, and D. Roberts. "Product Differentiation, Sanitary Barriers, and Arbitrage in World Poultry Markets," *Global Food Trade and Consumer Demand for Quality, Krissof et al (eds)*, Kluwer Academic/Plenum Publishers, New York, 2002, pp. 147-164.

7. Pindyck, R., D Rubinfeld, *Econometric Models and Economic Forecasts*, Second edition, McGraw-Hill Book Company, New York, 1981.

8. REPORT, "*Evaluations of the CODEX ALIMENTARIUS and other FAO and WHO Food Standards Work"*, FAO/WHO Publication, Rome, November 15, 2002.

9. Taha, F.A. *"The Poultry Sector in Middle-Income Countries and Its Feed Requirements,"* Economic Research Service*, UDSA, Agriculture*; Agriculture and Trade Report, WRS-0302, Washington, DC, 2003, pp. 42.

10. United Nations Trade Data, http://intranetapps.fas.usda.gov/untrade/, April 2004.

11. United Nations Food and Agriculture Organization (FAO). FAO database, http://faostat.fao.org/, April 2004.

12. World Trade organization, "*Committee on Sanitary and Phytosanitary Measures, Document."* G/SPS/GEN/204/Rev.3, March 26, 2003. pp. 122.

13. *WTO Agreements & Public Health*—A Joint Study by the WHO and the WTO Secretariat, 2002, page 129.

14. World Health Organization, *WHO Global Strategy for Food Safety*, Food Safety Program-2002, World Health Organization, 2002. http://www.who.int/fsf.

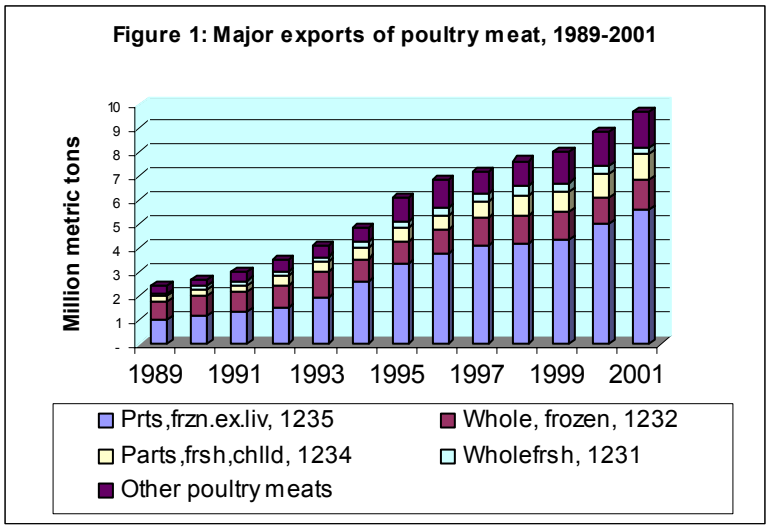
Figure 1: Major exports of poultry meat, 1989-2001
Million metric tons
10
9
8
7
6
5
4
3
2
1
-
1989
1991
1993
1995
1997
1999
2001
Prts,frzn.ex.liv, 1235
Whole, frozen, 1232
Parts,frsh,chlld, 1234
Wholefrsh, 1231
Other poultry meats

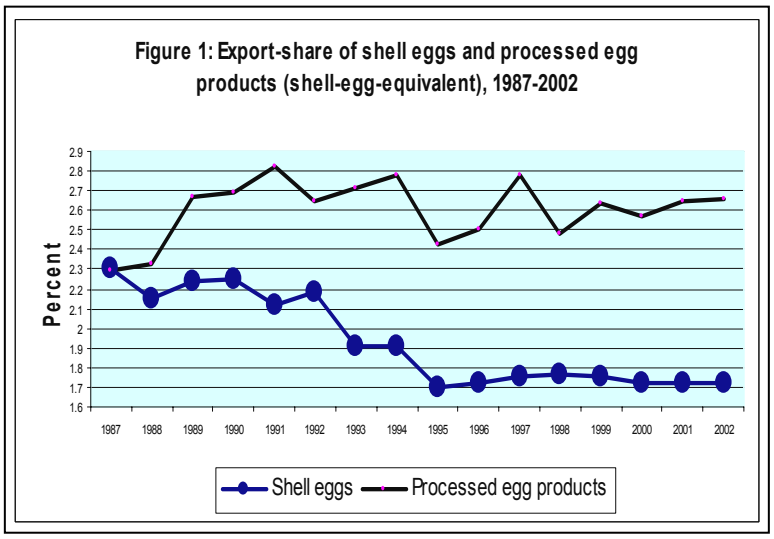
Figure 1: Export-share of shell eggs and processed egg products (shell-egg-equivalent), 1987-2002
Percent
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Shell eggs
Processed egg products

Table 1: Major exporters of frozen poultry, in 2001

Exporters	Whole birds		Parts		Total frozen	
	1,000 tons	Share	1,000 tons	Share	1,000 tons	Share
United States	70.1	5.9	2,711.80	48.3	2,782	40.9
EU-15	403.9	34	1,222.10	21.8	1,626	23.9
Brazil	583	49.1	734.3	13.1	1,317	19.4
China	26	2.2	343	6.1	369	5.4
Thailand	1.8	0.2	328	5.8	330	4.8
Canada	2.1	0.2	72.2	1.3	74	1.1
Hungary	33.3	2.8	44.1	0.8	77	1.1
Poland	8.5	0.7	17.8	0.3	26	0.4
Others	58.6	4.9	144.7	2.6	203	3
Total	1,187.2	100.0	5,618.0	100.0	6,805.2	100.0

Source: United Nations Statistics Division, Website http:// intranetapps.fas.usda.gov/untrade/June 2004

Table 2: Major exporters of fresh and chilled poultry, in 2001

Exporters	Whole birds		Parts		Total fresh or chilled	
	1,000 tons	Share	1,000 tons	Share	1,000 tons	Share
EU-15	209.9	76.1	789.1	70.8	999	71.9
United States	34.4	12.5	170.6	15.3	205	14.7
Hungary	1.6	0.6	36.2	3.3	37.8	2.7
China	15.2	5.5	18.5	1.7	33.7	2.4
Poland	0.7	0.2	9.4	0.8	10	0.7
Canada	4.8	1.8	3.8	0.3	8.6	0.6
Others	9.3	3.4	86.9	7.8	96.2	6.9
Total	275.9	100	1,114.40	100	1,390.40	100

Source: United Nations Statistics Division, Website http:// intranetapps.fas.usda.gov/untrade/June 2004

Table 3 : Analysis of poultry, eggs and product Exports,1971-2002

Explanatory Variables	Intercept	Own price	Shell egg price	GDP	Time	Adj-R^2 without dummy	Adj-R^2 with dummy	Dummy	Models' F-test restricted vs. unrestricted
Poultry	22.95** {15.9}	-1.197** {7.48}	N/A	-0.024 {0.31}	0.371** {4.24}	0.927	0.957	0.548** -4.69	22.01**
All eggs	16.17** {24.47}	-0.297** {3.92}	N/A	-0.061 {2.01}	0.209** {6.89}	0.896	0.912	0.114** {2.50}	6.25*
Processed eggs	16.64** {14.08}	-0.042** {3.18}	N/A	-0.058 {1.14}	0.19** {3.52}	0.793	0.813	0.24** {3.27}	10.70**
Shell eggs	13.93** {29.64}	-0.123** {2.29}	N/A	-0.041* {1.88}	0.217** {8.24}	0.925	0.923	-0.043 {1.12}	1.25
Yolk, dried	15.67** {8.45}	-1.225** {1.93}	0.653 {0.83}	-0.165* {1.79}	0.287** {2.45}	0.779	0.846	0.453** {3.58}	12.78**
Albumen, dried	16.24** {13.54}	-0.936** {2.82}	0.513 {1.37}	-0.144** {2.46}	0.194** {2.88}	0.813	0.838	0.21* {2.23}	4.97**
Liquids,dried	15.57** {20.78}	-0.356** {4.47}	N/A	N/A	0.157** {4.07}	0.822	0.852	0.166** {2.63}	6.69*
Liquids	14.44** {17.19}	-0.405** {4.10}	N/A	N/A	0.134** {3.48}	0.801	0.821	0.124* {2.03}	4.11

Critical value for F-test at v1=1, v2=27 is 4.22 for 5 percent significance and 7.77 for 1 percent significance level.
N/A = Not Applicable

Table 4: Share- export analysis of eggs and products,1987-2002

Explanatory Variables	Intercept	Own price	Poultry Price	% GDP	Time	Adj-R^2 without dummy	Adj-R^2 with dummy	Dummy	Models' F-test restricted vs. unrestricted
Poultry	0.074	-0.217*	N/A	0.085	1.158**	0.942	0.962	0.21**	8.96*
	{0.054}	{1.79}		{1.44}	{7.20}			{2.99}	
All eggs	1.877**	-0.418*	0.376**	N/A	N/A	0.522	0.702	-0.099*	5.22*
	{3.24}	{2.28}	{3.16}					{2.28}	
Shell eggs	9.26	-0.231	0.294	N/A	-0.552	0.835	0.889	-0.220**	8.204*
	{1.33}	{1.62}	{1.67}		{1.39}			{2.86}	
processed eggs	-0.933	-0.583*	0.641**	N/A	0.514**	0.543	0.586	-0.095	3.15
	{1.10}	{2.01}	{2.63}		{3.68}			{1.77}	

Critical value for F-test at v1=1, v2=12 is 4.75 for 5-percent significance level, and 9.33 for 1-percent significance.
N/A = Not Applicable.