# TWO ESSAYS ON THE SANITARY AND PHYTOSANITARY REGULATIONS AFFECTING MEXICO-U.S. AGRICULTURAL TRADE

by

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## ABSTRACT

Sanitary and Phytosanitary (SPS) regulations are designed to impede the unintentional movement of pests. In an attempt to reduce concerns about the use of SPS regulations as hidden barriers to trade, the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA) mandate their members to enact SPS regulations based exclusively on biological scientific merit, under an open regulatory process. However, there are some concerns among American officials about the possibility that Mexico may have enacted stricter-than-necessary SPS regulations to compensate for tariff reductions imposed by NAFTA.

A political economy analysis of the enactment of SPS regulations in Mexico suggests that Mexico has not systematically enacted SPS regulations as compensation for tariff reductions. Institutional changes, new regulatory procedures, and political commitment, have reduced the possibility that Mexico enacts economically protectionist SPS regulations, forcing vulnerable domestic industries to seek for other primary sources of protection such as labeling requirements and anti-dumping investigations. In spite of such an improvement, Mexico has enacted some controversial SPS regulations. However, they were enacted not as a compensation for tariff reductions but mainly in retaliation for what Mexican officials perceived as American protectionist SPS regulations such as the former U.S. ban on Mexican avocados (denoted as the avocado case).

Mexican avocados are currently allowed to enter the country under a systems approach. The systems approach consists in several steps which successively reduce the probability of pest infestation. The last of these steps restricts imports only to the northeastern states of the U.S. A cost-benefit analysis (CBA) is applied to investigate the adequacy of the former U.S. ban on Mexican avocados, as well as the limited trade regulation which has replaced it. The analysis departs from previous deterministic CBA of SPS regulations by taking into account the uncertain nature of pest infestations. The stochastic CBA suggests that the limited trade regulation currently in place is suboptimal. By applying a systems approach only inside Mexico (allowing the free trade of pest-treated avocados), welfare gains with a marginal increase in risk would have been expected.

**Abstract**

## This Dissertation is Dedicated to

**My wife, *Daniela Verthelyi*.** I love and respect her very much. She is the smartest person I have ever known. And the sweetest. She is also very supportive and beautiful. Life is exciting and fun just because she is here. She makes me very happy!

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**My sister, *Silvia*.** Always laughing, always energetic, always brave in adversity.. "*aunque vengan degollando*"

**My nephews, *Sebastián* and *Tomás*.** They are smart, very smart. But most important, they are simply adorable. I am very proud of them.

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# ACRONYMS

| | |
|---|---|
| AGSAL | World Bank's Agricultural Adjustment Loans |
| AI | Avian Influenza |
| AMEG | *Asociación Mexicana de Ganaderos* (Mexican Livestock Association) |
| APA | Administrative Procedure Act |
| APHIS | Animal and Plant Health and Inspection Service |
| CAC | California Avocado Commission |
| CBA | Cost-Benefit Analysis |
| CEA | Cost-Effectiveness Analysis |
| CFR | Code of Federal Regulations |
| CNG | *Confederación Nacional Ganadera* (Mexican Livestock Association) |
| CODEX | Codex Alimentarius Commission |
| CONAPOR | *Confederación Nacional Porcina* (Mexican Pork Association) |
| CONASAG | *Comisión Nacional de Sanidad Animal* (Mexican Phytosanitary Agency) |
| CONASUPO | *Compañía Nacional de Subsistencias Populares* |
| CS | Consumer Surplus |
| CUA | Cost-Utility Analysis |
| DIGIF | *Dirección General de Inspección Fitosanitaria* (SPS Enforcement Agency) |
| DIGSA | *Dirección General de Salud Animal* (Animal Health Agency) |
| DIGF | *Dirección General Forestal* (Forestry Directorate) |
| DIGSV | *Dirección General de Sanidad Vegetal* (Plant Health Agency) |
| EC | European Community |

| | |
|---|---|
| EEP | Export Enhancement Program |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| ERS | Economic Research Service |
| ES | Expected Value of Surplus |
| ESA | Endangered Species Act |
| EU | Expected Utility |
| EUM | Expected Utility Model |
| EVFBP | Expected Value of Fair Bet Point |
| FAO | Food and Agricultural Organization |
| FAS | Foreign Agricultural Service |
| FDA | Food and Drug Administration |
| FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act |
| FSIS | Food Safety and Inspection Service |
| GATT | General Agreement on Trade and Tariffs |
| GOM | Government of Mexico |
| IMF | International Monetary Fund |
| IPPC | International Plant Protection Convention |
| MAP | Maximum Agreeable Payment |
| MERCOSUR | South American Trade Agreement (Argentina, Brazil, Paraguay, Uruguay) |
| MT | Metric Tons |
| NAFTA | North American Free Trade Agreement |
| NAPPO | North American Plant Protection Organization |
| NCA | National Cattlemen Association |
| NOM | *Norma Oficial Mexicana* |
| NOM-EM | *Norma Oficial Mexicana de Emergencia* |
| OMB | Office of Management and Budget |

| | |
|---|---|
| OP | Option Price |
| ORACBA | Office of Risk Assessment and Cost-Benefit Analysis |
| PPI | Potentially Pareto Improving |
| PPQ | Plant Protection and Quarantine |
| PROCAMPO | *Programa de Apoyos Directos al Campo* |
| PRRS | Porcine Respiratory and Reproductive Syndrome |
| PS | Producer Surplus |
| PSE | Producer Subsidy Equivalents |
| RDU | Rank-Dependent Utility |
| SAGAR | *Secretaría de Agricultura, Ganadería y Desarrollo Rural* (Secretariat of Agriculture and Rural Development) |
| SECOFI | *Secretaría de Comercio y Fomento Industrial* (Secretariat of Trade and Industrial Development) |
| SEMARNAP | *Secretaría de Medio Ambiente,Recursos Naturales, y Pesca* (Environment, Natural Resources, and Fishery Secretariat)) |
| SEU | Subjective Expected Utility |
| SEUM | Subjective Expected Utility Model |
| SPS | Sanitary and Phytosanitary |
| TBT | Technical Barrier to Trade |
| TIF | Mexican Approved Slaughter House |
| TGA | Therapeutic Goods Administration (Australia) |
| TSCA | Toxic Substances Control Act |
| U.S. | United States |
| USC | United States Congress |
| USDA | United States Department of Agriculture |
| VS | Veterinary Services |
| WTO | World Trade Organization |

| | |
|---|---|
| WTP | Willingness to Pay |

*Chapter I*

# INTRODUCTION

## I.1. The Problem in General

Agricultural trade conveys the risk of introducing exotic pests to areas previously free of them. Such risks have motivated the worldwide adoption of Sanitary and Phytosanitary (SPS) regulations designed to impede the unintentional movement of pests. Although SPS regulations are acknowledged as necessary, the possibility that such measures are established as disguised barriers to trade has concerned researchers (e.g., Hillman, 1978, 1991), domestic policy-makers, international organizations such as the World Trade Organization (WTO), and the members of regional trade arrangements such as the North American Free Trade Agreement (NAFTA).

In an attempt to reduce concerns about the misuse of SPS regulations, the WTO and NAFTA mandate their members to enact such rules based exclusively on biological scientific merit. Further, members have to enact SPS regulations based on open and transparent procedures. In this manner, the WTO and NAFTA are expected to reduce the scope of SPS regulations disputes to biological grounds, thus minimizing the influence of economically motivated interest groups in the regulatory process.

This dissertation focuses on SPS regulatory disputes between Mexico and the United States in the period 1993-1997, during which NAFTA has been negotiated and implemented. Although praised by its proponents and many experts in the U.S., it is not clear how successful NAFTA has been in avoiding the enactment of unfair SPS regulations. Evidence suggests that NAFTA's regulatory approach has not precluded the enactment of controversial barriers to trade. American officials have shown concern about the possibility that the

Mexican government may have enacted stricter-than-necessary SPS regulations in order to compensate domestic interest groups for the tariff reductions imposed by NAFTA (Office of the U.S. Trade Representative, 1996). The concern is that tariff reductions, together with a reduction in other support policies, may have motivated vulnerable Mexican agricultural interest groups to extract protection from the government of Mexico (GOM) by promoting the enactment of compensatory SPS barriers to trade.

The claim by some American officials that an eruption of trade-restrictive SPS regulations occurred in Mexico after NAFTA is difficult to evaluate. First, there is a lack of systematic knowledge about how SPS regulations are enacted in Mexico. No clear basis for understanding the factors that may shape Mexican SPS regulations into either biologically reasonable instruments or blatant barriers to trade is available. Second, even if all parts of the regulatory process were identified, the evaluation of SPS regulatory decisions is never straightforward. Interest groups and scientists may disagree about the evaluation criteria for SPS regulations. Economists, who are trained to apply Pareto improving criteria to chose among policies, may find it difficult to apply such a criterion when there is risk involved and preferences are not well known. Further, no such attempts to evaluate Mexican SPS regulations have been published.

### I.2. Goals of this Dissertation

This dissertation is designed to evaluate the presumption that Mexico has been enacting SPS regulations as a compensation for tariff reductions under NAFTA. It may be possible that at least some Mexican SPS barriers have been enacted taking in mind considerations other than pest-risk avoidance. Economic protection, as well as retaliation against U.S. regulations, may be a principal factor behind some of Mexico's SPS regulations. If that is the case, an economic evaluation of the most relevant SPS regulations affecting agricultural trade between Mexico and the United States is desirable. This dissertation has a twofold goal. First, this dissertation aims to investigate the political economy of Mexican SPS regulations. The factors that shape SPS regulations into scientifically sound devices or flagrant barriers to trade will be identified and analyzed. The political economy identification of the Mexican enactment of SPS regulations will be used to test the hypothesis that NAFTA has induced the enactment of compensatory SPS regulations. Second, this dissertation aims to evaluate the economic impact of a relevant SPS regulation. Such an evaluation will require the incorporation of the risk of pest infestation associated to the traded commodity into the welfare analysis of the regulation. Because past economic evaluations of SPS regulations were deterministic (in the sense that they had not considered the uncertain occurrence of pest infestations), a methodology to incorporate the pest risk into the economic analysis will be developed. The commodity to be evaluated is chosen based on its relevance to Mexican-U.S. SPS trade disputes, and according to the availability of the data required for the analysis (e.g., pest risk assessments). The commodity which better satisfies these two requirements is U.S. avocados. There is a close relationship between the political economy of several controversial Mexican SPS regulations and the U.S. ban on Mexican avocados (denoted as "the avocados case" from now on). Also, the difficult access to the pest risk assessment on Mexican SPS regulations makes the well documented avocados case the ideal vehicle to evaluate.

### I.3. Organization of this Dissertation

The dissertation is organized as follows. The two main objectives are pursued in separate essays, each including its own literature review, methods, results, and discussion chapters. Chapters II to V cover the first essay of this dissertation, which focus on the political economy of Mexican SPS regulations. Chapters VI to IX, cover the second essay, which focus on the economic evaluation of SPS regulations. A summation of this dissertation and a discussion about future lines of research is presented at the end.

# Essay I

# The Political Economy of Mexican SPS Regulations

*Chapter II*

# THE POLITICAL ECONOMY OF MEXICAN SPS REGULATIONS: INTRODUCTION

The first goal of this dissertation is to describe and understand the Mexican regulatory process for SPS regulations. The main factors behind the enactment of Mexican SPS trade restrictions will be identified, described, and analyzed in a political economy framework. More specifically, the possibility that Mexico has enacted compensatory SPS regulations is investigated by an evaluation of the following hypotheses:

Hypothesis H1: *Mexico has enacted SPS regulations as compensation for tariff reductions.*

Hypothesis H2: *Changes in the regulatory process in Mexico have facilitated the capture of Mexican regulatory agencies by domestic interest groups.*

Hypothesis H3: *The Government of Mexico (GOM) has instructed its agents to avoid confrontations with American officials and interest groups.*

Hypothesis H4: *The enactment of controversial SPS regulations is indicative that Mexican regulatory agencies have been captured by domestic interest groups.*

The evaluation of hypothesis H1 represents one of the primary objectives of this dissertation. The auxiliary hypotheses H2, H3, and H4 provide information necessary for the evaluation of H1. This first essay is organized as follows, Chapter III describes the methodology of political economy analysis, including a literature review on the theory of regulation. Chapter IV describes the legal framework by which SPS regulations are enacted in Mexico. Chapter V makes use of the political economy approach to evaluate the hypothesis that Mexico has not systematically enacted SPS regulations as a compensation for tariff reductions.

*Chapter III*

# POLITICAL ECONOMY: LITERATURE REVIEW

## III.1. Introduction

This chapter briefly reviews the literature that is relevant to the enactment of sanitary and phytosanitary regulations. A comprehensive review appears in Romano (1995). Most of the literature has been developed by American scientists, who implicitly have the American political framework in mind. Thus, most of the terminology developed in the literature fits well the American political system. However, the theory is general enough to be satisfactorily applied to other countries and political regimes. Section III.2 reviews the literature on capture of regulatory agencies. Section III.3 reviews the mechanisms available to politicians to monitor the performance of regulatory agencies.

## III.2. The Capture of Regulatory Agencies

Public interest theories claim that government intervention in the form of regulations may be required to alleviate market failures. Such an approach reflects a perception of the government as an omniscient, benevolent dictator (Swinnen and van der Zee, 1993). Departing from the public interest theories, Stigler (1971) developed the concept of a market for regulations, where supply and demand are represented by the government and interest groups, respectively. Stigler concluded that producers would be the winners of this competition against consumers because of i) their large per-capita stakes, which encourage them to organize to seek regulation, and ii) their relative small group size, which allows them to more easily overcome the cost of organizing. Stigler denoted this regulatory process as "capture," since the producers would at the end take control of the governmental agency supposedly created to regulate them.

Peltzman (1976) generalized Stigler's model by assuming a vote-maximizing regulator/politician who seeks political support from both consumers and producers. He concluded that in their search for political support, regulators face a trade off between consumers' and producers' wealth. Stigler and Peltzman provide a simple but fundamental model of a struggle between producers and consumers. Capture theory has subsequently been expanded to include competition between producers. For instance, Tollison (1991) describes the case of producers of butter seeking regulation that would raise the price of margarine.

The Stigler and Peltzman models assumed homogeneous interest groups. However, it has long been recognized that interest groups are rarely homogeneous (e.g., Olson, 1965). Building on this idea, capture theory has also been applied to explain why industries might ask to be regulated. Buchanan and Tullock (1975) postulated that such a situation may arise when firms within an industry are heterogeneous with respect to cost. Low-cost firms may seek regulations that increase operational cost for all members of the industry, forcing small, high-cost business to close. Low-cost firms might ask for such regulations when the advantage of reduced competition overweighs the increase in cost due to the regulation.

The existence of heterogeneous groups has also been applied to explain the existence of environmental regulations. Environmental regulations are difficult to explain by capture theory, since this theory predicts that only interest groups with large enough incentives are able to organize and obtain regulation (Farber, 1992). Bartel and Thomas (1987) and High and Coppin (1988) applied the idea of heterogeneity within industries to show that, based on environmental and safety concerns, high-cost firms may seek regulations that would act as barriers to entry. Becker (1985) pointed out that barriers to entry are one of the regulations most commonly sought by industries.

An alternative approach to explain the enactment of environmental regulations focuses on the supply side (Weingast, 1981, Farber, 1992). This approach explores the motivations of legislators and regulators to enact environmental regulations, which are difficult to explain by capture theories. Capture theories do not explain well how concentrated and powerful industries are outmanuvered over the enactment of environmental regulations by less organized consumers. The supply-sided theory of regulation, also termed New Institutionalism (e.g., Kalt, 1994), attempts to provide an explanation to the enactment of this type or regulations. Under the new institutionalism framework, institutions are viewed as exogenous, in a context that cannot be changed overnight. New Institutionalism views the supply of regulation as constrained by a set of laws and other rules. These guidelines must by followed by the players in regulatory process. Such a legal and institutional constraint may help to explain the enactment of environmental regulations unfavorable to powerful industries. New Institutionalism views the supply of regulations as constrained by a set of laws and other factors, i.e., poltical institutions, that every player must follow. For instance, Kalt (1994) pointed out that there are situations where precedent cannot be ignored. Kalt and Zupan (1984) showed that the inclusion of the prevailing ideology in the model may help to explain some "non-economic" regulations. Ideological constraints may explain why some outcomes of the regulatory process, even if beneficial for the most powerful interest groups, are never realized. The enactment of some environmental regulations may be explained by the presence of some of these constraints.

Weingast (1981) investigated the factors that encourage regulatory stability over time. He found that regulatory equilibrium arises when the three branches of government show stable policies towards the issue that is the focus of the regulation. More specifically, equilibrium occurs when there is low or intermittent presidential interest, clear court precedents with little expectation of change, and stable patterns in public opinion and the relative power balance of interest groups. In other words, equilibrium occurs when neither the Executive nor the Congress are induced to intervene, and the Courts have no incentives to rule against the current *status quo*.

### III.3. Governmental Oversight of Regulatory Agencies

Perhaps because the authors implicitly assumed a strong linkage between them, the Stigler (1971) and Peltzman (1976) models of capture do not separate the agency from the government. Their approach has been subsequently enriched by the separation of government and agencies and the description of their interrelations.

In order to differentiate agencies and government, McCubbins at al. (1987) pointed out that a key difference between them is that while politicians are subject to oversight by the electorate, agencies' officials are not. In consequence, the decisions of the agencies' officials may depart from the policies that the Congress and the President have chosen. Such a departure or "slack" may have undesirable consequences for politicians, who thus are induced to gain control over the agency.

The problem of bureaucratic compliance has been recognized as a principal-agent problem (Mitnik, 1975, 1980, Rose-Ackerman, 1979, Moe 1984). Under this framework, agencies are induced to comply with politicians by a system of punishments and rewards. There are several means available to politicians to punish and reward agencies. McCubbins at al. (1987) listed some of them: the removal or appointment of civil servants, appropriations and reauthorization bills, public hearings and investigations, legislation or executive orders.

The influence of government may vary across the different hierarchical strata of an agency. Rourke (1984) pointed out that career administrators at the top of an agency may have far more influence over the direction of an agency's policies than any of its professional employees. Professional employees are individuals with highly developed skills (e.g., pathologists, entomologists, etc.). The primary loyalty of professionals remains to their own profession. Because of their focus on their skills, professionals commonly have difficulty in seeing problems in their full complexity (e.g., Rourke, 1984, Wilson, 1984).

Administrators on the other hand are individuals who perform auxiliary but vital tasks like handling funds, coordinating the work of professionals, and establishing effective liaison with the community (e.g., Rourke, 1984, Wilson, 1984). While professionals are primarily committed to attaining the goals their skills orient them towards, administrators are more likely to emphasize economy in use of resources. Administrators are likely to be more sensitive than professionals to the need for compromise in pursuing objectives. Thus, the tendency is strong for career administrators, especially at the top of the organization, to adjust their recommendations to fit what they believe are the policy views of the political executive (Rourke, 1984).

Governmental influence may also vary according to the type and characteristics of the regulatory agency. Broadly speaking, there are two types of regulatory agencies, the independent commission and the line agency. They differ in the way their heads are appointed and removed. Line agencies are usually headed by a single individual who is appointed and removed by the Executive, sometimes without requiring congressional confirmation. Independent commissions are headed by several individuals whose appointment require confirmation by the Congress and serve for a fixed amount of time. The multi-head nature of independent commissions, and the fixed terms their heads must serve, tend to protect this type of agencies from the influence of both the Executive and the Congress. However, this same characteristic makes these agencies short of political support and thus vulnerable to the pressure of interest groups. On the other hand, line agencies tend to enjoy a political support that would make it more difficult for ouside interest groups to capture them. However, such a political dependence makes these agencies more accountable to the Executive's desires (e.g., Congressional Quarterly, 1982).

The Executive may control regulatory agencies through the appointment of loyal administrators at key posts, especially for line agencies. The Executive enjoys also some quasi-legislative mechanisms of control. Presidents can issue Executive Orders, directives and statements mandating what agencies do. The importance of the Office of Management and Budget (OMB) as a mechanism of control, especially for "major" regulations (i.e., those which an expected economic impact larger than $100 million) has been summarized by McCubbins at al. (1987), who pointed out that "before concerning themselves with how Congress may treat a budget request, agency heads may first negotiate approval of the funding levels they want from the OMB".

Weingast (1981) pointed out that the political power of any individual or organization is not unlimited. Thus, as for any scarce resource, the President's political power has to be applied in an economically efficient way. An efficient mechanism of oversight for the Executive means the President reserves his influential power only for his highest priority areas. In consequence, the Executive does not intervene in every on-going regulatory program. Only when a particular area becomes a high priority item on a president's agenda is the regulatory agency subject to the political influence of the Executive.

The enactment of new legislation could be used by the Congress to exert control of regulatory agencies. However, as Reagan (1987) pointed out, once some regulation is in place, corrective legislation is often not credible. Politicians, who are risk averse, prefer known policies that were agreed on in advance, rather than being involved in a on-going political struggle. Corrective legislation is not cost free, since it requires the political coordination of several members of the Congress and the President (McCubbins et al., 1987).

Agencies also may be controlled through administrative procedures. The traditional study of administrative law perceives these administrative procedures as a mean to ensure fairness in the agency's decisions. McCubbins et al. (1987) pointed out that administrative procedures may also serve as a vehicle for oversight and control of regulatory processes. Administrative procedures both limit the agencies' range of feasible regulatory options and allow the participation of important constituents in the decision-making process. This helps ensure that the agency is responsive to their interests, but open up the possibility of capture as well. Also, the characteristic delay of administrative procedures is a consequence of the requirement that agencies follow intricate decision making processes. Such a requirement allows affected constituents to "pull the fire alarm," that is, to alert the political principals and legislators to act before the *status quo* is altered (McCubbins et al., 1989).

McCubbins et al. (1987, 1989) argued that while the guidelines established by the Administrative Procedure Act (APA) are designed to ensure that agencies' policies are neither "arbitrary" nor "capricious" (by reducing an agency's information advantage over its political sponsors) they also increase the efficacy of ex post sanctions. Administrative procedures force regulatory agencies to share the information they have with all interest parties. Such an aperture favors transparency in the agency's actions. Transparency means more fairness for the interest parties. However, the existence of open and transparent regulatory processes do not eliminate the possibility of capture. Romano (1995) illustrates this point by describing how low-risk imports of European nursery stock were not able to enter the U.S. for more than 20 years because of some pest risk concerns. Such a ban was enacted in spite of the open and transparent regulatory process currently in place in the U.S.

*Chapter IV*

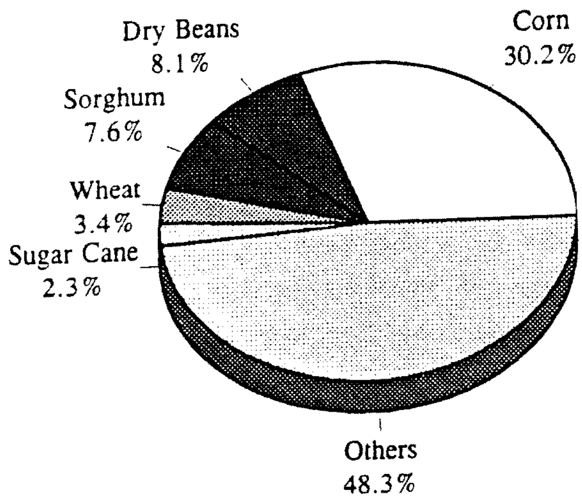
# THE ENACTMENT OF SPS REGULATIONS IN MEXICO

## IV.1. Introduction

Motivated in part by the financial constraints it faced after the debt crisis of 1982, the Government of Mexico (GOM) has been involved in a profound transformation of its agricultural sector. Highly regulated for most of this century, Mexican agriculture is currently facing an extensive, market-oriented process of deregulation that aims to boost its productivity. This chapter summarizes the principal features of the Mexican agricultural sector (section IV.2), provides a description of the enactment process for Mexican SPS regulations (section IV.3), and classifies the Mexican SPS regulations that have been controversial to U.S. exporters (section IV.4). A political economy evaluation of such SPS regulations is provided in Chapter V.

## IV.2. Mexican Agriculture

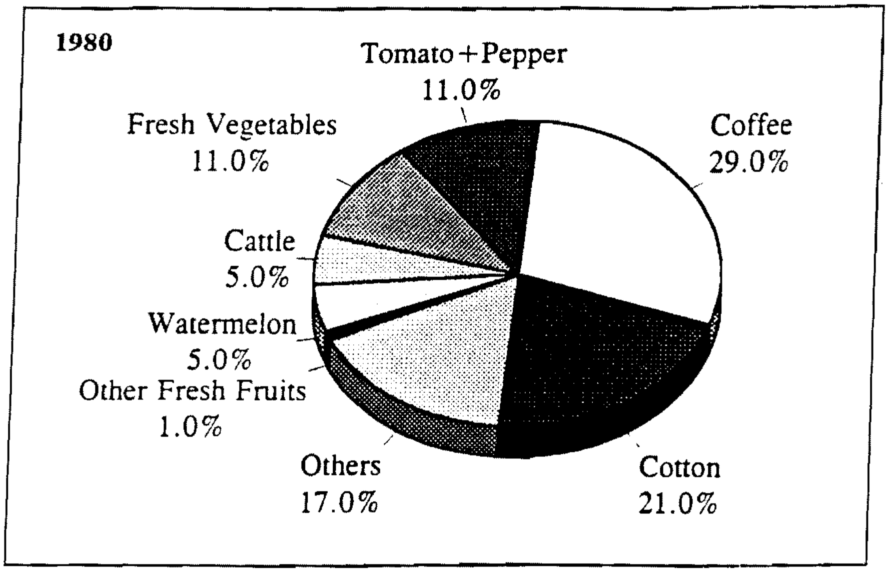
Mexican agriculture is very diverse. Wheat, sorghum, oilseeds, cotton, sugarcane, vegetables, and forage crops are produced on the irrigated farms of the arid north; corn and beans on the non-irrigated farms of central Mexico; and coffee, rice, and sugarcane on the southern tropical farms. Figure IV.1 shows that corn and dry beans are the most important Mexican crops in terms of acreage. Both crops are important sources of rural employment. Their farming is also socially and culturally very important. Corn-made




| Crop | Area (1000 HA) |
|---|---|
| Corn | 7512 |
| Dry Beans | 2022 |
| Sorghum | 1900 |
| Wheat | 850 |
| Sugar Cane | 575 |
| Cottonseed | 560 |
| Others | 12000 |

**Figure IV.1. Harvested Area of Several Mexican Crops in 1997**

Source: F.A.O.



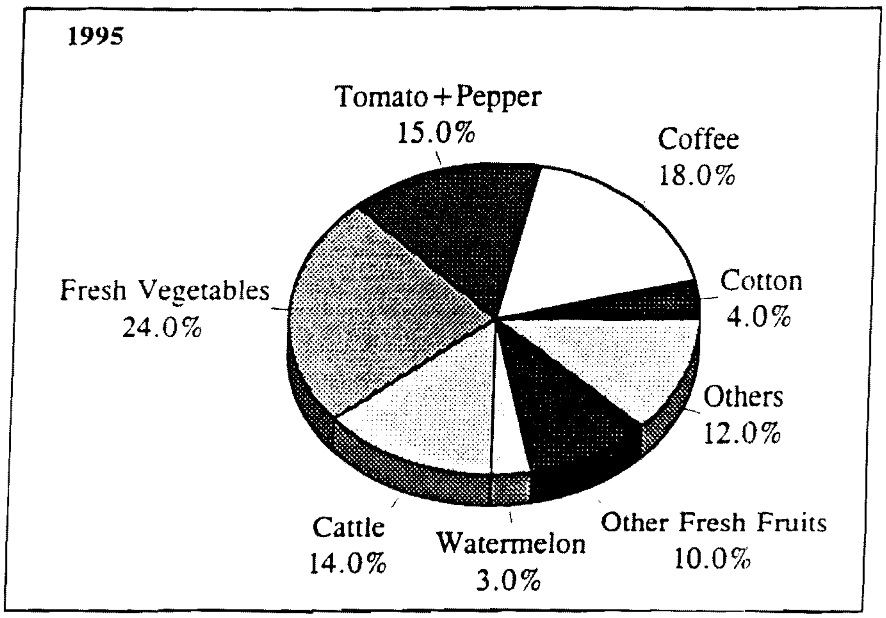




**Figure IV.2. Commodities Contributing to the Value of Mexican Agricultural Exports (1980 and 1995).**

Source: Statistical Center (Centro de Estadisticas Agropecuarias), SAGAR food (e.g., *tortillas*) represents the most traditional nutritional source for the poor (Valdes, 1994b). In spite of its large acreage, corn, dry beans and the other grains have never contributed much to Mexican agricultural exports.

Figure IV.2 compares the contribution of different agricultural commodities to Mexican exports in 1980 and 1995. Horticultural and fruit products were responsible for more than 52 percent of the value of all Mexican agricultural exports in 1995. Such a figure denotes a reversal from 1980, when cotton and coffee contributed to 50 percent of the value of all Mexican agricultural exports. Cotton and coffee were responsible for 22 percent of the value of all Mexican agricultural exports in 1995.

Livestock are also important in Mexico. Figure IV.2 shows the important contribution of cattle to Mexican agricultural exports. Although they do not appear in Figure IV.2, pork and poultry are also important livestock. Table IV.1 shows that the stocks of cattle, pork and sheep, which had increased during the 1970s and 1980s, have decreased since then. The number of chicken produced in Mexico, on the other hand, has tripled in the last 25 years.

**Table IV.1. Number of Head of Cattle, Sheep, Pigs and Chickens in Mexico (1970-1997).**

| Year | Cattle | Sheep | Pigs | Chickens |
|---|---|---|---|---|
| **1970** | 22,798,000 | 6,113,150 | 10,297,770 | 140,300,000 |
| **1975** | 24,301,010 | 6,330,300 | 13,179,400 | 141,095,000 |
| **1980** | 27,742,000 | 6,482,000 | 16,890,000 | 178,134,000 |
| **1985** | 31,489,170 | 6,373,227 | 17,232,900 | 218,883,000 |
| **1990** | 32,054,300 | 5,846,000 | 15,203,500 | 234,055,000 |
| **1995** | 30,191,000 | 5,987,000 | 15,923,000 | 330,000,000 |
| **1996** | 28,141,000 | 5,897,000 | 15,405,000 | 386,000,000 |
| **1997** | 26,900,000 | 5,897,000 | 15,020,000 | 393,000,000 |

Source: FAO

Mexican agriculture has long operated under a particular regime of land tenure. There are three types of landholding in Mexico: private, communal and public. Land is approximately evenly held under private or communal landholding. The communal landholding or *ejidos* originated in the land reform that followed the Mexican Revolution of 1910, and were further developed during the reform waves of the 1930s and 1960s. Most *ejidos* are small-scale farms which produce low-yield rainfed crops. Low in technology, the *ejidos* usually provide only subsistence levels of production. Most *ejidos* do not participate in international markets. Only a small fraction of them produce enough to market their products (World Bank, 1996).

Traditionally, the Mexican government has shown distrust for the action of market forces in the agricultural sector. The land reforms of the 1910s, 1930s and 1960s aimed to achieve some of the equity goals of the Mexican government. However, the simultaneous achievement of food self-sufficiency, the provision of abundant food for urban areas, and the earning of foreign exchange were difficult to attain with low agricultural productivity. Aiming to boost productivity, Mexico invested heavily in technology. The peak of governmental investment on technology occurred from the 1940s through the 1960s, when irrigation was expanded, new land was opened, and research efforts produced high-yield crop varieties of wheat. Subsequently, financial constraints during the 1970s and 1980s induced the government to shift its focus from technological long-term investment to short-term policies such as price support, input subsidies, and crop insurance (Economic Research Service, 1992).

Traditionally, the GOM has been very protective of Mexican agriculture. Two of the GOM's main protective tools were the use of import licenses and support prices. Under the import licensing system, requests to import agricultural goods into Mexico were received and evaluated by the *Secretaría de Comercio y Fomento Industrial* (Trade and Industrial Development Secretariat, or SECOFI). SECOFI's decision to allow the entry of imports was based on criteria such as whether the imports were also produced in the country, and if domestic production can satisfy domestic needs (Grennes et al., 1991).

Support prices have long been available for most grain and oilseeds. The GOM has traditionally guaranteed purchase of these commodities from farmers at supported price through the governmental *Compañía Nacional de Subsistencias Populares* (CONASUPO), or National Organization for the People's Subsistence. Farmers have also enjoyed subsidies of various kinds made available by the government. Subsidies for inputs like fuel oil, fertilizers, seed, irrigation, and electricity, as well as credit at low (even negative) interest rates were provided to farmers (Valdes, 1994b).

In order to achieve its goal of providing inexpensive food to urban areas, the GOM has also been active on the demand side of agricultural markets. Consumer price control on the "Mexican basket of basic commodities" is carried on by the GOM through CONASUPO (Plunkett, 1996). Further, in order to ensure that the domestic demand for products such as coffee, cotton, and beef was satisfied by domestic production, the GOM has required licenses to export these commodities. Moreover, the GOM has intervened actively along the whole chain of food distribution. The GOM buys domestic and import commodities, owns and operates processing plants, and operates a network of retail stores. Until not so long ago, CONASUPO was the only agency authorized to import most grains, oilseeds and dairy products (Economic Research Service, 1992).

Such an interventionist strategy collapsed in the early 1980s. In 1982, a severe decline in oil prices created an acute financial crisis in Mexico, which had sustained economic growth in the 1970s by heavily borrowing from international markets (Dornbusch and Fischer, 1986). Immersed in this financial crisis, Mexico suspended the payment of the interest of its foreign debt. Such a decision abruptly ended a decade of sustained growth based on foreign borrowing. Per-capita annual income growth in Mexico fell from 5.4 percent in 1981 to -2.6 in 1982.

Induced by this crisis, a political renovation occurred in Mexico in the 1980s. A new generation of technocrats rose to power (World Bank, 1994a). International organizations such as the International Monetary Fund (IMF) and the World Bank were approached by the GOM for financial help. These organizations successfully lobbied the new Mexican leadership for a drastic policy change (Skully, 1994). The new leadership acknowledged that a structural adjustment was required and the GOM committed to reverse old policies and open the country to trade and foreign investment.

As a consequence of such a reversal, government intervention in the agricultural sector has been declining since 1987, even before NAFTA was put in place. Mexico has liberalized its import licensing requirements and restructured the way it intervenes in agricultural markets. The liberalization of Mexican imports was energized by Mexico joining the General Agreement of Trade and Tariffs (GATT) in 1986. All import categories were subject to import licenses in 1982. By 1986, only 35 percent of imports were covered by the licensing system (Grennes et al., 1991).

In order to illustrate the evolution of the GOM's protectionist policies, Figure IV.3 shows the estimated level of Producer Subsidy Equivalents (PSE) for nine Mexican commodities from 1984 to 1992. Figure IV.3 shows different support levels for the nine commodities considered over time. Mexican producers of grain crops had in general received a higher level of subsidies than livestock producers. Corn, soybeans, sorghum, and dry beans received more support than wheat. Corn and dry beans were protected because of their importance to *ejidos*, while sorghum and soybeans were heavily subsidized in an import-substitution effort. Wheat was produced by commercial farms and received relatively less support (Grennes et al., 1991). Of the basic livestock products, poultry and pork received more support than beef. PSE estimates for beef even show negative values for the period considered, reflecting the export taxes the GOM levied beef producers (Nelson et al., 1995). Figure IV.3 shows that most PSE estimates peaked in the mid-1980 in response to a drop in world prices (Valdes, 1994a). They have shown a general descending trend since then.

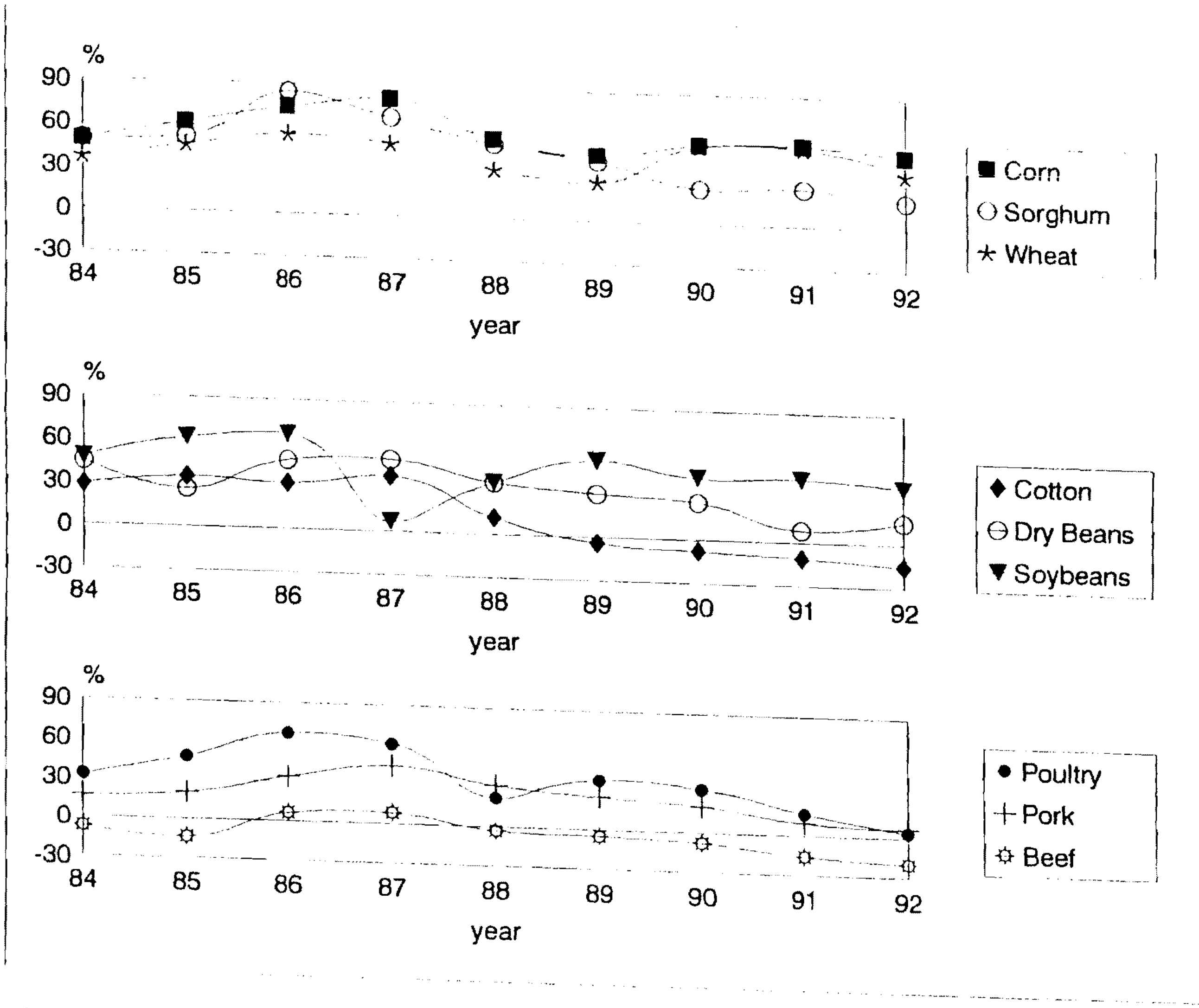



Figure IV.3. Producer Subsidy Equivalents (PSE) for 9 Mexican commodities

Source: Valdes, C. (1994)

## IV.3. NAFTA

The decision to open the economy by the new Mexican leadership was coherently followed in the international arena. In 1986, Mexico joined the General Agreement on Tariffs and Trade (GATT). As part of its new commitments with the GATT, Mexico reduced its maximum border tariffs from 100 percent to 50 percent. A further reduction was unilaterally implemented by Mexico in 1987, establishing a maximum tariff of 20 percent (USTR, 1995).

The GOM also actively pursued several international trade agreements. On December 23, 1991, Mexico and Chile signed the *Acuerdo de Complementación Económica* (Economic Complement Agreement) which reduced and eliminated several trade restrictions. On December 17, 1992, Mexico signed the NAFTA. On three successive days of 1995, on January 9, 10, and 11, Mexico signed trade agreements with Colombia and Venezuela (the *Grupo de los Tres* -Group of Three- agreement), Costa Rica, and Bolivia, respectively. Mexico is currently pursuing trade agreements with other Latin American countries, in particular with MERCOSUR[1], and with the European Union (EC) (SECOFI, 1997).

Particularly relevant for Mexico is NAFTA. Since it was implemented on January 1, 1994, NAFTA has been lowering all import tariffs among members. Tariffs are being phased out over a 10- to 15-year period. With regard to agriculture, NAFTA members have agreed "to convert [their] quantitative restrictions into tariff quotas" (Chapter 7, Subchapter A, Annex 704.2, Section I, Appendix A). Mexico has converted its remaining import licensing system to tariff-rate quotas (TRQ) or ordinary tariffs. A TRQ allows a certain amount of import to enter duty-free, while quantities over the quota are levied an over-quota tariff. The over-quota tariff was initially estimated to be similar to the border

[1] MERCOSUR is a custom agreement signed by Argentina, Brazil, Paraguay and Uruguay. Chile joined MERCOSUR as an associate in 1997.

protection provided by the non-tariff measure during the 1989-1991 period. The NAFTA TRQ volume is set to grow at a 3 percent annual rate.

In order to provide added protection to sensitive agricultural commodities while these tariffs are being phased-out, NAFTA includes a special safeguard provision (Chapter 7, Subchapter A, Article 704). Under this provision, NAFTA members allow a determined quantity of imports at the NAFTA preferential tariff rate. Once the quota is met, the importing country may apply the tariff rate in effect at the time the agreement went into effect or the most favored nation (MFN) rate then in effect, whichever is lower. Like the TRQ, the quota level grows at a 3 percent annual compound rate for Mexican-U.S. safeguards (5 percent for Mexican-Canadian safeguards) during the phase-out period. Special safeguard have been applied by the U.S. for Mexican imports of tomatoes, eggplant, chili peppers, squash, watermelon and onions, by Mexico on Canadian and American imports of live swine, pork, and potato products, fresh apple, and coffee extract, and by Canada on Mexican imports of fresh cut flowers and certain fresh and frozen fruits and vegetables (Chapter 7, Subchapter A, Article 704.3).

The Subchapter B of NAFTA's Chapter 7 lists NAFTA's provisions on SPS measures. Like the 1994 WTO agreement, NAFTA acknowledges the right of its members to establish SPS measures which reflect their desired levels of protection, and are based on scientific principles (Chapter 7, Subchapter B, Article 754). NAFTA members should join international standardizing organizations such as the Codex Alimentarius Commission, the International Office of Epizootic, the International Plant Protection Convention, and the North American Plant Protection Organization (Chapter 7, Subchapter B, Article 755).

NAFTA also establishes guidelines about the appropriateness of risk assessments (Chapter 7, Subchapter B, Article 757). The agreement recognizes the principle of regionalization, by which members must acknowledge and take into account the prevalence of relevant pests or diseases in different areas or regions in performing pest risk assessments (Chapter 7, Subchapter B, Article 758).

NAFTA requires each party to notify all other members about any proposed or final SPS regulation at least 60 days prior to the adoption of such standard. When necessary, NAFTA allows members to publish SPS regulations on a provisional basis using incomplete data, and to revise them when new information is available (Chapter 7, Subchapter B, Article 760).

NAFTA also mandates its members to establish a Committee on SPS Measures. Such a Committee is constituted by representatives of each member country. The Committee is designed to facilitate the enhancement of food safety and SPS conditions in the member countries, the activities of the member countries regarding equivalence of SPS standards and use of international guidelines, technical cooperation between member countries, and consultations on specific matters regarding SPS standards. The Committee is mandated to promote the creation of working groups to ease and solve technical controversies (Chapter 7, Subchapter B, Articles 722 and 764).

Additional NAFTA mechanisms to solve SPS and other disputes are instituted in Section A, Chapter 20. NAFTA established the Free Trade Commission, an institution comprised of cabinet-level representatives of the member countries or their designees, to have the responsibility to resolve trade disputes. However, there is a determined number of steps that members must take before a dispute can be considered by the Free Trade Commission. NAFTA mandates its members first, to consult each other upon a SPS controversy, in efforts to reach a mutually satisfactory agreement. At this stage, NAFTA members must provide upon request all information relevant to the dispute.

Second, if the consulting parties do not resolve the controversy within thirty days (or another period of time agreed upon), a party may request a meeting of the Free Trade Commission. The Free Trade Commission will convene within ten days of such a request and try to settle the dispute by appointing working groups or technical advisers.

Third, if the dispute is still unsolved after another specified period, any party can request to the Secretariat for the establishment of an arbitral panel. The Secretariat then will instruct the Free Trade Commission to establish a panel of five experts. The panel must issue an initial report within ninety days after the last panelist is selected. Procedures for the arbitral panel assure members the right of at least one hearing before the panel and the opportunity for initial and rebuttal written submissions. The panel's hearing, deliberations, initial report, and all written submissions to and communications with the panel are confidential. A final report to the disputing parties must be presented within thirty days after the presentation of the initial report. The Free Trade Commission will publish the final report within fifteen days after receiving it.

Fourth, NAFTA mandates its members to conform with the determinations and recommendations of the panel. NAFTA stipulates that, whenever possible, the resolution should be the non-implementation or the removal of the controversial SPS regulation. If such a resolution is not possible, members may attempt to agree on a particular compensatory scheme. If such an agreement is not possible either, the complaining party may impose its own compensatory measure. Such a compensation must be communicated by the complaining member to the Free Trade Commission, which then must evaluate the appropriateness of the unilateral measure within sixty days after being imposed.

### IV.4. Deregulation

NAFTA's provisions mandated Mexico to abandon its old regulatory process for SPS regulations and adopt a more transparent one. However, Mexico had started such a transformation several years before NAFTA was negotiated. In the aftermath of the Mexican financial crisis of 1982, international organizations such as the IMF and the World Bank suggested to the GOM that it de-regulate the Mexican economy. The accession to power of a new generation of Mexican leaders made the country susceptible to such suggestions. Structural adjustment, promoted by both the IMF and the World Bank, became an integral part of the long term strategy to deal with Mexican foreign debt (World Bank, 1994a). The Mexican need for regulatory reform was "incorporated into the policy dialogue which typically accompanies adjustment lending" (World Bank, 1994b).

The World Bank made two agricultural adjustment loans (AGSAL) to Mexico. The first one, AGSAL I, provided $300 million to Mexico during the 1988-1990 period. The objectives associated with the loan were: i) to reduce government intervention in agricultural markets, ii) to abolish quantitative restrictions on many agricultural imports, iii) to reduce the role of CONASUPO, iv) to eliminate subsidies on farm inputs, v) to increase the efficiency and volume of public investment in agriculture, vi) to decentralize and reduce staff of the agricultural ministry, and vii) to establish a more targeted food subsidy program with adequate funding (e.g., the creation of food vouchers of *tortibonos* to assist the urban poor). The second agricultural adjustment loan, AGSAL II, lent $400 million to Mexico from 1991 to 1993 to reduce further the government's role in the sector (World Bank, 1996).

In October 1995, the GOM launched the *Alianza para el Campo* (Alliance for the Rural Sector). The *Alianza* is an agriculture-oriented program undertaken by the government with the participation of "farmers and their organizations" aiming to replace the government's goal of food self-sufficiency by food accessibility at competitive prices (Presidency of Mexico, 1995). The *Alianza* encompasses five programs: PROCAMPO, PRODUCE, Technical Assistance, Marketing Assistance, and Repopulation of the Cattle Herd. PROCAMPO (*Programa de Apoyos Directos al Campo*, or Program of Direct Aid to the Rural Sector) was originally announced in 1993. It involves the elimination of price supports for corn, beans, wheat, sorghum, rice and soybeans, while offering direct payment to producers of these six crops.[2] PRODUCE (Program of Support for Agricultural Capitalization) offers support for investments in mechanization, irrigation, regional development, and livestock infrastructure. Technical assistance is available under several research and extension programs. Marketing assistance for improving the handling and marketing of agricultural products is also offered. A program aimed to repopulate cattle herds affected by the 1994-1995 peso crisis is also in place (Crawford and Link, 1996).[3]

The Mexican government has also revised the structure of land ownership. In January 1992, the administration of Carlos Salinas de Gortari amended Article 27 of the Mexican Constitution of 1917, providing an opportunity to *ejidos* and *ejidatarios* to move to a private form of land tenure. On February 26, 1992, the *Ley Agraria* (Agrarian Bill), which implements the changes to the Article 27, was published. The Agrarian Bill has given *ejido*'s Assemblies the right to vote for ending the *ejido* (Ley Agraria, 1992, Title III, Article 23).

By implementing all of these changes, the Mexican government is expecting to achieve a twofold goal: to reduce the financial burden imposed by its intervention in the agricultural sector, and to boost productivity by increasing the incentives to private, commercial farmers. However, support for the new policies is not universal. Some members of the Mexican Academia (Ramos et al., 1996) and some producers (Stockard et al., 1997) have voiced their opposition to the departure from protectionist policies.

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[2] The World Bank initially resisted PROCAMPO and advocated for a less expensive program which focused only on low income farmers. However, the World Bank finally accepted PROCAMPO "as a way to facilitate commodity price liberalization and to deal with the political need to support agriculture while minimizing the negative allocative effects" (World Bank, 1996).

[3] On December 20, 1994, the GOM announced a devaluation of the peso. Investors panicked and ran out from the Mexican currency. The GOM's debt, and interest rates rose dramatically. A liquidity crisis which threaten the anking system arose. An international assistance effort lead by the U.S. helped to halt the crisis and recover the Mexican economy (Sachs et al., 1995).

It may be possible that producers facing lower levels of formal protectionism from the government may seek the implementation of SPS regulations as hidden barriers to trade. This hypothesis is examined in the following section, when the particular regulatory changes affecting the enactment of SPS in Mexico are examined.

## IV.5. Mexican Regulatory Process for SPS Issues

In 1995, the GOM declared its commitment to update regulatory procedures regarding SPS regulations until they "reach a status equivalent to that of our principal trade partners" (Presidency of Mexico, October 31, 1995, Alianza para el Campo). This section describes the legal framework in which Mexican SPS regulations are enacted. It is divided into three parts. First, the institutions and organizations in charge of enacting SPS regulations in Mexico are presented. Second, relevant legislation is examined and compared to the legislation in place in the U.S. Third, Mexican SPS regulations controversial to U.S. interests are presented.

### Mexican Organizations Responsible for SPS Regulations

The enactment of most SPS regulations in Mexico is a responsibility of the *Secretaría de Agricultura, Ganadería y Desarrollo Rural* (Agriculture, Livestock, and Rural Development Secretariat), or SAGAR for short. Two subagencies within the Secretariat, the *Dirección General de Salud Animal* (Animal Health General Directorate, or DIGSA) and the *Dirección General de Sanidad Vegetal* (Plant Health General Directorate, or DIGSV) are directly responsible for the enactment of SPS regulations. These two sub-agencies are merged in the *Comisión Nacional de Sanidad Agropecuaria* (Agricultural and Livestock Health Committee, or CONASAG) as the agency actually in charge of protecting the country from the entry of exotic pests and diseases. The roles of

SAGAR, CONASAG, DIGSV and DIGSA are broadly paralleled in the U.S. to that of the USDA, the Animal and Plant Health and Inspection Service (APHIS), and within APHIS, the Plant Protection and Quarantine (PPQ), and Veterinary Services (VS). Figure IV.4 illustrates the current Mexican administrative structure responsible for the enactment of SPS regulations.

Before 1995, DIGSA and DIGSV were directly accountable to the Under-Secretary of Agriculture. SAGAR's reorganization in 1995 elevated the Mexican regulatory agencies to make them directly accountable to the Secretary of SAGAR. The official justification for such a move was:

i) to enact SPS regulations with as much independence from political decisions within SAGAR as possible (Presidency of Mexico, 1995).

ii) to allow CONASAG to present a unified approach to the discussion, enactment and enforcement of SPS regulations policies in Mexico. Such a unification of agencies would

allow Mexico's officials to increase their bargaining power in discussing SPS-related issues with their trading partners (Martínez, 1997).

The unification of all SPS-related agencies was not complete. In 1995, the GOM created the *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (Environment, Natural Resources, and Fisheries Secretariat, or SEMARNAP). SEMARNAP is responsible for the enactment of SPS regulations on forest and wood products. The agency in charge of these regulations is the *Dirección General Forestal* (General Directorate for Forestry, or DIGF). Differently from DIGSA or DIGSV within SAGAR, DIGF is not directly subordinate to the Secretary of SEMARNAP. Hierarchically dependent from the Under-secretary of Natural Resources, DIGF has also been given other responsibilities besides the enactment of SPS regulations.

The isolation of DIGF from CONASAG regarding SPS issues is perplexing to some extent. Such an isolation does not correspond to the manifested GOM's strategy of concentrating all SPS issues into a single agency. According to some Mexican officials, the GOM wanted to signal the importance Mexico gives to all environmental issues by creating SEMARNAP and including all forestry-related SPS issues within its orbit (Martínez, 1997).

The 1995 reorganization of SAGAR has relieved DIGSV and DIGSA of enforcing SPS regulations. Figure IV.4 illustrates that the enforcement of Mexican SPS regulations is the responsibility of the *Dirección General de Inspección Fitosanitaria de Puertos, Fronteras, y Aeropuertos* (General Directorate for Phyto-Sanitary Inspection of Ports, Borders, and Airports, or DIGIF). Border inspection of wood and forest products have been also performed by DIGIF's inspectors. This situation may change in the future since Mexican officials have acknowledged the existence of plans within SAGAR to provide SEMARNAP with its own border inspectors (Martínez, 1997)

DIGSA and DIGSV's responsibilities include the identification of potential phytosanitary problems, the completion of risk and cost-benefit analyses, and the writing of initial drafts for proposed regulations (final drafts must be approved by SAGAR's *Secretaría Jurídica*, or Judicial Department). Such responsibilities parallel those attributed to APHIS in the U.S. However, it has been acknowledged that, in spite of such formal similarities, the resources available to DIGSA and DIGSV to perform their task are far less than those available to APHIS (Juarez et al., 1996).

To alleviate its financial limitation, a common practice for DIGSA and DIGSV, especially when they face technically complicated problems, is to delegate part of their responsibilities to other organizations. Thus, it is usual for DIGSA and DIGSV to sign cooperative agreements with outside scientists to perform risk and cost-benefit analyses (Martínez, 1997).

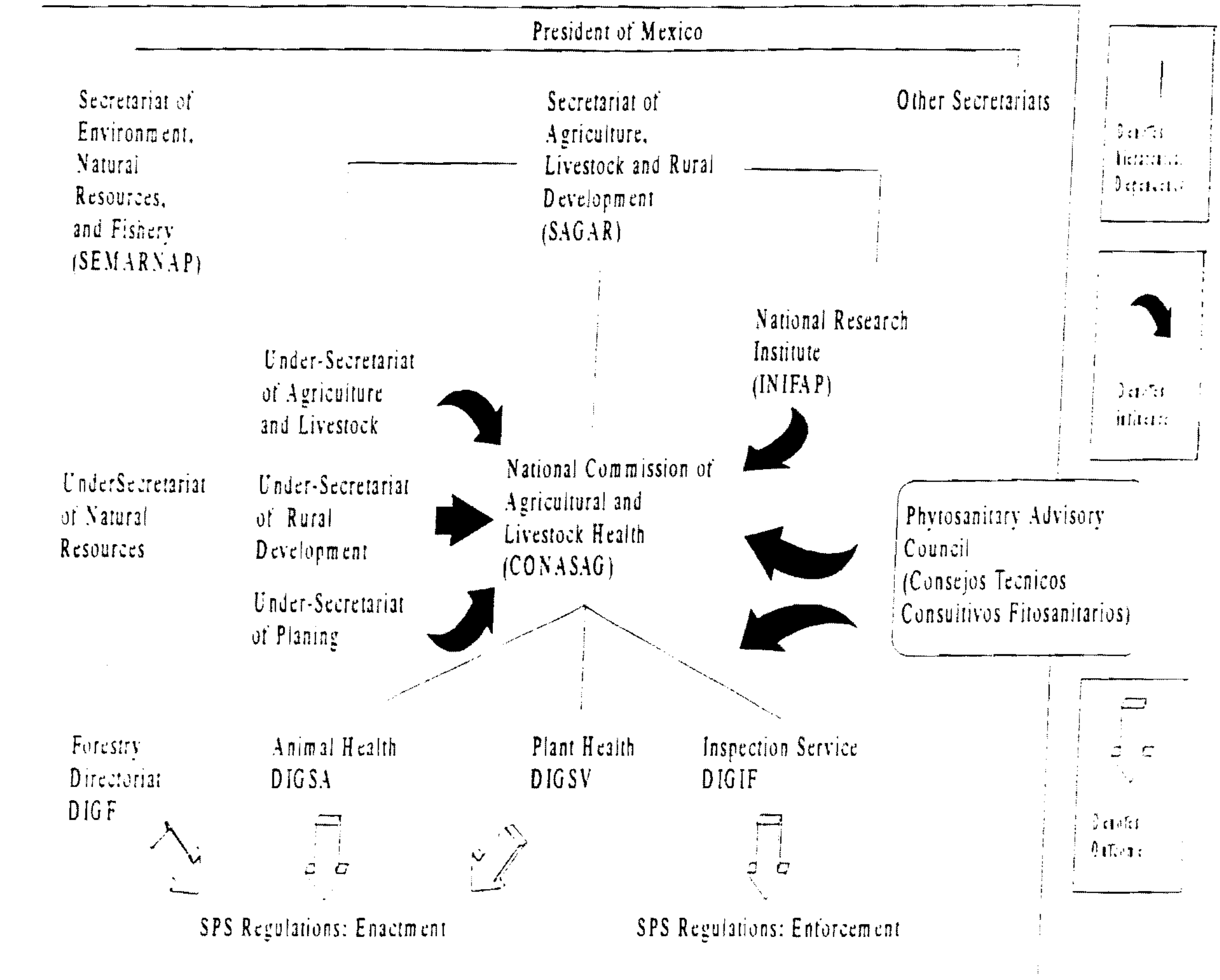


**Figure IV.4. Hierarchical Organization of Mexican Agencies in Charge of Enacting and Enforcing SPS Regulations**

Source: *Diario Oficial,* April 12, 1996

## Mexican Legal Framework for Enacting SPS Regulations

The first Mexican legislation aimed at protecting the country from the entry of exotic pests was the *Ley de Plagas* (Pests Act), published on November 15, 1924 in the *Diario Oficial* (the Mexican counterpart to the U.S. Federal Register). This bill was replaced by the *Ley de Sanidad Fitopecuaria* (Phytosanitary and Sanitary Federal Act), published in the *Diario Oficial* on August 29, 1940. Another *Ley de Sanidad Fitopecuaria* replaced the 1940's law on December 13, 1974, and dictated the mechanisms by which SPS regulations were enacted in Mexico for almost 20 years. As described below, the *Ley de Sanidad Fitopecuaria* of 1974, referred as the "old legislation" herein, was in synchrony with the more general import licensing system prevailing at that time. As described above, agricultural goods entered Mexico under an import licensing system controlled by SECOFI. Under that framework, SPS measures could be enacted as part of the permission SECOFI gave to importers (Chapter V, Articles 100 and 101). The lack of transparency of the regulatory process for SPS regulations, as well as their close relationship to the economic-based decisions taken by SECOFI, made foreign exporters suspicious about the scientific basis for SPS regulations.

As part of the process of opening its economy during the second half of the 1980's, the GOM made efforts to make the regulatory process for SPS measures more transparent while the new regulations were being prepared. On May 10, 1991, the *Secretaría de Agricultura y Recursos Hidráulicos* (Agricultural and Hydric Resources Secretariat) or SARH published in the *Diario Oficial* a handbook of administrative procedures for agricultural and forestry imports and exports (*Manual de Procedimientos Administrativos Para la Importación y Exportación de Productos Agropecuarios, Forestales y Agroquímicos*, SAGAR, 1991).[4] The *Manual* specified that the enactment of SPS

[4] The Mexican Agriculture and Livestock Secretariat has had various formal names over time. In order to facilitate the exposition, this dissertation will use the acronym SAGAR each time the text refers to the Secretariat of Agriculture.

regulations was a responsibility of SAGAR, after the reception of an import request by SECOFI. As an indication of the regulatory changes that were about to come, the Manual emphasized the importance of SPS regulations being "nondiscriminatory regarding who applies and their country of origin" as well as the importance of allowing proper revision to the enacted SPS regulations. However, because of the regulatory control SECOFI exerted over SPS regulations through the import licensing system prevailing in Mexico, the process was still not transparent.

Further updating of the Mexican regulatory system occurred with the publication of the *Ley Federal Sobre Metrología y Normalización* (Standardization Federal Act) on July 1, 1992. The regulatory changes established by this law were later completed by the *Ley Federal de Procedimiento Administrativo* (Administrative Procedures Federal Act) of August 4, 1994. The 1992 and 1994 legislation mandate that all Mexican government agencies publish their regulations in the *Diario Oficial*. They also specify that any final regulation should be published as a *Norma Oficial Mexicana* (Mexican Official Norm, or NOM). Mirroring the U.S. APA of 1940, the Standardization Federal Act established that all NOMs must first be published as a *Proyecto de NOM* (Proposed NOM), giving interested parties a period of 90 days to comment on such proposals. The regulatory agency must evaluate the comments received, consider the need to modify the proposed NOM, and then publish the subsequent final NOM.

The Standardization Federal Act also establishes a third type of regulation called *Norma de Emergencia* (Emergency Rule, or NOM-EM). A NOM-EM is a rule that avoids the usual process of reception and analysis of comments, becoming valid as soon as it is published in the *Diario Oficial*. Because a NOM-EM avoids the delays involved in the usual rule-making process, such rules are suitable to address situations of extreme urgency.

Also like the APA, Mexican regulatory agencies must publish in the *Diario Oficial* all their non-regulatory activities, such as dispositions, appointments, clarifications, corrections, or agreements (*acuerdos*). Like the NOM-EM, the publication of these activities is not open to public debate. Such a lack of debate can be justified by the non-regulatory nature of such publications, which are aimed to inform the public about decisions which would affect them only indirectly (Martínez, 1997). However, the Mexican regulatory agencies have applied these type of informative publications with a large discretion. The Mexican agencies have published as *acuerdos* the designation of some areas as free of pests or diseases. For instance, DIGSA's designation of *Baja California* and *Baja California Sur* as free of avian influenza (*Diario Oficial*, May 29, 1996, page 63). Also, some clarifications and modifications to final rules were published without a comment period (e.g., the modification of DIGSA's final rule affecting the National Campaign against Aujeszky's disease, NOM-007-ZOO-1994, published in the *Diario Oficial* on June 12, 1995). Although published without being open to public debate, neither Canada nor the U.S. have complained about these SPS regulations.

In order to implement the new regulatory rule-making basis for agriculture, the GOM, through SAGAR and SECOFI, signed an agreement with several private cattle interest groups in June 1992 to develop a new regulatory framework for livestock imports (Dirección General Jurídica, 1993). This new regulatory framework expanded later to legislation covering the entry of other agricultural imports. This new regulatory framework, referred as the "new legislation" herein, was enacted in 1993 and 1994. It constitutes two separate pieces of legislation which, together, have replaced the *Ley de Sanidad Fitopecuaria* of 1974. They are the *Ley Federal de Salud Animal* (Animal Health Federal Act) and the *Ley Federal de Sanidad Vegetal* (Plant Health Federal Act), published in the *Diario Oficial* on June 18, 1993 and January 5, 1994, respectively.

There are some apparent similarities between the old and new legislation. Like the old legislation, the new legislation i) invokes science as the basis for enacting SPS regulations, ii) allows international cooperation with foreign regulatory agencies, and iii) allows for the participation of private interest groups in the regulatory process. These similarities are more apparent than real, since the old and new legislation approach these issues in a different way.

The first apparent similarity between the old and new Mexican legislation is their reliance on science. Both legislations emphasize the use of science as a basis for the enactment of SPS regulations. However, such reliance is explicitly stated only in the new legislation. The *Ley de Sanidad Fitopecuaria* of 1974 made only very loose references to the role of science in the enactment of SPS regulations. It mandated SAGAR to "determine and study" a comprehensive list of potential pests and diseases for agriculture (*Ley de Sanidad Fitopecuaria* of 1974, Chapter V, Article 61, 1980). Explicit calls for scientific bases for enacting SPS regulations in the old legislation appear only in a few marginal places. For instance, in order to determine the adequacy of chemical and other phytosanitary measures, the old legislation established that:

> "[SAGAR must perform] scientific research regarding all agricultural elements, substances, and products [to be used in phytosanitary programs]" (Title II, Chapter IV, Article 37).

In contrast, the use of science as the basis for enacting SPS has been explicitly and strongly stated in the new legislation. Both the *Ley Federal de Salud Animal* and *Sanidad Vegetal* state that:

> "The official regulations...must be based on scientific principles..[and] on a cost-benefit analysis which includes a risk analysis; take international guidelines into account; and be disregarded as soon as the scientific basis [for the regulation] can no longer be sustained" (*Ley Federal de Salud Animal* (Title II, Chapter I, Article 13) and *Ley Federal de Sanidad Vegetal* (Title I, Chapter II, Article 20).

Notice that, as it is quoted above, SAGAR is mandated by the new legislation to perform cost-benefit analyses when enacting SPS regulations. This stipulation parallels the requirement by the Office of Management and Budget (OMB) of the U.S. that a cost-benefit analysis must be performed when a proposed regulation is expected to cause an economic impact larger than $100 million. Also, as in the U.S., the current Mexican legislation does not clearly explain the role that cost-benefit analyses should play during the regulatory process.

The second apparent similarity between the old and new Mexican legislations is their recognition of the importance of international cooperation with foreign regulatory agencies. The *Ley de Sanidad Fitopecuaria* of 1974 authorized SAGAR "to sign [cooperative agreements with foreign agencies] to prevent, control, and eradicate pests and diseases" (Title I, Chapter III, Article 14). The new legislation strengthens this authority. The new legislation not only allows SAGAR to consider international cooperation, but also mandates the agency to take international guidelines into account. Such a mandate is stronger than the sole call to international cooperation that appears in the old legislation.

The third and last apparent similarity between the old and new Mexican legislation refers to the participation of private interest groups during the regulatory process. The mechanisms by which interest groups are allowed to participate differ substantially between the old and new legislation. The *Ley de Sanidad Fitopecuaria* of 1974 promoted the creation of regional and local phytosanitary organizations as a channel of participation for interested farmers and other groups. In its Article 15, the *Ley de Sanidad Fitopecuaria* mandated SAGAR to:

> "[organize]..all interested groups, whenever [SAGAR] considers it necessary, in *Comites Regionales de Sanidad Vegetal*, *Comites Regionales de Salud Animal*, *Juntas Locales de Sanidad Vegetal*, and *Juntas Locales de Sanidad Vegetal*, which will ... cooperate [with SAGAR regarding sanitary and phytosanitary issues]" (Title I, Chapter III, Article 15).

The goal of such organizations was to collaborate with SAGAR in the identification of sanitary and phytosanitary issues, and the elaboration and execution of sanitary and phytosanitary programs (*Ley de Sanidad Fitopecuaria*, Article 27). The old legislation required these organizations to be self-funded (*Ley de Sanidad Fitopecuaria*, Article 29), although SAGAR reserved for itself the role of supervising the utilization of such funding (*Ley de Sanidad Fitopecuaria*, Article 30).

To some extent, the role established by the old legislation for the *Comités Regionales* and *Juntas Locales* resembled the one usually atributed to extension agents. These organizations had the important role to promote and help the implementation of phytosanitary programs. Officials of these organizations were expected to monitor the phytosanitary status of their region and warn SAGAR about surges of new pests and diseases. It is in this regard that the *Comités Regionales* and *Juntas Locales* performed as channels of participation for interest groups in the enactment of SPS regulations (Martínez, 1997).

Unfortunately, such a channel of participation was not open to all interest groups. The old legislation specified that the officials of the regional and local organizations had to be elected among:

> "farmers and representant of all sectors involved with agricultural production, gathered in a general assembly, with the presence of SAGAR's officials" (*Ley de Sanidad Fitopecuaria,* Chapter III, Article 24).

Such a specification circumscribed the participation in the enactment of SPS regulations only to Mexican farmers and other domestic interest groups operating through formally sanctioned, organized structures. No special provision was established in the old legislation for foreign interest groups. Moreover, access by domestic interest groups may have been restricted. Participation required the previous consensus of the regional and local organizations, which may not always have been possible to achieve.

The participation of interest groups in the enactment of SPS regulations was facilitated by the new legislation. The new legislation, while keeping some channels of participation similar to those provided by the old law, has opened participation to both domestic and foreign interests.[5] As described above, the new legislation mandates SAGAR to publish all proposed SPS regulations in the *Diario Oficial*, open a 90 days period of time to receive comments from interested parties, evaluate such comments, and make the necessary corrections before publishing the final rule. Such a mandate increases the transparency of the regulatory process, by exposing the rule to the public before its enactment.

To summarize, the concepts of reliance on science, international cooperation, and participation of interest groups, were present in both the 1974 and 1994 legislation affecting Mexican procedures for enacting SPS regulations. But the new legislation has provided a sharp change in the implementation of such concepts. As mandated by NAFTA and encouraged by international organizations such as the IMF and WTO, the new legislation has clearly established the need for internationally accepted scientific evidence and an open regulatory processes. All these changes, in particular the opening of the regulatory process, have increased the transparency of the enacted SPS regulations.

### IV.6. Controversies Involving Mexican SPS Regulations

This section describes the SPS-related controversies which had affected U.S. agricultural exports to Mexico since NAFTA was enacted. These cases provide the database upon which the evaluation of the hypotheses about the political economy of Mexican SPS regulations are evaluated. The description of the data, is based on:

i) Personal interviews with APHIS and Foreign Agricultural Service (FAS) officials. These officials helped the author to individualize the Mexican SPS regulations which are controversial to U.S. exports,

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[5] The National (Regional) Advisory Boards of Plant and Animal Health (*Consejos Técnicos Consultivos Nacionales (Regionales) de Sanidad Animal y Vegetal)* were created to perform basically similar advisory and extension tasks as the former *Comités Regionales* and *Juntas Locales*.

ii) Written communications with members of U.S. industries,

iii) The examination of press reports, newsletters and other non-academic publications by U.S. agencies and industries,

iv) Examination of relevant and public (non-confidential) FAS reports from Mexico. These reports are written by the office of the U.S. agricultural attache in Mexico, and since 1996 are made available to the public via the Internet,

v) Personal interviews with the agricultural counselor of the Mexican Embassy at Washington, D.C.,

vi) Written communications with SAGAR's officials,

vii) Examination of Mexican legislation, and

viii) Examination of SAGAR and SEMARNAP's regulations published in the *Diario Oficial* since the last months of 1993. These regulations were examined from the microfilm archives of the Library of Congress, at Washington D.C. A list of all final SPS regulations published by DIGSV was also obtained by mail, upon request, in march 1997.

Since September 1997, all final SPS regulations published by DIGSA and DIGSV have been made electronically available in SAGAR's website (http://www.sagar.gob.mx/conasag.htm).[6] Also in September 1997, SEMARNAP has made electronically available a list containing the regulations published by the Secretariat (http://www.semarnap.gob.mx/octubre97.htm).

Appendix A1 lists all SPS regulations published by DIGSA, DIGSV, and DIGF as NOM or NOM-EM. Totals of 54, 75, and 14 of these regulations have been published by DIGSA, DIGSV, and DIGF, respectively. These regulations encompass most Mexican SPS measures. SPS measures enacted as *acuerdos* (agreements) are not included in

[6] Up to November 1997, emergency and proposed norms have not been made available on the Internet.

Appendix A1, unless they announced the extension of a NOM-EM.[7] Technical barriers to trade (TBT) other than risk-reducing SPS regulations are not specifically described in this section (for instance, a label dispute affecting the entry of poultry meat in brine to Mexico).

Regulations appear ordered by issue in Appendix A1. An issue corresponds to the title appearing in the publication of a regulation. Regulations published by DIGSA, DIGSV, and DIGF are currently distinguished by the generic denominations NOM-ZOO, NOM-FITO, and NOM-RECNAT, respectively. However, all emergency and proposed regulations published during 1993 and part of 1994 were published as NOM-SARH1, NOM-SARH2, and NOM-SARH3, where the letters SARH referred to the old denomination to which SAGAR was known (*Secretaría de Agricultura y Recursos Hidráulicos*), and the single number behind the letters SARH denoted the agency which published the norm.

Regulations in Appendix A1 are ordered as they appear in the official list of final SPS regulations currently available from DIGSA, DIGSV, and DIGF. The numerical denomination of these final regulations does not necessarily correspond to their chronological enactment. For instance, the final norm NOM-006-ZOO-1994 was published before NOM-005-ZOO-1993. Notice that DIGSA had used an inconsistent numerical denomination for its earlier SPS regulations. DIGSA's earlier emergency, proposed, and final rules for a single issue did not share a similar numerical denomination. For instance, the entry of animals into Mexico has been regulated by the numerically different emergency NOM-EM-010-ZOO-1995, proposed NOM-022-ZOO-1994, and final NOM-024-ZOO-1995. Such a lack of numerical correspondence makes the regulatory evolution of a norm difficult to trace over time. Such a confusing problem was corrected by DIGSA in 1995.

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[7] For instance, the *Acuerdo* extending NOM-EM-023-FITO-1995, published in the *Diario Oficial* on January 26, 1996.

Adding to such tracing difficulties, DIGSA, DIGSV, and DIGF's final rules do not refer to the proposed rule to which they are related. Also, while APHIS includes the comments it receives to a proposed rule in the publication of the final rule, the Mexican agencies publish those comments separately, increasing the difficulties in tracing regulations back.

The occurrence of mistakes during the publication of the *Diario Oficial* adds to the tracking difficulties. Typographical errors are not infrequent. For instance, the proposed rule NOM-013-ZOO-1994 was referred as NOM-O14-ZOO-1994 in the published comments. Some regulations have been published misplaced in the *Diario Oficial*. For instance, DIGSV's extensions to NOM-EM-023-FITO-1995 and NOM-EM-024-FITO-1995 were published under the Secretariat of Energy's section in the 1996 annual index of the *Diario Oficial*. Monthly indices for the *Diario Oficial* are specified to be published around the 15th day of the following month. However, this schedule has been rarely maintained. Annual indices for the *Diario Oficial* are only available since 1996. Unfortunately, these annual indices have not been referenced, and they have been published in issues as delayed as March (1997) or October (1996) of the following year.

All these mistakes have made difficult the elaboration of Appendix A1. But more important, the occurrence of at least some of these errors denote the inexperience of Mexican agencies during the enactment of the first NOMs. The amelioration of some of these mistakes over time may be related to the regulatory experience gained by the Mexican agencies under the new legislation.

The remaining of this section describes the Mexican SPS regulations that have been or are controversial to U.S. interest groups. It is important to notice that only a fraction of all SPS regulations enacted in Mexico are controversial to U.S. officials. Among the 143 SPS regulations enacted by DIGSA, DIGSV, and DIGF since 1993, only 9 of them have been controversial to U.S. officials. The controversial regulations are the final NOM-019-ZOO-1994, NOM-024-ZOO-1995, NOM-044-ZOO-1995, NOM-008-FITO-

1995, NOM-011-FITO-1996, NOM-014-FITO-1996, NOM-017-FITO-1996, NOM-028-FITO-1995, and NOM-013-RECNAT-1997. It is also important to notice that the controversial aspects of these regulations sometimes is associated with the work plans for their implementation, rather than with the rule itself.

The remaining of this section is organized as follows. Subsection a) describes Mexican-U.S. controversies covering a broad spectrum of goods. Subsection b) describes the SPS controversies that involve particular commodities.

a) Controversies Covering a Broad Spectrum of Goods

There have been three controversies covering a broad spectrum of goods that have affected agricultural trade between Mexico and the U.S.

1. *Unappropriated Comments on Proposed Regulations*

The *Ley Federal Sobre Metrología y Normalización* of 1992 mandates regulatory agencies to address all comments they receive after a proposed NOM is published. However, the legislation does not specify how the reviewed comments must be addressed. American officials complain that some comments are not properly addressed when published in the *Diario Oficial*. They complain that sometimes it is difficult to relate the answers to the comments the agency has received. This makes it difficult for interest groups to verify if all comments have been properly addressed.[8] Such an obstacle reduces the ability of interest groups to monitor the adequacy of the enacted SPS regulations (David, 1997).

[8] For instance, on April 11, 1994, DIGSA published its responses to the comments received for the proposed NOM-001-ZOO-1993. Many of DIGSA's responses were very unclear. One of such responses was: "*The modification of issue number 5.2.1. was accepted.*" Such a response did not provide a clear indication about the nature of the modification that was approved.

### 2. *Inadequate Enactment of Emergency Rules*

The *Ley Federal Sobre Metrología y Normalización* of 1992 established NOM-EM as one of the three types of rules possible to be enacted by Mexican agencies. Rules that are considered as NOM-EM escape the comments and revisions that follow a proposed NOM. Because of the lack of participation involved in this type of regulation, SPS regulations enacted under a NOM-EM are not as transparent as other Mexican norms.

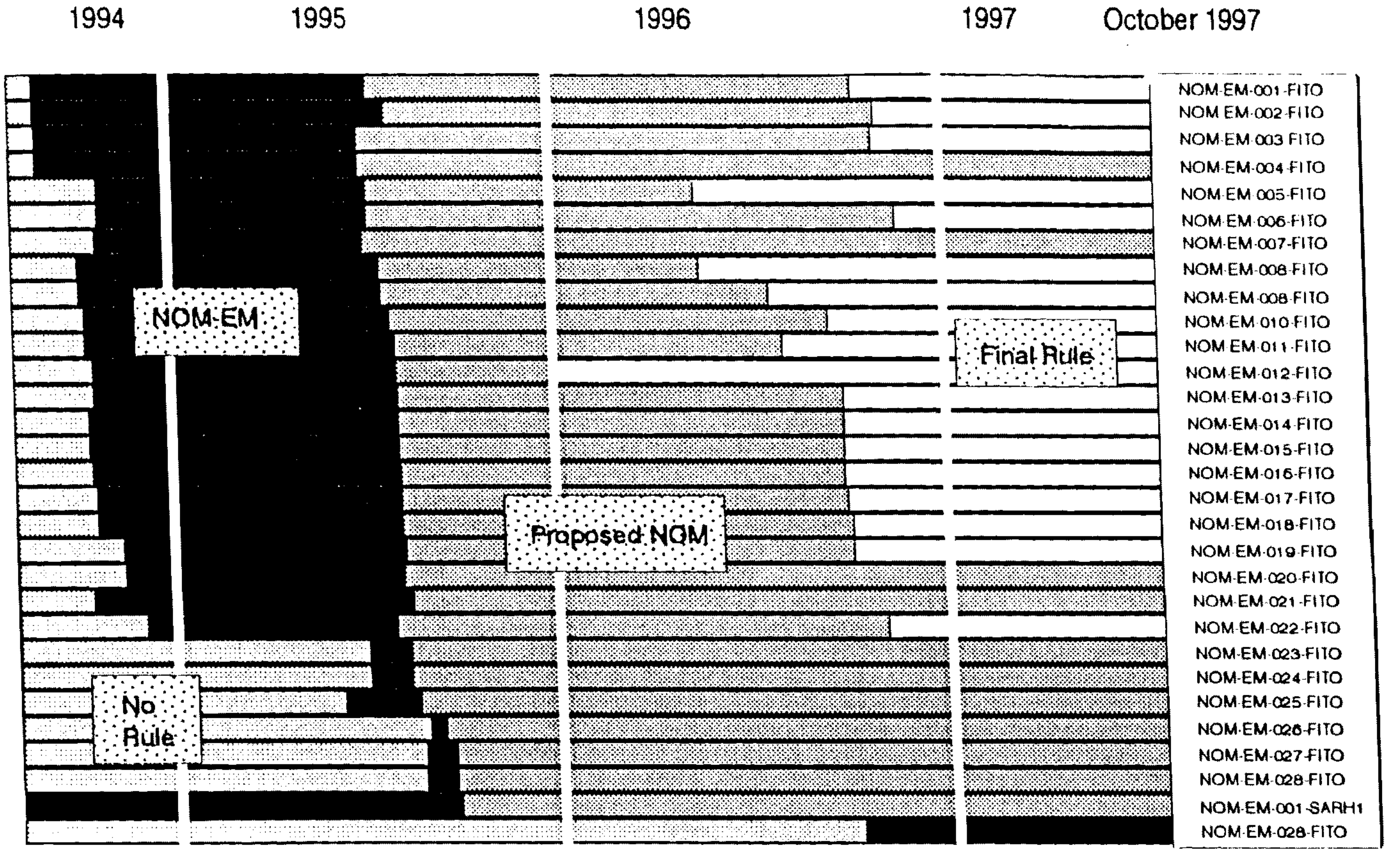
NAFTA allows the enactment of emergency SPS regulations in response to sudden pest outbreaks. However, concern about the enactment of NOM-EMs by Mexico has arisen in the U.S. Appendix A1 shows that 39 percent of the 143 SPS regulatory issues have been regulated as NOM-EM at some point in time (56 emergency rules). American officials have complained that the enactment of many of the NOM-EM has created unnecessary trade disruption. More specifically, U.S. officials complained first, that Mexico had enacted an excessive number of NOM-EM. Second, U.S. officials complained that many of the NOM-EM cannot be justified under NAFTA, since they were not enacted in response to the surge of an unexpected risk. And third, U.S. officials complain that Mexico has applied NOM-EM to commodities that actually do not convey risk for Mexican producers (Office of the United States Trade Representative, 1996).

Mexican officials have acknowledged that most NOM-EM have not been enacted in response to a sudden pest detection (Martínez, 1997). They claim that the enactment of a large number of NOM-EM originated in the need to fill the regulatory vacuum created by the elimination of the import licensing system for agricultural products in 1994. Mexico claims the publication of NOM-EM was required under the premise that the emergency regulations prevented pest and disease risks until appropriate NOMs could be enacted (Martínez, personal communication). Table IV.2 shows the year these emergency rules were enacted.

**Table IV.2. Number of SPS Regulations Enacted as NOM-EM by Mexican Agency and year of enactment**

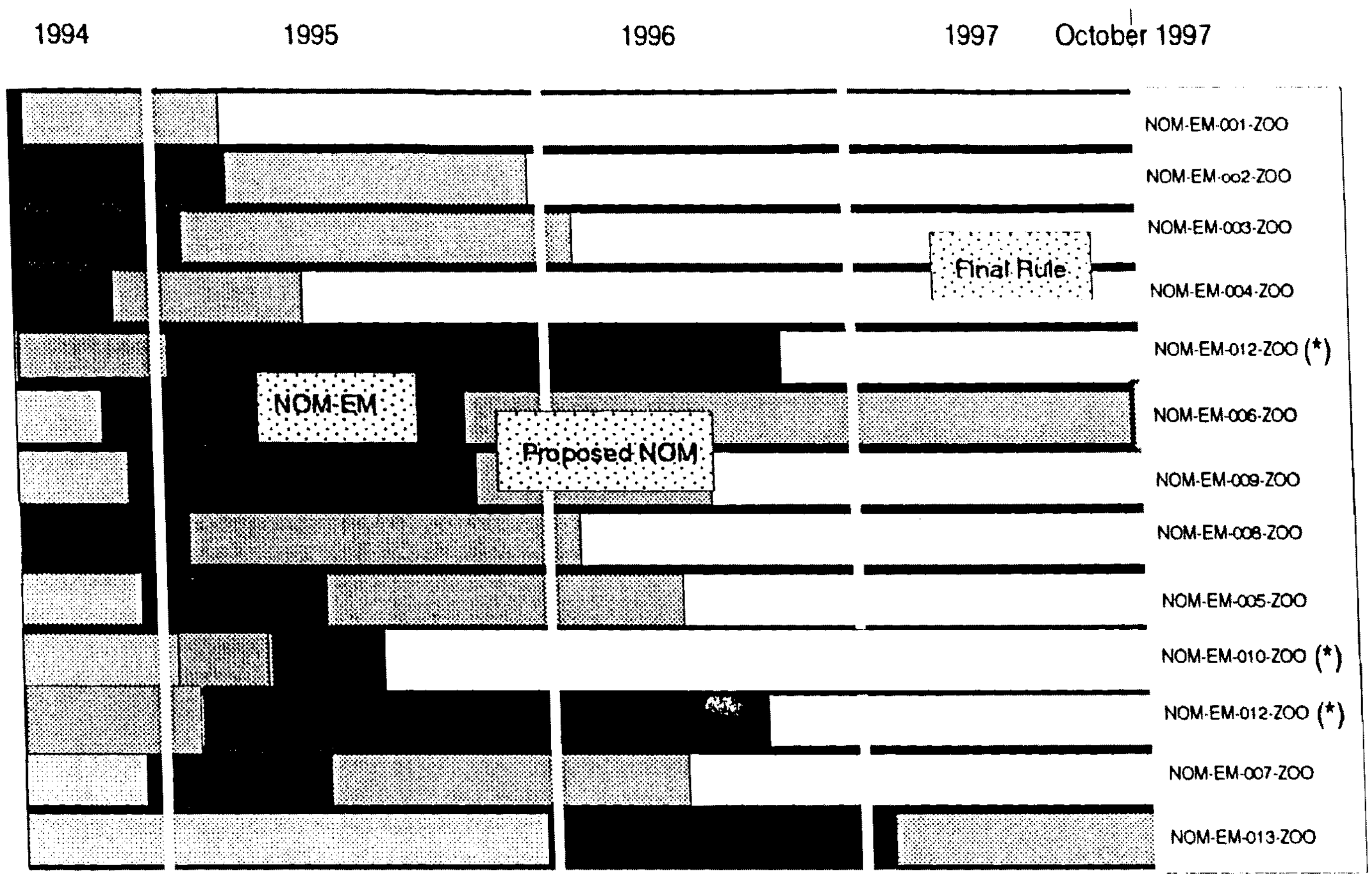
| | DIGSA | DIGSV | DIGF | Total |
|---|---|---|---|---|
| **1993** | 1 | 1 | 1 | 3 |
| **1994** | 8 | 22 | 11 | 41 |
| **1995** | 3 | 6 | 1 | 10 |
| **1996** | 1 | 1 | 0 | 2 |
| **1997** | 0 | 0 | 0 | 0 |
| **Total** | 13 | 30 | 13 | 56 |

Table IV.2 shows that most of the NOM-EM were enacted during the first two years after NAFTA went into effect. Figure IV.5 illustrates the regulatory evolution of the 56 SPS regulations originally enacted as NOM-EM. Each horizontal bar in Figure IV.5 represents a regulatory issue. The sections in black, gray and white in each horizontal bar denote different regulatory stages: the time elapsed between the SPS measure was enacted as a NOM-EM and the corresponding proposed NOM was published, the period between the proposed rule and the final NOM are published, and the period since the final rule went into effect.



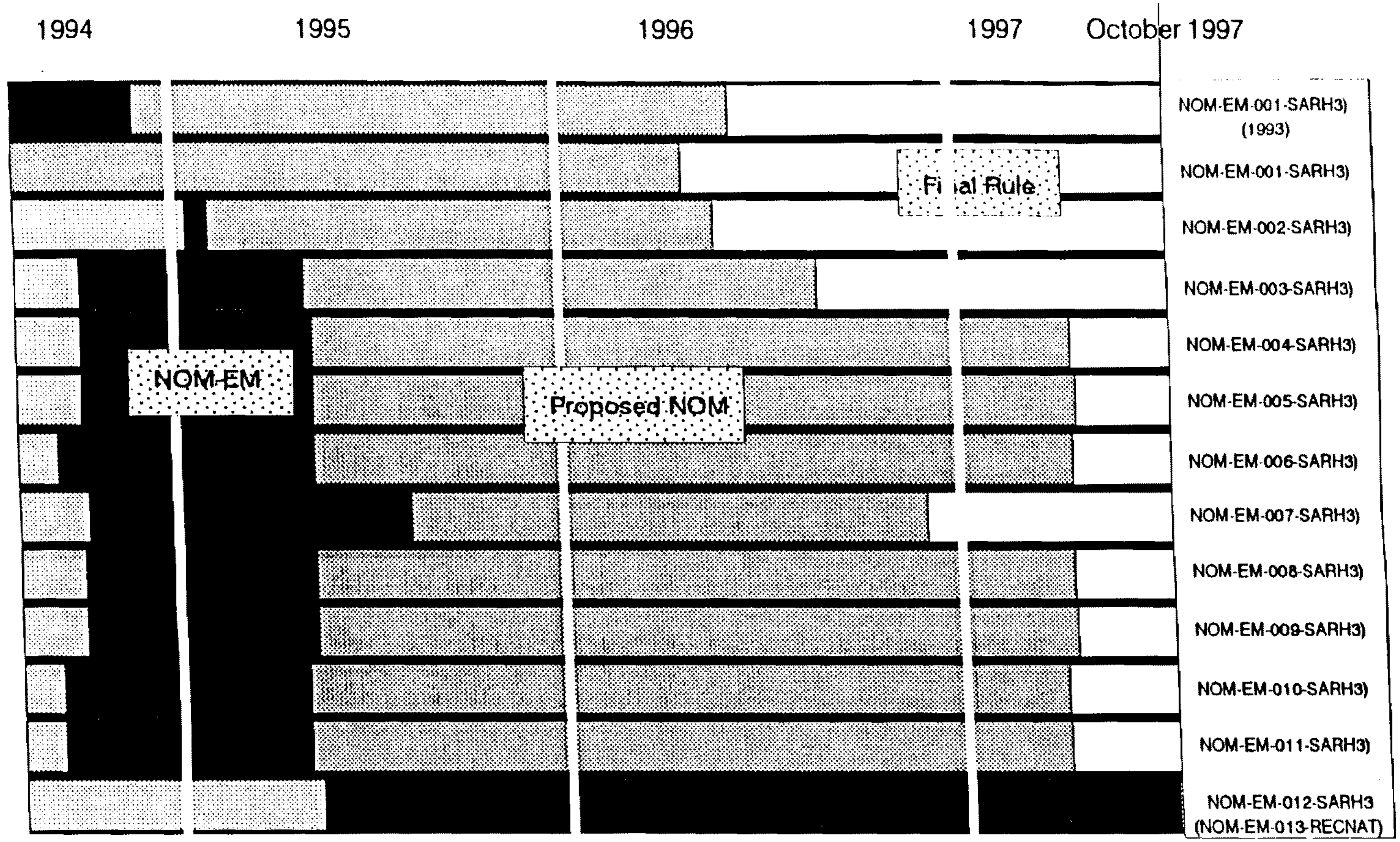

Each horizontal line denotes a different SPS. Black, gray, and white bars denote the time the issue evolved as a NOM-EM, proposed NOM, and final NOM, respectively.

**Figure IV.5a. Emergency Rules Enacted by DIGSV: Its Regulatory Evolution Over Time**




Each horizontal line denotes a different SPS. Black, gray, and white bars denote the time the issue evolved as a NOM-EM, proposed NOM, and final NOM, respectively. Symbol (*) signals an SPS issue were a proposed NOM precedes a NOM-EM

**Figure IV.5b. Emergency Rules Enacted by DIGSA: Its Regulatory Evolution Over Time**




Each horizontal line denotes a different SPS. Black, gray, and white bars denote the time the issue evolved as a NOM-EM, proposed NOM, and final NOM, respectively.

**Figure IV.5c. Emergency Rules Enacted by DIGF: Its Regulatory Evolution Over Time**

Figure IV.5 illustrates that:

i) Most NOM-EMs enacted in 1994 lead to a proposed NOM in 1995.

ii) The average time a regulatory issue spent as a NOM-EM before a proposed NOM was published was 264 days.[9]

iii) In most cases, the time required for a proposed NOMs to yield a final NOM was longer than the time elapsed from the enactment of the NOM-EM to the publication of the proposed rule. The average time required for a proposed norm to become final was 469 days.

iv) Most NOM-EMs enacted in 1994 remained effective until the end of 1996, when they were replaced by the final rule.

v) Figures IV.5a-IV.5c denote the existence of different regulatory patterns among the Mexican regulatory agencies. DIGSV and DIGF show a more consistent schedule of publication than DIGSA. DIGSA's publication schedules seems to depend more on each particular regulatory issue than that of DIGSV. Also noticeably, there are three DIGSA's regulatory issues showing a reversal in their order of publication, i.e., with proposed rules were enacted before NOM-EMs.

The existence of regulatory differences between DIGSA and the other agencies may result from the biological nature of the products it covers. Pests and diseases affecting a family of plants may share some common characteristics that could facilitate the pest risk analyses of the commodities involved. However, the regulatory differences between DIGSA and the other agencies may also respond to some particular characteristics of these agencies. For instance, according to some observers, the animal-health technicians have generally enjoyed a better professional relationship with APHIS' Veterinary Service than DIGSV with APHIS' Plant Protection and Quarantine officials. Such a difference has been attributed to the particular trade characteristics of cattle, which is imported and exported to

[9] Average estimated over all SPS emergency rules that yielded a proposed NOM

both sides of the border (David, 1997), while plant trade has been traditionally more isolated in Mexico (Sheesley, 1997). However, there has been a continuous improvement of the professional relationship between plant regulatory officials since 1994, when NAFTA came into effect (Sheesley, 1997).

3. *Enforcing SPS Regulations: Border Issues*

The creation of DIGIF as a separate organization denotes the importance SAGAR attributes to the enforcement of SPS regulations. Mexican enforcement of SPS barriers at the border was further improved by changes in personnel and more intense monitoring of their activities. Mexico has replaced many of its old corp of inspectors by new, younger ones. The elimination of inspectors who were accustomed to old practices may have helped to increase the transparency of the process. Furthermore, the new corp of inspectors was completed with individuals who have earned some degree in agronomy (Sheesley, 1997).

The transparency of the SPS regulation enforcement has been increased further by CONASAG's routine monitoring of its port personnel. Because of such an increased control, Mexico has reduced the incidence of bribery during border inspections (Sheesley, 1997). However, American officials complain that SAGAR's increased pressure on border inspectors to strictly comply with the law, has reduced the flexibility of the entire system. According to these officials, some Mexican border inspectors, afraid of breaking the law and being punished by their supervisors, have shown a tendency to block the entry of U.S. shipments even for minor, irrelevant formalities. Further, American officials contend that the division of SAGAR's enacting and enforcing responsibilities for SPS regulations into separate agencies may have created some bureaucratic problems. The added bureaucracy has created some communication problems between the enacting and enforcing agencies, causing confusion among SPS enforcers and U.S. exporters regarding the requisites

Mexico imposes to imports (David, 1997).

Overall, the reorganization of SAGAR and the availability of more adequately trained border inspectors have improved the enforcement of Mexican SPS regulations. However, these improvements have not precluded the existence of controversies. For example, Zertuche (1994) reported the following problems at Mexican port inspection stations:

> "Since the beginning of NAFTA in January 1994, "border issues" have dominated trade between Mexico and the United States. Many U.S. exporters have complained that crossing products is now more difficult, more tedious, with NAFTA than before NAFTA. Many of the problems are the result of:
>
> 1. Frequent, and seemingly steady, changes (announced and unannounced) to import procedures by the Secretariat of Agriculture (SARH) on sanitary and phytosanitary issues and the Secretariat of Commerce and Industrial Development (SECOFI) on inspection procedures. These changes cause tremendous confusion on the part of Mexican inspectors, freight forwarders, customs agents, and transporters.
> 2. Outdated, far too small, inefficient inspection in the custom area of Nuevo Laredo.
> 3. Almost endless, repetitive and duplicative bureaucratic and paperwork procedures required by several GOM agencies.
> 4. The attempt on the part of the GOM, particularly SARH, to implement "new" sanitary and phytosanitary regulations, equal, they say to U.S. standards, but without sufficient resources at the border to implement these procedures in reasonable time so as not to impede the free flow of trade."

Likewise, Tom Cooper, a representative for California Macadamia Nut Products stated in March 1997 that:

> "..the biggest problem a businessman has in dealing in Mexico is the problem of not having proper papers for the products we are, or could be, transporting. It is getting better but we are always subject to the possibility of search, seizure, and possible detainment if we do not cooperate with inspection officials." (Cooper, 1997).

Budget limitation of Mexican agencies have been signaled as one of the reasons behind the border's controversies. For instance, a FAS report stated:

> "Inspectors from Mexico's Secretariat of Agriculture (SAGAR) only work one shift, five days a week at the Nuevo Laredo port of entry. Consequently, rail companies report serious backlogs of rail cars carrying grain into Mexico. SAGAR has refused requests for additional personnel or longer inspection times (Conlon, 1997c)"

American officials are also worried about the possibility that some delays may be caused by pressure mounted by the Mexican domestic industry. For instance, a FAS report of December 1996 pointed out:

> "The reduced Mexican inspection schedule is attributed to lack of sufficient resources. However, meetings with the Chihuahua Cattlemen's Association indicate that they put pressure on the government to slow the crossing, citing the problem of cheap "cancer eye" cattle entering Mexico and driving prices down (Stockard et al., 1996)"

American officials expect that the privatization of the Mexican rail system will reduce some of the border-related controversies. On December 20, 1996, the GOM announced that the country's northeastern railway system was awarded to a consortium formed by Mexican and American companies (Stockard et al., 1996).

b) <u>Controversial SPS Regulations With a Direct Effect on Particular Animal Products</u>

There have been four controversies involving animal health issues that have been identified: the requirement of external pesticide application against some ticks, sanitary requirements for breeding cattle, a requirement to perform blood tests for Porcine Respiratory and Reproductive Syndrome (PRRS) to live Pork, and a blood test against avian influenza (AI). For each controversy, the Technical Issues under question are described and the Market Characteristics for the affected products are provided.

1. *External Pesticide Application Against Boophilus sp.*

*Technical Issue*

The enactment of emergency rule NOM-EM-004-ZOO-1994 on July 14, 1994 established a National Campaign against ticks of the genus *Boophilus*. This regulation required U.S. cattle imported into Mexico to be treated with a particular pesticide against ticks of this genus. This measure was considered inappropriate by U.S. officials since the U.S. is free of *Boophilus spp*. The U.S. complained to Mexican authorities about this requirement, especially after a proposed rule was published on November 10, 1994 (NOM-020-ZOO-1994). Mexican authorities acknowledged the American's complain and removed the pesticide requirement when the final rule was published on May 19, 1995 (NOM-019-ZOO-1994).

*Market Characteristics*

Cattle are among the traditional commodities traded between Mexico and the U.S. Typically, Mexican farmers send feeder cattle to the U.S. (mainly through Texas and New

Mexico), while the U.S. send back the animals for slaughter after they gained some weight.[10] Table IV.3 illustrates the pattern of trade in cattle and beef over time.

In spite of the historical relationship, voices of discontent have risen lately both sides of the border. Both the U.S. and Mexican industries have experienced economic difficulties during recent years. The U.S. cattle industry has been hurt by a 1995 fall in prices. Some U.S. farmers have blamed NAFTA for the arrival of a large number of Mexican feeder cattle in the U.S. during that year. However, it may hard to attribute all the change to NAFTA. As the National Cattlemen's Association (NCA) has pointed out, NAFTA did not significantly modify policies affecting the import flow of cattle from Mexico compared to those previously in effect.[11]

Instead, the 1995 surge in Mexican cattle exports to the U.S. could be explained in part by the peso crisis,[12] and also by the severe drought that had affected northern Mexico. The peso crisis reduced domestic demand for meat as well as increased the cost of inputs (e.g., grains, credit). The decrease in the Mexican demand for beef caused a reduction in exports of U.S. cattle and beef to Mexico. At the same time, both the peso crisis and the drought had induced Mexican farmers to liquidate their herds, increasing the sale of animals in the U.S. (Lambert, 1996).

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[10] Mexican cattle directed to slaughter houses have accounted for only a minimal fraction of U.S. cattle imports. Slaughter cattle imports have been practically shut down since 1995, after Food Safety and Inspection Service (FSIS) officials found residues of coumaphos (a pesticide used to kill ticks) in fat samples of slaughter cattle from Mexico (Lambert, 1995)

[11] The enactment of NAFTA brought the following tariff changes on beef products:

i) The U.S. eliminated a 2.2 cents/kg tariff it imposed on Mexican beef cattle, as well as tariffs on Mexican fresh, chilled and frozen beef and veal. U.S. imports of beef edible offal (variety meats) already entered the country duty free.

ii) Mexico eliminated a 15 percent tariff on live slaughter animals, a 20 percent tariff on fresh/chilled beef, and a 25 percent tariff on frozen beef. Those duties had been imposed by Mexico on November 11, 1992. Before then, all these duties had been zero. A 20 percent tariff on beef edible offal will be phased out over a 10 year period.

[12] On December 20, 1994, the GOM announced a devaluation of the peso. After the announcement, investors panicked and ran from the peso. Interest rates arose. Credit for the private sector became highly expensive, causing a severe liquidity crisis for the GOM in 1995 (Sachs et al., 1995).

Seeking some relief from their problems, on May 2, 1994, the Mexican cattle industry complained to the GOM that the U.S. beef industry was violating anti-dumping laws in exporting beef to Mexico. On June 3, 1994, SECOFI announced an investigation on such a complain. The NCA joined the U.S. beef industry in the fight against the Mexican cattle industry's accusation.

**Table IV.3. Mexico-U.S. Trade of Cattle, Beef and Veal (1990-1996)**

| Year | U.S. Imports | | U.S. Exports | |
|---|---|---|---|---|
| | Live Cattle (no. of heads) | Beef and Veal (MT) | Live Cattle (no. of heads) | Beef and Veal (MT) |
| 1990 | 1,261,204 | 1,156 | 64,226 | 28,104 |
| 1991 | 1,034,245 | 559 | 210,075 | 63,617 |
| 1992 | 982,038 | 299 | 251,506 | 67,986 |
| 1993 | 1,296,609 | 1,071 | 76,854 | 38,032 |
| 1994 | 1,072,126 | 1,257 | 128,636 | 70,478 |
| 1995 | 1,653,408 | 2,101 | 14,641 | 28,871 |
| 1996 | 456,246 | na | 115,249 | 58,649 |

Source: FATUS (1990-1996).

The confrontation between the Mexican and American cattle industries has been soothed since its mid 1990s inception. On January 17, 1996, the NCA and the Mexican Livestock Association (CNG) signed a Memorandum of Understanding "under which both organizations have committed themselves to work together to strengthen fair and equitable bilateral commerce, without subsidies or disguised barriers to trade" (NCA, 1996). Under this Memorandum, the CNG requested that SECOFI terminate the anti-dumping investigation. SECOFI complied with such a request by publishing an announcement in the *Diario Oficial* on April 25, 1996.

The ameliorated relationship between the Mexican and cattle industries took place under better market conditions. In 1996, Mexico began to recover from the peso crisis. The recovery induced an increase in demand for meat products in Mexico. Table IV.3 shows the 1996 rise in U.S. cattle exports. The Mexican industry has not been able to capitalize fully from the increased Mexican demand. In spite of receiving some relief from the GOM, cattle stocks remain low. The large sales of 1995 have depleted Mexican cattle inventories.[13]

The sharp rise in imports of U.S. beef in 1996 has renewed the concern of the Mexican cattle industry. In spite of its improved relationship with the NCA, in December 1996, CNG officials threatened to submit another dumping claim against U.S. beef imports to SECOFI (Stockard et al., 1996). On April 7, 1997, the Mexican Association of Feedlot Owners (AMEG) submitted to SECOFI a petition for an anti-dumping investigation against meat imports from the U.S. AMEG is seeking compensatory duties between 18 to 84.68 percent. Up to August 1997, SECOFI had not responded to AMEG's petition. AMEG represents the Mexican feedlot producers. AMEG's political weight is much lower than that of CNG. AMEG has been lobbying CNG for political help in their request (Russell, 1997).

[13] In June 1997, The GOM announced a line of credit for the Mexican cattle industry to re-populate the depleted herds.

2. *Sanitary Requirements for Breeding Cattle.*

*Technical Issue*

The NOM-024-ZOO-1995 regulates the entry and mobilization of animals into Mexico. DIGSA's implementation of this NOM for breeding cattle requires, among others, that breeding cattle entering Mexico must carry a sanitary certification showing that the animals:

i) are either virgin heifers (or artificially bred) or vaccinated against campylobacter. A blood test for campylobacter is also needed,

ii) have been vaccinated against leptospirosis (a blood test is also required), and

iii) are both clinically free and vaccinated against Infectious Bovine Rhinotracheitis (IBR).

American officials claim that such certification is unnecessary since the involved pathogens are present on both sides of the border (David, 1997).

*Market Characteristics*

American breeding cattle are in demand in Mexico, particularly since 1995, when the re-population of Mexican herds has become an important policy for the GOM. Such a herd re-population constitutes one of the five programs which encompass the *Alianza para el Campo.*[14] Further, in June 1997, Banrural, the Rural Development Bank of Mexico, announced the availability of loans to breeding cattle importers. These loans would cover up to 85 percent of the value of the breeding imports (Conlon, 1997a).

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[14] The other four programs are: PROCAMPO, PRODUCE, Technical Assistance, and Marketing Assistance.

The U.S. is well positioned to satisfy the demand for breeding stock. Even before NAFTA, Mexico has been an open market for U.S. breeding cattle and genetics. About 75 percent of all overseas U.S. shipment of breeding stock goes to Mexico. About 72 percent of all imports of breeding cattle came from the U.S., while Canada supplies another 26 percent (Zertuche, 1995a). Furthermore, Mexico has not imposed any tariffs under NAFTA on U.S. breeding cattle or animal genetic products. Mexican imports of breeding cattle had grown strongly until 1991, when they peaked at about $60 million. Since then, the value of breeding cattle exports declined until they reached $34 million in 1993. In 1994, U.S. exports rebounded to $61.3 million. The peso crisis and the drought in the north of Mexico reduced the demand for U.S. breeding stock in Mexico. The value of U.S. exports of breeding stock to Mexico totalized $21.9 million in 1995. U.S. exports of breeding cattle to Mexico during the first half of 1996 went up to 8,004 head, compared to 959 head during the same period in 1995 (Conlon, 1997b).

3. *Requirements to Perform Blood Tests For Porcine Respiratory and Reproductive Syndrome (PRRS) to Live Pork.*

*Technical Issue*

The NOM-024-ZOO-1995 regulates the entry of animals into Mexico. However, this controversy originates even before this norm was first enacted as an emergency rule (NOM-EM-010-ZOO-1995). In 1992, SAGAR has issued a regulation aimed to control Porcine Respiratory and Reproductive Syndrome (PRRS), or *Síndrome disgénico* in Spanish. The PRRS is a relatively new disease in Mexico. In 1992, Mexico closed its border to the entry of American live pork because of this disease. However, PRRS has subsequently been detected also in Mexico. After several complains made by APHIS, in 1995 DIGSA eased the 1992 prohibition and allowed the entry of American animals directed to Mexican federally approved slaughter plants. DIGSA still requires blood tests for animals to be used for breeding purposes. The test is expensive and APHIS claims it is unnecessary since Mexico has the disease. APHIS also claims that the requirement is discriminatory against American producers, since similar tests are not requested for transactions involving potentially infected Mexican animals (David, 1997).

*Market Characteristics*

Pork is an expanding industry in the United States. By 1996, the U.S. had become the second largest world exporter, up from the 7th place in 1992. Japan is by far the largest pork importer, with 43 percent of total world imports in 1995. Mexico, although counting for just 2 percent of the total world imports, is still the 7th largest pork importer and an attractive market for U.S. exports (National Pork Board, 1996). The U.S. is the main supplier of pork products to Mexico. Table IV.4 shows that since NAFTA was enacted, the U.S has provided more than 60 percent of Mexico's pork imports.

**Table IV.4. Mexico and the U.S. Trade of Pork and Pork Products (1990-1996)**

| Year | U.S. Imports from Mexico | | U.S. Exports to Mexico | |
|---|---|---|---|---|
| | Live Pork (no. of head) | Pork meat (MT) | Live Pork (no. of head) | Pork meat (MT) |
| 1991 | 0 | 5 | 253,208 | 26,827 |
| 1992 | 0 | 0 | 97,920 | 35,383 |
| 1993 | 0 | 0 | 30,464 | 29,000 |
| 1994 | 0 | 0 | 123,430 | 43,911 |
| 1995 | 0 | 13 | 4,956 | 20,968 |
| 1996 | 0 | 0 | 40,637 | 22,524 |

Source: FATUS (1990-1996).

The Mexican pork industry has been struggling in Mexico lately. The rise in international prices for feed grain and the peso devaluation were two of the main factors for its decline. According to FAS, Mexican pork producers cannot compete with their American counterparts because of their higher feed costs and herd management inefficiencies (Zertuche, 1995b). The peso devaluation raised input costs and deteriorated the consumption power of the urban population. The Mexican National Pork Producer's Association (CONAPOR) has been trying to halt pork imports from the U.S. even before NAFTA was in place. In March 1993, CONAPOR requested SECOFI an anti-dumping investigation against U.S. pork imports that entered Mexico during May 1991 and May 1992. In spite of a preliminary answer favorable to CONAPOR in September 1993, on August 26, 1994, SECOFI closed the case after finding no evidence that the U.S. imports had injured the Mexican producers during the period in question (Economic Research Service, 1997).

Lately, CONAPOR has blamed NAFTA for its problems.[15] In particular, CONAPOR complains that NAFTA allowed the entry of "cast-off low quality pork products" from the U.S. as inexpensive inputs by meat processors. Imports of both turkey meat and mechanically deboned meat (MDM) from the U.S. are replacing pork as a source for sausage and cold cut production, mainly turkey ham (Trejo, 1997). The pork industry has been affected by those poultry imports because pork processors are responsible for about one third of all pork sales in Mexico (Zertuche, 1995b). Furthermore, SECOFI has allowed the U.S. to exceed the 1995 and 1996 NAFTA TRQ without charging the corresponding over-quota tariff. The Mexican pork industry has unsuccessfully demanded

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[15] Since NAFTA was announced, the Mexican pork industry expected to be negatively affected by the agreement. Prior to NAFTA, Mexico maintained a 20 percent duty on non-purebred hogs. Under NAFTA, Mexico has implemented TRQ safeguards for U.S. and Canadian imports of slaughter swine, fresh, chilled, and frozen pork and ham. The initial quotas under these safeguards were 324,300 heads of live swine heavier than 50 kilograms, 5,000 MT of swine meat, carcasses and half-carcasses, fresh or chilled, 15,200 MT of ham, etc.

the GOM to block such over-quota imports of MDM (Crawford and Link, 1996).[16]

The Mexican pork industry's frustration with NAFTA has been further exacerbated by APHIS' delay in publishing a final regulation on "regionalization." APHIS published a proposed rule in the Federal Register on April 18, 1996, which established importation criteria for ruminants and swine based on the level of risk in specific geographical regions. The Mexican pork industry, which claims it enjoys a region free of relevant diseases, has manifested its discontent with APHIS' delay in following up with a final rule. Such a delay is perceived by the Mexican pork industry as an unjustified technical barrier to trade. The Mexican pork industry argues that this has been an asymmetric compliance with NAFTA by the GOM and the U.S. (Flores et al., 1997).

Seeking relief, CONAPOR has requested the GOM to: i) implement some type of financial help for farmers, and ii) restrict the use of cooked ham for products made of pure-pork ham. The GOM has shown some responsiveness to those demands. On December 6, 1996, SAGAR announced the "Pork Industry Support Program", which would subsidize pork producers who send animals to federally inspected slaughterhouses (Trejo, 1997). Also, SECOFI has initiated the draft of a regulation to restrict the use of the label "cooked ham" for products made up of pure-pork ham (Flores, 1996a). A visit of President Clinton to Mexico in May, 1997, subsequently helped to defuse the controversy. In the associated BNC's report, the U.S. states its commitment to declare the State of Sonora a low risk zone for hog cholera.

[16] The Mexican poultry industry has expressed less appreciation to the entry of MDM than the Mexican pork industry because it produces basically for the whole bird market. The Mexican poultry industry cannot offer low-valuecuts to the sausage industry (Crawford and Link, 1996)

4. *Tests Against Avian Influenza.*

*Technical Issue*

Since 1994, DIGSA has required all U.S. poultry and poultry products entering the country to be accompanied by a health certificate verifying they originated from flocks with no clinical, serological, or viral evidence of AI (NOM-EM-005-ZOO-1994). This requirement was strengthened in 1995 to require that all adult birds be tested against avian influenza using the agar gel precipitin test (amendment to NOM-EM-005-ZOO-1994, published in the Diario Oficial on 1/3/96). The emergency rule was made permanent when the final regulation took effect on August 14, 1996 (NOM-044-Z00-1995).

APHIS claims such a regulation is extremely restrictive, since it does not distinguish between non-pathogenic and highly pathogenic AI. Non-pathogenic AI is present all over the world. However, the U.S. is free of the highly pathogenic AI. APHIS contends that by not distinguishing between the strains of AI, DIGSA is imposing an unjustified technical barrier to trade (David, 1997).

*Market Characteristics*

Like the pork industry, the Mexican poultry industry has suffered the consequences of the peso crisis and the rise of feedgrain prices.[17] In order to provide relief to the industry, SECOFI has increased the TRQ for feed grains, especially corn, during the past few years (Juárez, B., and S. Trejo, 1997).

The increase in poultry meat imported from the U.S. is shown in Table IV.5. Such an increase has caused concern to the Mexican poultry industry. The industry has been particularly concerned with the importation of U.S. poultry meat in brine. The industry has complained against what they call "technical contraband" imports of fresh poultry. The industry has claimed that, in order to profit from the tariff differential from imported fresh poultry and poultry in brine, Mexican importers were temporarily importing fresh poultry in a brine solution, which they then rinsed and sold as fresh upon their entry into Mexico[18].

The situation recently improved for the Mexican poultry industry. The recovering of the Mexican economy has increased the domestic demand for poultry (Juárez and Flores, 1997). And on December 20, 1996, SECOFI accommodated the poultry industry's concern by publishing in the *Diario Oficial* changes in the explanatory notes for import tariffs that are expected to reduce the entry of U.S. poultry in brine.

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[17] Upon the enactment of NAFTA, Mexico converted its import licensing regime for fresh, chilled, and frozen poultry imported from the U.S. to a TRQ. The initial quota for poultry imports coming from the U.S. was 95,000 metric tons (MT). This quota is increasing an annual 3 percent over 10 years. The 1997 quota is set at103,838 MT. U.S. exports in excess of the quota were initially levied at:

i) for whole turkey: $1,850 per MT for whole turkey (but not less than 133 percent),

ii) for chicken and other poultry: $1,680 per MT (but not less than 260 percent).

Over the first 6 years of the agreement, an aggregate 24 percent of the over-quota tariffs are being eliminated. The remaining tariffs will be eliminated over the rest of the 10-years transition period. For 1997, the over-quota tariffs were set at:

i) for whole turkey: $1,554 per MT for whole turkey (but not less than 112 percent),

ii) for chicken and other poultry: $1,411 per MT (but not less than 218 percent).

[18] In 1996, imports of poultry meat in brine from the US. were subject to a 7 percent import tariff, with no TRQ. Poultry meat imports were subject to a TRQ with an over-quota tariff no inferior to 117 percent for turkey, and 227 percent for chicken.

## Table IV.5. Mexican Production and Imports of Chicken and Turkey Meat (1985-1996)

| Year | Chicken Meat | | Turkey Meat | |
|---|---|---|---|---|
| | Production (MT) | Imports (MT) | Production (MT) | Imports (MT) |
| 1985 | 551,704 | 18,592 | 40,577 | 0 |
| 1986 | 672,641 | 19,118 | 33,841 | 0 |
| 1987 | 672,893 | 21,752 | 29,113 | 0 |
| 1988 | 627,449 | 75,291 | 29,499 | 2,604 |
| 1989 | 611,032 | 38,694 | 22,978 | 3,793 |
| 1990 | 750,427 | 40,415 | 24,595 | 3,088 |
| 1991 | 857,947 | 61,239 | 20,569 | 22,844 |
| 1992 | 898,495 | 85,787 | 13,002 | 39,384 |
| 1993 | 1,040,029 | 113,269 | 12,012 | 56,723 |
| 1994 | 1,126,008 | 124,143 | 9,240 | 70,211 |
| 1995 | 1,283,867 | 118,733 | 9,240 | 70,726 |
| 1996 | 1,145,000 | 102,823 (*) | 9,240 | 70,466 (*) |

Source: FAO, except (*), obtained from FATUS. Symbol (*) denotes trade only with the U.S.

c) *Controversial SPS Regulations With a Direct Effect on Particular Plant Products*

There have been seven controversies involving plant health issues that have been identified: the requirement for fumigation of sweet cherries, the delay in the approval of a work plan to allow the entry of Christmas Trees from Northeastern U.S., a fumigation requirement for U.S. stone fruits, a requirement to monitor northwestern apples, a ban on the Entry of Florida, Texas, and Arizona Citrus, a requirement to fumigate cotton and cotton products, and a required fumigation of wheat against Karnal bunt. For each controversy, the Technical Issues under question are described and the Market Characteristics for the affected products are provided.

1. *Requirement for Fumigation of Sweet Cherries.*

*Technical Issue*

Until 1992, the entry of sweet cherries to Mexico had been regulated by an import licensing system. In 1992, DIGSV required U.S. cherries shipped to the Mexican market to be fumigated with methyl bromide in order to eliminate three pests of concern.[19] Fumigation with methyl bromide is performed at Mexico's ports of entry, causing delays and increasing commercialization costs (Sheesley, 1997). The 1992 requirement was later formalized by the enactment on October 6, 1994, of the emergency rule NOM-EM-008-FITO-1994, and by a proposed and final NOM-008-FITO-1995, published on August 14,

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[19] Methyl bromide is a fumigant which is being phased out inthe U.S. for its potential damage on the ozone layer. Under the Clean Air Act, the EPA has prohibited the production and importation of methyl bromide starting January 1, 2001. In addition, EPA has frozen U.S. production and importation in 1994 at1991 levels (December 10, 1993 - 58 FR 65018).

1995, and July 8, 1996, respectively.

American officials complain that such a measure is not scientifically based. The U.S. industry points out that the Mexican concern did not originate from any pest finding by port inspectors. U.S. officials claimed that "between 1987 and 1991 the U.S. exported 476 tons of APHIS inspected and certificated sweet cherries to Mexico with no pest problems, concerns, or issues reported by Mexico's plant health officials" (APHIS, 1994). Furthermore, APHIS contended that sweet cherries from the States of California, Oregon, and Washington were not attacked by the pests about which Mexico was concerned with (APHIS, 1994).

In response to a request made by the U.S. government, a NAFTA panel was appointed to analyze this issue. The panel included three plant quarantine officials (one each from Mexico, the U.S., and Canada), and a chairperson from Europe. The panel concluded that Mexico had the right to be concerned with the involved pests, but it had no need to request pest measures beyond those currently applied by U.S. growers. According to Kraig Naasz, vice-president of the Northwest Horticultural Council, the fact that Mexico produces very few cherries was a major factor in the panel's decision (Warner, 1996).

In spite of the NAFTA panel resolution, the entry of U.S. sweet cherries to Mexico was restricted until 1997. On February 20, 1997, soon after APHIS published a final rule allowing the entry of Haas avocados from Mexico, the U.S. Secretary of Agriculture Dan Glickman announced that Mexico will allow the importation of sweet cherries from the U.S.[20] According to Secretary Glickman, sweet cherries from California, Washington, and Oregon will begin to be exported to Mexico by mid-April from California, and the end of May 1997 from Washington and Oregon (Jones and Redding, 1997).

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[20] The ban on Mexican avocados has been described in detail by Roberts and Orden (1997)

*Market Characteristics*

Under NAFTA, Mexico eliminated a previous 20 percent tariff on U.S. sweet cherries. Compared with the U.S., Mexico is a very small producer of sweet cherries (APHIS, 1994).

**Table IV.6. Sweet Cherry Exports to Mexico (1987-1995)**

| Year | From Washington State (Tons) | Total U.S. (Tons) |
|---|---|---|
| 1987 | 7.9 | 33 |
| 1988 | not available | 71 |
| 1989 | 73.9 | 96 |
| 1990 | 86.1 | 142 |
| 1991 | 188.8 | 211 |
| 1992 | 0 | 0 |
| 1993 | 0 | 0 |
| 1994 | 0 | 0 |
| 1995 | 0 | 0 |

Sources: San Joaquin Valley Shippers, Northwest Cherry Growers, and FAS/USDA, as cited in APHIS, 1994.

Table IV.6 shows that exports of American sweet cherries to Mexico have increased during the early 1990s. Sweet cherry exports ceased in 1992 based on some DIGSV's phytosanitary concerns. Table IV.6 illustrates the volume of U.S. exports of sweet cherries to Mexico from 1985 to 1995.

2. *Delay in the Approval of a Work Plan to Allow the Entry of Christmas Trees from Northeastern U.S.*

*Technical Issue*

Before 1997, the entry of Christmas trees to Mexico must comply with phytosanitary regulations specified by emergency rule NOM-EM-012-SARH3-1994. This emergency rule imposed restrictions on American growers regarding, among others, the type and origin of the trees. It has been the restricted origin of the trees which has generated controversy among U.S. growers. According to the emergency rule, growers from the northeastern states of the U.S. are not allowed to ship their trees to Mexico. This restriction has motivated APHIS and growers in the affected U.S. States to propose a work plan which addresses the Mexican concerns (Flores, 1996b).

Discussions for such a work plan were held during the second half of 1996. According to FAS, the continuous addition of new requisites to be incorporated into the international phytosanitary certificates caused the delay in the approval of the work plan (Zertuche, 1996). Nevertheless, U.S. northeastern growers failed to ship trees to Mexico for the 1996 Christmas season based on market conditions (Gutierrez, 1997). A proposed rule for the entry of Christmas trees was published by DIGF on July 7, 1997 (NOM-013-RECNAT-1997).

*Market Characteristics*

The Mexican market for U.S. Christmas trees has been growing during recent years. Traditional Mexican decorative items like *piñatas* and nativity scenes have been increasingly combined with articles closer to the American tradition, like candy canes and Christmas trees. Price reductions associated with NAFTA may help to explain such a change in demand. The Mexican tariff for Christmas trees was eliminated when NAFTA went into effect.[21] The increased demand for Christmas trees in Mexico faced an unprepared domestic industry. Only a few specialized plantations growing Christmas trees exist in Mexico. Canada, and specially the U.S. provide most of the Christmas trees that Mexico imports (Zertuche, 1995c).

3. *Fumigation Requirement for U.S. Stone Fruits.*

*Technical Issue*

After the 1991 season, Mexican authorities were concerned that the pests Apple maggot, Plum curculio, and oriental fruit moth could enter the country through U.S. exports of stone fruits. In response to this concern, Mexico issued post-harvest requirements which affected the access of American stone fruits. The U.S. industry considered the Mexican requirement to fumigate the fruit with methylbromide excessive. In particular, U.S. officials considered discriminatory the fumigation of canning peaches, since Mexican peaches exposed to the same pests were shipped to processing plants without fumigation (Juarez, 1996).

In 1994, DIGSV enacted NOM-EM-008-FITO to regulate the entry of fruits into Mexico. A work plan for the entry of peaches and nectarines to Mexico for the 1994-1995 season was signed by APHIS and DIGSV. The work plan required fumigation of the fruit to be exported, as well as the presence of Mexican inspectors for inspections and certifications. The additional cost imposed on U.S. growers by the 1994-1995 work plan was considered excessive by the U.S. industry (Sheesley, 1997). However, these costs

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[21] U.S. Christmas trees faced a 20 percent tariff before NAFTA

were reduced one year later, when the work plan for 1995-1996 was signed in February 1996. According to Jim Rice, director of technical and transportation services for the California Grape and Tree Fruit League (cited in Good Fruit Growers, 1996), the U.S. industry expects that inspection costs for a plum facility will drop from $6,500 in 1995/96, to $2,000 in 1996/97. Furthermore, "the industry is hopeful a pilot program with an alternative protocol of fruit inspection and fruit cutting ...[may provide] data to support peach and nectarine shipments in 1997 without fumigation" (Good Fruit Growers, 1996). Officials at APHIS have also manifested their satisfaction with the technical outcome of this dispute (Gutierrez, 1997).

*Market Characteristics*

Mexico has been an important market for U.S. stone fruits since the early 1990s. However, as it is shown in Table IV.7, exports of stone fruits increased until 1991, then suffered a three years decline until they returned to their growing path in 1994. NAFTA has reduced tariffs on U.S. stone fruits entering Mexico.[22] The reduction in U.S. exports between 1992-1993 was justified by Mexico based on phytosanitary concerns. U.S. exports of peach, plums and nectarines were affected by Mexican restrictions. According to FAS, peach and plum production in Mexico is large and very stable around 175,000 and 88,000 MT, respectively. Nectarines are not commercially produced in Mexico.

[22] Before NAFTA, Mexico charged a 20 percent tariff on fresh peach imports from the U.S. Under NAFTA, in 1994, Mexico reduced this tariff to 15 percent. The remaining tariff will be phased out by the year 2001.

**Table IV.7. Mexican Imports (in MT) of Fresh Peaches and Nectarines, 1987-1996**

| Origin | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| U.S./1 | 700 | 6,200 | 13,100 | 9,900 | 18,700 | 8,781 | 6,785 | 15,750 | 11,674 | 8,801 |
| Chile/1 | 0 | 0 | 100 | 100 | 1,000 | 5,356 | 5,215 | 9,858 | na | na |
| Others | na | na | na | na | na | 44 | 39 | 115 | na | na |
| Total | 700 | 6,200 | 13,200 | 10,000 | 19,700 | 14,181 | 12,039 | 25,734 | na | na |

Source: Zertuche, 1995d., and FATUS (years 1995 and 1996). /1: The U.S. and Chile are the two leading sources of peaches. Mexico does not produce nectarines. All consumed nectarines are imported from Chile and the U.S. American and Chilean products enjoy the tariff reductions approved by NAFTA and the Mexico-Chile free trade agreement. Chilean and the U.S. products do notcompete with each other because of reversed seasonality. American peaches do compete with Mexican peaches, while Chilean peaches compete with Mexican apple and pears.

In 1987, imports constituted about 2 percent of all peaches consumed in Mexico. In 1991, before the SPS regulation was enacted, the import share of U.S. peaches increased to 9 percent of the domestic market. FAS estimated that the solution to the controversy would allow a 10 percent contribution of imports to the consumption of peach in Mexico in the year 2,000 (Zertuche, 1995d).

4. *Monitoring of Northwestern Apples.*

*Technical Issue*

Until September 1994, only certain counties in the States of Washington and Oregon had been allowed to ship apples to Mexico. DIGSV was concerned with the presence of Apple maggot, Plum curculio, tufted apple budmoth, and oriental fruit moth in the apples to be exported. On October 6, 1994, DIGSV enacted the NOM-EM-008-

FITO-1995, which regulates the entry of fresh fruits and vegetables to Mexico. Such an emergency rule expanded the areas where growers are allowed to export apples to Mexico. However, the rule required that U.S. growers from the Northwest of the U.S. had to allow Mexican inspectors to monitor their orchards. DIGSV also required U.S. packing houses to be inspected, and that apples to be exported to Mexico must receive a cold treatment. These requirements were considered excessive by the U.S. industry. For instance, in order to record the required temperatures, warehouses would have to keep their air conditioning running. The common practice of lowering costs by temporarily interrupting the supply of conditioned air without significatively rising the temperature of the fruit would not be possible (Warner, 1995).

Kraig Naasz, vice president for international trade at the Northwest Horticultural Council (NHC) claims that the Mexican decision resulted from a retaliatory strategy for APHIS' delay in allowing the entry of Mexican avocados to the U.S. He asserted that "if we want to be treated fairly, we have to treat other people fairly". Furthermore, Naasz declared that the NHC:

> "has been one of the most vocal in supporting access to the United States for Mexican avocados under conditions that are fair and scientifically based. It is believed that the ban on Mexican avocados is one of the reasons that Mexico imposes a very rigorous protocol for U.S. apples going into Mexico." (Good Fruit Growers, 1996).

In spite of such considerations, the northwestern American growers acceded to the Mexican requirement. A new work plan for the 1996/1997 season to export apples from northwestern U.S. (Washington, Oregon, and Idaho) to Mexico was signed on August 15, 1996 by DIGSV and APHIS, signaling the end of this dispute (Conlon, 1996).

The agreement reached between DIGSV and growers from the northwestern U.S. States could be expanded in the future to other States. On June 17, 1997, DIGSV officials visited apple orchards in Colorado and Utah as a previous step to the elaboration of a work plan for allowing the entry of apples from these States to Mexico (Juárez et al., 1997).

*Market Characteristics*

NAFTA has stimulated U.S. exports of fresh and processed apples to Mexico.[23] Table IV.8 shows the evolution of the U.S.-Mexican trade over time. The TRQ was reached in 1995 (and 1996), forcing all U.S. apple shipments beyond that quantity to be levied with a 20 percent tariff. The U.S. exports increased sharply in 1996, after the Mexican economy recovered from the peso crisis. Apple accounted for 71 percent of the total value of all fresh fruits exported to Mexico in 1995.[24]

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[23] Under NAFTA, U.S. apples enter Mexico under a TRQ system. Initial TRQ was set at 55,000 MT. TRQ grows at a 3 percent compounded annual rate. The 1997 TRQ is set at 60,099 MT. The 20 percent in-quota tariff Mexico imposed on U.S. apples in 1994 will be phased out by the year 2,000. The in-quota tariff for 1997 is 12 percent. The over-quota imports are subject to the 20 percent tariff non-NAFTA countries face. The Mexico-Chile free trade agreement does not contain any provision for apple imports. Apple from Chile are subject to the 20 percent duty.

[24] Pears accounted for 20 percent of total value of fresh fruits exported to Mexico in 1995. Thus, apple and pears together represent about 90 percent of all fresh fruit exports to Mexico. Remaining commodities include grapes (4 percent), citrus (2.5 percent), berries, peaches, plums and others (Crawford and Link, 1996).

## Table IV.8. Production, Trade and Consumption of Apples in Mexico (1980-1996)

| Year | Production (MT) | Imports (MT) | Exports (MT) | Consumption per capita (kg/yr) | Imports over Consumption |
|---|---|---|---|---|---|
| 1980 | 261,772 | 5,151 | 26 | 4 | 0.0214 |
| 1981 | 290,750 | 2,389 | 10 | 4 | 0.0091 |
| 1982 | 292,750 | 94 | 24 | 4 | 0.0004 |
| 1983 | 287,766 | 17 | 12 | 4 | 0.0001 |
| 1984 | 458,503 | 26 | 2 | 6 | 0.0001 |
| 1985 | 423,071 | 11 | 42 | 5 | 0.00 |
| 1986 | 447,804 | 589 | 40 | 5 | 0.0015 |
| 1987 | 486,297 | 1,891 | 11 | 6 | 0.0043 |
| 1988 | 506,765 | 3,258 | 3,663 | 6 | 0.0072 |
| 1989 | 505,959 | 1,095 | 4,580 | 5 | 0.0025 |
| 1990 | 456,538 | 5,299 | 8,128 | 5 | 0.0130 |
| 1991 | 527,373 | 21,953 | 7,782 | 6 | 0.0451 |
| 1992 | 598,230 | 63,464 | 10,492 | 7 | 0.1084 |
| 1993 | 537,774 | 127,046 | 12,327 | 7 | 0.2168 |
| 1994 | 487,698 | 163,164 | 13,082 | 6 | 0.2847 |
| 1995 | 413,323 | 84,776<br>74,370* | 10,972<br>690* | 5 | 0.2079 |
| 1996 | 426,323 | 81,215* | 1,789* | na | na |

Source: FAO, except 1996 production (SAGAR), and (*), obtained from FATUS. Symbol (*) denotes trade only with the U.S.

Table IV.8 shows that the proportion of apples consumed in Mexico that comes from imports has risen from almost zero in 1984 to 28 percent ten years later.[25] This increase has concerned the Mexican domestic industry. Apples represent the largest tree fruit crop in Mexico and its production has grown only moderately (Zertuche, 1995e).

In 1997, the Fruit Growers Association of the state of Chihuahua (Unifrut) asked the GOM for protection (Juarez et al., 1997). On March 6, 1997, SECOFI announced in the *Diario Oficial* the start of an anti-dumping investigation against imports of red and golden delicious apple from the U.S. On September 1, 1997, SECOFI published in the *Diario Oficial* a preliminary resolution to its investigation which calls for a provisional compensatory duty of 101 percent to U.S. apples. A public hearings on SECOFI's resolution was set on October 16, 1997.

5. *Ban on the Entry of Florida, Texas, and Arizona Citrus*

*Technical Issue*

Since the last months of 1994, Mexico has prohibited the entry of Florida and Arizona fresh citrus by issuing emergency rule NOM-EM-011-FITO-1994. This prohibition was based on expressed concerns about Caribbean fruit fly and canker (Florida), and medfly (Arizona and Texas). U.S. exports were allowed only from California. The U.S. claims such measures are unfair since Caribbean fruit fly and canker exist on both sides of the border, and Arizona and Texas have never had medfly infestation. In January 1996 DIGSV and APHIS elaborated a work plan by which citrus, mostly grapefruit, from areas of Texas free of fruit fly could be exported to Mexico without the fumigation requirement (Texas Department Council, 1996). No agreement

[25] The U.S. contributes approximately 95 percent of all Mexican apple imports. Chile provides aboutanother 4 percent (Zertuche, 1995e)

was reached for citrus coming from Arizona and Florida (Juárez et al., 1996).

APHIS and DIGSV officials maintained negotiations about the elaboration of a work plan to solve this issue. On March 31, 1996, a group of Representant of the U.S. House Committee on Agriculture arrived to Mexico to discuss several trade issues with Mexico. In April, 1996, after returning from Mexico, Bob Smith (Republican, Representant from Oregon, and Chairman of the House Committee on Agriculture) asked President Clinton to recognize the Mexican State of Sonora as free of hog cholera and the Mexicali Valley as free of Karnal bunt. The Chairman pointed out to the President that once the U.S. provides such a recognition, "Mexico is expected to show a similar willingness to resolve non-tariff trade barriers" (House Committee on Agriculture, 1997).

The visit of President Clinton to Mexico in May 1997 set the stage to announce the political decision to find a solution to this controversy. Agriculture Secretary Dan Glickman announced that the U.S. would recognize Sonora as a low-risk region for hog cholera, and the Mexicali Valley as free from Karnal bunt. Mexico announced DIGSV will recognize Florida's citrus production as free from citrus canker and Arizona as free of medfly. In September 1997, DIGSV recognized Arizona's citrus production as free of Mediterranean and Mexican Fruit flies, opening the door for the entry of Arizona citrus into Mexico (Trejo et al., 1997).

*Market Characteristics*

Mexico is an important world producer of citrus. The U.S. is the largest export market for Mexican oranges. However, the U.S. is also an exporter of citrus to Mexico. U.S. exports of oranges and grapefruit have increased under NAFTA, but the ban on

Florida, Texas, and Arizona citrus restricted U.S. exports in 1995.[26]

**Table IV.9. International Trade of Citrus in Mexico (1990-1996)**

| Year | Imports (MT) | Exports (MT) |
|---|---|---|
| **1990** | 4,591 | 92,543 |
| **1991** | 1,171 | 110,639 |
| **1992** | 820 | 106,203 |
| **1993** | 207 | 125,421 |
| **1994** | 3,540 | 146,017 |
| **1995** | 12,481 | 187,061<br>148,652* |
| **1996** | 0* | 148,023* |

Source: FAO. Except (*), obtained from FATUS and denoting Trade only between Mexico and the U.S.

The recovery of the Mexican economy has boosted U.S. exports in 1996, as it is shown in Table IV.9. However, Table IV.9 shows that Mexico is a net exporter of citrus. Mexico is expected to continue to be a net orange exporter in the future, with the U.S. as its largest export market (Flores, 1996c). Mexican exports of tangerines and grapefruit to the U.S. have decreased over the past years. The use of methylbromide by Mexican tangerine producers have limited tangerine and grapefruit exports to the U.S.

[26] Before NAFTA, Mexico had a 20 percent tariff on fresh oranges, grapefruit and limes. Under NAFTA, Mexico has eliminated the lime duty and reduced the orange and grapefruit tariff to 15 percent in 1994. This tariff will be phased out in the year 2004.

6. *Fumigation to Cotton and Cotton Products.*

*Technical Issue*

On October 14, 1994, Mexico published in the *Diario Oficial* the emergency rule NOM-EM-014-FITO-1994, imposing fumigation and quarantine requirements on the entry of U.S. cotton into Mexico. Mexico's justification for this emergency rule was to prevent the spread of boll worm, cotton boll weevil, and white fly complex. The U.S. claimed such measures are unfair since these pests exist in Mexico. Furthermore, the U.S. bale compression standards eliminate these pests. A proposed rule which took into account the U.S. concern was published in the Diario Oficial on August 30, 1995 (NOM-014-FITO-1995). On December 2, 1996, DIGSV published the correspondent final rule. Such a final rule closed the controversy (Sallyards, 1997).

*Market Characteristics*

Mexico's cotton production has been recovering after a dramatic failure of the 1992 and 1993 crops. Table IV.10 shows that the Mexican cotton area in 1993 was one of its lowest, resulting in record-high imports (Crawford and Link, 1995). Production has been recovering since then. The rise in international prices, the successful eradication efforts against white fly, and the modernization of the textile industry are some of the reasons behind the recovery (Juarez, 1996). Also, PROCAMPO's reduction in price support for corn has induced producers to shift into cotton. A GOM subsidy to cotton producers in 1994 has also encouraged the cotton recovery (Crawford and Link, 1995).

The full recovery of the Mexican cotton industry has been delayed by bad weather conditions and financial difficulties. The peso crisis increased the cost of inputs, while the liberalization of input markets created some uncertainty for producers. Cotton prices fell again in 1996, slowing further the large recovery the industry experienced in 1995.

The 1992 and 1993 decline in domestic production enabled U.S. exporters to enter the Mexican market and strengthen their trading relationships (Sallyards, 1995). NAFTA has allowed the U.S. to maintain its volume of cotton exports to Mexico, even during the peso crisis (Phillips and Howland, 1996). Although Mexico remains a net importer of cotton, the recovery of the Mexican industry may reverse this trade pattern in the future.

Interestingly, the modernization of the Mexican textile sector has caused some spinning facilities to operate more efficiently with U.S. cotton. Modernization is expected both to increase exports of U.S. cotton to Mexico, and to leave Mexican supplies free for export (Crawford and Link, 1996)

**Table IV.10. Production and International Trade of Cotton Lint in Mexico (1990-1996)**

| Year | Production (MT) | Imports (MT) | Exports (MT) |
|---|---|---|---|
| 1990 | 201,476 | 37,180 | 57,566 |
| 1991 | 202,189 | 41,059 | 54,416 |
| 1992 | 32,650 | 106,795 | 25,393 |
| 1993 | 26,615 | 177,708 | 7,163 |
| 1994 | 119,030 | 158,072 | 27,618 |
| 1995 | 218,829 | 114,784 | 93,424<br>620* |
| 1996 | 379,276 | 149,871* | 10,175* |

Source:SAGAR, except (*), obtained from FATUS and denoting Trade only between Mexico and the U.S.

7. *Fumigation of Wheat Against Karnal Bunt.*

*Technical Issue*

On September 1, 1995, DIGSV proposed a norm which regulate the general conditions for the entry of wheat into Mexico (NOM-017-FITO-1995). With the comments on this proposed rule still on evaluation, the USDA announced on March 8, 1996, the discovery of Karnal bunt fungus in durum wheat seed in Arizona, and subsequently in New Mexico, Texas, and California. Karnal bunt is a fungal disease of wheat which is harmless to humans but reduces the quality of the affected grain by leaving an unpleasant odor in the flour made from it.

DIGSV took USDA's announcement into account when it published the final rule on December 5, 1996. This rule allows the entry of U.S. wheat from unaffected U.S. States as long as the grain is tested and certified free of Karnal bunt by APHIS. It also allows wheat imports produced or stored in the affected U.S. States if they are fumigated with methyl bromide. Such a rule was considered excessively restrictive for APHIS. APHIS considered the testing of wheat coming from areas free of Karnal bunt unnecessary. Also unnecessarily restrictive was considered the fumigation requirement to wheat originated from the affected States, since this requirement also affects wheat coming from counties where Karnal bunt has not been detected. APHIS claims the certification requirement should be sufficient in those cases (Gutierrez, 1997).

Karnal bunt has been detected in Mexico since the late 1970s. In 1996, DIGSV has requested APHIS to recognize the Mexicali Valley as free of Karnal Bunt. Mexican producers and officials had become upset by APHIS' delay in producing such recognition (Gutierrez, 1997). A possible solution to this problem has been announced during the March 1997 visit of President Clinton to Mexico.

*Market Characteristics*

NAFTA has facilitated imports of U.S. wheat into Mexico.[27] NAFTA has favored U.S. and Canada's wheat producers by effectively removing E.C. and Argentine wheat from the Mexican market. However, Mexico's total wheat imports and imports from the U.S. declined in 1994 because of a favorable weather which allowed an exceptionally large Mexican crop. In 1995, the peso crisis reduced Mexicans' purchase power. Because of the crisis, SECOFI lifted price controls on wheat and eliminated a wheat milling subsidy. However, SECOFI left price control in place for corn *tortillas*, inducing consumers to switch from wheat to corn (Crawford and Link, 1996).

Table IV.11 shows that in spite of the reduced consumption, U.S. exports of wheat to Mexico increased in 1995. The Mexican wheat production decreased in 1995. The peso crisis arose input costs for wheat producers, in special credit and irrigation, affecting yields (Crawford and Link, 1995). The severe 1995 drought in northern Mexico further reduced wheat production. U.S. exports to Mexico also benefited from a lower availability of export supplies in Canada (Crawford and Link, 1996).

The competition from U.S. wheat increased the struggle of domestic wheat producers. Seeking protection, in 1994 the Mexican industry asked the GOM to initiate an anti-dumping investigation associated to imports of wheat from the U.S. and Canada. On April 4, 1994, SECOFI announced it initiated an investigation on subsidized wheat imports from the U.S. and Canada. On March 7, 1996, SECOFI published on the *Diario Oficial* the conclusion of such investigation. SECOFI announced it will not retaliate against U.S. and Canadian wheat because the U.S. suspended the use of the Export Enhancement Program (EEP) in Mexico and Canada discontinued the use of export

[27] Under NAFTA, Mexico replaced its import licensing requirement for all wheat coming from the U.S. by a 15 percent tariff. This tariff will be phased out by the year 2004.

subsidies.

**Table IV.11. Mexican Production and Imports of Wheat (Unmilled) (1985-1996)**

| Year | Wheat | |
|---|---|---|
| | Production (MT) | Imports (MT) |
| **1985** | 5,214,315 | 560,721 |
| **1986** | 4,769,731 | 224,426 |
| **1987** | 4,415,391 | 434,935 |
| **1988** | 3,664,828 | 1,199,655 |
| **1989** | 4,374,739 | 446,657 |
| **1990** | 3,930,934 | 358,808* |
| **1991** | 4,060,738 | 312,508* |
| **1992** | 3,620,503 | 409,432* |
| **1993** | 3,582,450 | 967,100* |
| **1994** | 4,150,920 | 625,203* |
| **1995** | 1,778,000 | 791,473* |
| **1996** | 1,810,000 | 1,553,688* |

Source FAO. Symbol (*) from FATUS (only from the U.S.)

*Chapter V.*

# DISCUSSION: THE POLITICAL ECONOMY OF MEXICAN SPS REGULATIONS

## V.1. Introduction

The changes described above to the Mexican regulatory process for SPS regulations have been welcomed by U.S. officials (Sheesley, 1997). Nevertheless, controversies around some SPS regulations have arisen between Mexico and its trade partners, particularly the United States. The existence of such controversies are a primary motivation behind the postulation of hypotheses H1-H4 of this dissertation. As mentioned in Chapter I, four hypotheses are tested:

H1: *Mexico has enacted SPS regulations as compensation for tariff reductions.*

H2: *Changes in the regulatory process in Mexico have facilitated the capture of Mexican regulatory agencies by domestic interest groups.*

H3: *The Government of Mexico (GOM) has instructed its agents to avoid confrontations with American officials and interest groups.*

H4: *The enactment of controversial SPS regulations is indicative that Mexican regulatory agencies are susceptible to capture by domestic interest groups.*

Hypothesis H1 is the most relevant hypothesis in terms of the political economy of Mexican SPS regulations. Hypotheses H2-H4 are auxiliary hypotheses, which support the analysis of H1. Sections V.2, V.3, and V.4 evaluate hypotheses H2, H3, and H4, respectively. Section V.5. provides an evaluation of H1, the main hypothesis of this part of the dissertation.

## V.2. Evaluation of an Hypothesis on Regulatory Changes and Capture

Hypothesis H2 postulates that procedural and institutional changes have facilitated the capture of Mexican regulatory agencies in the political economy sense described in Chapter II. This section evaluates H2 by first examining Mexican procedural and institutional changes.

### Procedural Changes and Their Impact on Mexican SPS Regulations

The design of regulatory procedures either avoid or facilitate the capture of regulatory agencies. Hypothesis H2 reflects these possibilities by postulating that the newly-adopted Mexican procedures have actually facilitated the capture of DIGSA, DIGSV, and DIGF by domestic interest groups.

The evidence suggests that the new Mexican procedures, rather than facilitate, may have discouraged the capture of DIGSA, DIGSV, and DIGF. By mimicking the American APA, the new Mexican procedures have increased both the transparency and stability of the system. Closed, non-transparent regulatory procedures may facilitate the capture of regulatory agencies. Powerful interest groups with access to Mexican officials may be given an institutional advantage against foreign interest groups. Foreign interest groups, which may not enjoy similar levels of accessibility to Mexican officials, may find it easier to counteract the influence of domestic groups on regulatory agencies with more transparent procedures.

The increased transparency of the new regulatory process may have helped foreign interest groups to prevent the capture of DIGSA, DIGSV, and DIGF. Open regulatory procedures allow foreign interest groups to monitor domestic groups. Such monitoring power may help foreigners to gather the necessary political support to counteract the influence of domestic groups.

The increased transparency of the new regulatory process may have improved the quality of the enacted SPS regulations. Lack of participation by foreign interest groups may preclude the enactment of optimal SPS regulations, even if the regulatory agencies were not captured. Such a lack of participation reduces the information available to the Mexican decision-makers. Because of such incomplete information, Mexican regulatory agencies may adopt scientifically sound but unnecessarily trade disruptive SPS regulations.

The newly-adopted Mexican regulatory procedures have also increased the stability of the system. In the past, one of the most frequent complaints made by foreign exporters to SAGAR was the enactment of *unexpected* SPS regulations. Such unexpected barriers, even if scientifically justified, have generated confusion among foreign exporters and unnecessarily disrupted trade. Because of their quasi-legislative nature, the new Mexican procedures are less susceptible to unexpected modifications. Politicians and regulators are politically risk averse and dislike unnecessary reopenings of established norms. The enactment of laws and regulations are never free of political costs. Transparent normative procedures may increase the exposure of lawmakers and regulators to political risks (i.e., politicians who take side during legislative and regulatory negotiations may be commended by some of their constituents but infuriate others). The larger political cost to which politicians and regulators may be exposed under transparent regulatory processes discourages the enactment of unexpected changes.

Institutional Changes and Their Impact on Mexican SPS Regulations

The capture of regulatory agencies is also influenced by the institutional framework in which agencies work. Line agencies (i.e., agencies which are hierarchically accountable to the Executive, like APHIS, DIGSA, DIGSV, or DIGF) face a particular relationship with their principal (i.e., the Executive). It may be possible for line agencies to successfully ask the Executive for the political support they need to avoid being captured by interest groups. However, line agencies are more susceptible, and therefore responsive, to the political needs of the Executive.

The 1995 reorganization of SAGAR has strengthened the relationship between the GOM and its SPS-related regulatory agencies. The reorganization of SAGAR has increased DIGSA and DIGSV's accountability to the Mexican Executive. Such an increase in the oversight of DIGSA and DIGSV may have reduced the possibility that the agencies would deviate from the GOM's intended policies. At the same time, the reorganization of SAGAR has increased DIGSA and DIGSV's responsiveness to the Executive's political goals. Two of the highest priorities for both Presidents Salinas de Gortari and Zedillo have been the transformation of Mexico's economy, and the economic integration with the U.S. Hence, the institutional changes that took place in Mexico may have induced DIGSA and DIGSV to avoid regulations which may unnecessarily conflict with the GOM's priorities regarding trade.

The creation of DIGIF as a separate agency in charge of the enforcement of SPS regulations gives further support to the idea that SAGAR's reorganization has discouraged, rather than facilitate, the enactment of unfair SPS regulations. Although the creation of DIGIF as a separate agency has created some bureaucratic delays at port inspections, the benefits associated with a separate DIGIF have outweighted the inconvenience it has originated. The creation of a separate DIGIF has expanded GOM's oversight of the entire phytosanitary process. Such an increased oversight may have discouraged the enactment of SPS regulations as hidden barriers to trade. The replacement of the old corps of inspectors by a new and better trained one, gives further support to such conclusion.

The institutional improvement attained by SAGAR's SPS agencies has not been achieved by SEMARNAP's DIGF. DIGF is a SEMARNAP agency hierarchically placed in a position similar to the one DIGSA and DIGSV had occupied before SAGAR's reorganization. DIGF depends directly on the Under-secretary of Natural Resources, and only indirectly on the Secretary of SEMARNAP. The enactment of forestry-related SPS regulations is only one of the many tasks assigned to DIGF. Hence, the Mexican institutional changes which have favored the transparency of SAGAR's SPS-related agencies may have had the opposite effect with regard to DIGF. However, such a negative impact on forestry-related SPS measures has been counterbalanced by the new, open regulatory process that DIGF, like DIGSA and DIGSV, must follow.

## Evaluation of the Hypothesis

The arguments above suggest H2 should be rejected. There is little indication that the Mexican institutional and regulatory changes have facilitated the capture of DIGSA and DIGSV by domestic interest groups. The evidence suggests just the opposite: the institutional and regulatory reforms may have discouraged such capture. The 1995 Mexican institutional changes have reduced the possibility that DIGSA and DIGSV are captured. Further, even if there is no institutional improvement regarding DIGF, the enactment of forestry-related SPS regulations may be less vulnerable to capture under the new legislation. DIGF, like DIGSA and DIGSV, must comply with the new and more open regulatory process. In consequence, it seems plausible that the new Mexican regulatory procedures and institutional structure have discouraged the enactment of unfair SPS regulations.

Even if the Mexican regulatory and institutional changes may have made more difficult the capture of DIGSA, DIGSV, or DIGF by domestic interest groups, the capture possibility cannot be eliminated. Domestic groups still enjoy access to informal channels of communication with politicians and regulators which are not available to foreigners. Also, although economic integration with the U.S. is a high priority for the GOM, it is not its only political objective. Political leaders remain responsive to the needs of powerful domestic industries. In consequence, although H2 is rejected, the possibility of capture cannot be dismissed. The new Mexican regulatory procedures may have reduced, but they have not eliminated the chances that DIGSA and DIGSV are captured by domestic interest groups.

## V.3. Evaluation of an Hypothesis on Avoiding Conflict With the U.S.

The new Mexican regulatory procedures parallel those in place in the U.S. The adoption of American-style regulatory procedures may suggest that the GOM has been particularly responsive to the regulatory preferences of its American trade partners. The evidence shows that the World Bank and the IMF have played an important role in the shaping of new Mexican procedures. The financial assistance that these international organizations provided to Mexico in the late 1980s and early 1990s was associated to the initiation by Mexico of drastic structural adjustments and the adoption of transparent regulatory procedures. Further, the evidence shows that SAGAR was encouraged by the World Bank to reduce or eliminate its intervention in the agricultural sector.

However, the evidence of influential international organizations over Mexico's policies cannot be straightforwardly interpreted as evidence about the United States being influential. It could be argued that the United States exerts a large political influence over these international organizations, but such a political weight would be too indirect to be applied as evidence in favor of H3.

There is some evidence suggesting that the Mexican political leaders have willingly accepted those changes. The ideology of the Mexican political leaders who ascended to power in the 1980s has favored open market policies. The GOM may have realized the advantages associated with transparent regulatory process, independently of the World Bank and the IMF suggestions.

The strongest evidence in favor of H3 is related to the peso crisis and the crucial role the U.S. government has played in its solution. The crucial help provided by the Clinton Administration to President Zedillo during the peso crisis may have enhanced the political responsiveness of the GOM to the suggestions of its American counterpart. It is reasonable to assume that the GOM was eager to avoid unnecessary confrontations with an Administration to which it may own its political survival.

Further, it is possible to argue that the GOM's need for political support from the U.S. government went beyond the peso crisis. The GOM has needed such support to secure the viability of their new policies. The transformation of the Mexican economy has been opposed by some domestic interest groups. Such opposition started before anticipated benefits of the new policies had time to spread through the society. The collapse of the peso may have delayed such a spreading of benefits even further, increasing the political vulnerability of the GOM. The GOM needed to look for political support among those who are expected to benefit from its policies. Early American political support for the new policies may have been crucial for the GOM. NAFTA has helped the GOM to gather the political support necessary to balance domestic opposition. Hence, it may be possible to argue that because of its need to receive American support, the GOM has become especially receptive to American concerns.

All the above-mentioned evidence points toward the acceptance of H3. However, the occurrence of controversial SPS regulations and SECOFI's favorable reception to some domestic industries' anti-dumping complaints preclude a clear acceptance of H3. The occurrence of some controversies affecting U.S. exports would suggest that H3 be rejected. But the occurrence of controversies does not necessarily imply that H3 must be rejected either. Only 9 of the 123 SPS issues regulated by Mexico since 1993 have been controversial to U.S. agricultural exports. Even these controversies, although important, have been solved or at least soothed over time.

Further, the mere existence of controversies does not force H3 to be rejected. The GOM may have instructed its officials to avoid unnecessary conflict with the U.S. and still some disputes may have arisen. It may be possible that professional employees at SECOFI, DIGSA and DIGSV did not comply with the GOM's stated policy.[28] Such a deviation may have been important during NAFTA's first years, when professional employees at DIGSV did not trust their American counterparts as much as the administrators did (Sheesley, 1997). Years of mutual distrust between APHIS and DIGSV may have contributed to such a difference in attitude at the staff level. Further, Sheesley contends that the severity of some of the controversial SPS regulations enacted by Mexico can be explained by such distrust (in particular, Sheesley claims that the excessive monitoring costs originally imposed by DIGSV on Washington apple growers was in part caused by such distrust). The relaxation of such monitoring requirements over time supports Sheesley's opinion.

The occurrence of some confrontations between Mexico and the U.S. could also be explained by the simultaneous existence of several priorities in the GOM. Certainly, the GOM's policies are largely shaped by the power and political needs of its constituents. SECOFI's anti-dumping investigations can be associated with its responsiveness to the complains of powerful domestic groups. The GOM may have instructed its agents to avoid conflicts with American officials, but some confrontations may have arisen due to a conflict between different GOM's political goals.

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[28] As it was mentioned above, there are several possible motivations for such a "slack". For instance, administratos tend to be more susceptible to the political needs of their principals than professional employees. Also, professional employees may enjoy a close relationship with the agency's clients (e.g., farmers, growers), a closeness that may induce them to be especially concerned with their clients' needs.

In summary, the existence of controversial SPS regulations and the imposition of anti-dumping countervailing duties impede a clear acceptance of H3. Although the logic behind the argumentation impedes the strict acceptance of H3, the evidence shows the GOM has been politically inclined to avoid conflict with the U.S.

## V.4. Evaluation of an Hypothesis on Controversial SPS Regulations and Capture

The evaluation of hypotheses H2 suggests that the GOM has made serious efforts to discourage the enactment of unfair SPS regulations. In spite of such a conclusion, Mexico has enacted some SPS regulations which have been criticized by U.S. officials and interest groups. The occurrence of these SPS-related controversies contributed to impede a clear acceptance of H3. This section evaluates H4 by analyzing the political economy of such controversies.

### Controversies Covering a Broad Spectrum of Goods

The first of the controversies covering a broad spectrum of goods involves the enactment of a large number of emergency rules (NOM-EMs) by DIGSA, DIGSV, and DIGF. U.S. officials have contended that many of the NOM-EMs have been enacted as hidden barriers to trade. Appendix A1 and Table 2 in the text show that most of the NOM-EM were enacted during the first two years after the new regulatory procedures were approved. About 79 percent of all NOM-EMs (44 regulations) were enacted during 1993 and 1994. The number of NOM-EM that were enacted since then has been significatively lower: only 10 in 1995 and 2 in 1996 (17 and 4 percent of all enacted NOM-EMs, respectively). Such a progressively reduced schedule of publication may justify the Mexican claim that those NOM-EM were published to fill a regulatory vacuum. Moreover, the publication of a proposed NOM for most NOM-EM within a year after the emergency rule was published reinforces such a position.

The Mexican defense of its use of NOM-EM may be weakened by the possibility that the enactment of EM was not the optimal vehicle to fill a regulatory vacuum. Perhaps it may have been more time-efficient for SAGAR to publish all the regulations the agency had in place in 1993 as proposed NOM, as imperfect as they were, instead of publishing them as NOM-EM. Such a strategy would have given SAGAR enough time to receive and collect comments and suggestions from interest groups before publishing a final, improved version of the rule, while avoiding the publication of restrictive NOM-EM, most of which were in effect for two years until they were replaced by final rules.

The fact that the Mexican regulatory agencies had not pursued a more time-efficient regulatory strategy does not necessarily imply that the NOM-EM were enacted as protectionist devices. It is possible that the quality of SAGAR's risk assessments prior to 1994 were not adequate to allow their publication as proposed NOM. The arbitrariness of the import licensing system prevailing in Mexico at that time may have precluded the need for quality risk analyses. Some U.S. officials believe that was the case. These officials believe that no serious risk analyses were attempted by DIGSA or DIGSV under the old legislation (Gutierrez, 1997).

The second broad controversy is associated with border inspection problems. Both the creation of a separate inspection unity within SAGAR, and the hiring of a new corps of inspectors, have been important improvements for the Mexican border inspection service. However, such advances did not avoid the occurrence of border-related controversies.

It has been postulated that some of the border problems resulted from the limited resources Mexico has available for border inspection. However, there is also evidence showing that some Mexican interest groups have asked SAGAR for a tougher enforcement of border measures as a way to delay the entry of imports. This leaves open the question of the real cause of some border controversies.

Even if some of the border controversies could be considered as protectionist devices, it has been broadly acknowledged that the situation has dramatically improved since the 1995 institutional changes. The NAFTA's Binational Committee (BNC) report of May 1997 states that:

> "Lastly, Mexico announced that it would increase the number of border inspection points and number of border inspectors in order to guarantee a faster and more efficient service in accordance with agricultural trade needs."

Thus, even if there is evidence that border issues may have been used by Mexico to delay or block some American imports, the continuous improvement verified in this area provides some evidence for the rejection of H4.

The remaining controversy affecting a broad spectrum of goods that was described in this dissertation relates to the ambiguous way DIGSA, DIGSV, and DIGF have published the comments they received for proposed NOMs. Although it may be tedious and frustrating for American officials, the publication of some ambiguous responses hardly can be motivated by protectionist considerations. The lack of precision observed in the publication of some SPS regulations is consistent with the relative sloppiness of the *Diario Oficial* that the author found during the elaboration of Appendix A1 and reported in the text.

Thus, although the publication of unclear responses may have some effect on the transparency of the process, it is the content of the final rule which matters. As long as the transparency of the process can be restored by ensuing personal communications, the impact of sloppy responses on the fairness of the process should be minimal. Therefore, the contribution of this controversy to the acceptance of H4 is disregarded.

Controversies Involving Animal Health SPS Regulations

The reduction in beef consumption caused by the peso crisis, as well as the entry of beef imports from the U.S. have negatively impacted the Mexican cattle industry. Such an economic strain may have prompted the Mexican cattle industry to seek the enactment of some protectionist SPS regulations. The Mexican NOM-EM of July 1994 could be considered as protectionist. APHIS complained that the barrier was unnecessarily trade restrictive. DIGSA disregarded APHIS' complaints when the agency published the proposed NOM of November 1994. But in the final NOM published in May 1995 DIGSA accepted APHIS' complaints as valid.

DIGSA's delay in acknowledging APHIS' complaints could be considered a temporary form of protectionism. However, there are other considerations which suggest that was not the case. The absence of quality risk assessments may have forced SAGAR to enact a large number of excessively tough NOM-EM. It may be possible to argue that DIGSA's delay in acknowledging the validity of APHIS' complaint was based on the absence of previous risk analyses, the agency's inexperience in performing risk analyses, and the sudden need to develop SPS regulations for many traded commodities.

The fact that APHIS' points of view were finally taken into account by DIGSA, and that the period of time consumed by the regulatory process was not excessive defuse the suspicion of DIGSA's capture.[29] In any case, even if such a suspicion could have been justified in 1994, the final solution to this issue shows that by 1995, DIGSA was responsive to APHIS' concerns, defusing the idea of DIGSA being captured by the domestic industry.

There is other evidence that the Mexican cattle industry has sought economic relief from the GOM. In 1995, the Mexican domestic industry submitted a dumping complaint

[29] The total time elapsed between the enactment of the NOM-EM and the final rule was 11 months. The time elapsed between the proposed and final NOM was 6 months.

against the U.S. beef industry to SECOFI, it threatened another one in 1996, and finally submitted it in 1997. SAGAR has also been responsive to the cattle industry. In 1995, SAGAR included cattle re-population as one of the five basic programs included in the *Alianza para el Campo*. Thus, the evidence shows that the Mexican cattle industry is powerful in Mexico, and that it has been actively seeking protection from the GOM. However, as of December 1997, the only protection that the domestic cattle industry has obtained from SAGAR came in the form of financial assistance. SECOFI is still evaluating the adequacy of AMEG's request for an anti-dumping investigation for U.S. imports. The evidence suggests no SPS regulation was enacted to protect the domestic industry.

The evidence in favor of rejecting H4 is stronger with the Mexican SPS regulations affecting the entry of U.S. breeding cattle to Mexico. It is difficult to perceive the SPS regulation as a hidden barrier to trade, since the Mexican cattle industry depends on the supply of U.S. breeding animals. Therefore, it is reasonable to assume that DIGSA based its decision purely on technical considerations when the SPS regulation affecting the entry of breeding cattle was enacted.[30]

The analysis of the Mexican SPS regulation affecting the entry of American live pork does not differ much from the SPS regulation on live cattle. There are many similarities between these regulations. The SPS regulation of 1992 could be (and it has been) considered a hidden form of protectionism by APHIS and the U.S. pork industry. Like the SPS regulation on live cattle, most of the controversy surrounding the SPS regulation on live pork lasted until 1995. That year DIGSA acknowledged APHIS' complaints and removed its restriction for most live pork. Also like the SPS regulation on live cattle, the remaining unsolved controversy involves the entry of breeding stock, an important input for the pork industry. Finally, like the cattle industry, the Mexican

[30] This argument holds even though DIGSA's justifications for the barrier have been considered technically flawed by APHIS.

pork industry has been active in its quest for relief from SECOFI.

There are some differences between the Mexican SPS regulations on live cattle and pork. DIGSA's restriction on American live pork started in 1992, before the new legislation was in place. Thus, the initial toughness of the Mexican SPS regulation on live pork cannot be explained as a drawback associated with DIGSA's need to fill a regulatory vacuum. Based solely on such a fact, it could be argued that, at least initially, DIGSA did enact its SPS regulations on pork as a protectionist device.

However, like the SPS regulation on live cattle, the initial toughness of the SPS regulation could also be explained by the lack of U.S. participation in the regulatory process. Such restricted participation may have limited the information available to DIGSA, causing the initial SPS regulations to be unnecessarily trade disruptive.

In any case, the cessation of the live pork dispute shows that by 1995 DIGSA had modified its initial position regarding the imports from the U.S. As for the SPS regulation on live cattle, it can be argued that DIGSA's correction of the SPS regulation on live pork rested on the *success* of the regulatory reforms. The solution to the controversy may indicate that the reforms to the Mexican regulatory process have successfully isolated DIGSA from the undue influence of domestic interest groups.

The "successful insulation" conclusion is enhanced by the GOM's other responses to the Mexican pork industry. The pork industry faced not only the removal of the SPS regulation, but also SECOFI's authorization to importers to exceed the TRQ levied under NAFTA. Both measures increased the competition the domestic industries faced by imports. The pork industry was able to extract some protection from SECOFI (i.e., a labeling rule on cooked ham) and also from SAGAR (i.e., a financial support program). However, the pork industry was not able to impose a trade restrictive SPS regulation.

Finally, the evaluation of the SPS regulation on poultry is not clear. The poultry industry has obtained some regulatory relief from SECOFI (regulated entry of poultry in brine from the U.S.). While the other SPS regulations controversies on livestock were solved by 1995, the SPS regulations on poultry is still in place (no longer as an emergency, but as a final rule). DIGSA's decision to keep the SPS regulation in place in spite of APHIS' complaints may be indicative either of the influence of the poultry industry, or of technical disagreement with APHIS. Without further assessment of the biological merits of the SPS regulation, the contribution of this controversy to the evaluation of H4 cannot be fully determined.

Controversies Involving Plant Health SPS Regulations

The Mexican SPS regulation on sweet cherries provides the strongest evidence in favor of the capture of a Mexican regulatory agency. Sweet cherries had been entering Mexico from the U.S. before 1992, when imports were stopped because of the enactment of a SPS regulation. This ban was maintained until 1997. There is evidence suggesting that the ban on sweet cherries cannot be technically justified. One piece of this evidence is the NAFTA panel's ruling against the ban. Another is the eventual removal of the ban by DIGSV. Two important questions arise: why did DIGSV suddenly stop the entry of sweet cherries in 1992? And why did the agency lift such a ban in 1997?

One possible explanation for the enactment of the ban is the capture of DIGSV by the Mexican industry. However, the economic importance of the Mexican sweet cherry industry is relatively small. It is very unlikely that the Mexican sweet cherry industry could have mounted any significative pressure on DIGSV.

Alternatively, APHIS and spokesmen for the U.S. industry have postulated that the Mexican SPS regulation on sweet cherries was enacted as a retaliation for the U.S. ban on Mexican avocados. The available evidence strongly suggests the pertinence of this alternative argument. In particular, the announcement by DIGSV of the lift of the sweet cherry ban shortly after APHIS published a final rule allowing the limited entry of Mexican avocados into the U.S. The strength of the Mexican avocado industry gives further support to this argument. DIGSV may have enacted the ban on U.S. sweet cherries under the pressure exerted not by the Mexican sweet cherry industry, but the Mexican avocados industry. The evidence suggests that DIGSV has been captured to avoid the entry of U.S. sweet cherries into Mexico. However, such a capture was not achieved by the a domestic industry vulnerable to incoming imports, but by another powerful industry which utilized this SPS regulation to favor its own position against APHIS. In other words, the evidence in the sweet cherries case strongly suggests that DIGSV was captured, but not by a Mexican industry seeking a vehicle for tariff compensation, but by the Mexican avocados industry, which utilized the SPS regulation to retaliate and force the American sweet cherry industry to press APHIS to rule in its favor.

The controversy involving the Mexican restrictions on the entry of Christmas trees from the northeast of the U.S. to Mexico cannot be considered evidence in favor of the capture of DIGSV either. The Mexican Christmas tree industry is also relatively small. It is unlikely that such a small industry would be able to exert any undue pressure on DIGSV. Moreover, the dispute ended by consensus. After several meetings between APHIS and DIGSV, the technical differences present in the original Mexican SPS regulations were solved.

The Mexican SPS regulation on stone fruits is an example of an excessively tough SPS regulation which has been continuously eased since its initial enactment. When this SPS regulation was enacted, the monitoring requirements set by DIGSV for the northwestern orchards were considered excessive by APHIS. Over time, DIGSV has acknowledged this complaint. The Mexican regulatory agency has been relaxing the rule during the past couple of seasons to the point where it is considered fair by APHIS. The SPS regulations on stone fruits may illustrate the progressive increase in trust between SAGAR and APHIS' officials.

The Mexican SPS regulation on apples from the northwest of the U.S. has also been considered unfair by American officials. In particular, the U.S. industry considered the monitoring requirements imposed by DIGSV as unnecessarily costly. The solution to the controversy in 1996 suggests that at that time, DIGSV was not captured by the Mexican apple industry. However, the strategic shift to request anti-dumping actions from SECOFI undertaken by the Mexican apple industry once DIGSV relaxed the SPS regulation on apples may give support to the idea that DIGSV was captured by the industry before 1996. It could be argued that before 1996, the Mexican apple industry was free riding on DIGSV's general phytosanitary concerns. The initial toughness of the SPS regulation on apple, as well as the relaxation of the ban, may have resulted from the general increased familiarity of DIGSV with the enactment of SPS regulations after 1993, and from the progressive elimination of the mutual distrust between DIGSV and APHIS. The evidence regarding these possibilities is not clear. The latter is the explanation preferred by some APHIS' officials. However, some U.S. producers have visualized the initial toughness of DIGSV's SPS regulation as another retaliatory measure against APHIS's ban on Mexican avocados.[31]

The DIGSV ban on exports of citrus from Florida and Arizona constitutes another SPS regulations controversy recently solved. It is interesting to note that Mexico is one of the largest producers of citrus in the world. The economic vulnerability of the Mexican citrus industry to U.S. imports is lower than for other industries subjected to SPS disputes. The citrus industry is politically strong in Mexico.

APHIS has argued that the ban on Arizona's citrus ignores that similar risks are also present in California, a state from which DIGSV allows citrus to be imported. APHIS also contends that the prohibition on the entry of citrus from Florida ignores the

[31] Some members of the U.S. apple industry have asserted that the excessive initial rigor of the SPS regulation could be viewed as a retaliation for the U.S. ban on Mexican avocados. Such a possibility could not be corroborated by the author. Further, the fact that the controversy ended before APHIS lifted the ban on avocados suggests the inadequacy of such an explanation.

efforts made by growers and state officials to satisfy Mexican safety requirements. Some APHIS officials therefore have contended that the Mexican SPS regulation on citrus is related to the trade dispute on tomatoes between Mexico and Florida (Gutierrez, 1997). No evidence for such a claim has been developed in this dissertation.

Although no evidence was developed linking the enactment of these Mexican SPS restrictions to the tomato dispute, there is evidence linking the Mexican trade restrictions with APHIS' failure to recognize Sonora and Mexicali Valley as areas free of hog cholera and Karnal bunt, respectively. After some political negotiations, the solution to the dispute was announced during the May 1997 visit of President Clinton to Mexico, after the U.S. lifted the SPS regulations questioned by DIGSV.

Like the ban on Christmas trees, the Mexican SPS regulation on cotton does not provide evidence in favor of H4. The dispute originated in 1994, but was resolved less than one year later, when DIGSV acknowledged APHIS' complaints.

More interesting are the SPS regulations affecting the entry of wheat into Mexico. Some APHIS officials contended that the SPS regulation was enacted in retaliation for APHIS' failure to recognize the Mexicali Valley as an area free of Karnal Bunt. No evidence was developed in this dissertation to corroborate these claims. The future reaction by DIGSV to APHIS' recognition of the Mexicali Valley as a zone of a low incidence of Karnal bunt may provide the evidence necessary for the evaluation of the dispute.[32] A relaxation of the current restrictions on U.S. wheat may suggest that rtaliation was a primary motive for the enactment of the controversial SPS regulations.

In summary, the evidence provided by most controversies does not support the capture of H4. However, there are a few cases where the evidence strongly suggests the capture of the Mexican regulatory agency and, therefore, the rejection of H4. The evidence in favor of the capture of a Mexican agency is particularly strong in the case of

[32] The BNC made this announcement during the visit that President Clinton made to Mexico on May 5 to 7, 1997.

the SPS regulation on sweet cherries. Although not as conclusive, the evidence obtained from the Mexican SPS regulations on apple and citrus also supports the rejection of H4. Although they are only a fraction of all the examined controversies, the occurrence of these few cases obliges the rejection of H4. The enactment of some controversial SPS regulations denotes that, at least under adequate circumstances, Mexican regulatory agencies are susceptible to be captured by domestic interest groups.

### V.5. Evaluation of an Hypothesis on Compensatory SPS Regulations

Based on the evaluation of the auxiliary hypotheses H2 to H4, this section discusses and evaluates H1: the possibility that Mexico has enacted SPS regulations as a compensation for tariff reductions in the period 1986-1997. The analysis carried in section V.2 has suggested the rejection of H2. The evidence presented during the discussion of the GOM's reforms suggests that the reorganization of the Mexican regulatory process has discouraged the enactment of unfair SPS regulations. Such a conclusion is further supported by the strategic shift made by the domestic industries in their search for governmental relief. The analysis of the SPS regulations on cattle, pork, poultry, apple and wheat show that Mexican industries have relied on SECOFI for help. The Mexican cattle, apple, and wheat industries have requested that SECOFI initiate anti-dumping investigations against American imports. The Mexican pork and poultry industries have requested from SECOFI particular technical regulations that would affect the entry of imports. It could be argued that the modernization of the Mexican regulatory process for SPS regulations has been successful in making vulnerable Mexican industries to prefer SECOFI as a source of protection rather than SAGAR. This conclusion contradicts the argument that Mexico has enacted SPS regulations to compensate domestic agricultural interest groups for tariff reductions. In other words, the rejection of H2 erodes the support for H1.

The rejection of H2 reduces but does not erase the possibility that H1 could be accepted. It has been shown that protectionist SPS regulations can be enacted even under transparent, highly-regarded regulatory processes (e.g., see the discussion of the APHIS' ban on European nursery stock, Romano, 1995). Thus, the rejection of H2 is not sufficient for H1 to be rejected. However, the rejection of H2 does put some constraint on H1. Hypothesis H1 postulates that the enactment of controversial SPS regulations was based on economic reasons. The rejection of H2 does not make H1 invalid, but eliminates the possibility that the enactment of the controversial SPS regulations was a consequence of the redesign of the regulatory regime for SPS decisions. The evidence shows that these regulatory reforms have not stimulated, but reduced the possibility that DIGSA, DIGSV, and DIGF enact compensatory SPS regulations.

There is also evidence in favor of the GOM asking its officials to avoid unnecessary conflict with their American counterparts, as postulated by H3. The evidence is not conclusive, but shows that the GOM has increased its oversight of DIGSA and DIGSV to force the regulatory agencies to comply with its policies. The evidence also shows that economic integration with the U.S. is one of the high priorities for the Mexican government. However, the evidence was not strong enough to accept H3 without reservation. Part of the reason is the very existence of the controversial SPS regulations. The existence of controversies between American and Mexican officials clearly indicates that not all conflicts have been avoided. The occurrence of such controversies precludes the unambiguous acceptance of H3.

The analysis of several Mexican SPS regulations, in particular the one on sweet cherries, shows that the Mexican regulatory agencies are susceptible to capture by domestic interest groups, and therefore, that H4 should be accepted. However, the acceptance of H4 does not contradict the rejection of H2. The regulatory agencies have been captured despite the efforts made by the GOM to avoid this outcome. More important, the acceptance of H4 provides almost no support for H1. First, the capture of the Mexican regulatory agencies has occurred only in a few of the SPS regulations investigated. Second, the acceptance of H4 was based on evidence that shows that the Mexican regulatory agencies were captured by domestic industries seeking not tariff compensation, but retaliation against APHIS. The analysis of the SPS regulation on sweet cherries suggests that DIGSV decision-making rested on economic considerations as well as risk assessments. However, it was not the Mexican sweet cherry industry which captured the agency in the cherry case. The Mexican sweet cherry industry is too small to exert much pressure on DIGSV. The evidence shows that DIGSV was indeed captured, but by the Mexican producers and exporters of avocados. The evidence shows that DIGSV enacted the SPS regulation on sweet cherries to press APHIS to remove its ban on Mexican avocados. Thus, although the evidence regarding the Mexican SPS regulation on sweet cherry shows that the regulatory agencies are indeed susceptibility to capture, it also shows that such a capture was not motivated by a tariff reduction. DIGSV was captured by a third party looking for retaliation.

A question arises: why were sweet cherries chosen as the vehicle for retaliation? It could be argued that for a commodity to be a good vehicle for retaliation it is necessary that a ban on such commodity would cause some damage to U.S. exporters without having any important impact on Mexican consumers or producers. Sweet cherries have those requisites.

The idea of retaliation as a motivation for capture is not unique to the SPS regulation on sweet cherries. Such a possibility has also been postulated for the SPS regulation on citrus, wheat, and apples. The evidence strongly suggests that the disputes over citrus and wheat were at least in part, motivated by a Mexican retaliatory strategy against what DIGSV perceived as unfair U.S. SPS regulations. Retaliation has also been postulated for the Mexican SPS on apples. Although in this case retaliation does not refer to the enactment of the SPS regulation *per se*, but to its implementation. The monitoring requirements imposed by DIGSV in the initial SPS regulation on apples were considered excessively tough by U.S. officials. APHIS officials have postulated that DIGSV wanted to impose monitoring requirements as tough as the one APHIS has imposed to Mexican avocados growers. Similar argumentation has been produced to explain the tough measures that DIGSV has initially imposed on American stone fruit growers.

In any case, the progressive relaxation of DIGSV's monitoring requirements for apples and stone fruits suggests that the basis for such possible retaliation has eroded over time. The development of workable relationships between professionals on both sides of the border has been an important deterrent for some unnecessary tough SPS regulations. By sharing better and trusted information over time, the possibility to avoid unnecessary tough SPS regulations is reduced. The evidence shows that the professional relationship between Mexican and U.S. regulatory officials has improved over time.

Also, the retaliatory nature of the cases where DIGSV was captured provides fuerther support to the acceptance of H3. The GOM have instructed its agents to avoid conflicts with their American counterparts and still, DIGSV could not avoid being captured by domestic industries. The retaliatory nature of these conflicts suggests that, at least under the Mexican perspective, the SPS controversies were originated not by DIGSV, but by APHIS. The retaliatory nature of these conflicts suggests that Mexican officials have blamed APHIS for the lack of solution to their demands (e.g., APHIS' failure to allow the entry of avocados from Michoacan). Such a perception helps to explain how the capture of DIGSV took place under the instructed policy of good will toward the U.S. denoted by H3.

The evidence suggests that H1 must be rejected. The evidence does not support the hypothesis that Mexico has enacted SPS regulations as compensation for tariff reductions. However, such a conclusion cannot be interpreted as if Mexico has not enacted unfair SPS regulations (nor other non-tariff barriers to trade). It may have been possible that, in spite of the lack of evidence, some domestic industries vulnerable to tariff reductions could have been influential during the enactment of some controversial SPS regulations. For instance, the enactment of a large number of NOM-EMs has been justified by DIGSV's need to fill a regulatory vacuum. However, it might be possible that the enactment or duration of some NOM-EMs were also influenced by the action of vulnerable industries. Also, excessive delays reported for some U.S. exports at some points in time have been attributed mainly to resource limitations at Mexican port inspections. It is possible that some domestic industries could have been influential enough to promote some of these delays. In any case, the evidence shows that the Mexican vulnerable industries have shifted their strategic demand for governmental protection out of the SPS area. The evidence shows that the Mexican vulnerable industries prefer to seek protection in the form of anti-dumping measures or other TBTs.

In summary, this study concludes that the enactment of SPS regulations as a compensation for tariff reduction was not a general policy of the Mexican regulatory agencies. Further, this study shows that the institutional and regulatory changes implemented by the GOM in 1994 have reduced such a possibility. However, such a conclusion must not be interpreted as if Mexico had not enacted unfair SPS regulations. The evidence shows that Mexican regulatory agencies have been captured in the past to enact retaliatory regulations. Also, the possibility that some industries had captured the Mexican SPS agencies for some (brief) periods of time cannot be ruled out. This study confirms the adequacy of open and transparent regulatory procedures to reduce the incidence of unfair SPS.

*Chapter VI*

## Summary

Economists have warned against the possibility that the signature of tariff-reducing international trade agreements may induce countries to enact compensatory SPS regulations and other TBT. Some U.S. officials are concerned that in Mexico, such a possibility has become reality. The eruption of SPS regulations in Mexico soon after NAFTA went into effect gave an empirical basis to those concerns. This dissertation has investigated these concerns under a political economy framework.

Trade and regulatory reforms in Mexico were initiated in the middle 1980s. They originated in response to the Mexican debt crisis of 1982. Government intervention in the Mexican agricultural sector was very large before 1982. The GOM was present in almost every aspect of the production and consumption chains. Half of the agricultural land ownership was structured in low-producing *ejidos*. Food self-sufficiency was a high priority for the GOM. Agricultural production was highly protected. Agricultural imports were restricted. Agricultural exports were allowed only after domestic demand was satisfied. Urban consumption of staple food was highly subsidized. All these policies were interconnected in a very complex and expensive system developed and expanded under increasing oil-related revenues, but collapsed in 1982.

The debt crisis of 1982 triggered a wave of structural reforms in Mexico. Because of the crisis, a new political leadership akin to open-market policies rose to power in Mexico. Mexico joined the GATT in 1986. The new Mexican leadership approached international organizations such as the World Bank and the IMF for financial help. These organizations provided the needed financial help while the GOM started a process of deregulation of the Mexican economy. Open and transparent regulatory procedures were adopted. Government intervention in the economy was reduced.

The structural adjustments promoted by the new Mexican leadership conveyed important political risks. Mexican interest groups which used to live under a governmental umbrella began to voice their opposition to the new policies. The signature of NAFTA helped to diffuse such an opposition. The economic integration with the U.S. helped the GOM to gather political support for its new policies. The political support from interest groups which benefit from NAFTA helped the GOM to counterbalance the influence of its political opponents.

NAFTA also imposed a deeper commitment to the structural reforms already under way to the Mexican leadership. The GOM initiated reforms to deregulate the agricultural sector. The role of CONASUPO in the commercialization of agricultural goods was reduced. The import licensing system was abandoned. The regulatory process for SPS regulations was transformed. A more open and transparent regulatory process for SPS was enacted. Regulatory agencies were mandated to enact SPS regulations based on internationally accepted scientific guidelines. SAGAR was restructured. SPS regulatory agencies were made directly accountable to the Secretary of SAGAR. A separate agency to enforce SPS regulations was created.

All these changes have improved the quality of the Mexican SPS regulatory process. The increased openness and transparency of the regulatory process have allowed the participation of foreign interest groups during the making of SPS measures. Such increased participation has reduced the possibility that Mexican regulatory agencies are captured by domestic industries. Also, foreign participation has allowed Mexican agencies to produce better SPS regulations. Some initially unnecessary tough SPS regulations have been soothed after Mexican and American officials progressively worked out their technical discrepancies. The participation of foreign interest groups in the regulatory process for SPS regulations has increased the stability of the system, making it more difficult for the Mexican regulators to enact unexpected SPS regulations.

The reorganization of SAGAR has increased the governmental oversight of the regulatory process for SPS regulations. Such an increased oversight has had two related effects on SPS regulatory agencies: an increase of governmental protection against influential interest groups, and an increase in the regulatory agencies' susceptibility to the political needs of the GOM. In other words, the reorganization of SAGAR has reduced the possibility of capture of DIGSA and DIGSV by domestic industries as long as such a capture conflicts with the GOM's political needs.

Governments usually pursue several political, even contradictory goals. One of the most important goals for the GOM has been the economic integration of Mexico with the U.S. Such a goal originated the GOM's need to avoid unnecessary conflicts with the U.S. The crucial financial help provided to Mexico by the World Bank, the IMF (two international organizations highly influenced by U.S. policy-makers), and the U.S. government itself increased the GOM's need to avoid controversies with the U.S.

In spite of the relatively new Mexican amiable attitude toward the U.S., some controversial SPS regulations have been enacted. Among the most controversial of these Mexican SPS regulations is the enactment of a large number of NOM-EMs. The enactment of a large number of NOM-EMs soon after NAFTA was put in place arose concern among American officials. However, such a regulatory eruption was motivated mainly by the Mexican need to fill a regulatory vacuum. The absence of pre-NAFTA adequate pest risk assessments induced the Mexican regulatory agencies to enact NOM-EMs to fill the regulatory vacuum. Quality-based pest risk assessments were unnecessary under the obscure import licensing system that prevailed in Mexico before NAFTA. Regulatory inexperience and resource limitations also caused the enactment of preventive NOM-EMs. The decrease in the number of NOM-EMs over time has been used in this dissertation as evidence in favor of the fair use of NOM-EMs by DIGSA and DIGSV. Although such an explanation is accepted, some vulnerable Mexican industries may have behaved as free-riders of the initial toughness of these NOM-EMs.

DIGSA and DIGSV have improved not only the enactment but also the enforcement of SPS regulations. The creation of a separate inspection unity within SAGAR and the hiring of a new corps of inspectors are among the main reasons for such improvement. However, U.S. exporters are still facing some border problems. Although there is evidence showing that some of these border problems may have been related to the political action of some domestic industries, they are generally attributed to insufficient resources or bureaucratic inexperience by the Mexican SPS agencies. In any case, it is acknowledged that these border issues have shown a substantial improvement since NAFTA.

As mentioned above, one of the reasons for the progressive improvement of Mexican SPS regulations is the continuous gain in regulatory experience by DIGSA and DIGSV. Such an improvement has been paralleled by an increased trust between Mexican and American officials. Years of mutual distrust between APHIS and the Mexican regulatory agencies (particularly DIGSV) had made more difficult the initial development of SPS regulations in Mexico. The initial toughness of the Mexican SPS regulations on apples and stone fruits has been attributed, at least in part, to such distrust. The creation by NAFTA of a bi-national working group to deal with SPS issues has contributed to sooth such differences. SPS controversies such the ones affecting cattle, apples, Christmas trees, stone fruits, and cotton have been worked out over time during successive discussions between Mexican and U.S. officials.

Thus, it has been acknowledged that NAFTA has further improved the enactment of SPS regulations in Mexico. SPS regulatory processes in Mexico are more open and transparent than ever. Still, there are three SPS regulatory processes in which the evidence suggests the capture of DIGSV by domestic industries: the SPS regulations on wheat, citrus, and sweet cherries. These SPS regulations show a common particularity: they have been enacted in retaliation against what Mexican officials perceived as unfair

APHIS' regulations. In particular, Mexican officials were particularly disturbed by APHIS' failure to allow the entry of avocados from Michoacan.[33]

The SPS regulations on wheat, citrus, and sweet cherries show that, in spite of the improvement of procedures and institutions, Mexican regulatory agencies are still susceptible to be captured by domestic industries. Such a conclusion is not surprising since it has been illustrated by Romano (1995) that the capture of SPS regulatory agencies may occur even under a very open and transparent regulatory processes such as the one in place in the U.S. What makes the capture of DIGSV interesting for this dissertation is its retaliatory motivation. It is particularly revealing that during the regulatory process for sweet cherries, DIGSV was captured not by the domestic industry at risk (i.e., the Mexican sweet cherry industry), but by the powerful Mexican avocados industry. DIGSV was captured by retaliatory purposes, rather than to enact tariff-compensation regulations.

The reduction in tariffs imposed by NAFTA have induced vulnerable Mexican industries to seek alternative sources of protection. This dissertation shows that the enactment of compensatory SPS regulations was not a viable alternative for the vulnerable industries. These industries were forced to look for alternative sources of protection such as the enactment of TBT (e.g., the poultry industry) or the initiation of anti-dumping investigations (e.g., the cattle and apple industries).

The transparency of the regulatory process has been deservedly credited with a large portion of the success achieved by the Mexican SPS regulatory agencies. This dissertation confirms the general adequacy of the WTO's and NAFTA's approach towards SPS regulations. The adoption of open, transparent, and scientifically based regulatory processes by trading partners tends to reduce the enactment of SPS as hidden barriers to trade. However, this dissertation also confirms a previously reported limitation of the WTO's and NAFTA's approach. As in Romano (1995) and Roberts and Orden (1997),

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[33] The avocados case has also been mentioned as a retaliatory motivation for other tough SPS regulations such as thoseaffecting apples and stone fruits.

open and transparent regulatory processes are successful in reducing the enactment of unfair SPS regulations as long as the regulatory agencies enjoy the necessary political support to avoid being captured by powerful interest groups.

# Essay II

# The Economic Impact of APHIS' Ban on Mexican Avocados

*Chapter VII*

# INTRODUCTION

International organizations like the World Trade Organization (WTO) and agreements such as the North American Free Trade Agreement (NAFTA) mandate their members to enact sanitary and phytosanitary (SPS) regulations to prevent the entry of exotic pests into areas previously free of them. The WTO and NAFTA allows each country to establish the level of SPS protection that it considers appropriate as long as SPS regulations are based on scientific principles and risk assessments; are applied only to the extent necessary to provide a country's appropriate level of protection; and do not result in unfair discrimination or disguised restrictions (NAFTA, Article 712). With these requirements, the WTO and NAFTA expect to induce their members to avoid the enactment of unnecessary trade restrictive SPS regulations. However, SPS regulations enacted in compliance with the WTO and NAFTA may not be optimal. Scientifically sound SPS regulations may provide effective biological protection to domestic producers, but have a negative impact on consumers and on social welfare.

Potentially Pareto improving (PPI) criteria can be used to evaluate the economic impact of SPS regulations. Cost-benefit analysis (CBA) has been applied by regulatory agencies to evaluate the economic impact of major regulations such as the one which affects the entry of Mexican avocados into the U.S. (Evangelou et al., 1993). However, past economic evaluations of SPS regulations may have yielded biased results. Past CBA of SPS regulations have assumed that a pest infestation would occur with certainty. Economic evaluations which treat the occurrence of pest infestations as certain may overstate the protection aspects of SPS regulations. Such evaluations have little utility for impartial regulators since they provide information only on the extremes (i.e., with a unity probability of occurrence). Impartial regulators should be particularly interested in the expected impact of SPS regulations. Therefore, one goal of the second part of this dissertation is to incorporate the uncertain occurrence of pest infestations into the economic evaluation of SPS regulations.

The WTO and NAFTA have acknowledged the right of their members to establish their own levels of protection. Such a concession is an implicit recognition of the existence of different geographical endowments as well as different attitudes toward risk among countries. However, like risk in general, attitudes toward risk have been ignored in past evaluations of SPS regulations. Economic evaluations of SPS regulations may yield different outcomes depending on the domestic producers' degree of risk aversion. Hence, it could be important to incorporate the risk of pest infestation into the evaluation of SPS analysis has to take the producers' attitudes toward risk into account.[33]

Uncertainty and attitudes toward risk are empirically incorporated into the economic evaluation of the avocado case. This case involves a longstanding dispute involving the entry of Mexican avocados into the U.S. The Animal and Plant Health and Inspection Service (APHIS) delayed the entry of Mexican avocados based on some phytosanitary concerns. Working under a framework of certainty, APHIS concluded that a pest infestation associated with Mexican imports of avocados would reduce both producers' and consumers' welfare (Evangelou et al., 1993). Such a conclusion may have been biased since APHIS ignored the probabilistic nature of the pest infestation. The first part of this dissertation has shown that the ban on Mexican avocados played a crucial role

[33] Consumers and Regulators may also bear the risk of pest infestation. However, consumers usually do not bear the risk of pest infestation. Consumers may be exposed to a SPS risk when pest infestations cancause food safety concern. Regulators also bear a risk with the SPS regulations they enact. However, the risk they bear is different that the one beared by producers or consumers. For instance, while producers usually bear the risk that a pest infestation reduce profits, regulators bear the risk of punishment by their principals. The regulators' degree of aversion to such a risk may play an important role in the enactment of SPS regulations. However, such a risk is not investigated in this dissertation.

in the development of SPS barriers in Mexico. Therefore, another goal of this dissertation is to apply the methodology developed for the analysis of SPS regulations under uncertainty to the avocado case. The outcome of this analysis will be compared against Evangelou et al.'s conclusions.

In summary, the goals of the second part of this dissertation are: i) to incorporate the risk of pest infestation and attitudes toward risk into the economic evaluation of SPS regulations, and ii) to apply such a methodology to the avocado case. The outcome of the analysis is compared against the one Evangelou et al. made under certainty.

The second part of this dissertation is organized as follows. Chapter VIII reviews the literature on cost-benefit analysis applied to risk-reducing regulations. Chapter IX provides an overview of the avocado case. Chapter X introduces the supply and demand functional forms used in the analysis and presents a methodology to incorporate the risk of pest infestation into the economic evaluation of SPS regulations. Chapter XI presents the results of applying such a methodology to the avocado case. Chapter XII discusses the results.

*Chapter VIII*

# THE ECONOMIC EVALUATION OF RISK-REDUCING POLICIES. LITERATURE REVIEW

## VIII.1. Introduction

Cost-benefit analysis is a methodology utilized by economists to assess regulatory policies. However, many actual policy decisions about risk-reducing regulations have ignored CBA. This chapter explores this paradox by reviewing the literature on cost-benefit analysis applied to risk-reducing regulations. Section VIII.2. reviews some legal aspects of the role of economic evaluations of risk-reducing policies. Justifications and criticisms directed at the application of CBA to the evaluation of risk-reducing policies are reviewed in section VIII.3. Sections VIII.4 and VIII.5 focus on welfare analysis under uncertainty: section VIII.4. reviews models for decision-making under uncertainty, while section VIII.5 reviews the adequacy of different measures of uncertain benefits and costs for evaluating the Pareto properties of risk-reducing projects. Finally, section VIII.6 reviews the empirical application of CBA to risk-reducing policies, particularly SPS regulations.

## VIII.2. Legal Aspects of the Economic Evaluation of Risk-Reducing Regulations

Regulatory processes in the United States must follow the guidelines established by the Administrative Procedures Act (APA) of 1946 and other pieces of legislation, including newer laws and presidential executive orders (EO). Among the most important of these is the Regulatory Flexibility Act of 1980 and the Executive Orders (EO) 12291 of 1981, and 12866 of 1993.

The Regulatory Flexibility Act of 1980 (5 U.S.C., 601-612) requires agencies, among other things, to publish an analysis of the expected economic impact of intended regulations. The EO 12291 of 1981 and the one which has replaced it, the EO 12866 of 1993, require agencies to send to the Office of Management and Budget (OMB) a cost-benefit analysis of all major regulations (regulations with an expected economic impact larger than $100 million). The OMB evaluates the proposed regulations partly on the basis of Cost-benefit analysis. The EO 12866 is defined by Lutter and Morrall (1994) as an attempt to use welfare economics as the basis for making regulatory decisions.

The legal mandate to perform an economic evaluation of all new regulations has been contradicted by other legislation which requires agencies to avoid economic considerations during regulatory processes. Portney and Stavins (1994) noted that "the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Safe Drinking Water Act, and the Comprehensive Environmental Responses, Compensation, and Liability Act (i.e., the "Superfund" Act) virtually prohibit the Administrator of the Environmental Protection Agency (EPA) from considering costs in setting standards." There are only two environmental statutes which require the EPA to balance costs and benefits in establishing environmental standards: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the Toxic Substances Control Act (TSCA) (Van Houtven and Cropper, 1996). Thus, a paradox arises with the Regulatory Flexibility Act and EO 12991 mandating environmental agencies to perform economic evaluations that other legislation forces the agencies to disregard.

The ambiguous legal status between setting safety standards and considering the costs necessary to attain them is not unique to the United States. In Australia, the Therapeutic Goods Administration (TGA), similar to the American Food and Drug

Administration (FDA), is legally mandated to approve new drugs based only on biological considerations. However, cost-effectiveness analyses (CEA) are required for a governmental reimbursement of the approved drugs (Mitchell, 1996, Frend, 1996). A similar structure occurs in the province of Ontario, Canada (Schulman et al., 1996, Blackmore and Magid, 1997). More generally, Rovira (1996), reviewing the legal status of economic evaluations for health technologies in Europe, concluded that "economic evaluation is not systematically and explicitly applied to resource allocation in health systems, including the regulation and financing of drugs, in any European country." Further, Rovira "...suspects that economic evaluation often is used not to illuminate choices, but just as *a posteriori* legitimization of a decision taken on other grounds (page DS184)."

### VIII.3. Cost-benefit Analysis: Justification and Criticisms

As Meier (1985) has pointed out, "nothing could make more sense than to issue regulation only if the regulation provides more benefits than costs." Cost-benefit analysis allows the identification of regulatory policies that show expected marginal benefits larger than marginal costs. Such policies are Pareto improving, since winners of the regulation could, in theory, compensate the losers in such a way that nobody will be worse off (e.g., Viscusi, 1992, Portney and Stavins, 1994). Further, policies which focus on minimizing risk no matter what the cost may be not only economically inefficient, but also riskier than policies based on CBA. For instance, Osteen (1994) has pointed out that the Delaney clause, by mandating the elimination of all pesticides associated with a non-zero carcinogen risk, may have induced farmers to apply alternative, riskier pesticides.[34] Further, because of its reliance on a money metric, CBA has the ability to aggregate

[34] The "Delaney clause" actually consists of three parallel provisions applicable to three classes of food constituents: food additives, color additives, and animal drug residues (Merril, 1988)

dissimilar effects such as those affecting health or profit into a single measure of benefits (Kopp et al., 1996).

In spite of being advocated by economists, CBA is often disregarded as the basis for decisions about environmental regulations (e.g., Lave, 1981, Asch, 1990, Viscusi, 1992, 1994, Breyer, 1993, Lutter and Morrall, 1994, Portney and Stavins, 1994). Several reasons have been postulated for the disregard of economic analyses during policy-making. Some critics argue that CBA applied to risk-reducing regulations rarely yield objective evaluations, since it is usually based on assumptions imposed by researchers (Armour, 1993). Zinke (1987) contends that economists who apply CBA to situations where information is less than perfect must rely on assumptions and theoretical constructs which may reduce the objectivity of the analysis. Implicit in this criticism is the perception that physical sciences are more objective than social sciences like economics. Viscusi (1992) speculates that this line of criticism may actually reflect the difficulty that some scientists have in recognizing the value of economic analyses of regulations.[35]

Some authors have criticized the application of CBA to situations where there is significant uncertainty, as opposed to known risk. CBA based on incomplete or unreliable data may be extremely sensitive to new information. In those cases, policies enacted based on methodologically correct but highly sensitive and unstable CBA may prove erroneous once new information arrives (Kravchuk, 1989). In particular, CBA has methodological problems to incorporate attitudes toward risk (Stallworth, 1994).[36]

Another line of criticism points out the difficulties associated with the specification of all pertinent costs and benefits into CBA (Brush and Clems, 1995). Particularly

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[35] This line of criticism is embedded into the philosophical debate between utilitariansand deontologists. Utilitarians are individuals who make decisions after carefully pondering the consequences of their acts. On the other hand, deontologists like Immanuel Kant emphasize the moral aspects of decision-making. Thus, while utilitarians usually rely on methodologies such as CBA for deciding between alternative policies, deontologistswould make their choices based on pre-established moral standards (Sagoff, 1996).

[36] See Chapter V.5 for a detailed review of CBA under uncertainty.

difficult is the identification and incorporation of future costs and benefits into the analysis. To do so fully requires adequate forecast both of the future impact of the policy and the preferences of future generations (Crandall, 1988).

All the above-mentioned criticisms of CBA focus on the limitations of the methodology when it is applied with less than perfect information. However, it is precisely under incomplete information that CBA becomes a fundamental methodology for decision-making. Although not as conclusive as under a perfect world, the outcome of a CBA provides important information for decision-making. In particular,CBA allows decision-makers to perceive the economic consequences of alternative policies. The quality of decision-making processes is enhanced when agents are fully informed about not only the biological, but also the economic consequences of alternative actions.

In order to deal with the problems that CBA faces under incomplete information, empirical economists apply sensitivity analysis. Sensitivity analysis allows decision-makers to evaluate the economic consequences of alternative policies under different informative assumptions. The importance of sensitivity analysis for CBA has been internationally acknowledged. For instance, the elaboration of sensitivity analysis for health-related CBA has been suggested by all current and proposed international guidelines (Power, 1996, Rovira, 1996, DeVries and Gagnon, 1996).[37] The importance of CBA goes beyond the addition of an economic dimension for decision-making. The consistent application of CBA for decision-making may enhance the transparency of regulatory processes. With an increased transparency in regulatory processes, decision-makers may become more accountable for their decisions. Further, CBA may also provide a framework for consistent data collection and evaluation, as well as facilitate the identification of uncertainties and other gaps in knowledge (Kopp et al., 1996).

[37] See section VIII.6.

In summary, it is because the estimates of costs and benefits are, in most cases, uncertain, that the outcomes of CBA are rarely used *per se* to prove the adequacy of a chosen policy. However, CBA should be fundamental for decision-making. As Arrow et al. (1996) pointed out: although "benefit-cost analysis is not sufficient for designing sensible public policy, if properly done, it can be very helpful to agencies in the decision-making process."

## VIII.4. Decision-Making Under Uncertainty

The behavior of economic agents may differ substantially from what is commonly predicted by economic theory under certainty. Such an effect may be relevant to the analysis of risk-reducing policies such as SPS regulations (MacLaren, 1997). Several models have been proposed to incorporate such uncertainty. Among them, one of the most often applied has been the Expected Utility Model (EUM) of von Neumann and Morgenstern (1947). The mathematical goal of the EUM is to represent preferences to acts x by the utilities associated with each state of nature s weighted by the probability $p^s$ of occurrence of the states of nature:

$$EU(x) = \sum_s p^s \, U(x(s)) \qquad \textbf{[VIII.1]}$$

Based on a series of axioms, the EUM predicts that rational decision-makers would choose actions yielding the largest expected utility. Utility functions are usually set as concave (convex) to represent decision-makers' risk aversion (taking) behavior. Measures of attitudes toward risks related to such a concavity (convexity) have been developed by Arrow (1974) and Pratt (1964) and wide utilized since then.

The EUM has received several criticisms. These criticisms are often related to situations where violations of one of more of the EUM's axioms seem problematic.

Among these criticisms, there are three which are particularly relevant to the analysis of SPS regulations. One is the difficulty the EUM face when dealing with non-monetary elements such as environmental diversity (Buschena and Zilberman, 1994). The expected utility of SPS regulations which may affect environmental diversity may be difficult to evaluate because of the problems associated with ascribing a monetary valuation to the existence of such diversity. Another criticism points out that in order to justify the application of the EUM, researchers must assume that economic agents are able to gather and compute all the necessary information to produce rational choices. It is hard to satisfy this requirement because of the human limitations associated with the acquisition and processing of knowledge as diverse as biology, economics and statistics However, such a criticism may not be as important when applied to regulatory agencies. It might be possible to assume that regulatory agencies do have the capability to collect and process all the available data. A third criticism of the EUM focuses on the validity of the probabilities applied in the analysis. By definition, the EUM takes probabilities as given. But, for SPS issues, disputes usually center around the probability of occurrence of a pest infestation rather than on their impact (MacLaren, 1997).

As an alternative to known probabilities, Savage (1954) developed a set of axioms by which subjective probabilities can be applied to represent preferences under uncertainty. Under those axioms, a subjective expected utility model (SEUM) allows decision-makers to choose alternatives among a unique subjective expected utility (SEU). As the EUM, the SEUM weighs the utility associated with each alternative under the different states of nature by the probability of occurrence of such states of nature. The SEUM subjectively modifies probabilities according to the individuals' belief about the states of nature. In this sense, the SEUM may be better suited than the EUM to model growers' and farmers' preferences regarding SPS regulations

Like the EUM, the SEUM portraits a decision-maker as behaving as if he or she possesses complete and exhaustive information about all possible states of the world. A drawback with SEUM is that it forces the decision-maker to choose according to his or her subjective probabilities without any consideration about his or her belief about the adequacy of his or her estimates. Such an ambiguity creates a new risk. The SEUM requires that decision-makers are ambiguity neutral. The Ellsberg's paradox shows how ambiguity-averse individuals would prefer prospects with lower expected utility but with less ambiguous occurrence (Ellsberg, 1961). Ambiguity aversion adds another dimension to the enactment and analysis of SPS regulations. MacLaren (1997) pointed out that regulatory processes for SPS regulations may reflect not only risk- but also the decision-makers' ambiguity-aversion. For instance, ambiguity aversion may explain why some farmers continuously request information about pests, even if the likelihood that such new information would alter their decision is slim. Also, Heath and Tversky (1991) showed that the individuals' degree of ambiguity aversion may vary according to their prior knowledge on the risky issue (i.e., regarding the individuals' competence, knowledge, skill, and comprehension on the subject).[38]

This factor may be relevant to explain the attitude of farmers demanding protective SPS regulations, in particular for farmers who had suffered from pest infestations in the past. For instance, during his study of a U.S. ban on European nursery stock, Romano (1995) found that many of the U.S. growers who asked APHIS not to allow the entry of European imports expressed their fear that the new imports would cause a pest outburst similar to others they have suffered in the past. The growers' perception of the probability of occurrence of an exotic pest infestation was inconsistent with the actual likelihood of such an event, but may have had an important impact on the political economy aspects of the case.[39] Attitudes toward risk and the psychological factors which affect it may be

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[38] The literature shows several other psychological factors that may affect attitudes towards ambiguity. For instance, ambiguity aversion seems to increase when individuals bet on gainsrather than losses (Shoemaker, 1991, Weber and Kirsner, 1997).

[39] The nursery stock case is a longstanding dispute in which an European request for imports of nursery stockin artificial media has been under APHIS' review for more than 20 years. In January 1996, APHIS published a final

relevant to explain the enactment of unnecessary tough SPS regulations. However, as described in the first part of this dissertation and in the avocado case detailed by Roberts and Orden (1997), the producer's demand for protection may also be based on political economy considerations.

There have been several attempts to deal with ambiguity in decision-making. Camerer and Weber (1992) provide a detailed review of these approaches. One of these approaches is the rank-dependent utility (RDU) model (Quiggin, 1972). In RDU models, probabilities are not necessarily additive. In other words, in RDU models, two alternative and mutually exclusive events A and B do not necessarily have probabilities which add to one. The difference between unity and the added probabilities [1 - p(A) - p(B)] is used in RDU models as a measure of the faith of the individuals' belief about probabilities, i.e., on p(A) and p(B).

The EUM, SEUM and RDU are not the only models available for decision-making under uncertainty. Several other models have been proposed. Some of them are derivations of the EUM (Prospect Theory (Kahneman and Tversky, 1979), Anticipated Utility (Quiggin, 1982), Regret Theory (Loomes and Sugden, 1982), and Case-Based Decision Theory (Gilboa and Schmeidler, 1997)). These models add restrictions to the way individuals weigh each state of nature. For example, the case-based decision theory assumes individuals prefer choices which resemble some particular option they took in the past.

Another group of models for decision-making under uncertainty departs from the standard utility theory. One of these models is Roy's safety-first rule. Roy's rule chooses the alternative which would minimize the probability of occurrence of an unfavorable outcome (Roy, 1952). Telser (1956) and Kataoka (1963) advanced Roy's approach by

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rule allowing the entry of 4 nursery stock genera out of more than 40 still under evaluation. The rule was challenged in court by the domestic industry. In October 1997, the Court ruled in favor of APHIS' SPS regulation. However, up to November 1997, no regulatory initiative regarding the remaining genera has been initiated by PPQ (Kelly, 1997).

incorporating a significance level to control the likelihood of a type I error in decision rules. The significance level under both Telser's and Kataoka's rules would serve as a proxy for the decision-makers' risk aversion. Safety rules have been considered as positive models which are empirically followed by many decision-makers (Moscardi and de Janvry, 1977, Collins et al., 1991) even though the theoretical justification for these models is not always clear (Buschena and Zilberman, 1994).

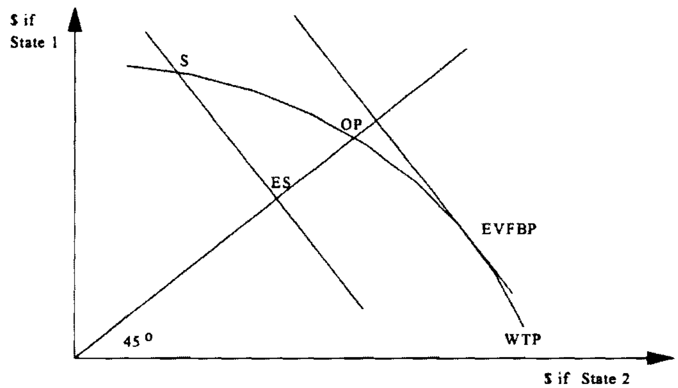
### VIII.5. Cost-Benefit Analysis Under Uncertainty

The previous section has reviewed concepts such as risk- and ambiguity-aversion. This section takes into account these concepts to review different measures of benefits and costs under uncertainty. Such measures are applied to evaluate the Potentially Pareto Improving (PPI) criterion for risk-reducing policies. PPI has been postulated as an adequate criterion for choosing between policy alternatives, since those which pass the PPI test allow gainers the possibility to compensate losers. Although the PPI is a well-established criterion, its implementation is not straightforward when policies to be evaluated involve uncertain benefits and costs.

In order to focus the review, it is useful to follow Graham (1981) and imagine a situation where there are two possible states of nature (e.g., absence or occurrence of a pest infestation). Imagine also that there is a welfare condition associated with each state. The government is studying a project that would affect (supposedly increase) individuals' welfare. Such a project would be approved if it is shown to be PPI. The question Graham asks is: what is the appropriate measure of such a change in welfare? Perhaps the simplest of such measures could be obtained by weighing the welfare changes associated with all uncertain states of nature by their probability of occurrence. Such a methodology would yield the policy's expected value of surplus (ES). However, policy decisions based on expected value of surplus may not be optimal, since ES does not take risk attitudes into account. Risk-averse people may want to pay more than the ES to avoid uncertain events (Weisbrod, 1964, Graham, 1981).

The option price (OP) of a project takes into account such a willingness-to-pay. The OP represents an ex-ante sure payment (i.e., independent of what state of nature occurs). The OP denotes the maximum payment that individuals will make when they are indifferent about which state of nature would occur (Bishop, 1982)[40].

**Figure VIII.1. State-Conditional Compensation Points**




Source: Meier and Randall (1991)

Figure VIII.1 illustrates the differences between ES and OP for a project involving two possible states of nature. Point S in Figure VIII.1 denotes the payoff of the project corresponding to the certain occurrence of the states of nature 1 or 2. Agents may be willing to pay S for the project. However, point S does not take into account the uncertain occurrence of the states of nature. When such an uncertainty is taken into account, the ES point is reached. However, agents may be willing to pay more than ES for the project. The point OP in Figure VIII.1 takes into account the agents' risk aversion.

[40] Weisbrod (1964) argued that the difference between OP and ES, which is denoted as option value (OV), should always be positive. Shmalensee (1972) showed that the sign of OV couldactually take any value, although it is usually positive, Freeman (1984) pointed out that when uncertainty is due only to income across states of nature then OV may be negative.

According to Graham, OP is just one among all possible maximum payments a society is willing to pay for a project. He has shown that there are infinite willingness-to-pay loci (WTP) associated with a project. Each WTP locus is associated to a particular distribution of risk. For instance, the OP corresponds to the WTP locus where individuals are indifferent about which of the states of nature would occur. This indifference is what make OP the adequate ex-ante welfare measure to evaluate if projects are PPI when there are similar individuals facing a collective risk and no insurance is available (Meier and Randall, 1991). A risk is said to be collective if the occurrence of the uncertain event is faced by all agents. If some individuals may escape such an event once it occurs, then the risk is said to be individual (Graham, 1981).[41] If individuals were not similar, or if contingent markets were available, it might be possible to find an alternative distribution of risk that would leave everybody better off.

Graham (1981) showed that when there is an individual risk, state-dependent compensation schemes are possible, and insurance is unavailable, there are some other WTP loci which may be more adequate to evaluate if projects are PPI. In any case, rational individuals will refuse to pay for a project beyond the WTP loci because no compensation scheme would restore them to their initial wealth. On the other hand, if the actual payment for the project lies inside the WTP loci, Graham (1981) showed that individuals would enjoy an ex-ante surplus with the project. Thus, according to Graham's approach, a project will pass a PPI test if there is at least one point where the aggregate WTP is positive in all states. The existence of such a locus would make compensation possible and the project PPI.

In his approach, Graham (1981) treats costs as certain, leaving the benefits associated with the project as the only source of uncertainty. Graham (1981) claimed that

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[41] For instance, the risk associated with the entry of an agricultural pest into an island inhabited exclusively for vulnerable producers would be collective. On the other hand, if a large number of consumers that were indifferent to the pest infestation were also present in such an hypothetical island, the risk would be individual.

an extension of his model to include uncertain costs would be straightforward. Such an extension was attempted by three mathematically similar approaches. Ready (1993) took costs into account by considering them negative benefits. Meier and Randall (1991) and Freeman (1991) mirrored Graham's (1981) approach by treating losers separately from gainers and defining the willingness-to-accept loci (Meier and Randall, 1991) and the compensation loci (Freeman, 1991).

Mendelsohn and Strang (1984) contended that since complete and fair contingent claims usually do not exist and the government is unable to individualize and collect all state-dependent payments, OP should be the appropriate measure of benefits for PPI evaluations. Graham (1981, 1984) disagreed. Graham (1984) contended that the government may find the collection of sure, state-independent payments (i.e., those associated with OP) as difficult as those associated with state-dependent payments. Cory and Saliba (1987), Colby and Cory (1989), and Freeman (1991) contend that, since compensation is rarely paid, arguments about the feasibility of compensation payments are irrelevant.

Graham (1981, 1984) considers OP as an adequate measure of welfare only for situations involving collective risks, since it is the largest payment that can be guaranteed in all states of the world. Colby and Cory (1989) agree with Graham. These authors contend that when risk is individually borne, a decision to reject a project because OP is lower than the cost of the project may be too stringent. As it was mentioned before, it might be possible to find another payment combination in the WTP loci that is larger than the cost of the project. The existence of such a combination would suggest the project is PPI. Cory and Saliba (1987) and Colby and Cory (1989) postulated that the ideal measure of benefits for investigating PPI properties would be the WTP loci where the ex-post compensation scheme maximizes the individuals' ex-ante expectation. Cory and Saliba (1987) and Colby and Cory (1989) denominated such a point as the expected value of the fair bet point (EVFBP in Figure VIII.1). The authors postulated that, when state-conditional compensation is possible and fair insurance is available, the expected value of the fair bet point (EVFBP) may be the adequate measure of welfare[42,43]. Graham agrees. He contends that under the circumstances described by Cory and Saliba and Colby and Cory (i.e., state-conditional compensation and fair insurance are possible) the EVFBP would yield the maximum possible payment that aggregated individuals are willing-to-pay. Therefore, such a locus would be ideal to evaluate the PPI condition of a project, since the largest possible payment combination would have been found[44].

Mendelsohn and Strang (1984) and Ready (1993) doubt Graham's search for the largest possible payment. They contend that if such a maximum payment were actually paid, then it might be possible that such a payment would be excessive for the service the government would provide for the project. Mendelsohn and Strang (1984) contend that, even if the WTP locus were larger than the cost of the project, such an eventuality cannot be optimal. Graham (1981), as well as Meier and Randall (1991), and Freeman (1991) defend their search for the largest possible payment by claiming that compensation payments may become an issue only if the society decides to actually make such payments. They sustain that the PPI test requires only the identification of a locus where payments were larger than the cost.

Ready (1993) claimed that both OP and the EVFBP fail to take proper account of the reallocations of risk that may occur with the project. According to Ready (1993), EVFBP overstates benefits by including all potential benefits that may occur. At the same

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[42] If complete contingent claims markets would exist, then the discussion about the adequacy of WTP or OP for PPI purposes would be irrelevant (Ready, 1993).

[43] Notice that the EVFBP differs from ES. The ES is estimated as the weighted average of each states of nature's surplus, with the probability of occurrence of each state as the weighing factor. The EVFBP also applies probabilities of occurrence as weighing factors, but to average combination of willing-to-pay loci.

[44] A similar criteria was followed by Graham (1981) to claim OP is the ideal measure of benefits when individuals are similar, risk is collective, and no complete contingent market is available. Under such circumstances, OP would be the maximum ex-ante aggregated payment that could be collected.

time, OP ignores such risk reallocations. In order to capture such risk effects, Ready (1993) proposed another measure for the benefits of the project: the maximum agreeable payment (MAP).

As implicit in the preceding paragraphs, there have been some confusion and discussion in the literature about what is the ideal measure of costs and benefits under uncertainty.[45] That is so even after Meier and Randall's (1991) clearly pointed out that there is no ideal measure. The adequate measure of costs and benefits has to be chosen regarding the particular circumstances involved.

The above discussion focuses on the adequacy of the WTP loci to evaluate risky projects. However, the estimation of such WTP loci may not be empirically feasible. It might be possible that under some circumstances the ES is the only measure available. The literature shows the conditions under which the use of ES for evaluating risky projects may be justified. One of them is the risk-spreading argument introduced by Arrow and Lind (1970). According to this argument, if the risk associated with the project is spread across participants, then individuals may act as risk neutral. Another argument is portfolio diversification. Such an argument assumes that individuals who participate in several risky projects behave as risk neutral (Meier and Randall, 1991). Arguments like those above may not hold in most SPS cases. In most SPS projects, the risk of pest infestation is borne only by a particular sector of the society. The ES may be the only measure available for evaluating SPS regulations. In that case, knowledge about the sign of OP would at least indicate the direction of the bias (Plummer and Hartman, 1986).

Not only the producers' attitude toward risk may play a role in shaping SPS regulations. Consumers' risk aversion may also be important to the economic evaluation of SPS regulations when the risk is beared by both producers and consumers. But perhaps more relevant, is the regulators' attitude toward risk. Regulators may also bear a risk

[45] See for instance Graham's reply (1984) to Mendelsohn and Strang (1984).

associated with the entry of exotic pests into the country. Although regulators may not be as much concerned by profit loss as being punished by their principals if a pest infestation occurs.

Finally, this section has focused on uncertainties associated with the occurrence of particular states of nature. Pope and Chavas (1985), working under a mean-variance framework, showed that supply curves may also be affected by price uncertainty. Supply curves under price uncertainty may shift to the left if producers are risk-averse. In other words, producers would produce less than expected under certainty if they are averse to price uncertainty. If price uncertainty arises in a SPS issue, then its impact on supply and CBA must be taken into account.

## VIII.6. Empirical Economic Evaluations of Risk-Reducing Regulations

This section reviews empirical economic evaluations of risk-reducing regulations. In particular, this section reviews i) how regulatory agencies have coped in the past with the paradoxical legal status of economic analyses, and ii) how regulatory agencies have addressed the technical issues reviewed in the last two sections. A review of economic analyses of past SPS regulations is provided at the end of this section.

### How Regulatory Agencies Have Faced the Legal Dilemma Regarding Risk-Reducing Regulations

Economic evaluations have been performed on regulations affecting areas as diverse as nuclear safety (e.g., Harding, 1990), occupational safety (e.g., French, 1994), property safety (Hakim and Shachmurore, 1996), environment (e.g., Lichtenberg et al., 1988, 1989, Frankhauser, 1994, Sunding, 1996), food safety (e.g., Falconi and Roe, 1990) and public health (e.g., Gelles, 1993). However, as mentioned above, some regulatory agencies do not have the authority to use economic criteria to evaluate products or policies. In spite of such a constraint, recent studies have shown that regulatory agencies like the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA) have not ignored the economic implications of their regulations. Van Houtven and Cropper (1996) investigated more than 200 regulations made by the EPA during 1987 and 1995 to conclude that the agency has taken economic evaluations into consideration during regulatory processes. In spite of being legally impeded from applying economic considerations in its ruling, the EPA took costs and benefits into account in more than 85 percent of all the enacted regulations. A similar conclusion was reached by DeVries and Gagnon (1996) after studying FDA's regulatory processes. These two studies provide some encouragement for those who favor the inclusion of economics in decision-making processes. Unfortunately, the authors of both studies did not pay close attention to those regulations in which the EPA disregarded cost-benefit analyses. It would have been interesting to explore the reasons why some regulations are enacted without economic analyses[46].

Particularly revealing with respect to SPS regulations is the process by which the human health profession is embracing economic analysis. Because of the relatively large amount of research these fields command, their approach to the economic evaluation of risk reducing policies is useful to the understanding of similar problems facing SPS regulations. It is interesting to note that until not long ago, the economic evaluation of new health policies (e.g., a new medical technology) was considered a sort of academic exercise by the medical profession. It was a type of exercise which had little impact on the application of the policy (DeVries and Gagnon, 1996). Concern about the rising cost

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[46] Note that Udvarhelyi et al. (1992) and DeVries and Gagnon (1996) disagree with authors such as Lave (1981), or Viscusi (1992, 1994) regarding how frequent regulatory agencies pay attention to economic evaluations. Such a disagreement may respond in part to the focus Udvarhelyi et al. (1992) and DeVries and Gagnon (1996) put on the generality of cases, while authors like Lave (1981) and Viscusi (1992, 1994) pay more attention to relevant case studies.

of medical care has altered this situation (Eisenberg, 1996, Udvarhelyi et al., 1992, Power, 1996). Managed care, which has become the predominant form of health-care delivery in the U.S., has motivated private business to obtain economic information that would help them to predict and control their health costs (Power, 1996).

The interest in the economic evaluation of human health regulations has continuously expanded since Weinstein and Stason proposed the use of cost-effective analyses for health and medical practices for the first time in 1977 (Schumock et al., 1996, Penar, 1996). Udvarhelyi et al. (1992) estimated that by 1987 the amount of pharmaceutical and medical journal articles which mentioned either cost-effectiveness or cost-benefit analyses increased by 82 percent. Table VIII.1 shows the number of citations obtained from the MEDLINE data base after applying the keywords "cost-benefit" and "cost-effectiveness" for the years 1987 up to 1996.

**Table VIII.1. Number of Citations Obtained From MEDLINE Database After Searching for the Keywords "Cost-Benefit" and "Cost-Effectiveness"**

| Year | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of citations | 107 | 99 | 112 | 166 | 190 | 189 | 256 | 281 | 396 | 491 |

Unfortunately, the increased demand for economic analyses has found the economic profession unprepared. As Power (1996) has pointed out:

> "For years, proponents of cost-effectiveness analysis have felt like lone voices in the wilderness, crying to decision makers: 'this is really a good thing. You need this.' Now, they are on the verge of winning the fight to be heard. ...[]... Users of cost-effectiveness analysis (CEA) have agreed that it is important to invite the CEA 'emperor' to the table. The bad news, if you'll forgive the fairytale analogy, is that finally having invited him, they have discovered that the emperor still is back there in his room contemplating his clothes. He has decided that it is probably important to wear clothes, but he has not decided which clothes to wear." (Power, 1996, pages DS200 and DS201).

In other words, once the economic profession has been asked for conclusive and consistent empirical evaluations of risky medical technologies, it is not prepared to deliver. There is some confusion between analysts and users about the appropriate methodology to perform the economic evaluation of risk reducing regulations. One of the reasons for such confusion is some lack of uniformity in the terminology (Rovira, 1996). For instance, the terms cost-effectiveness and cost-benefit have been applied interchangeably by some authors in the past (e.g., Detsky and Naglie, 1990, Hayman et al., 1996).[47]

Perhaps more important, there is no consensus about how economic evaluations of risk-reducing policies should be performed. As Udvarhelyi et al. (1992) pointed out, the increased interest in economic evaluations in the medical field was not paralleled by an increase in the quality of those analyses. Udvarhelyi et al. (1992) reported that only a fraction of all the articles they reviewed appropriately specified those who will benefit from the policy (18 percent), included all component costs in their analyses (4 percent), used discounting techniques (48 percent), or applied some sort of sensitivity analysis (30 percent). Further, Drummond (1985) pointed out that even if all costs were individualized, cost mispecification is a frequent methodological problem.

Such methodological confusion has motivated researchers around the world to develop a uniform protocol for the economic evaluation of risk-reducing medical policies. Such protocol, named "standardization" in the human-health jargon, attempts to establish the basic principles that appropriate economic evaluations must follow. Although possible, an agreement on such principles has not been reached yet (Power, 1996, Rovira, 1996, DeVries and Gagnon, 1996).

Standardization has been proposed by individuals (Jolicuer et al., 1992, McGhan and Lewis, 1992), industries, and governments (DeVries and Gagnon, 1996). Europeans, Canadians and Australians are ahead in the discussion for such guidelines, while similar

[47] A clearer distinction between these methodologies is provided below

efforts in the United States have only recently started (Rovira, 1996, Power, 1996).[48] In any case, there is still no consensus among researchers in the medical field about which are the elemental characteristics such guidelines must contain. DeVries and Gagnon (1996) summarized the commonalities and main divergences in the European proposed standards. The authors pointed out that most proposals recommended economic evaluations i) take the society perspective, ii) compare the evaluated technology against the most frequently applied, iii) consider benefits that go beyond the basic indicators of mortality and morbidity, iv) consider longer rather than shorter time horizons, v) include time discounting when appropriate, and vi) include a sensitive analysis. On the other hand, DeVries and Gagnon (1996) have identified the following main divergences between proposals: a) the methodology of analysis that should be applied, b) the mechanisms by which costs must be measured, and c) the appropriate techniques to estimate quality of life.

The need to account for costs and benefits with solid risk and CBA analysis has also reached the USDA. On October 14, 1994, the Federal Crop Insurance Reform and Department of Agriculture Reorganization Act established the Office of Risk Assessment and Cost-Benefit Analysis (ORACBA). ORACBA's primary role is to ensure that all the risk-reducing regulations enacted by the USDA are based on solid biological and economic principles. All major regulations proposed by USDA's agencies must be reviewed by ORACBA before reaching the office of the Secretary of Agriculture.

## Review of methodologies applied in past regulations

There are four methodologies for economic analysis commonly applied in the pharmaceutical and medical field: cost-minimization, cost-efficiency, cost-benefit, and

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[48] European countries which guidelines have been proposed are: United Kingdom, Spain, Italy, the Nordic Countries, Switzerland, France, Germany, Belgium, and the European Union as a whole. Until 1995, the United Kingdom guidelines were the only ones receiving some sort of official support (Rovira, 1996).

cost-utility analysis (Shackley, 1996). Cost-minimization compares policies based only on expected cost. Because it does not take benefits into account, it has been disregarded for appropriate economic analysis. Cost-effectiveness is the most cited methodology in the human health literature. Udvarhelyi et al.'s (1992) report that from 77 articles they reviewed, 70 (91 percent) focused on cost-effectiveness and only 7 (9 percent) on cost-benefit analysis. Part of the popularity of this technique is due to its simplicity. Cost-effectiveness analysis does not require a monetary valuation of benefits. Such a characteristic is appropriate for many medical issues where benefits are usually defined in terms like "life years gained" or "cases detected" (Shackley, 1996). Given the difficulties inherent to the estimation of benefits, some of the guidelines mentioned above propose the adoption of cost-effectiveness analysis (CEA)[49] as the adequate methodology of analysis. Further, some guidelines have gone as far as to propose the avoidance of cost-benefit analyses (DeVries and Gagnon, 1996).

Data limitation is the main reason for preferring CEA to CBA. However, by not including benefits into the analysis, policies chosen by CEA are not guaranteed to be optimal (Baumol and Oates, 1988). Larson et al. (1996) characterized the solution they achieved with CEA as second-best, appropriate only because of data limitations.

Empirical restrictions may explain the preference of CEA to CBA. However, such a preference may respond to other reasons. Interest groups which expect to bear the cost of the policy may prefer such a policy to be evaluated by methodologies which emphasize costs over benefits (Taylor and Chrischilles, 1997).

The last methodology applied in the economic evaluation of human health policies is cost-utility analysis (CUA). Such a methodology has been characterized as intermediate between cost-effectiveness and Cost-benefit analyses (Shackley, 1996). CUA is actually a variation of cost-effectiveness analysis in which the benefits are measured in terms of

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[49] CEA is a systematic quantitative method for comparing the costs of alternative means of achieving the same stream of benefits or a given objective (Defense Economic Analysis Council, 1997)

quality-adjusted life years (Taylor and Chrischilles, 1997).

Attitudes toward risk have been largely ignored in the human health literature on cost-effectiveness and cost-benefit analysis. Gelles (1993) claims to have performed the first empirical economic evaluation which applies a WTP measure of life. Not all current evaluations of human health policies have been performed following the WTP approach. The FDA has published in the Federal Register regulations where life value was estimated based on either the WTP (FDA, 1996) or the human capital (FDA, 1997) approaches.[50]

The general preference for CEA among human health analysts is reversed among those who evaluate environmental issues. A search made in the ECONLIT data base (1969-1996) for the words environment, cost, and effectiveness has yielded 21 citations, while a search for environment, cost, and benefit yield 120. The simplicity of CEA may be especially attractive to a field where human life is the sole and ultimate benefit to be evaluated. The profusion of environments, each with their own distinctive benefits to be evaluated, may be an important reason for the larger use of CBA in the evaluation of environmental policies.

The relative larger importance of CBA for evaluating environmental issues has not precluded the application of CEA. Broadly speaking, CEA has been applied to evaluate policies aimed to achieve a certain environmental target. For instance, Larson et al. (1996), Harrington and McConnell (1993), and Krupnick et al. (1990), applied CEA to evaluate policies aimed to achieve a certain reduction in pollution, an efficient vehicle emissions control, and a given safety level for methanol vehicles, respectively. As

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[50] There are two most frequently used methods to evaluate life in the medical literature. One of them is the human capital procedure. This method estimates value of life from the time humans dedicate to work and the risk premium they associate with riskier jobs. The second is the willingness to paymethod. This method investigates the trade-offs between risks and benefits in individuals' consumption decisions. This method was developed by Fisher et al. (1989) in order to take into account some humans' attitudes towards risk which are ignored by the human capital procedure. The FDA has currently adopted the Fisher et al. (1989) method. The FDA is currently estimating the value of life as $5 million (Braslow, 1997).

mentioned above, the evaluation of this type of policies is particularly suited to CEA. The evaluation of environmental policies when benefits are also considered requires CBA. However, the estimation of such benefits is not trivial since environmental benefits are usually nonmarketable. In order to solve the problem, several methods to elicit an individual's willingness-to-pay have been proposed. Contingent valuation is perhaps the most popular of them (Mitchell and Carson, 1989).

Economic Evaluation of SPS Regulations

The previous discussion about human-health and environmental risk-reducing regulations is also appropriate to SPS regulations. However, the economic evaluation of SPS regulations presents some particular issues. Like many environmental regulations, SPS regulations are aimed to affect agricultural production. However, different from the typical environmental regulation, the producers are those who usually bear the risk that SPS regulations want to alleviate. Such a differentiation between environmental and SPS regulations has motivated producers to show a different attitude toward regulatory agencies. While environmental regulations are typically unwanted by producers, farmers usually promote and seek the enactment of SPS regulations.

Food safety and SPS regulations share their concern for the presence of unwanted organisms (pests, germs) in agricultural products. However, these regulations typically differ in the subject of their direct concern. While food safety regulations aim to protect consumers, the direct goal of many SPS regulations is to protect agricultural producers.

In spite of the importance and analytical particularities of SPS regulations, the interest of academia in the evaluation of these regulations has been disappointing. For instance, the number of citations associated with the keywords "phyto" and "sanitary" which appeared in the ECONLIT database from years 1969 to 1997 was 21. Such a figure represents only 5 percent of the total number of citations for the keywords "cost-effectiveness" and "cost-benefit" found in the MEDLINE database for just 1996. Further, a search made on the Agricola 1992-1997 database for the keyword "Cost-benefit" yielded only 61 citations. Search of the same databases by applying the keywords "phytosanitary and costs," and "phytosanitary and economics" yielded 2 and 3 citations, respectively.

Such a poor recovery of journal articles does not mean lack of interest in the area. A growing number of economic studies focusing on SPS regulations are underway. Broadly speaking, these studies have attacked the analysis of SPS regulations based on three different approaches: the inventory-type analysis, the political economy analysis, and the welfare analysis. The inventory-type approach focuses on the identification and description of SPS measures. Studies made under this approach have aimed to collect and systematize the available information on SPS. Perhaps the best example of this type of studies has been performed by Roberts and DeRemer (1997), which inventoried the controversial SPS regulations that faced U.S. agricultural exports in 1995 and 1996. An early attempt to extract further information from this inventory has been presented by Thornsbury et al. (1997). Another inventory which focuses on SPS regulations enacted by the U.S. is also underway (Horwitz, 1997).

The inventories mentioned above are the only ones that have been elaborated with such a general scope and detail. Other inventories have focused either on particular commodities or countries. Curtis (1994) briefly discussed the SPS regulations that faced U.S. poultry exports to Central America. Krissoff et al. (1997) published an overview of the worldwide technical barriers to trade (including pertinent SPS measures) that faced U.S. fresh apple exports in 1996. Johnson (1997) discussed technical and other SPS regulations affecting the entry of meat and apples to New Zealand. A detailed inventory of all SPS regulations enacted by Mexico since 1993 has been discussed in the first essay of this dissertation and it appears in Appendix A1.

The second group of SPS studies focuses on the political economy of SPS regulations. Some of these studies concentrate on the effectiveness of international trade agreements like the WTO in preventing the enactment of unfair SPS regulations (e.g., Abbot, 1997, Thiermann, 1997, and Stanton, 1997). Other political economy studies focused on the possibility that regulatory agencies could be captured by powerful interest groups. Romano (1995) and Romano and Orden (1997) investigated the political economy of a long standing APHIS ban on European nursery stock in artificial media. Roberts and Orden (1997) described the political economy of the U.S. ban on Mexican avocados in detail. The analysis of the political economy of Mexican SPS regulations is the focus of the first part of this dissertation.

The third group of SPS studies aims to estimate the welfare impact of SPS regulations. In the U.S., most of the economic evaluations of SPS regulations have been performed by APHIS. Like any other regulatory agency, APHIS is mandated by the Regulatory Flexibility Act and the EO 12291 and 12866 to produce an economic evaluation for each regulation with an expected impact of $100 million. However, APHIS has not faced many major cases. The first of such major SPS regulations that APHIS has faced occurred in the late 1980s, with the entry of nursery stock from Europe (Romano, 1995).

Evangelou et al. (1993) investigated the welfare impact of APHIS' ban on Mexican avocados by modeling impacts of a pest infestation as a deterministic parallel shift in supply. Modeling the impact of regulations as shifts in supply had been applied in previous welfare analyses. For instance, a shift in supply was proposed and modeled to estimated the welfare impact of pesticide regulations in the U.S. (Lichtenberg et al., 1988), a pseudorabies eradication program (Ebel et al., 1992, Forsythe and Corso, 1994), and a bovine brucellosis eradication program in the U.S. (Amosson et al., 1981). All the above-mentioned studies modeled the effect of the policies they investigated as deterministic shifts in supply.

Assumptions about the shift in supply are relevant to welfare analyses. Duncan and Tisdell (1971) demonstrated that the estimated changes to producer and consumer surplus may be severely affected by the type of shift that is assumed. Lindner and Jarret (1978, 1980), and Miller et al. (1988) investigated in detail the welfare consequences of assuming parallel, pivotal divergent, and pivotal convergent shifts in supply. Broadly speaking, they concluded that technological innovations should be modeled as pivotal divergent shifts, while parallel shifts are better suited to model the welfare impact of tariff or tax changes.

Summer and Lee (1997) developed a very complete model to analyze SPS regulations. The authors recognized the possibility that some SPS regulations may also shift domestic demand. Unfortunately, the authors failed to incorporate both uncertainties and attitudes toward uncertainties in their model. Such a failure has appeared also in previous studies which modeled the impact of governmental SPS policies as deterministic shifts in supply. MacLaren (1997) points out the importance of risk and ambiguity aversion in SPS analyses. Unfortunately he did not provide any guidance about how such aversions could be empirically incorporated into the CBA analyses of SPS regulations. Orden and Romano (1996), in an earlier publication from this dissertation, incorporated such an uncertainty in their analysis of the U.S. SPS regulation on Mexican avocados. The authors modeled the risk of a pest infestation associated with Mexican imports as an uncertain shift in the domestic supply of avocados.

Most of the economic evaluations of SPS regulations have not been published in scientific journals. Some of the evaluations of SPS regulations made by members of academia came in the form of reports funded by interest groups which participate in SPS disputes (e.g., Carman and Cook, 1996). Perhaps the first journal article showing the economic evaluation of a SPS regulation involved the study of a European phytosanitary restriction to the entry of American tobacco (Overton et al., 1995). Unfortunately, the authors treated the SPS regulations as a quota, ignoring the risks associated with the policy, leaving the trade disruption caused by the SPS regulations as the solely relevant effect of the measure. Recently, an investigation by Paarlberg and Lee (1997) on a SPS regulation on foot and mouth disease in the U.S. has been accepted for publication by the

American Journal of Agricultural Economics. Paarlberg and Lee (1997) followed a not very different approach to the one adopted by Orden and Romano (1996).

As noted above, most of the economic evaluations of SPS regulations in the U.S. have been performed by APHIS, which is legally mandated to do so. APHIS economic and biological analyses have not been uniformly done in the past.[51] In an attempt to provide a uniform methodology to the evaluation of animal-health regulations, Forsythe (1997) proposed that all animal-related SPS regulations enacted by APHIS must pass an economic evaluation which models parallel shifts in supply and takes the evolution of the disease into account through a Markovian transition matrix. If adopted, such an approach would not only provide a uniform methodology of analysis, but also a comprehensive criteria to enact SPS regulations.[52]

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[51] For instance, APHIS has applied trade analysis (no shift in supply) to the evaluation of the Nursery Stock Case (Romano, 1995), and assumed a deterministic shift in supply in the avocado case (Evangelou et al., 1993)

[52] This proposal will be discussed at a USDA workshop in May 1998.

*Chapter IX*

# OVERVIEW OF THE CONTROVERSY

## IX.1. The Mexican and U.S. Avocado Industries

Mexico and the U.S. are two important producers of avocados, accounting for 37 and 8 percent of global production, respectively. Mexico is the largest avocado producer in the world, with a total production approximately equal to the combined production of the next seven largest producers. Mexico is also the world's largest consumer of avocados. Mexico exports only 7 percent of total production (Graef, 1995). Europe, Canada, and Japan are Mexico's main avocado markets (Juárez and Stockard, 1996). The U.S. is the fourth world exporter of avocados. It exports about 5 to 7 percent of its production, with the Netherlands, Japan, and Canada as its most important markets (Plunkett, 1996).

Both in Mexico and the U.S., avocado production is highly concentrated in one state. The state of Michoacan produces more than 85 percent of Mexican Haas avocados (Juárez and Stockard, 1996), while California accounts for 86 percent of all U.S. avocados production (Graef, 1995). Most of the avocados produced in California are grown in San Diego County. However, because of high water costs, avocados acreage has been slowly declining in San Diego County since 1990 (Bertelsen et al., 1995). Haas is the variety of avocados most produced in California. Top-worked trees (trees propagated by using established trees instead of seedlings for the rockstocks) produce commercial-size crops after 2-3 years and new plantings after 3-4 years. Avocados trees reach their full-bearing potential after 7 years. The expected useful life of avocados trees is about 40 years, although older trees have been reported (Bertelsen et al., 1995).

On average, Mexican orchards yield between 7 and 9 metric tons per hectare. California yields are lower than Mexico (about 5 metric tons per hectare). Although avocados generally experience fewer pest problems than other tropical fruits, there are some pests of concern for California producers which are usually kept in control with biological pesticides.

Both Mexican and U.S. orchards are capable of producing all year around. However, Michoacan's harvest peaks from October to February. California also produces all year around, although its peak season goes from March to August, with lowest levels from September to December. Avocados producers have large harvest flexibility since avocados can be stored on the tree for weeks or even months. Florida markets 90 percent of its harvest between August and December. In 1992, hurricane Andrew severely damaged Florida avocados orchards.

Per capita consumption of avocados is 7 and 1 kilogram in Mexico and the U.S., respectively. California has the highest per-capita avocado consumption in the U.S. Annual consumption of fresh avocados in the northeastern part of the U.S. represents 8 percent of the total consumption in the country (between 10,000 and 15,000 tons).

In 1996, the U.S. imported 25,000 tons of fresh avocados worth $23 million. Chile has supplied about two-thirds of these imports, mainly from September to December. In 1996, Chilean avocados faced a U.S. tariff of 12.9 cents per kg. Mexican avocados to the U.S. (Alaska) faced a 7.9 cents/kg tariff in 1996. This NAFTA tariff will be phased out by the year 2003.

Avocados prices reflect a seasonal pattern. They decline from February to May, and rise from June to November. Overall, there is a substantial difference between the wholesale prices of Mexican and Californian avocados. Table IX.1 illustrates such a price differential.

**Table IX.1. Wholesale Prices of Haas Avocados. U.S. Dollars Per Pound.**

| Source/Destination | Week of 1/5/94 | Week of 4/22/94 | Week of 7/15/94 | Week of 10/21/94 |
|---|---|---|---|---|
| Mexico/Montreal | .41 | .53 | .76 | -- |
| California/New York City | 1.31 | -- | -- | 1.73 |
| California/Los Angeles | -- | 1.19 | 1.44 | 1.73 |

Source: Roberts and Orden (1997).

A large proportion of California avocado growers use cooperative organizations to market the fruit. The oldest and largest avocado growers' cooperative in California is Calavo, founded in 1924. Calavo markets nearly half of the Californian avocados. Since 1962, the California Avocado Commission (CAC) administers the state marketing order. Members of CAC include both growers and handlers. There is no federal marketing order for avocados in California. The California Avocado Society is another important organization which disseminates information about research programs and cultural practices. The Florida Avocado Administrative Committee manages a federal marketing order which provides for minimum grades and standards (Bertelsen et al., 1995).

## IX.2. The Evolution of the Regulatory Process

This section summarizes the evolution of the regulatory process affecting the entry of Mexican avocados into the U.S. The chronology here summarized has been extracted from the detailed and well-documented report on this controversy provided by Roberts and Orden (1997). The 1914 SPS regulation restricting the entry of Mexican avocados to the U.S. has evolved into a longstanding dispute between the two countries. In 1914, the U.S. prohibited the importation of avocados from Mexico based on phytosanitary concerns over the existence of seed weevils in Mexican orchards. Although seed weevils cause negligible damage to trees or foliage, their larvae tunnel into the fruit, reducing its quality and destroying the seed. At the time the first quarantine was enacted, no known chemical or natural control was available.

During the early 1970s, with the advent of new pesticides and cultural practices, the GOM claimed that there was no reason for the U.S. ban. DIGSV requested APHIS to allow imports from the state of Michoacan. Such a request was denied based on a literature review which showed the existence of several pests of quarantine significance in Michoacan, among them seed weevils and seed moths.

APHIS officials were invited to Michoacan to investigate the existence of these pests. After spending 560 man-days performing field surveys in Michoacan during May, June, and September 1973, APHIS officials found only two fruit flies. In November 1973, the APHIS scientific staff reversed its previous, literature-based ban, and recommended that APHIS allow the entry of four varieties of avocados from Michoacan into states located to the north and east of Colorado, Idaho, Kansas, Kentucky, Missouri, Utah, and Virginia. Such a geographical restriction was aimed to provide an extra, climatic source of protection against the introduction of exotic pests from Mexico. A proposed rule under these guidelines was drafted by APHIS officials in 1974. However, such a proposed rule was never published. Intense opposition to the importation of avocados from Michoacan arose in the U.S. in 1975. In 1976, APHIS notified DIGSV that some seed weevils had been recovered in field surveys lately performed in the area and therefore, APHIS had to reverse its position to its pre-1973 ban. The regulatory process for Michoacan avocados stalled.[53]

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[53] The northwestern Mexican state of Sinaloa was briefly included in DIGSV-APHIS negotiations. After some joint field surveys, APHIS seemed inclined in 1978 to allow the entry of avocados from Sinaloa. Representant of the California and Florida avocados industry did not consider such surveys conclusiveenough. The U.S. industry lobbied the Florida and California members of Congress to press the USDA to stop APHIS proposal. No record orevidence of regulatory progress in this issue has been registered since then.

No important development occurred for more than 10 years after 1976. In 1990, during the early Mexico-U.S. negotiations on NAFTA, the avocado case immediately surfaced. In 1990, DIGSV submitted a work plan for importation of Michoacan avocados to APHIS. APHIS rejected the work plan because it failed to address some pests of concern. A revised work plan was submitted by DIGSV in 1991. APHIS rejected this revised work plan because of concerns about the quality of the Mexican risk assessment. At that time, APHIS and DIGSV's officials started to develop a strategy to move the process forward. Such a strategy would require Mexico to show that Michoacan was a pest-free area or develop an all-inclusive treatment for the pests.

At the same time, APHIS informed DIGSV that the agency had extended the scope of pests of concern to include some fruit flies. APHIS requested DIGSV to initiate studies about the new pests of concern. DIGSV officials were upset by this new requirement. In July 1992, Ing. Gutiérrez Samperio, head of DIGSV, pointed out that when discussions with APHIS started, seed weevils were the only pests of concern. He contended that there was no need for the later U.S. request since Haas avocados are not "good hosts" to fruit flies. Further, Mr. Gutiérrez Samperio stated that given APHIS' new request, perhaps some of the research that supported export of U.S. stone fruit to Mexico might have to be reexamined. The Mexican arguments did not change APHIS' position and DIGSV went back to develop a work plan to satisfy APHIS' requirements.

A new work plan presented by DIGSV in 1992 was rejected by APHIS, which again was not satisfied with the quality of the Mexican risk assessment. In the middle of this impasse, APHIS published on October 19, 1992, a proposed rule allowing exports of Mexican avocados to Alaska. In spite of receiving more than 300 negative comments from the U.S. industry, on July 27, 1993, APHIS published a final rule allowing imports of Mexican avocados to Alaska.

By June 1994, the fruit fly research on Haas avocados was complete. On July 5, 1994, DIGSV formally requested APHIS to permit the entry of avocados from Michoacan.

APHIS officials still were not completely satisfied with the quality of DIGSV's pest risk assessment. During the following months, APHIS and DIGSV officials worked together to sort out these problems. On November 15, 1994, APHIS published an Advanced Notice of Proposed Rule-making and Public Meetings in the Federal Register. In this publication, APHIS announced its intention to allow the entry of Haas avocados from approved orchards under a "system approach" to pest-risk management.

The U.S. industry vehemently opposed APHIS' intentions. At the core of the U.S. industry's complaint was the contention that the scientific basis for APHIS' decision was too incomplete to guarantee the negligible risks APHIS attributed to its proposal. On July 3, 1995, APHIS published a proposed rule which basically followed the general lines stated in the advanced note of 1994. However, the 1995 proposed rule restricted Mexican imports to the northeastern states of the U.S. and to a November-February period of time.

The opposition was again, intense. Such an opposition was manifested at five public hearings held by APHIS (Washington, D.C., Homestead, FL, New York, NY, Chicago, IL, and Escondido, CA), by the comments the agency received (about 85 percent of the 2,080 comments opposed the proposed rule), and in the publication by the domestic industry of three one-page adds in the Washington Post ("How Much Evidence Does USDA Need? The Smoking Gun," "Dear Mr. President: The USDA Signs Death Warrant," and "Dear Mr. President: Are You Willing to Risk California?"). In spite of such opposition, on February 5, 1997, APHIS published in the Federal Register a final rule allowing the entry of Mexican avocados into the U.S. This final rule, which was approved by both ORACBA and OMB, was very similar to the proposed rule of 1995 (APHIS has added to the final rule a requirement for Mexican avocados to carry an identification sticker).

## IX.3. APHIS Risk Assessment

There are eight pests involved in the avocados controversy: the small avocado seed weevils (*Conotrachelus perseae*, and *Conotrachelus aguacatae*), large avocado seed weevil (*Heilipus lauri*), avocado stem weevil (*Copturus aguacatae*), avocado seed moth (*Stenoma catenifer*), and three species of fruit flies: *Anastrepha ludens*, *Anastrepha serpentina*, and *Anastrepha striata*.[54] The large avocado seed weevil was responsible for the 1914 ban on Mexican avocados. Seven of the current pests of concern have not been found in the U.S. Only *Anastrepha ludens* occurs in the Lower Rio Grande valley of Texas, but it is under quarantine control. The weevils and moth pose a potentially serious threat to the U.S. avocado industry. The fruit flies are not considered serious pests of avocados but pose a threat to other crops such as citrus. APHIS contends that Haas avocados are poor hosts to fruit flies.

**Table IX.2. Estimated Outbreak Frequency of Mexican Avocados Pests in the U.S. under free trade.**

| Pest | Outbreak Frequency (per year) | | | | Number of years between outbreaks[1] |
|---|---|---|---|---|---|
| | Mode | Mean | Minimum | Maximum | |
| **Fruit Flies** | 0.0139 | 0.0518 | 0.000202 | 0.547 | 72 |
| **Seed weevil** | 0.0105 | 0.0419 | 0.000151 | 0.415 | 95 |
| **Stem weevil** | 1.389 | 5.183 | 0.0202 | 54.756 | 0.7 |
| **Seed moth** | 0.00282 | 0.012 | $3.99 \times 10^{-5}$ | 0.111 | 355 |

Source: Firko (1995). [1]: Computed as inverse of mode.

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[54] Some scientists were also concerned about hitchhiking plantpests and other plant pests not previously identified as avocado pests. However, APHIS claims "there is no reason to believe that the risk of new internal fruit pests is significant even before any mitigation.... This risk would be relatively the same (before mitigation) as the risk for the hundred of other fresh agricultural commodities that are imported or exportedfrom the United States" (Miller et al., 1995).

Further, APHIS contends that Haas avocados attached to the tree are not a preferred host to *Anastrepha spp.* (Miller et al., 1995). Table IX.2 shows the frequency of pest outbreaks that APHIS would expect to occur in the U.S. under unregulated free trade (Firko, 1995).

### IX.4. APHIS Risk Management: The System Approach

APHIS' final rule allows the entry of Mexican avocados into the U.S. through a system approach. Such an approach consists of nine successive safeguards aimed to make the risk of involuntary pest introduction negligible. These nine measures involve field surveys, trapping and field bait treatments, field sanitation practices, host resistance, post-harvest safeguards, winter shipping, packinghouse inspections, port-of-arrival inspection, and limited U.S. distribution. Some of these requirements are:

i) Only Haas avocados from approved orchards in four municipalities in Michoacan will be authorized to enter the U.S. The four municipalities are Periban, Salvador Escalante, Uruapan, and Tancitaro. This restriction was imposed mainly because of the small seed weevils. While the large seed weevil and seed moth do not occur in the entire Michoacan, small seed weevils do, except in the four districts included in the regulation (Miller et al., 1995).

ii) Shipping of avocados will be permitted only during November to February. APHIS contends that the cooler winter temperatures will reduce the possibility that the exotic pests would establish in the new environment.

iii) In order to reinforce the negative effect of the winter climate on the exotic pests, avocado imports are limited to only 19 northeastern American states (Connecticut, Delaware, Illinois, Indiana, Kentucky, Maine, Maryland, Massachussets, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin) and the District of

Columbia.

APHIS' expected success of the system approach is reinforced by the experience of other countries such as Japan, which imports Haas avocados from Michoacan under less restrictive measures than those imposed by APHIS. Looking at data from 1992 to 1994, APHIS reports that no presence of the eight pests of concern was detected by Japan port authorities. APHIS contends the system approach will reduce the risk of pest infestation by any of the eight pests of concern to a minimum (Miller et al., 1995).

By using Monte Carlo simulation, and assuming that the probability of success of each mitigation step is independent from the others, Firko (1995) estimated APHIS expected reduction in the probability of pest infestation under its system approach. Table IX.3 shows APHIS' estimated frequencies of pest outbreaks that would be expected in the U.S. under APHIS SPS regulation.

**Table IX.3. APHIS' Estimated Outbreak Frequency of Mexican Avocados Pests in the U.S. Under APHIS regulation**

| Pest | Outbreak Frequency (per year) | | | | Number of years between outbreaks[1] |
|---|---|---|---|---|---|
| | Mode | Mean | Minimum | Maximum | |
| **Fruit Flies** | $8.64 \times 10^{-8}$ | $3.57 \times 10^{-7}$ | $2.02 \times 10^{-10}$ | $3.45 \times 10^{-6}$ | > million |
| **Seed weevil** | $6.66 \times 10^{-7}$ | $3.13 \times 10^{-6}$ | $1.18 \times 10^{-8}$ | $2.62 \times 10^{-5}$ | > million |
| **Stem weevil** | $8.77 \times 10^{-5}$ | $3.87 \times 10^{-4}$ | $1.35 \times 10^{-6}$ | $3.45 \times 10^{-3}$ | 11,402 |
| **Seed moth** | $1.87 \times 10^{-7}$ | $8.98 \times 10^{-7}$ | $3.46 \times 10^{-9}$ | $7.34 \times 10^{-6}$ | > million |

Source: Firko (1995). [1]: Computed as inverse of mode.

Based on the frequencies shown in Table IX.3, APHIS officials were convinced that the system approach will succeed in reducing the probability of pest infestation to negligible values. However, the validity of APHIS' estimates has been severely questioned by the domestic industry. Burmaster and Wilson (1995) while applauding APHIS for applying Monte Carlo techniques and a system approach, criticized all the remaining methodological aspects of the risk assessment. Among others, the authors complained that APHIS has wrongly assumed that each mitigation step is independent from the other, underestimated the lack of biological information on the exotic pests, chose inappropriate distribution of frequencies for the Monte Carlo simulation, based its estimates on a compact and homogeneous group of experts which lacks input from outside scientists, and did not take human error into account.

Nyrop (1995), in a study commissioned by the Florida Avocado and Lime Committee, also criticized APHIS' risk assessment. The author complained about the lack of biological knowledge about the pests of concern as well as the validity of the assumptions used by Firko in his Monte Carlo simulation: "the Monte Carlo simulation is not needed and only provides a veil of analytical objectivity; the model predicts what was initially assumed." In another study commissioned by the California Avocado Commission (CAC), Urbanchuk (1995) claims there are incentives to illegal transshipment of avocados from the 19 northeastern states to the restricted states which should be considered important. Alternative estimates to APHIS' estimated frequencies of pest infestation were elaborated by Nyrop and appear in Table IX.4.

**Table IX.4. Nyrop's Estimated Outbreak Frequency of Mexican Avocados Pests in the U.S. under APHIS regulation**

| Pest | Years to Pest Establishment | |
|---|---|---|
| | High Efficacy[a] | Low Efficacy[b] |
| Fruit Flies | 1,000-10,000 | 3-50 |
| Seed weevils and seed moth | 3-5 | 1 |
| Stem weevil | 5-20 | 1 |

Source: Nyrop (1995). [a]: Based on the assumption that APHIS mitigation measures would have their highest efficacy and a likelihood of establishment (if a pest arrives undetected to the country) of 1 in 100.[b]: Based on the assumption that APHIS mitigation measures would have their lowest efficacy and a likelihood of establishment of 1 in 100.

After comparing his estimates in Tables IX.4 with those in Tables IX.2 and IX.3, Nyrop concluded that "...the knowledge base upon which this [APHIS] analysis rests is very weak and the determination that pest risks are insignificant cannot be supported. In fact, the risk of introducing some pests may actually be quite high!" Nyrop forecasts a weevil infestation occurring between the first and twentieth years the SPS regulation is in place (i.e., a probability of pest infestation in a paricular year ranging from 1 to .05). Such a range of estimated probability of pest infestation is larger than the one APHIS has estimated would occur under free trade (i.e., from .0202 to 1, as it is shown in Table IX.2). Nyrop's range of estimated probability of fruit fly infestation (from $10{,}000^{-1}=.0001$ to $3^{-1}=.33$) is also larger than what APHIS expects under its system approach ($2.02\times10^{-10}$ to $3.45\times10^{-6}$ in Table IX.3), but lower than what APHIS would expect under free trade (.000202 to .547 in Table IX.2). In summary, the California avocado industry and APHIS came with substantially different pest risk assessments.

The extreme divergence between APHIS and Nyrop's risk analyses is surprising. The estimated annual probabilities of pest infestation range from practically zero to one. As an economist, it is difficult to assess the appropriateness of APHIS or Nyrop's risk assessments. However, there is evidence suggesting that probabilities obtained by Nyrop may have been overestimated. Nyrop failed to consider that APHIS' rule will reduce the incentives for smuggling low-quality but inexpensive Mexican avocados into the U.S. A decrease in the illegal entry of pest-risk avocados may reduce the overall probability of pest infestation.[55] Second, Nyrop's approach to his risk analysis was centered more to illustrate the importance of relying on proven assumptions than to obtain a verifiable outcome. While presenting his analysis at the APHIS' public hearing on avocados at Washington, D.C., Nyrop announced that he was not sure about which pest risk assessment was correct. Nyrop announced that the main goal of his pest risk assessment

[55] Such a possibility has also been ignored in APHIS' pest risk assessment.

was to point out that APHIS' evaluation may have yielded a very different outcome under a different set of assumptions. Therefore, it is reasonable to assume that Nyrop may have stretched the assumptions in which he based his analysis in order to obtain an extreme outcome.

*Chapter X*

# THE INCORPORATION OF RISK INTO THE ECONOMIC EVALUATION OF SPS REGULATIONS

## X.1. Introduction

The welfare impact of agricultural trade policies is usually measured by changes in producer surplus (PS) and consumer surplus (CS). Surplus measures have been used by APHIS to evaluate the impact of the entry of Mexican avocados (Evangelou et al., 1993). Unfortunately, APHIS's approach has failed to incorporate the risk of pest infestation into the analysis. Welfare changes associated with SPS regulations are expected to occur because of the direct economic impact of the arriving imports (as in a typical trade welfare analysis), and the uncertain occurrence of pest infestations. This chapter describes how the uncertain occurrence of a pest infestation can be incorporated into the economic evaluation of SPS regulations.

The chapter is organized as follows. Section X.2 incorporates the risk of pest infestation into the functional forms applied by Evangelou et al. in their evaluation of the APHIS regulations on Mexican avocados. A methodology to incorporate the producers' attitudes toward risk is presented. Section X.3 describes the expected welfare changes associated with the entry of Mexican avocados and possible pest infestation.

## X.2. The Incorporation of the Risk of Pest Infestation into the Supply of Avocados.

The risk of pest infestation is incorporated into the supply functional forms applied by APHIS to evaluate the avocado case. Evangelou et al. have specified the supply of avocados as the annual quantity of avocados produced in the U.S. as a linear function of one-year lagged farm prices and production (S1) and its logarithmic version (S2):

$$\text{S1:} \qquad Q_t = \alpha_1 p + \alpha_2 Q_{t-1} + \xi_t \qquad [X.1]$$

$$\text{S2:} \qquad \ln(Q_t) = \alpha_1 \ln(p) + \alpha_2 \ln(Q_{t-1}) + \xi_t \qquad [X.2]$$

where Q and p denote quantity and price of avocados, $\alpha_i$ regression coefficients, $\xi_t$ is an error term, and suffix t denotes time. In Evangelou et al., S1 and S2 are applied to the aggregate U.S. supply of avocados, without distinguishing between Florida and California avocados. Such an assumption was made for simplicity since California produces more than 85 percent of all U.S. avocados.

There are two sources of uncertainty associated with a risk of pest infestation: i) its occurrence, and ii) its impact on domestic production. The occurrence of a pest infestation is the source of uncertainty that is typically debated during SPS regulatory processes. This source of uncertainty is the focus of both Firko and Nyrop's risk assessments (see Tables IX.3 and IX.4). The uncertain impact of a pest infestation is conditional to its occurrence. It may consist of two different but related effects: iia) production costs may increase after a pest infestation because of an expanded use of pesticides and other pest-control practices, and iib) a reduction in yields may also occur. Denote cy as the reduction in yields expressed as percent of quantity produced that is expected to occur after a pest infestation. Denote cp as the percent of marginal cost that is expected to increase after a pest infestation occurs because of an increased application of pest control practices. Denote:

$$Q^0 = f(p)$$

as the pest-free supply as a function of price p. If a pest infestation occurs and yield reduces a cy fraction, then the supply shifts to:

$$Q = f(p)(1\text{-}cy)$$

And the inverse supply becomes:

$$p = f^{-1}(Q^0 (1\text{-}cy)^{-1})$$

If the pest infestation also causes a cp increase in production costs, then the supply shifts further to:

$$p = f^{-1}(Q^0 (1\text{-}cy)^{-1})(1+cp)$$

The stochastic occurrence of the pest infestation can be taken into account by incorporating its probability of occurrence $\pi$ into the analysis. Thus, the expected supply of avocados when there is a risk of pest infestation (E(S)) becomes the weigthed average of the supply of avocados before imports arrive and after a pest infestation occurs with certainty:

$$E(S) = \pi\, f^{-1}(Q^0 (1\text{-}cy)^{-1})(1+cp) + (1\text{-}\pi)f^{-1}(Q^0)$$

Notice that, the expected shift in supply becomes a function of the probability of pest infestation, adjusted by the impact of such an infestation on yield and production cost. No shift in supply will occur if $\pi=0$, or if cy and cp are both null.

Thus, in the avocado case, if a pest infestation occurs at time t, the estimated supply S1 and S2 decrease to:

[from S1] $$Q_t = ( \alpha\ p + \alpha_2\ Q_{t-1})(1 - cy) \qquad [X.3]$$

[from S2] $$\ln(Q_t) = [\ \alpha_1\ \ln(p) + \alpha_2\ \ln(Q_{t-1})] + \ln(1 - cy) \qquad [X.4]$$

where $\alpha$ and $\alpha$ are estimates of parameters $\alpha_1$ and $\alpha_2$. Assuming $Q_{t-1} = \bar{q}$ (the average quantity produced in the series), the estimated inverse supply function of avocados after a cy reduction in yields is:

$$\text{[from S1]} \qquad p = [Q_t - \alpha \; \bar{q}\,(1\text{-cy})] \; \alpha^{-1} \, (1\text{-cy})^{-1} \qquad \text{[X.5]}$$

$$\text{[from S2]} \qquad p = \exp\{[\ln(Q_t) - \ln(1\text{-cy}) - \alpha \; \ln(\bar{q})] \; \alpha^{-1}\} \qquad \text{[X.6]}$$

where exp denotes exponentiation on base e (the base for natural logarithms). Alternatively, if $Q_{t-1} = Q_t$ (denoting a steady state), then the estimated inverse supply functions after a cy yield reduction are:

$$\text{[from S1]} \qquad p = [Q_t\,(1 - \alpha \; (1\text{-cy})] \; \alpha^{-1} \, (1\text{-cy})^{-1} \qquad \text{[X.7]}$$

$$\text{[from S2]} \qquad p = \exp\{[\ln(Q_t)(1 - \alpha \;) - \ln(1\text{-cy})] \; \alpha^{-1}\} \qquad \text{[X.8]}$$

The incorporation of cp into [X.5] and [X.6] yields:

$$\hat{S1}^{s}: \qquad p = [\,[Q_t - \alpha \; \bar{q}\,(1\text{-cy})] \; \alpha^{-1} \, (1\text{-cy})^{-1}\,]\,(1 + \text{cp}) \qquad \text{[X.9]}$$

$$\hat{S2}^{s}: \qquad p = [\exp\{\ln(Q_t) - \ln(1\text{-cy}) - \alpha \; \ln(\bar{q})] \; \alpha^{-1}\}]\,(1 + \text{cp}) \qquad \text{[X.10]}$$

where the superscript "s" denotes a shifted supply. Incorporation of cp into [X.7] and [X.8] is straightforward and is not shown for simplicity. Equations [X.9] and [X.10] represent the indirect supply S1 and S2 after a reduction in yields occurs on top of an increase in the cost of pest control measures.

Equations [X.9] and [X.10] implicitly assume that cy and cp are known with certainty. As mentioned above, that might not be the case. Assume that cy and cp follow a discrete joint probability distribution. The expected shift in supply could be estimated from that joint distribution.

Unfortunately, there is usually very little information available about the joint distribution of cy and cp. Sensitivity analysis can be used to investigate the impact of cy and cp in the supply of avocados. Based on a review of technical papers and personal communications, Evangelou et al. (1993) estimated the occurrence of a weevil infestation would cause a 41 percent increase in cost due to a larger volume of pesticide to be applied, and 20 percent reduction in yields.[56]

Supplies $^{s}$ and $^{s}$ in [X.9] and [X.10] are conditional to the occurrence of a pest infestation.[57] Thus, if a pest infestation occurs, supply is expected to shift to $^{s}$ or $^{s}$. If no infestation occur, then the supply estimated by equations [X.1] and [X.2] hold. Denote $\pi$ as the probability of occurrence of a pest infestation associated with the entry of Mexican avocados to the country. Then, the expected inverse supply of avocados is:

$$\text{E(S1)}: \; p = \{[[Q_t - \alpha_2 \bar{q}\,(1\text{-cy})]\,\alpha_1^{-1}\,(1\text{-cy})^{-1}\,](1+\text{cp})\}(\pi) + \{[Q_t - \alpha_2 \bar{q}]\alpha_1^{-1}\,\}(1-\pi) \qquad [X.11]$$

$$\text{E(S2)}: \; p = [\exp\{[\ln(Q_t)-\ln(1\text{-cy})-\alpha_2\ln(\bar{q})]\alpha_1^{-1}\}](1+\text{cp})(\pi)+[\exp\{\ln(Q_t)-\alpha_2\ln(\bar{q})]\,\alpha_1^{-1}\}](1-\pi) \qquad [X.12]$$

In other words, the expected supply of avocados is the weighted average of the original (pre-trade) inverse supply (obtained from [X.1] from [X.2]) and the post-infestation inverse supply (equations [X.9] and [X.10]), with $\pi$ as the weighting factor.

Equations [X.11] and [X.12] represent the expected supply of avocados assuming that there is only one pest of concern. As mentioned above, there are eight pests of

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[56] Evangelou et al. (1993) considered that these figures overestimate the increase in production cost.

[57] Equations [X.9] and [X.10] become [X.1] and [X.2] if cy=cp=0.

concern in the avocado case. Each of these pests is associated with a particular occurrence and impact on the supply of avocados. Assume for a moment that each of the eight pests of concern has an independent impact on the supply of avocados. Independent in the sense that each pest of concern has an impact on the supply of avocados unrelated to other measures of pest control or yield reductions. Under this definition of independence, each pest of concern would contribute to the shift in supply in an additive way. Denote $E[S1^s - S1]^k$ as the expected contribution of the kth pest of concern to the shift in supply. Denote each of the eight pests of concern as "a", "b",..., "h". Then, the total expected shift in supply would result from the added expected contribution of all pests of concern to the shift:

$$E[S1^s - S1]^{a+b+..+h} = E[S1^s - S1]^a + E[S1^s - S1]^b + \ldots + E[S1^s - S1]^h \qquad [X.13]$$

where a, b,...,h identifies each of the eight pests of concern.

However, the assumption of such an independent impact is unrealistic. Pesticides and cultural practices used to control some of the pests may also affect the viability of others. Because of this dependency, equation [X.13] is better expressed in a conditional form:

$$E[S1^s - S1]^{a+b+..+h} = E[S1^s - S1]^a + E[S1^s - S1]^b \,|\, E[S1^s - S1]^a + \ldots$$
$$\ldots + E[S1^s - S1]^h \,|\, E[S1^s - S1]^{a+b+\ldots+g} \qquad [X.14]$$

In other words, equation [X.14] shows that the expected contribution (impact) of all pests of concern to the shift in the supply of avocados can be expressed as the expected contribution of one of these pests to the shift, plus the successive expected marginal impact of the remaining pest after the increase in expected marginal cost and/or reduction in yields associated with the remaining pests.

Equation [X.14] requires biological information about the pest of concern that may not be available. Equation [X.14] can be greatly simplified if most of the expected shift in supply can be attributed to a single pest of concern, making the expected contribution of the remaining pests to the total shift in supply negligible. Assume that pest 'a' in [X.14] is such a determinant pest. Then, [X.14] can be simplified to:

$$E[S1^s - S1]^{a+b+..+h} \sim E[S1^s - S1]^a \qquad [X.15]$$

If [X.15] holds, then equations [X.9] and [X.10] can be used as a good approximation to the shift in supply expected after the entry of Mexican avocados. Equations [X.9] and [X.10] represent the general form used in this study to evaluate the APHIS ban on Mexican avocados. It is assumed that seed weevils are the crucial group of pests of concern (i.e., pest 'a' in [X.15]). The importance of seed weevils as pest of oncerns has been pointed out by Firko and Nyrop and appears in Tables IX.2 to IX.4.

The value of the weighting factor $\pi$ in equations [X.11] and [X.12] is crucial to the analysis. Differences about the value of $\pi$ are usually at the core of SPS disputes. APHIS and the avocados' industry have argued extensively about the value of $\pi$. Table IX.3 shows that APHIS has estimated that its system approach would reduce $\pi$ for the pest of concerns to negligible values. On the other, the domestic industry contends that the actual value of $\pi$ for some pests, in particular stem weevils, is close to one.

Equations [X.11] and [X.12] assume that avocados producers are risk neutral. Risk averse producers may reduce the supply of avocados even further. Risk averse growers facing an uncertain pest infestation with possible increases in production cost and/or yield reductions may abandon the production of avocados or shift acres to alternative crops before the pest infestation occurs.

The growers' risk aversion can be incorporated into the supply of avocados through a Mean-Variance model. The grower's problem can thus be formulated as a maximization of uncertain profit:

$$\text{Max PR} = pQ - C \qquad \text{[X.16]}$$

where PR and C denote profit and production cost as a function of Q. Because of the entry of Mexican avocados, production cost and output are uncertain. Assume that the uncertain output and production cost are distributed as:

$$Q \sim \begin{cases} Q_0 & \text{with probability} \quad (1-\pi) \\ Q_1 = Q_0(1-cy) & \text{with probability} \quad \pi \end{cases}$$

$$C \sim \begin{cases} C_0 & \text{with probability} \quad (1-\pi) \\ C_1 = C_0(1+cp) & \text{with probability} \quad \pi \end{cases} \qquad \text{[X.17]}$$

Assume also that C and Q has the following joint distribution:

$$CQ \sim \begin{cases} Q_0\, C_0 & \text{with probability} \quad (1-\pi) \\ Q_1\, C_1 & \text{with probability} \quad \pi \end{cases} \qquad \text{[X.18]}$$

where $Q_1$,$C_1$,$Q_0$,and $C_0$ denote the output and production cost associated with (suffix 1) and without a pest infestation,respectively.[58] Hence, the expected profit for avocados growers E(PR) is:

$$\begin{aligned} E(PR) &= E(pQ) - E(C) \\ &= p\{\pi\, Q_1 + (1-\pi)\, Q_0\} - \{\pi\, C_1 + (1-\pi)\, C_0\} \\ &= p\{\pi Q_0(1-cy) + (1-\pi)Q_0\} - \{\pi C_0(1+cp) + (1-\pi)C_0\} \end{aligned}$$

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[58] It is assumed that the occurrence of the pest infestation will have a $Q_1C_1$ impact on Q or C. Such an assumption is consistent with the avalilable information and it was applied to the previous analysis made under risk neutrality. In cases where different combinations of levels of Q and C are possible after a pest infestation, information about the likelihood of such levels will be needed. For instance, if not only $Q_1C_1$, but also $Q_0C_0$, $Q_0C_1$, and $Q_1C_0$ were also possible after a pest infestation with probabilities $\kappa^{11}$, $\kappa^{01}$, and $\kappa^{10}$, then the probability of occurrence of each $Q_iC_j$ after the pest infestation will be equal to $\pi(\kappa^{ij})$. In that case, tnotice that the total probability of occurrence of $Q_0C_0$ will be equal to $(1-\pi)+\pi\kappa^{00}$.

$$= pQ_0\,[(1-\pi)+\pi(1-cy)] - C_0\,[(1-\pi)+\pi(1+cp)]$$

$$= pQ_0\,(1-\pi cy) - C_0(1+\pi cp) \qquad [X.19]$$

The variance of profit Var(PR) is defined as:

$$\mathrm{Var(PR)} = \mathrm{Var}(pQ) + \mathrm{Var(C)} + 2\mathrm{Cov}(pQ,C) \qquad [X.20]$$

where

$$\mathrm{Var}(pQ) = p^2\,\mathrm{Var}(Q) = p^2\{E(Q^2) - [E(Q)]^2\} \qquad [X.21]$$

$$\mathrm{Var}(C) = E(C^2) - [E(C)]^2 \qquad [X.22]$$

$$\mathrm{Cov}(C,pQ) = p\mathrm{Cov}(C,Q) = p\{E(CQ) - E(C)E(Q)\} \qquad [X.23]$$

and

$$E(Q^2) = (1-\pi)\,Q_0^2 + \pi\,Q_0^2\,(1-cy)^2$$

$$= Q_0^2\,(\,1 - \pi + \pi + \pi cy^2 - 2\pi cy\,)$$

$$= Q_0^2\,(\,1 + \pi cy^2 - 2\pi cy\,) \qquad [X.24]$$

$$[E(Q)]^2 = [(1-\pi)\,Q_0 + \pi\,Q_0\,(1-cy)]^2$$

$$= [Q_0\,(1-\pi\,cy)]^2$$

$$= Q_0^2\,(1-\pi\,cy)^2 \qquad [X.25]$$

$$E(C^2) = (1-\pi)\,C_0^2 + \pi\,C_0^2\,(1+cp)^2$$

$$= C_0^2\,(\,1 - \pi + \pi + \pi cp^2 + 2\pi cp\,)$$

$$= C_0^2\,(\,1 + \pi cp^2 + 2\pi cp\,) \qquad [X.26]$$

$$[E(C)]^2 = [(1-\pi)\,C_0 + \pi\,C_0\,(1+cp)]^2$$

$$= [C_0\,(1+\pi cp)]^2$$

$$= C_0^2\,(1+\pi cp)^2 \qquad [X.27]$$

$$E(QC) = (1-\pi)Q_0C_0 + \pi Q_1C_1$$

$$= Q_0C_0\,\{(1-\pi)+\pi[(1+cp)(1-cy)]\} \qquad [X.28]$$

From [X.24] to [X.28], equations [X.21] to [X.23] become:

$$\begin{aligned}Var(pQ) &= p^2 [Q_0^2 ( 1 + \pi cy^2 - 2\pi cy ) - Q_0^2 (1- \pi cy)^2 ] \\ &= p^2 Q_0^2 [ \pi cy^2 - \pi^2 cy^2 ] \\ &= \pi(1- \pi) p^2 Q_0^2 cy^2 \qquad [X.29] \\ Var(C) &= C_0^2 ( 1 + \pi cp^2 + 2\pi cp ) - C_0^2 (1+\pi cp)^2 \\ &= C_0^2 [ \pi cp^2 - \pi^2 cp^2 ] \\ &= \pi(1- \pi) C_0^2 cp^2 \qquad [X.30] \\ Cov(C,pQ) &= p\{Q_0C_0\{(1-\pi)+ \pi[(1+cp)(1-cy)]\}- pQ_0 (1-\pi cy)C_0 (1+\pi cp) \\ &= pQ_0C_0[1-\pi+\pi(1+cp-cy-cpcy)-[1+\pi cp-\pi cy+\pi^2 cycp]] \\ &= pQ_0C_0\pi(1-\pi)cpcy \qquad [X.31]\end{aligned}$$

Equations [X.29], [X.30], and [X.31] can be used to estimate Var(PR) in [X.20]. Under a Mean-Variance model, avocados growers will choose an aggregate supply of avocados that maximizes the certainty equivalent of profits $Y_{ce}^{PR}$

$$\text{Max } Y_{ce}^{PR} = E(PR) - .5\, \lambda\, Var(PR) \qquad [X.32]$$

where $\lambda$ denotes the Pratt coefficient of absolute risk aversion. Using [X.29], [X.30],[X.31], equation [X.32] becomes:

$$\begin{aligned}\text{Max } Y_{ce}^{PR} &= pQ_0 (1-\pi cy) - C_0 (1+\pi cp) \\ &\quad - .5\lambda[ \pi(1-\pi)p^2 Q_0^2 cy^2+\pi(1-\pi)C_0^2 cp^2 + 2pQ_0C_0\pi(1-\pi)cpcy]\end{aligned} \qquad [X.33]$$

The supply of avocados under the risk of pest infestation is then obtained after differentiating [X.33] with respect to $Q_0$:

$$\begin{aligned}\delta Y_{ce}^{PR}/\delta Q_0 &= p (1-\pi cy) - S_0 (1+\pi cp) \\ &\quad -.5\lambda\{\pi(1-\pi)[2p^2 Q_0 cy^2+2C_0 cp^2 S_0+2p\, cpcy\, (C_0 +Q_0 S_0)\}\end{aligned} \qquad [X.34]$$

After equating [X.34] to 0, the first order condition is obtained. A risk-adjusted supply of avocados can be obtained by solving [X.34] for p. Because the term between brackets in equation [X.34] is positive, the expected aggregate supply of avocados will be less than predicted by equations [X.11] and [X.12] if growers are risk averse ($\lambda > 0$). The second term in [X.34] vanishes only under risk neutrality ($\lambda = 0$), certainty ($\pi = 0,1$), and at the trivial situation where the pest infestation has no impact on the supply of avocados (cp=cy=0)

Equation [X.34] is applied to investigate the importance of the producers' attitude toward risk in the evaluation of the avocado case. Because no estimate of $\lambda$ for avocado producers is available, a feasible range of coefficients of risk aversion is determined for each scenario investigated. For each scenario, the coefficient of absolute risk aversion is assumed to have a minimum at $\lambda = 0$ (risk neutral) and a maximum that would cause the expected supply of avocados to shift as much as it would under certainty of pest infestation. Larger values of $\lambda$ are considered unrealistic since they would indicate that domestic producers would overreact to the uncertain pest infestation, causing a preventive shift in supply larger than under certainty of pest infestation.

On the demand side, it is assumed that the risk of pest infestation is borne only by avocado growers, leaving demand unaffected by the regulation. For simplicity, Evangelou et al. specified a linear demand function in their analysis. Such a functional form is maintained in this study for comparative purposes. Alternatively,Carman and Cook (1996) applied the following functional form for the demand of avocados:

$$\text{D1:} \qquad p^*_t = \alpha_0 - \alpha_1 Q^*_t - \alpha_2 Y^*_t - \alpha_3 A^*_t \qquad \text{[X.35]}$$

where p, Q, Y, and A denote average annual real price for avocados, per capita sales of avocados in the U.S., disposable real income, and advertising and promotion real expenditures at time t, respectively. The symbol * denotes a Box-Cox transformation (i.e., $P^*=(P^{\lambda}-1)/\varsigma$ ).

Evangelou et al. specified a linear demand function where consumption of avocados is a linear function of prices:

$$\text{D2:} \qquad Q_t = \alpha_0 - \alpha_1 p_t \qquad [X.36]$$

Demand D1 and D2 assume that there is no substitution between avocados and other fruits. Carman and Cook argued they could not identify close substitutes or complements for avocados in the U.S.

### X.3. Welfare Analysis

A partial equilibrium analysis is applied to estimate the welfare impact associated with the entry of Mexican avocados into the U.S. Avocado imports from countries other than Mexico (e.g., Chile, Dominican Republic) and U.S. exports are ignored. Sensitivity analysis is performed for all combinations of supply and demand functions, i.e., S1-D1, S1-D2, S2-D1, and S2-D2. Welfare changes under autarchy (i.e., assuming no entry of avocados from Mexico) are compared against both a policy favoring free trade (no trade restriction) and the limited trade regulation enacted by APHIS.

Figure X.1.a shows the effects of free trade. Under autarchy, producer surplus in Figure X.1.a can be estimated by areas D+E+G+H. Consumer surplus is determined by areas A+B+C. When imports arrive, the domestic price $P_{D1}$ falls to the world price $P^w$ and consumer surplus increases (by D+E+F). If a pest outbreak occurs, production cost rises and yield lowers. Domestic supply shifts from S1 to $S1^s$.

**Figure X.1.a.**
**Welfare Effects Associated With th. Entry of Avocados Under Free Trade**

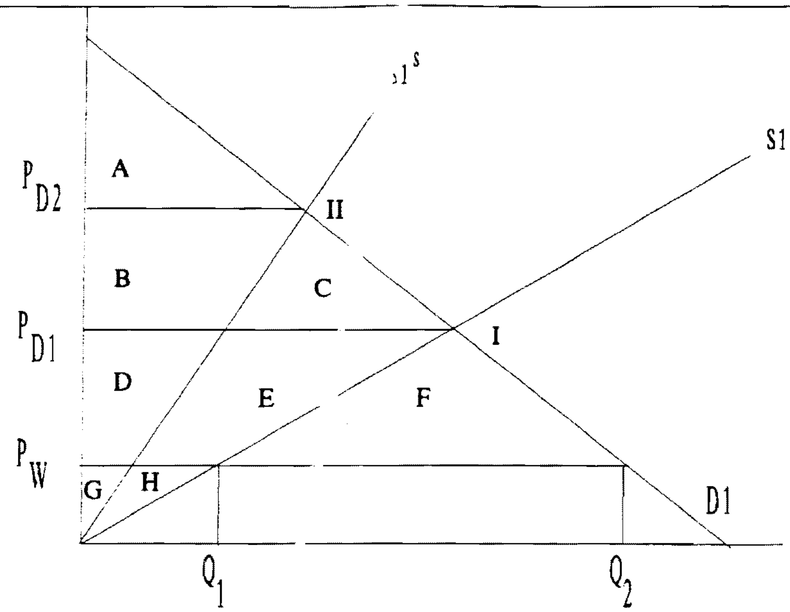
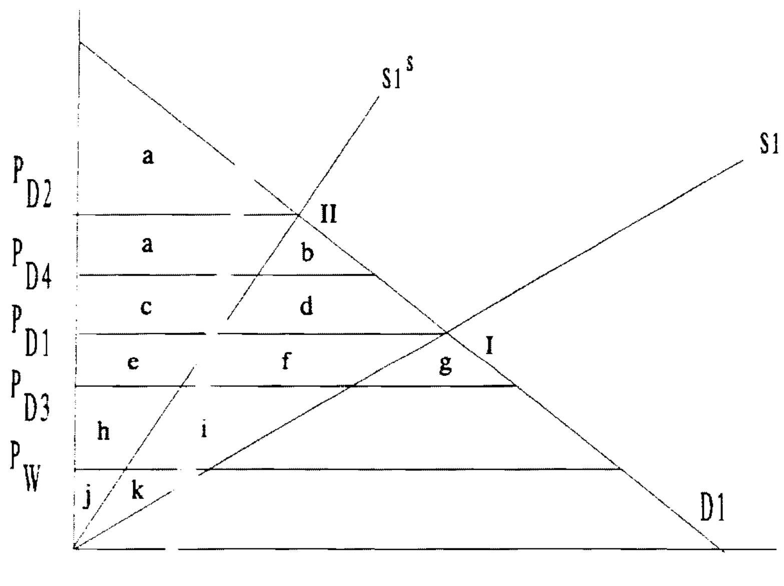



**Figure X.1.b.**
**Welfare Effects Associa.ed With the Entry of Avocados Under Limited Trade**




S1 and S1[s] denote : ipply of avocados before and after a pest infestation. Prices and areas appear as described in text

If APHIS reinstates the ban on Mexican avocados after the pest infestation, a new autarchy equilibrium is reached at a higher price $P_{D2}$. Consumer surplus falls by B+C. Producer surplus falls by E+H (the infestation effect), but rises by B. The net effect of the pest infestation under the new autarchy equilibrium is always negative (area C+E+H). On a probabilistic basis, the expected domestic supply function will lie between S1 and $S1^s$ in Figure X.1.a, with its location depending on the assumed level of pest infestation risk.

Although the assumption that APHIS would reinstate the ban on Mexican avocados after a pest infestation is consistent with previous statements made by the agency, the above analysis can also be expanded to investigate the possibility that APHIS would not interrupt the entry of avocados after a pest infestation. This alternative policy does not seem realistic in the short term, but it might be the one that will prevail in the long run if the eradication of the exotic pest is not possible. The WTO and NAFTA do not allow the enactment of SPS regulations to prevent the entry of pests already present in the receiving country. Hence, if a pest infestation occurs and its eradication is not feasible, it would be a matter of time before APHIS will be forced to lift the ban again.[59]

If the free entry of pest-treated Mexican avocados is not halted after an infestation, then the world price $P^w$ will still prevail. Producer surplus falls by D+E (the trade effect) and additionally by H (the infestation effect). Consumers are always better off, producers are always worse off, and the net effect on welfare (F-H) can be positive or negative.

Alternatively, if only limited imports are allowed, the domestic price would fall if there is no pest infestation, but not to the world price level. The effects on consumers, producers and net welfare are fractions of the outcomes with unrestricted free trade. Pest infestation reduces domestic supply and affects the domestic price in the opposite direction from imports. The equilibrium price can rise or fall. Figure X.1.b illustrates the case when the domestic price rises after a pest infestation. When the domestic price rises from $P_{D1}$ to

[59] Pests like weevils, one established, may be economically unfeasible to eradicate (Balerdi, 1997).

$P_{D4}$, consumers are worse off (by c+d). Producer surplus rises (by c) with the higher prices but falls due to higher production costs (by f+i+k). Producers may be better or worse off than at the initial equilibrium (better if c>f+i+k). Producers may also be better or worse off than with trade but without a pest infestation (better if c+e>i+k). Whatever the outcome for producers, social welfare falls (by d+f+i+k) compared to its level at the initial equilibrium, or compared to its level with trade but without pest infestation (by d+f+i+k+g) which results in price $P_{D3}$ in Figure X.1.b. Initially, limited imports cause the domestic price to fall from $P_{D1}$ to $P_{D3}$. Once a pest infestation occurs however, the domestic supply shifts from S1 to $S1^s$. If the import ban is reinstated, the domestic price rises to $P_{D2}$, as before. With limited imports still available, domestic price moves up only to $P_{D4}$.

*Chapter XI*

# EVALUATING THE IMPACT OF THE U.S. BAN ON MEXICAN AVOCADOS

## XI.1. Introduction

This chapter presents the results obtained after applying equations [X.11] and [X.12] to the avocado problem. This chapter is organized as follows. Section XI.2 presents the data and estimated supply and demand functions. Section XI.3 presents the results of the welfare analysis made under the assumption that APHIS will prohibit the entry of avocados imports once a pest infestation occurs. Such a policy is investigated for the short term, since it is assumed not sustainable in the long run. The 8 scenarios investigated (4 combinations of supply and demand under free and limited trade) appear in Appendix A2 in Tables A2-1 to A2-8. Section XI.4 presents the results obtained under the alternative assumption that APHIS will maintain the entry of Mexican avocados after an infestation. Although this policy is assumed to be realistic only for the long term, it is also investigated for the short run for analytical purposes. The outcome of the 16 scenarios investigated under the assumption that imports will be maintained appear in Tables A2-9 to A2-24 in Appendix A2. Section XI.5 summarizes the results obtained under risk neitrality. Section XI.6 presents the results obtained from the incorporation of producers' risk aversion into the analysis.

## XI.2. Data and Estimation of Supply and Demand

As it was mentioned above, supply and demand functions applied in this dissertation are similar to those used by Evangelou et al. and Carman and Cook in their evaluation of the avocado case. As in Evangelou et al., the data used in the analysis was annual 1960-1990 U.S. avocados production and consumption. Data was obtained from the Economic Research Service (ERS) of the USDA. New York wholesale prices (in constant dollars) were used to estimate both supply and demand on a single comparable scale. New York wholesale prices for 1975-1990 were obtained from the Agricultural Marketing Service (AMS) of the USDA and are identical to those used by Evangelou et al. In order to extend the sample period, wholesale prices for the period 1960-1974 were backcast by regressing wholesale prices on farm level prices for 1975-1990, then using the coefficients of this regression and farm level prices for 1960-74 to approximate wholesale prices during the early years for which they were not available. Advertising and income data for the period was provided by Dr. Carman as it was used in Carman and Cook. Data for the analysis appears in Appendix A3. The Statistical Analysis System (SAS) package was used to estimate S1, S2, and D2 The statistical package Shazam, with the option Box-Cox, was applied to the estimation of D1. Consumer and producer surplus was estimated by using the integration option in the DERIVE software package. The estimated supply (S1 and S2) and demand functions (D1 and D2) are:

S1:
$$Q_t = \underset{(8.39)^*}{22.65\,p} + \underset{(.09)^*}{.76\,Q_{t-1}} \qquad R^2=.61 \qquad [XI.1]$$

S2:
$$\ln(Q_t) = \underset{(.11)^*}{.35\ln(p)} + \underset{(.07)^*}{.78\ln(Q_{t-1})} \qquad R^2=.65 \qquad [XI.2]$$

D1:
$$p^b_t = \underset{(.59)^*}{22.7} - \underset{(.0023)^*}{.1573\,Q^b_t} + \underset{(.000055)^*}{.0014Y^b_t} + \underset{(.00019)^*}{.0053A^b_t} \qquad R^2=.68 \qquad [XI.3]$$

$$\text{D2:} \qquad Q_t = \underset{(8.39)^*}{242{,}277} - \underset{(.29)^*}{52.2\, p_t} \qquad R^2 = .51 \qquad [XI.4]$$

The number between brackets denotes the standard deviation of the estimated parameter. The symbol * denotes statistical significance ($p < .05$). The suffix b in D1 denotes a Box-Cox transformation with an estimated $\varsigma$ of .34. Thus, for instance, $p^b_t = (p_t^{.34} - 1)/.34$. Elasticities of supply for S1 and S2 depend on assumptions made on the lagged variables. The estimated supply elasticities for S1 and S2 in the short run (after holding quantity produced constant at the series average $\bar{q}$) were inelastic: .28 and .35, respectively. In the long run, steady state scenario (assuming $Q_t = Q_{t-1}$), the supply elasticities for S1 and S2 were elastic: 1.19 and 1.6, respectively. The short and long run scenarios are defined in this study as those in which the supply of avocados is inelastic and elastic, respectively. The estimated demand elasticity for D2 is -.45. Estimated price flexibility for D1 is -.65, which corresponds to an estimated demand elasticity of -1.54.

The expected shift in supply is estimated for four values of $\pi$, representing the maximum and minimum probabilities of occurrence of an infestation with seed weevils estimated by APHIS and Nyrop. These four values are denoted as $\pi_{AM}$, $\pi_{Am}$, $\pi_{NM}$ and $\pi_{Nm}$, where AM, Am, NM, and Nm stand for APHIS maximum, APHIS minimum, Nyrop maximum, and Nyrop minimum, respectively. Thus, based on Firko's work, the maximum probability of a pest outbreak under a system approach for risk mitigation will be equal to $\pi_{AM} = .00345$. Such a value corresponds to the probability of a pest outbreak associated to the introduction of stem weevil. Firko also estimated that, under a system approach, the probability of infestation with stem weevil would have a minimum equal to $\pi_{Am} = 1.35\text{x}10^{-6}$. On the other hand, Nyrop estimated that the time expected to pass before a pest outbreak of stem weevils occurs under APHIS' rule would range from 1 to 20 years. Therefore, and according to Nyrop, the probability of pest infestation due to stem weevils in a particular year would range from $\pi_{Nm} = 1/20$ to $\pi_{NM} = 1$. As it was mentioned above, Nyrop may have been overestimating the probability of pest infestation.

However, Nyrop's estimates are representative of the claims made by the domestic avocados' industry.

The size of the impact of the pest infestation on the supply of avocados should have an important effect on the economic evaluation of the avocado case. Sensitivity analysis was performed to investigate the role of such an impact. Three impact scenarios were investigated: 60, 40, and 20 percent increase in cost of pesticide application, and 20, 10, and 0 percent reduction in yields (denoted as 60-20, 40-10, and 20-0 scenario from now on). As it was mentioned above, the 40-10 scenario does not differ much substantially with the one investigated by Evangelou et al.

### XI.3. Welfare Analysis Assuming APHIS will Prohibit the Entry of Avocados After a Pest Infestation

Results for these scenarios appear in Tables A2-1 to A2-8 in Appendix A2. Tables A2.1 to A2.8 show the estimated welfare impact of the entry of Mexican avocados for different supply and demand combinations when APHIS' ban is reinstated after a pest infestation. Because it is assumed that the reinsertion of the ban would not hold in the long run, Tables A2.1 to A2.8 report results only for the short run. The first row in these tables shows the initial autarchy, with Mexican imports prohibited. Tables A2-1, A2-3, A2-5, and A2-7. show the free trade scenarios. Tables A2-2, A2-4, A2-6, and A2-8 refer to the scenario where trade is limited to the northeastern states of the U.S. If there is no risk of pest infestation (2nd row in Tables A2-1 to A2-8), the reduction in domestic output from autarchy can be attributed exclusively to the price differential caused by the entry of imports (i.e., there is no shift in supply).

The 3rd, 7th, and 11th rows in these tables show the results for the scenarios where the pest infestation is expected to occur with certainty ($\pi$=1). As in Evangelou et al, when the pest infestation is certain to occur and the ban is reinstated, the entry of avocados is expected to cause a net welfare loss. Figure X.1 and Table A2.1 show the welfare impact of the entry of avocados for the S1-D1 scenario. The initial autarchy equilibrium is reached at \$1,416 ($P_{D1}$ in Figure X.1.a). With pest infestation occurring with certainty (3rd, 7th and 11th rows in Table A2-1), the supply shifts to $S1^s$. Once the ban on avocados' imports is reinstated, price jumps to a new autarchy equilibrium depending on the magnitude of the shift (point II in Figure X.1.a). For the 60-20 scenario, the new price equilibrium is reached at $P_{D2}$ = \$1,718. Production and consumption fall to 96,226 short tons. Consumer surplus falls by \$33,704,189 (area B+C in Figure X.1.a). Producer surplus falls only by \$10,484,189 since part of the loss originated by the shift in supply (E+H in Figure X.1.a) is offset by the gain in producer surplus caused by the new, higher, domestic price (B in Figure X.1.a). A net welfare loss of \$44,188,378 occurs (C+E+H in Figure X.1.a). The negative outcome of this analysis does not differ substantially than the one obtained by Evangelou et al.

However, it is interesting to note that, although a net welfare loss is expected, producers may end up being better off after the pest infestation. Depending on the shape of the supply and demand applied in the analysis and the size of the impact, the gain in producer surplus attributed to the new autarchy equilibrium price (area B in Figure IX.1.a) may be larger than the infestation loss (area E+H) in Figure IX.1.a). Table A2-1 shows that for the S1-D1 combination, although there is a net welfare loss of \$4.4 million associated with the 20-0 scenario, there is an estimated increase in producer surplus of \$680,001 after a pest infestation occurs and the ban is reinstated.

Notice that under certainty, the welfare analysis is identical under both the free and limited trade scenarios if the ban is reinstated after the pest infestation. Under certainty of pest infestation, the new autarchy is granted no matter if the trade was free or limited. For instance, Tables A2-1 and A2-2 show that for the S1-D1 combination, free and limited trade share the same three rows associated with certainty of pest infestation (rows number 3, 7, and 11) plus of course, the row associated with the original autarchy equilibrium (first row).

Opposite to the certainty of pest infestation scenario, trade benefits will occur under free trade and no risk of pest infestation ($\pi = 0$). The free and no risky trade would reduce the domestic price, cause a loss in producer surplus, a gain in consumer surplus, and a net welfare gain (2nd row in Tables A2-1 to A2-8). In the intermediate scenarios, where the occurrence of a pest infestation is uncertain, the direction of the net welfare change depends on the probability of pest infestation. Under uncertainty of pest infestation, the expected impact can be estimated by weighting the occurrence of the two states of nature considered (i.e., the occurrence and avoidance of a pest infestation) by their probability of occurrence. Because it is assumed that the flow of imports will be prohibited after a pest infestation, the international price has only a ($1-\pi$) probability to prevail in a particular year. Thus the price P of avocados that is expected to prevail in a particular year is estimated as:

$$P = \pi P_{D2} + (1-\pi) P_W$$

where $P_{D2}$ and $P_W$ denote the autarchy equilibrium price after a pest infestation and the free trade and no risk world price, respectively. When risk is involved (last 12 rows in Table A2-1), the expected size of the shift in supply depends on both the probability of occurrence of a pest infestation (ranging from $\pi = 1$ to $1.35 \times 10^{-6}$) and the impact of the infestation on production costs and yield. Tables A2-1 to A2-8 show that the smaller the shift in supply, the smaller is the domestic output affected by the pest infestation and therefore, the closer the results move to the free trade and no risk situation. Thus, the last row in Tables A2-1 to A2-8, which shows a negligible probability of pest infestation and the lowest impact on production costs, yields very similar figures to that estimated under free trade and no risk (2nd row).

Producer surplus decreases with the size of the expected shift in supply. Part of such a reduction in producer surplus is attributed to the price reduction caused by the free entry of Mexican imports and it does not vary with the level of risk (area D+E in Figure X.1.a). The remaining loss in producer surplus is caused by the expected shift in supply associated with the risk of pest infestation (area H in Figure X.1.a). Such a portion does vary with the level of pest risk, becoming negligible at negligible probabilities of pest infestation.

The last column in Tables A2-1 shows the expected net welfare gain for all the levels of risk investigated. Net welfare gain for the free trade scenario is estimated as the difference between the gain in consumer and producer surplus with respect to the autarchy situation. As expected, net welfare gain is maximum under free trade and no risk. For free trade under risk, the net welfare gain moves toward such a maximum as the probability of pest infestation becomes negligible. Table A2-1 shows that a large net welfare loss is expected with large probabilities of pest infestation. However, consumers are those who would bear most of the loss. Producers are partially compensated by the increase in production costs and reduction in yield by the new and higher equilibrium price that would occur after the ban is reinstated.

Alternatively, under limited trade the average price of avocados in the U.S. would not fall close to the international price (i.e., it would not reach the value of $P_W$=$878 per short ton assumed above). Garoyan (1995) estimated that as a consequence of APHIS' SPS regulation, and assuming no transhipment to other states, 7,638,275 lbs. (3,819 short tons) of Mexican avocados are expected to be imported to the northeastern states of the U.S. The values of $P_W$ that would induce an excess demand equal to the amount of imports forecasted by Garoyan (1995) are applied to evaluate APHIS' limited trade regulation. Price $P_{D3}$ in Figure X.1.b shows the expected U.S. average price of avocados under limited trade and no risk of pest infestation. Price $P_{D3}$ is assumed to represent the prevailing price outside of the northwestern region as domestic consumption displaced from that area is absorbed by a combination of expanded consumption elsewhere and reduced domestic supply. In the northeastern region, the prevailing price is $P_W$ = \$878. The gain in consumer surplus under the no risk scenario is therefore estimated as the expected gain in consumer surplus outside the northeastern market (where price is $P_{D3}$), plus the gain in consumer surplus expected inside the northeastern market (where price is $P_W$).

The contribution of the northeastern market to the gain in consumer surplus is estimated by multiplying the total expected gain in consumer surplus under free trade and no risk (area F in Figure X1.1.a) by the volume of Mexican imports expected in the restricted northeastern market (3,819 short tons), and divided by the volume of imports that would be expected in this market under free trade and no risk ($Q_2$ - $Q_1$ in Figure X1.1.a). The total consumer surplus is therefore estimated as the consumer surplus expected outside the northeastern market (at prices appearing in the first column on Tables A2-2, A2-4, A2-6, and A2-8 ), plus the expected consumer surplus inside the northeastern region (at a world price of \$878).

As it was mentioned above, Tables A2-1 to A2-8 show no difference when the pest infestation is certain (e.g., a \$44.2 million net loss for the 60-20 scenario). However, for low values of $\pi$, welfare gain is larger under free trade than under limited trade. For instance Table A2-1 shows that under free trade and negligible pest risk, a \$25.8 million net welfare gain is expected, while such a gain reduces to \$3.3 million under limited trade. Such a result is not surprising, since it reflects the optimal characteristics of free trade when no risk is involved. However, low probabilities of pest infestation might be unrealistic under free trade. In principle, the WTO and NAFTA justify the enactment of SPS regulations as a way to reduce $\pi$ while allowing as much trade as possible. As it was mentioned above, CBA like this one can help to evaluate the adequacy of alternative regulations (and therefore, to enact an optimal policy).

In order to evaluate alternative regulations it may be helpful to investigate how low a probability of pest infestation has to be reduced by a particular SPS regulation in order to expect a net welfare gain. A threshold $\pi^t$ is defined as the probability of pest infestation at which the SPS regulation shows no expected net welfare impact. Under $\pi^t$, winners and losers of the SPS regulation balance each other. Table XI.1 shows values of $\pi^t$ estimated for the free and limited trade scenarios, for the different impact of pest infestation investigated. Thus, while the limited trade scenario is expected to be PPI under APHIS' assumption of $\pi \leq .00345$, the probability of pest infestation has to be reduced below .37 (for the 60-20 impact scenario) before free trade is allowed in order to produce a welfare gain. If such a reduction cannot be achieved, free trade is not an adequate policy in the avocado case.

**Table XI.1. Probabilities of Pest Infestation Associated With No Change in Expected Net Welfare ($\pi^t$)**

| | Impact | S1-D1 | S1-D2 | S2-D1 | S2-D2 |
|---|---|---|---|---|---|
| FT | 60-20 | .37 | .37 | .38 | .38 |
| | 40-10 | .52 | .52 | .51 | .52 |
| | 20-0 | .85 | .84 | .62 | .79 |
| LT | 60-20 | .07 | .04 | .07 | .04 |
| | 40-10 | .13 | .08 | .11 | .07 |
| | 20-0 | .44 | .29 | .16 | 0.2 |

Assumptions: APHIS will reinstate the ban on Mexican avocados after a pest infestation. FT and LT denote Free Trade and Limited Trade, respectively. The 60-20, 40-10, 20-0 notation denotes alternative expected impact of the pest infestation on the supply of avocados as it appears in text. The S1-D1, S1-D2, S2-D1, and S2-D2 notation denotes four combinations of supply and demand as explained in text.

## XI.4. Welfare Analysis Assuming APHIS will Not Prohibit the Entry of Avocados after a Pest Infestation

Tables A2-9 to A2-24 in Appendix A2 show the expected welfare impact of the entry of Mexican avocados into the U.S. when such an entry is not interrupted after a pest infestation. The general format of these tables does not differ much from that on Tables A2-A8. Tables A2-9, A2-11, A2-13, etc. show free trade scenarios. Tables A2-10, A2-12, A2-14, etc. refer to the scenario where trade is limited to the northeastern states of the U.S.

The free trade scenario assumes a prevailing international price of $878. Because it is assumed that the flow of imports will not be halted after a pest infestation, the international price holds constant irrespective of the risk of pest infestation. If there is no risk of pest infestation (2nd row), the reduction in domestic output from autarchy can be attributed exclusively to the price differential caused by the entry of imports (i.e., no shift in supply). When risk is involved (last 12 rows), the reduction in domestic output is attributed to both the price differential and the expected shift in supply. Again, the size of the shift in supply depends on both the probability of occurrence of a pest infestation (ranging from $\pi = 1$ to $1.35x10^{-6}$) and the impact of the infestation on production costs and yield.

Because it is assumed that the risk of pest infestation is borne exclusively by producers and that imports will never be prohibited, consumer surplus remains constant under free trade for all levels of pest risk. The international price determines a domestic consumption for each scenario which is independent of the risk involved. Again, producer surplus decreases with the size of the expected shift in supply. Column "Transfer to Consumers" in Tables A2-9 to A2-24 and area D+E in Figure X.1.a show the part of the reduction in producer surplus attributed to the price reduction caused by the entry of Mexican imports which does not vary with the level of risk. The remaining loss in producer surplus is caused by the expected shift in supply associated with the risk of pest infestation, becoming negligible at negligible probabilities of pest infestation.

Table A2-9 shows that the initial equilibrium with avocado imports prohibited occurs at a domestic price of $1,385 and output of 132,430 tons. Consumer surplus is $134.4 million (area A+B+C in Figure X.1.a) and producer surplus is $91.6 million (area D+E+G+H in Figure X.1.a). When trade is completely liberalized and no pest infestation occurs, the domestic price falls to $878. Consumer surplus rises by $87.5 million (area D+E+F in Figure X.1.a), producer surplus falls by $55.2 million (area D+E in Figure X.1.a), and the net welfare gain is $32.4 million (triangle F). Again, the free trade and no risk scenario has a devastating effect on the domestic industry because it eliminates the large price differential sustained by the import ban.

The occurrence of a pest infestation exacerbates the negative effects of free trade on the domestic producers, and reduces the net welfare gain. For probabilities of pest infestation at Nyrop's minimum (Nm) or lower, the effect of an infestation on expected producer surplus is less than $2 million. In other words, the contribution of the pest infestation to the reduction in producer surplus (area H in Figure X.1.a) shrinks below $2 million when the probability of pest infestation becomes negligible. Thus, when the probability of pest infestation is negligible, the reduction in producer surplus comes almost entirely from the price reduction (area D+E Figure X.1.a), and the expected welfare impact of the pest infestation tends to disappear. As expected, in the low-impact scenario the expected net welfare gain moves closer to the expected net welfare gain under free trade ($32.3 million).

For the worst case scenario of certain infestation and highest costs (60-20), the direct impact of the pest infestation is to reduce producer surplus by $18.4 million (area H). However, differently from the scenarios where the ban is reinstated, a net welfare gain is expected when free trade is maintained after a pest infestation. Such a net gain is expected even under certainty of pest infestation, although in this case it reduces to $13.9 million (area

F-H). The benefit from trade overcomes the infestation loss. The threshold value $\pi^t$ for this scenario is equal to one. Thus, even when free trade under a certain pest infestation could be a bad phytosanitary policy, it is good economic policy, in the sense of raising net welfare. In consequence, from a welfare standpoint, a SPS regulation which allows a continuous free entry of Mexican avocados (even after a pest infestation), is PPI with respect to autarchy.

The limited entry of Mexican avocados has smaller economic effects than free trade when no pest infestation occurs, as shown in Table A2-10 under limited trade. The domestic price (for the aggregate market with the northeastern winter regional demand excluded) falls from $1385 to $1368 as domestic consumption displaced from the northeastern winter market is absorbed by a combination of expanded consumption elsewhere and reduced domestic supply. Outside of the northeastern region (not shown separately in Table A2-2), consumer surplus increases by $2.3 million. In the northeastern region, winter consumption increases and consumer surplus rises by $2.4 million as the price falls. The total gain in consumer surplus is then $4.7 million. A net welfare gain of $2.4 million is expected in this scenario. If no pest infestation occurs, the limited opening of trade has positive effects on northeastern winter consumer surplus, limited positive effects on other consumers and net welfare, and limited negative effects on domestic producers.

The occurrence of a pest infestation has a substantial effect on the domestic market when imports are limited. For the worst case scenario, increased marginal costs and lowered yields reduce producer surplus by $45.8 million. Differently from free trade, a substantial net welfare loss would occur after a pest infestation. After a pest infestation, and even if the ban is not reinstated, the limited trade regulation would yield a large net welfare loss. For instance, Table A2-18 shows a $40.3 million net welfare loss is expected under the worst scenario, while Table A2-2 (which also refers to the S1-D1 and short term model) shows a $44.2 million net loss for the same worst case scenario. The limited flow of imports allowed into the northeast cannot compensate for the loss in producer surplus caused by a pest infestation as it would have occurred under free trade.

Because the limited entry of avocados to the northeast is not halted, the largest economic effect of the pest infestation is felt by consumers outside of the northeastern winter market. With the increased domestic price in the worst case scenario, their consumer surplus falls by $44.8 million. Thus, most of the economic impact of pest risk is borne by consumers outside the northeastern winter market not by producers when trade is opened only to the limited extent that APHIS has allowed.

Most of the remaining scenarios investigated reach similar results to that outlined above for the long-run S1-D1. As before, the effects on producers and consumers under limited trade and no pest infestation are much smaller than under free trade. Consumers outside the northeastern winter market again bear most of the economic costs of pest risk. There are gains in expected consumer surplus when lower risk probabilities are assumed, and these gains offset expected producer surplus losses in almost all cases. The limited trade scenario is good economic policy unless there is a high probability of pest infestation (high $\pi$, low $\pi^t$ ).

### XI.5. Summary

As mentioned above, results presented in the preceding sections are shown in the 24 Tables appearing in Appendix A2. This section provides a summary of the most important of such results. Table XI.2 shows the welfare impact of the entry of Mexican avocados for the S1-D1, short run model, assuming a 40-10 impact, under the assumptions that a ban will be reinstated after a pest infestation occurs, and that not such an interruption will occur. Table XI.2 is built from some of the information appearing in Tables A2-1, A2-2, A2-17, and A2-18.

**Table XI.2. Summary: Expected Welfare Impact for the S1-D1, Short Run, 40-10 Scenario.**

| Policy | | Δ | π | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | .05 | .00345 | $1.35\text{x}10^{-6}$ | 0 |
| Ban Reinstated | Ltd. | CS | -19,782,277 | 5,299,014 | 6,527,997 | 6,619,066 | 6,619,082 |
| | | PS | -4,192,430 | -3,336,624 | -3,294,690 | -3,291,583 | -3,291,582 |
| | | Net | -23,974,707 | 1,962,390 | 3,233,307 | 3,327,483 | 3,327,500 |
| | Free | CS | -19,782,277 | 86,031,925 | 89,216,821 | 91,600,944 | 91,601,094 |
| | | PS | -4,192,430 | -62,724,603 | -63,592,680 | -65,805,161 | -65,805,244 |
| | | Net | -23,974,707 | 23,307,322 | 25,624,141 | 25,795,783 | 25,795,850 |
| Continuous | Ltd. | CS | -12,652,936 | 5,235,212 | 6,519,001 | 6,619,082 | 6,619,082 |
| | | PS | -7,456,940 | -3,560,508 | -3,309,678 | -3,291,626 | -3,291,582 |
| | | Net | -20,109,876 | 1,674,704 | 3,209,323 | 3,327,456 | 3,327,500 |
| | Free | CS | 91,601,094 | 91,601,094 | 91,601,094 | 91,601,094 | 91,601,094 |
| | | PS | -77,329,413 | -66,681,267 | -65,867,249 | -65,805,268 | -65,805,244 |
| | | Net | 14,271,681 | 24,919,827 | 25,733,845 | 25,795,826 | 25,795,850 |

Table XI.2 shows that producers are always expected to lose with the entry of Mexican avocados. However, the magnitude of such a loss varies with π. When π is negligible, then producers lose only because of their loss in market share to the Mexican imports. Such a loss is therefore larger under free trade than under APHIS' limited trade (i.e., compare the PS rows in the last column of Table XI.2). When π moves closer to unity, then producers may also lose because of the rise in production costs associated with the pest infestation. The PS rows in Table XI.2 shows how the loss in PS increases when π moves away from 0. However, the reinstatement of a ban on Mexican avocados would eliminate Mexican competition leaving the effects of the pest infestation as the sole cause of problems for the domestic producers. Such an effect is more noticeably under free trade than under limited trade (compare PS in rows 2 and 5 in Table XI.2). Also, once the ban is reinstated a new, higher domestic equilibrium is reached which compensates some of the infestation loss. Further, such a high new price equilibrium may cause producers to be better off (on average) after the pest infestation (not shown in Table XI.2, but for the S1-D2 scenario in Table A2-3).

Table XI.2 shows that APHIS' reaction to a pest infestation becomes important to the analysis only under a high probability of occurrence of such a pest infestation. When $\pi \rightarrow 0$, there is no difference in the expected welfare either if the ban is reinstated or imports are uninterrupted (e.g., the value of the first 6 rows of the last column are identical to those of the last 6 rows). This is so because under a low probability of pest infestation, APHIS' policy reaction after a pest infestation occurs becomes irrelevant to the analysis.

Although it is not shown in Table XI.2, producers may be better off after the occurrence of a pest infestation even if the ban on imports is not reinstated, as long as the amount of imports allowed is restricted. In other words, under some limited trade scenarios, the expected entry of imports and therefore, the expected reduction in price associated with such an entry is not large enough to eliminate the effect of the new, high equilibrium price on producers (see Table A2-12).

## XI.6. Risk Aversion

Table XI.3 shows the maximum values of producers' risk aversion ($\lambda$) that will cause a shift in the supply of avocados similar to the one expected to occur under certainty of pest infestation. Only short run scenarios were imports are not stopped after a pest infestation are considered. The maximum value of $\lambda$ is estimated for each scenario investigated after given appropriate values to cp, cy, $\pi$, q and p in [X.34] and solving for $\lambda$. Appropriate values for cp, cy, $\pi$, q and p appear in Appendix A2 in Tables A2-9 to A2-24. For instance, for the S1-D1, free trade, short run, cp=.6, cy=.2, $\pi$=.05

scenario, the values of q and p necessary to solve for $\lambda$ in [X.34] are 41,952 short tons and $878, respectively (see Table A2-9). Finally, the estimated range of $\lambda$ is compared against levels of risk aversion estimated for U.S. growers of citrus by Featherstone and Moss (1990). Featherstone and Moss considered growers with $\lambda < 0.000{,}005$, between 0.000,005 and 0.000,020, and greater than 0,000,100 as slightly, moderately, and strongly risk averse, respectively. However, these estimates were obtained for a 150 acres orchard. Thus, Featherstone and Moss' estimates of $\lambda$ are adjusted to represent total bearing acreage in California (55,996 acres for the 1997-1998 season, according to the California Avocado Commission). In consequence, the California avocados industry is assumed to be slightly, moderately, and strongly risk averse if $\lambda$ is less than 0.000,000,013, between 0.000,000,013 and 0.000,000,027, and greater than 0.000,000,268, respectively.

Table XI.3 shows that the maximum value of $\lambda$ that will cause a shift in the supply of avocados similar to the one expected to occur under certainty of pest infestation varies across models, but most importantly, it increases for low probabilities of pest infestation. In other words, avocados' growers have to be more risk averse to preventively reduce production when the probability of pest infestation is very low. Also, Table XI.3 shows that the size of the impact of the pest infestation influences the value of the maximum $\lambda$ for each scenario. The lower the impact the more risk averse the growers have to be to preventively shift the supply of avocados. However, almost all the estimated maximum values of $\lambda$ are larger than those that Featherstone and Moss consider as indicative of strong risk aversion. Table XI.3 suggests that only if the probability of pest infestation is relatively large ($\pi = .05$) and growers are strongly risk averse, some preventive reduction in production and shift in the supply of avocados may occur. Thus, for most of the scenarios considered, producer's degree of risk aversion is not expected to cause a preventive shift in supply.

Table XI.3. Maximum Coefficients of Absolute Risk Aversion Expected to Cause a Shift in Supply Similar to the One Expected Under Certainty of Pest Infestation

| | Impact | 60-20 | | | 40-10 | | | 20-0 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $\pi$ | .05 | .00345 | $1.35*10^{-4}$ | .05 | .00345 | $1.35*10^{-4}$ | .05 | .00345 | $1.35*10^{-4}$ |
| S1-D1 | FT-SR | .000,001,78 | .000,025,80 | .065,938,52 | .000,002,52 | .003,657,31 | .093,476,47 | .000,013,53 | .000,197,67 | .505,416,41 |
| | FT-LR | .000,000,38 | .000,005,87 | .015,078,13 | .000,000,60 | .000,009,15 | .023,456,42 | .000,003,56 | .000,051,76 | .132,324,10 |
| | LT-SR | .000,006,65 | .000,009,56 | .024,512,37 | .000,001,05 | .000,014,68 | .037,518,27 | .000,004,63 | .000,067,29 | .172,132,73 |
| | LT-LR | .000,000,04 | .000,000,73 | .001,870,84 | .000,000,09 | .000,001,41 | .003,613,13 | .000,006,76 | .000,009,79 | .025,104,67 |
| S1-D2 | FT-SR | .000,001,78 | .000,025,80 | .065,938,52 | .000,002,52 | .003,657,31 | .093,476,47 | .000,013,53 | .000,197,67 | .505,416,41 |
| | FT-LR | .000,000,38 | .000,005,87 | .015,078,13 | .000,000,60 | .000,009,15 | .023,456,42 | .000,003,56 | .000,051,76 | .132,324,10 |
| | LT-SR | .000,000,32 | .000,004,60 | .011,744,30 | .000,000,49 | .000,007,08 | .018,079,80 | .000,001,99 | .000,028,95 | .074,116,52 |
| | LT-LR | .000,000,02 | .000,000,27 | .000,705,38 | ,000,000,03 | ,000,000,54 | .001,390,20 | .000,000,26 | .000,003,76 | .009,684,16 |
| S2-D1 | FT-SR | .000,000,12 | .000,027,29 | .069,736,24 | .000,002,28 | .000,033,01 | .084,350,63 | .000,005,61 | .000,082,10 | .207,346,23 |
| | FT-LR | .000,012,72 | .000,178,56 | .455,262,66 | .000,015,81 | .000,221,10 | .563,668,01 | .000,038,32 | .000,538,16 | 1.358,538,10 |
| | LT-SR | .000,003,14 | .000,043,05 | .109,663,75 | .000,004,01 | .000,055,78 | .142,154,84 | .000,015,12 | .000,209,35 | .534,148,99 |
| | LT-LR | .000,000,22 | .000,003,14 | .003,022,30 | .000,000,29 | .000,004,11 | .010,512.38 | .000,000,34 | .000,007,81 | .020,119,51 |
| S2-D2 | FT-SR | .000,000,12 | .000,027,29 | .069,736,24 | .000,002,28 | .000,033,01 | .084,350,63 | .000,005,61 | .000,082,10 | .207,346,23 |
| | FT-LR | .000,012,72 | .000,178,56 | .455,262,66 | .000,015,81 | .000,221,10 | .563,668,01 | .000,038,32 | .000,538,16 | 1.358,538,10 |
| | LT-SR | .000,000,28 | .000,003,92 | .010,006,87 | .000,000,40 | .000,005,71 | .014,576,28 | .000,001,20 | .000,017,44 | .044,459,102 |
| | LT-LR | .000,000,08 | .000,001,12 | .002,851,09 | .000,000,20 | .000,001,53 | .003,899,73 | .000,000,23 | .000,003,28 | .008,354,98 |

Acronyms S1-D1 to S2-D2 denote a particular combination of supply and demand functional form. FT, LT, SR, and LR denote free trade, limited trade, short run, and long run. Numbers 60-20, 40-10, and 20-0 represent the three size of impact of pest infestation investigated. The symbol $\pi$ denotes probability of pest infestation.

*Chapter XII*

# DISCUSSION

This dissertation presents a methodology to incorporate the probability of pest infestations into the economic evaluation of SPS regulations. Although developed for the avocado case, the method can be generalized to a broad spectrum of SPS regulations. The procedure is appealing for its simplicity. The information required for the analysis was obtained from outside pest risk assessments. For simplicity, it was assumed that only producers bear the risk of pest infestations. Such an assumption should accommodate most SPS regulations. In cases where consumers could also be affected by exotic pests, the model could be extended to incorporate shifts in demand.

For simplicity, it has been assumed that the impact of a pest infestation on domestic production is known with certainty. Uncertain pest impacts can be incorporated into the model as long as their probability distributions are known. Such information is usually not available from pest risk assessments. Sensitivity analysis was applied to evaluate the avocado case for three different impacts of pest infestation.

Probabilities of pest infestation have also been assumed known. However, probabilities of pest infestation are hardly known in disputes about SPS regulations. Further, these probabilities are usually at the center of SPS controversies. In the avocado case, estimated probabilities of pest infestation range from near zero to unity. It is astonishing that scientists could have disagreed in such a manner. Nyrop has expressed that his goal was not to obtain accurate pest-risk estimates but to show how under alternative assumptions a different pest risk assessment could be obtained. The presumption that Nyrop's estimates are not as reliable as those estimated by APHIS was mentioned in this study but not incorporated into the analysis. The incorporation of such a presumption into the model may have required the author to perform a judgement on a biological issue in which he has no expertise.[60] Instead, sensitivity analysis was applied to evaluate alternative probabilities of pest infestation.

For simplicity, the model assumes that a single pest accounts for most of the infestation risk. A generalization to more than one pest of concern was suggested. However, information needed for such a generalization may not be available. Also, the marginal value of the added information may not worth the increased complexity of the model. In the avocado case, the technical information suggests that most of the impact of the pest infestation can be attributed to stem weevils.

When applied to the avocado case, the stochastic CBA reversed the negative results obtained by Evangelou et al. for most of the scenario considered. The stochastic CBA showed that welfare gains from trade should be expected when the probability of pest infestation is low. Such a result is hardly a novelty, since low-probabilities of pest infestation moves the analysis closer to the optimal non-risk free trade scenario. Hence, if there is a substantial risk of pest infestation under free trade, APHIS' limited trade regulation would be a good policy since it would reduce risk down to a level where trade is allowed and welfare rises.

However, APHIS' limited trade policy may be phytosanitary good, but not optimal. APHIS' current limited trade regulation cannot fully capture the benefits of trade. The analysis shows that net welfare gains are expected under free trade even after a pest infestation occurs, as long as the entry of avocados is never halted. Under this scenario,

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[60] A Bayesian approach could habe been applied tocorrect Nyrop's (and APHIS's) estimated probabilities of pest infestation. Based on past phytosanitary records of Mexican avocados exports (e.g., Mexican avocados exported to Japan), a prior probability distribution could have been constructed that, after combined with Nyrop and APHIS' estimates, would yield more reliable posterior estimates of probabilities of pest infestation. However, even such a methodology would have required the author to make some biological assumptions for which the author doesnot have the necessary background (e.g., similariries and differences between thepest-environment interaction in Japan and the U.S.).

the price differential between imports and domestic avocados is so large that net welfare gains are expected even under the certain occurrence of a pest infestation. The domestic industry would be swept out, but still a net welfare gain would be expected. Further, the expected gain would be larger under free trade than under limited trade and negligible probability of pest infestation. Thus, as long as imports are never interrupted, unrestricted and continuous free trade would have been a better policy than the current limited trade regulation imposed by APHIS.

However, unrestricted free trade may not be an optimal policy either. First, free trade is a bad phytosanitary and economic policy if the probability of pest infestation is high and APHIS reinstates the ban after a pest infestation. It is most likely that APHIS would halt the entry of Mexican avocados after a pest infestation.[61] A net welfare loss is expected to occur in this scenario.

Second, it could have been economically more efficient for APHIS to enact a SPS regulation that would affect only the production and movement of avocados inside Mexico, then allowing such risk-reduced avocados to be free traded to the U.S. The marginal reduction in the probability of pest infestation that APHIS has gained by limiting imports to the northeastern states may have not been economically justified. According to APHIS, by limiting imports to the northeast of the U.S., the agency has reduced the probability of pest infestation from a marginal minimum of .245 (from .25 with free entry, to .005 with the system approach) to a maximum of .7 (from .75 to .05) (Firko, 1995).

The values of $\pi_{Am}$ and $\pi_{AM}$ (APHIS' final estimates for the probability of pest infestation under a system approach that were estimated after taking all measures of

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[61] APHIS has declared that the agency will stop the entry of avocados if a pest infestation occurs. The analysis shows that the reinstatement of the ban is a bad economic policy in the avocado case. However, halting the entry of imports after a pest infestation could be both a good phytosanitary and economic policy for many other SPS issues. For instance, when domestic production is geographically spread all over the country, the interruption of the entry of imports after a pest infestation may help to prevent the dissemination of thepest. However, for commodities such as avocados where production is geographically concentrated in a few counties, the phytosanitary effectiveness of reinstating the ban may be very limited.

control into account) can be corrected (divided by the marginal probabilities attributed only to the imposition of a geographically limited trade) to estimate the range of probabilities of pest infestation that would have prevailed if APHIS had not restricted trade to the northeastern states.[62] Thus, when trade is not limited to the northeastern states, $\pi_{Am}$ and $\pi_{AM}$ would increase approximately to $(1/.245)[1.35\text{x}10^{-6}]=5.5\text{x}10^{-6}$ and $(1/.7)[.00345]=.005$, respectively. Hence, by imposing phytosanitary measures inside Mexico but allowing for free trade, APHIS' estimated maximum probability of pest infestation would have coincided to Nyrop's minimum. The stochastic CBA has shown that net welfare gains from free trade are still expected at $\pi=.05$. Hence, the marginal cost of reducing $\pi$ by limiting trade to the Northeast is not economically optimal. A combination of risk-reducing measures inside Mexico and free trade may have been economically more efficient. APHIS' current SPS regulation on avocados could have been improved if a stochastic CBA had been used to guide the decision-making process.

The limited trade policy enacted by APHIS has some interesting features. For many of the scenarios analyzed, a combination of high probabilities of pest infestation and limited trade is expected to simultaneously reduce expected net welfare change and increase producer surplus. The reinstatement of the ban after a pest infestation would increase production costs and domestic prices. Consumers would be worst off, but producers on average may end up being better off. Producer surplus would decrease because of the impact of the pest infestation on production costs and yields, but increase because of the higher domestic price. Depending on the functional forms applied, producers on average may end up being better off even if the ban is not reinstated after the pest infestation.

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[62] Marginal estimates have been published for seed moth. Marginal probabilities attributed to limited trade were published by Firko (1995) as the "probability that pests moves to a habitat suitable for growing." Because of lack of better data, these estimates are used as approximate estimates for steem weevil.

Thus, APHIS' enactment of a limited trade regulation is a second-best policy (i.e., second with respect to a combination of risk-reducing measures inside Mexico and free trade) which may end up favoring domestic producers. Such a possibility suggest that APHIS may have been captured by the domestic avocado industry. Because of the capture, APHIS may have been politically impeded to enact the best, optimal, regulation (a combination of risk-reducing measures inside Mexico and free trade). However, such a capture may have not been complete. At the same time, APHIS has been pressed by the Mexicans to enact a regulation which reflects the agency's own low-risk assessment. Impeded to block imports or allow free trade, APHIS may have enacted an intermediate solution. The limited trade regulation enacted by APHIS may be the result from a compromise between two antagonistic postures.

The perception of the enactment of the limited trade regulation as a compromised solution can find some support in the political economy analysis of the case. However, it raises an interesting question: given that producers are expected to be better off with limited trade if a pest infestation occurs, why did the domestic industry oppose this policy? The domestic industry claims $\pi$ is very high even with limited trade. APHIS has announced that the ban would be reinstated if a pest infestation occurs. Therefore, the domestic industry should expect to benefit from APHIS' current policy. However, the domestic industry has fervently opposed the SPS regulation.

There are several possible explanations for such an apparent contradiction. First, in spite of what they have claimed, the domestic industry may have actually believed that APHIS' regulation would reduce $\pi$ to negligible values. If that is the case, the domestic industry would have been fighting exclusively against the trade effects of APHIS' policy, with no actual concern about the risk involved in the SPS regulation. The limited trade regulation enacted by APHIS would have been a partial victory for the domestic industry. APHIS would have been captured by the domestic growers.

However, there is some evidence which contradicts this explanation (at least to some extent). The domestic industry may have actually believed that there is a high probability of pest infestation under APHIS' limited trade regulation. Important members of the scientific community have sided with the domestic industry's claim that there is a high probability of pest infestation associated with APHIS' limited trade regulation.

Second, producers may be uncertainty-averse. Producers may be uncertain about the value of $\pi$. Producers may perceive that $\pi$ is high if avocados enter the country, but they may have also recognized that APHIS's low-risk assessment could be correct. If producers are uncertainty-averse, they may have favored the maintenance of the *status quo* (i.e., no Mexican avocados allowed) because it is with no imports where $\pi$ is more precisely estimated.[63]

Third, the domestic industry is not homogeneous. Some producers would expect to be better off under the current limited-trade regulation if a pest infestation occurs and the ban is reinstated. But other producers may not be able to cope with the increase in costs and reduction in yields. The vulnerable producers may have had the predominant voice in the industry's response to APHIS. However, the evidence for this interpretation is weak since the domestic industry has appeared monolithically opposed to APHIS' "relaxation" of the ban on Mexican avocados.

Fourth, the domestic industry may have recognized that, on average, producers would be better off with APHIS' regulation if a pest infestation occurs, but only in the short run. The domestic industry may have realized that in the long run, it would be difficult for APHIS to maintain a ban on Mexican avocados when pests are present in both

[63] Even with no imports $\pi$ could be positive because of avocados' contraband. The contribution of smuggled, untreated avocados to the risk of pest infestation has been ignored by both the domestic industry and APHIS. There are two possible explanations for such universal ignorance. On one hand, the entry of inexpensive but sanitized avocados would reduce the economic incentives to smugglers. The domestic industry may have chosen to avoid an argumentation which favors the entry of treated avocados as a way to reduce the pest-risk caused by the low-quality, smuggled avocados. On the other hand, APHIS may have chosen not to acknowledge its failure at the border.

sides of the border and eradication is not possible. Thus, the domestic industry may have opposed APHIS because of its long-run concerns, even if the limited trade policy could have benefited them in the short run.

Finally, the domestic industry may have been misinformed about the economic impact of the pest infestation. The domestic industry may have not realized that they could be better off if APHIS' limited trade causes a pest infestation. Risk-averse producers may have opposed any "relaxation" of the ban if they were misinformed. It is likely that small growers were misinformed about the economic impact of the pest infestation. However, it is very unlikely that the domestic industry's leaders shared such a weakness, given their easy access to high-quality information.

All the above five reasons may have played some role in shaping the domestic industry's strategy to oppose APHIS' limited trade regulation. However, two of these reasons seem particularly compelling: the domestic industry's concern for the long run (the possibility that APHIS' limited trade strategy would be replaced by free trade), and the possibility that growers were uncertainty-averse. The importance of both these issues is relevant to the analysis of the avocado case and to the CBA of SPS regulations.

This dissertation has investigated both the short-term and long-term scenarios. Differences in the short and long run analyses are crucial to the producers' welfare. Avocados producers may (or may not) end up being better off in the short run, but they are likely to lose in the long term. As it was mentioned above, short-run vs. long-run considerations may have affected the domestic industry's strategy in the avocado case.

However, the length of the analysis is almost irrelevant for APHIS in the avocado case. Net welfare gains (losses) are expected under limited trade for low (high) values of $\pi$, irrespectively of the term considered in the analysis. Thus, there are other variables in the CBA of the avocado case which may have been more relevant to APHIS' decision making. APHIS may have been more concerned about reducing $\pi$ and geographically restricting trade than to the length of the period under analysis.

Uncertainty-aversion may explain a large portion of the domestic industry's opposition to APHIS. However, such a possibility has been ignored by APHIS. Even this dissertation has not dealt with the methodological problems associated with the incorporation of uncertainty-aversion into the CBA of SPS regulations. This dissertation has focused instead in the incorporation of the producers' risk aversion into the CBA of SPS regulations.

Failure to incorporate producers' risk aversion into the CBA of SPS regulations may have important consequences. When producers' risk aversion is incorporated into the model, shifts in supply larger than those expected under risk neutrality could occur. Larger shifts in supply than those expected under risk neutrality may reverse the outcome of CBA. In the avocados' case, such a possibility may not have been important. Net welfare gains are expected under free trade even for a full shift in supply (i.e., for high values of $\pi$). However, this dissertation shows that the incorporation of risk-aversion into the CBA of SPS regulations may be crucial.

In summary, deterministic economic evaluations of SPS regulations may yield biased outcomes. By ignoring the probabilistic structure of pest infestations, deterministic CBA investigate only extreme outcomes with no reference to their likelihood. The appropriateness of stochastic CBA has been pointed out in the literature but never before applied to the evaluation of SPS regulations. Such a methodology was applied to the avocado case and proved to be an improvement with respect to previous evaluations made under certainty. The application of a stochastic CBA to the avocado case has shown that the entry of avocados should be favored under some phytosanitary conditions. The combination of phytosanitary safeguards located inside Mexico and free exports should have been APHIS' optimal policy. Failure to enact such a policy could be explained by APHIS' failure to produce a stochastic CBA, by political economy considerations, or both. In any case, this dissertation shows that stochastic CBA are important mechanisms not only to evaluate, but also to guide the enactment of optimal SPS regulations.

# SUMMATION OF THIS DISSERTATION AND FUTURE RESEARCH

This dissertation investigates the mechanisms by which Mexican SPS regulations are enacted either as scientifically sound pest protections or blatant barriers to U.S. trade. Two different approaches to the analysis of SPS regulations are applied. The first essay applies political economy to investigate if tariff reductions have induced the GOM to enact compensatory SPS regulations. Such a hypothesis is largely motivated by the GOM's enactment of several controversial SPS regulations soon after NAFTA was put in place. Further, many of these controversial regulations were enacted as emergency measures, without giving U.S. officials the opportunity to comment on their content.

The evidence presented in the first part of this dissertation suggests the rejection of the compensatory regulation hypothesis. The quality and transparency of the Mexican SPS regulatory process has shown a noticeable improvement during the last years. Before NAFTA, SPS regulations in Mexico were enacted as part of an import licencing system. When required, phytosanitary restrictions based on obscure pest risk assessments were added to the import permits. The lack of transparence of the regulatory process and the unreliable scientific basis in which SPS regulations were enacted, made them susceptible to abrupt modifications that created confusion for U.S. exporters and made trade unnecessarily difficult.

The debt crisis of 1982 induced drastic political and economical changes in Mexico. A new group of political leaders rose to power. The GOM asked the IMF and the World Bank for financial help. A rescue package which required Mexico to deregulate its economy was negotiated. In a few years, Mexico eliminated its import licensing system, reduced governmental intervention in the economy, reorganized its institutions, enacted new legislation, opened regulatory processes to public debate, and pursued several regional trade agreements. The most relevant of the trade agreements signed by Mexico is NAFTA, which became operational in 1994.

Institutional changes have improved the quality of the Mexican SPS regulations. Mexican SPS regulatory and enforcement agencies have been reorganized to decrease their vulnerability to the influence of private interest groups. Also, the transparency of the regulatory process has been dramatically increased by new legislation. DIGSA and DIGSV are mandated under the new legislation to publish all their proposed regulations in the *Diario Oficial*. Mexican agencies are also mandated to open a period to receive and answer comments from interested parties before the final regulation is published.

The sudden enactment of large number of SPS regulations soon after NAFTA was enacted raised concern among U.S. officials. However, this dissertation shows that such a regulatory eruption was largely motivated by the GOM's need to fill the pre-existent regulatory vacuum. The new legislation mandated DIGSA and DIGSV to publish all SPS regulations based on sound biological science. In 1994, DIGSA and DIGSV found it difficult to comply with such a requisite. There was no scientifically-solid pest risk assessment to support many of the SPS regulations that Mexico had enacted at that time. DIGSA and DIGSV were facing a regulatory vacuum that the agencies struggle to fill. In consequence, DIGSA and DIGSV resorted to the enactment of emergency measures while adequate pest risk assessments were underway. Not surprisingly, some of the emergency measures enacted by Mexico were unnecessarily trade disruptive and generated justified concern among U.S. officials. However, those concerns have been moderated over time. The number of emergency measures enacted by Mexico has fallen as DIGSA and DIGSV acquired more regulatory experience. Further, APHIS and Mexican officials increased their cooperation to identify and solve potential technical controversies before they arise.

In spite of such an improvement, this dissertation shows that the Mexican regulatory agencies were not able to avoid being captured by some powerful domestic industries. Such capture is particularly noticeable in the sweet cherries, wheat and citrus cases. The enactment of these SPS regulations was not entirely based on phytosanitary concerns. However, the main motivation for the capture of DIGSV was not compensation for tariff reduction (as hypothesized), but retaliation against some APHIS' regulations that

Mexico perceived as unfair. DIGSV was not captured by domestic industries vulnerable to tariff reduction but by domestic industries that were not allowed to export to the U.S. because of phytosanitary barriers.

One of the industries that successfully pressed DIGSV for retaliation is the Mexican avocados industry. The Mexican avocados industry pressured DIGSV to enact a ban on U.S. sweet cherries that would press APHIS to ease its ban on Mexican avocados. The dispute ended in 1997 when APHIS announced that avocados from Michoacan were allowed to enter to a limited part of the United States. Soon after this decision, DIGSV lifted the ban on sweet cherries and announced the proximate solution to the wheat and citrus controversies. The solution to the avocado case has been crucial to the solution of other SPS controversies between Mexico and the U.S.

The economic importance of APHIS' ban on Mexican avocados is evaluated in the second part of this dissertation. A methodology which incorporates the risk of pest infestation and the producers' attitudes toward risk into the CBA of SPS regulations is developed. Such a stochastic CBA was used to estimate the net welfare changes expected under APHIS' limited trade regulation. The estimated net welfare changes obtained under this scenario are compared against scenarios where free trade and autarchy are assumed. Short and long term scenarios are analyzed. Also, the possibility that APHIS would either reinstate the ban on avocados once a pest infestation occurs or maintain the flow of imports is investigated.

The analysis shows the advantages of applying stochastic CBA to evaluate SPS regulations. As expected, the stochastic CBA reversed the conclusions of the deterministic CBA to show that net welfare gains are expected as long as the probability of pest infestation is relatively low. Hence, the limited trade regulation enacted by APHIS can be justified as a mechanism to simultaneously allow trade and reduce the probability of pest infestation. However, the limited trade regulation is not optimal.

The second part of this dissertation illustrates how stochastic CBA could have been used by APHIS to guide the enactment of optimal SPS regulations. The analysis suggests that compared against the limited trade regulation, a system approach which imposed SPS conditions inside Mexico and allowed the pest-treated avocados to freely enter the country would yield a significant increase in social welfare with a minimum increase in risk. By failing to perform a stochastic CBA APHIS was not able to recognize the possible existence of a welfare improving regulation.

Interestingly, the analysis shows that political economy considerations may have also contributed to the enactment of the limited trade regulation. The analysis shows an expected increase in producer surplus if a pest infestation occurs under the limited trade regulation (although a net welfare loss is expected). Hence, the enactment of the sub-optimal limited trade regulation may be viewed as a politically feasible solution to the controversy.

This dissertation also shows the potential impact that the inclusion of the producers' risk aversion may have on the outcome of the analysis. Although such an impact is negligible in the avocado case (e.g., welfare gains from free trade would be expected even if a pest infestation occurs with certainty), the inclusion of attitudes toward risk in the CBA of SPS regulations may have a determinant impact.

In summary, this dissertation has illustrated how political economy analysis and CBA can contribute to the evaluation, understanding, and design of SPS regulations. However, important efforts are needed before the economic profession could provide a systematic and consistent evaluation of SPS regulations. Research is needed both on the political economy and welfare aspects of the problem.

Most political economy studies of SPS regulations have focused on single case studies. The acquisition of a more general knowledge about the genesis and impact of SPS regulations is needed. There are several (but related) directions in which research can be expanded. First, there is a need for a systematic knowledge of the type and characteristics of the SPS regulations currently enacted in the world. A world wide inventory of SPS regulations affecting U.S. exports has been attempted. Second, particular SPS regulatory patterns within commodities need to be investigated. Such knowledge may help the design of more efficient trade policies. Research focusing in some commodities is also relevant. Third, efforts can be directed to understand how different countries approach the enactment of SPS regulations. The first part of this dissertation analyzes how SPS regulations are enacted in Mexico. It has been shown how opening of the Mexican regulatory process and the GOM's need for U.S. political support have reduced the enactment of unfair SPS regulations in Mexico. It would be important to investigate the relative importance of these factors in other countries. Such knowledge may help U.S. trade negotiators to design efficient trade strategies.

Political economy analyses of SPS regulations may be important to the CBA of these measures. CBA of SPS regulations based on incorrect political assumptions may yield biased outcomes. For instance, this dissertation has shown a close linkage between the political economy of Mexican regulations and the avocado case. A CBA for DIGSV's ban on sweet cherries may have yielded a net social welfare gain if such a CBA had included the benefits expected from the opening of the U.S. avocados' market.[33] However, the inclusion of political economy generated benefits and costs into the CBA of SPS regulations is not trivial and involves methodological and ethical considerations that need to be investigated. For instance, the inclusion of benefits and costs generated by political economy efforts in the *ex ante* CBA of SPS regulations opens the door for subjectivity. It may not be possible to forecast all possible political ramifications associated with the enactment of a SPS regulation. Also, there is a need to address the ethical considerations associated to account

[33] The CBA for the avocados' case has ignored the potential benefits that the lift of the ban on Mexican avocados is expected to generate for the U.S. sweet cherries' industry. Such an incorporation would not be adequate for an *ex ante* CBA since it was only at the end of the avocados' case when a definitive proof of the Mexican "tit-for-tat" strategy was obtained. Further, there are ethical and methodological considerations regarding the inclusion of politically economy generated benefits that need to be addressed first (see text).

for the outcome of an undesirable practice (tit-for-tat) as a benefit.

The second part of this dissertation illustrates how the absence of adequate CBA may cause decision-makers to enact suboptimal SPS regulations. However, much research is still needed before the CBA of SPS regulations become a consistent and reliable methodology. Disputes about the reliability of CBA may fuel instead of sooth SPS controversies.

Methodological CBA disputes in other risk-reducing areas are usually centered around the incorporation of all pertinent costs and benefits into parsimonious, empirically tractable models. The application of different assumptions to model similar problems opens the door to subjectivity and therefore, to controversy. Consistent criteria are crucial to the credibility and usefulness of CBA on SPS regulations. A protocol establishing the minimum requisites that an adequate CBA of SPS regulations should satisfy may soon be needed.[34]

Also, the development of such a protocol would help scientists to identify the information that pest risk assessments should provide. For instance, when pest eradication is possible, the CBA of SPS regulations may apply a Markovian process in which not only the probability of pest infestation but the probability of pest eradication are considered. However, probabilities of pest eradication are usually not estimated in pest-risk assessments.

Research is needed about the strategic and practical significance of incorporating risk aversion into the evaluation of SPS regulations. This dissertation has shown that attitudes toward risk and ambiguity may influence the CBA of SPS regulations. The WTO and NAFTA allow each country to set its own level of tolerable risk (implicitly allowing each country to define its own level of risk aversion). Subsequently, the routine incorporation of attitudes toward risk and ambiguity into the economic evaluation of SPS regulations seems appropriate. However, it might be possible that captured regulatory agencies could manipulate producers' risk and ambiguity aversions to yield economic evaluations suggesting the enactment of economically protectionist SPS regulations.

[34] As it was mentioned in the literature review, regulators in the human health field are currently discussing the elaboration of international guidelines for the CEA of risk-reducing policies.

Further, even if important, the empirical estimation of producers' attitudes toward risk and ambiguity may be economically unfeasible. Experiments designed to estimate such attitudes may be too expensive to justify their inclusion in the CBA of some SPS regulations.

Research is also needed on the relative weight that decision-makers should give to CBA during SPS regulatory processes. Forsythe (1997) has suggested that the enactment of SPS regulations should be bound to the outcome of the CBA. In other words, Forsythe has proposed that SPS regulations should be enacted each time the benefits expected from the regulation outweigh the expected losses. Although such a suggestion makes economic sense, it ignores the difficulties involved in reaching a consensus about the adequacy of CBA. It might be politically less disruptive to use the CBA as another source of information for decision-makers, allowing regulators and interest groups some latitude in the way they applied it.

# REFERENCES


Abbot, F. M. 1997. The Intersection of Law and Trade in the WTO System: Economics and the Transition to a Hard Law System. In: Understanding Technical Barriers to Agricultural Trade. Proceedings of a Conference of the International Agricultural Trade Research Consortium. David Orden and Donna Roberts, eds., January 1997., 33-48.

Amosson, S. H., R. A. Dietrich, H. Talpaz, and J. A. Hopkin. 1981. Economic and Epidemiologic Policy Implications of Alternative Bovine Brucellosis Programs. Western Journal of Agricultural Economics, 63:43-56.

APHIS. 1994. Analysis of Mexico's Requirement for Fumigation of U.S. Sweet Cherries (Prunus avium). APHIS/Trade Support Team. December 1994. 78 pages.

Armour, A. M. 1993. Risk Assessment in Environmental Policymaking. Policy Studies Review. Autumn/Winter 1993. 12(3/4):178-196.

Arrow, K. J. 1974. Essays in the Theory of Risk Bearing. North-Holland Publishing Co., Amsterdam.

Arrow, K. J., and R. C. Lind. 1970. Uncertainty and the Evaluation of Public Investment Decisions. American Economic Review, 60:364-378.

Arrow, K. J., M. L. Cropper, G. C. Eads, R. W. Hahn, L. B. Lave, R. G. Noll, P. R. Portney, M. Russell, R. Schmalensee, V. K. Smith, and R. N. Stavins. 1996. Benefit-Cost Analysis in Environmental, Health, and Safety Regulation. A Statement of Principles. Document sponsored by The Annapolis Center, the American Enterprise, and Resources for the Future, 35 pages.

Asch, P. 1990. Food Safety Regulations: Is the Delaney Clause the Problem or the Symptom? Policy Sciences, 23:97-110.

Balerdi, C. F. 1997. University of Florida Cooperative Extension Service. Dade County, Florida. Personal Communication.

Bartel, A. P. and L. G. Thomas. 1987. Predation Through Regulation. The Wage and Profit Effects of the Occupational Safety and Health Administration and the Environmental Protection Agency. Journal of Law and Economics. 30:239-264.

Baumol, W. J., and W. E. Oates. 1988. The Theory of Environmental Policy. Cambridge University Press, 2nd. ed. Cambridge. Massachusetts.

Becker, G. S. 1985. Public Policies, Pressure Groups, and Dead Weight Costs. Journal of Public Economics. 28:329-347.

Bertelsen, D., J. Harwood, H. Lee, A. Somwaru, and G. Zepp. 1995. Avocados: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance. Document prepared by the ERS/USDA in cooperation with the Federal Crop Insurance Corporation. February 23, 1995, 37 pages.

Bishop, R. C. 1982. Option value: An Exposition and extension. Land Economics, 58:1-15

Blackmore, C. C. and D. J. Magid. 1997. Methodologic Evaluation of the Radiology Cost-Effectiveness Literature. Radiology. 203:87-91.

Braslow, L. 1997. FDA Economist. Personal communication

Breyer, S. G. 1993. Breaking the Vicious Circle: Toward Effective Risk Regulation. Harvard University Press. Cambridge, Massachusetts.

Brush, G. J. and M. D. Clems. 1995. Market Failure and Chemical Use. Review of Marketing and Agricultural Economics, 63(3):394-407.

Buchanan, J. M., and G. Tullock. 1975. Polluter's Profits and Political Response: Direct Control versus Taxes. American Economic Review. 65:139-147.

Burmaster, D. E., and A. M. Wilson. 1995. Untitled. Comments to APHIS' pest risk assessment on the entry of Mexican avocados. Document commissioned by the California Avocado Commission to be presented at the Washington D.C. public hearing to debate the adequacy of the rule. September 1995, 23 pages.

Buschena, D. E., and D. Zilberman. 1994. What Do We Know About Decision Making Under Risk and Where Do We Go from Here? Journal of Agricultural and Resource Economics, 425-445.

Camerer, C., and M. Webber. 1992. Recent developments in Modeling Preferences: Uncertainty and Ambiguity. Journal of Risk and Uncertainty, 5:325-370.

Carman, H., and R. Cook. 1996. An Assessment of Potential Economic Impacts of Mexican Avocado Imports on the Californian Industry. Department of Agricultural Economics, University of California, Davis. Unpublished manuscript.

Colby, B. G., and D. C. Cory. 1989. Valuing Amenity Resources under Uncertainty: Does the Existence of Fair Contingent Claims Markets Matter? Journal of Environmental Economics and Management, 16:149-155.

Collins, A., W. N. Musser, and R. Mason. 1991. Prospect Theory and Risk Preferences of Oregon Seed Producers. American Journal of Agricultural Economics, 73:429-435.

Congressional Quarterly Inc. 1982. Regulation: Process and Politics. Congressional Quarterly. Washington, D.C.

Conlon, M. 1996. Mexican Weekly Highlights and Hot Bites (5). FAS Attache Report. AGR Number: MX6513. American Embassy, Mexico City, Mexico. September 3, 1996.

Conlon, M. 1997a. New Mexican Programs for the Importation of Cattle. FAS Attache Report. AGR Number: MX7635. American Embassy, Mexico City, Mexico. July 3, 1997.

Conlon, M. 1997b. U.S. Dominant in the Mexican Market for Breeder Cattle. FAS Attache Report. AGR Number: MX7621. American Embassy, Mexico City, Mexico. May 16, 1997.

Conlon, M. 1997c. Mexican Weekly Highlights and Hot Bites. Jan/Two. FAS Attache Report. AGR Number: MX7602. American Embassy, Mexico City, Mexico. January 1, 1997.

Cory, D. C., and B. Colby Saliba. 1987. Requiem for Option Value, Land Economics, 63:1-10.

Crandall, R. W. 1988. The Use of Cost-benefit Analysis in Product Safety Regulation. In: The frontier of research in the Consumer Interest: Proceedings of the International Conference on Research in the Consumer Interest. Maynes, E., ed; American Council on Consumer Interest (ACCI) Research Committee, ed. Columbia, MO. Pages 61-75.

Crawford, T. and J. Link. 1995. NAFTA: What's Up?. The NAFTA Economic Monitoring Taskforce. ERS-USDA. September 1995.

Crawford, T. and J. Link. 1996. NAFTA: Year Two and Beyond. The NAFTA Economic Monitoring Task Force. ERS-USDA. April.

Cooper, T. 1997. California Macadamia Nut Products. Personal communication.

Curtis, J. L. 1994. When Animal Health Issues Become Non-Tariff Barriers to Trade. Unnamed Document. Oregon State University. 54 pages.

David, M. 1997. APHIS-VS. Personal communication

Defense Economic Analysis Council. 1997. Economic Analysis Handbook. 2nd Edition. Naval Postgraduate School, Monterey, California.

DeVries, A. and J. P. Gagnon. 1996. Cost Effectiveness Evaluation in Health Care: Initiatives for a Standardized Methodology. In: 1996 Drug Outcome Sourcebook. Chapter Four: International Standards for Outcomes Studies. Faulkner and Gray, eds. Pages: 99-105.

Detsky, A. S., and I. G. Naglie. 1990. A Clinician's Guide to Cost-Effectiveness Analysis. Annals of Internal Medicine, 113:147-154.

Dornbusch, R. and S. Fischer. 1986. Third World Debt. Science. November 14, 1986. 234:837-841.

Drummond, M. F. 1985. Survey of cost-effectiveness and Cost-benefit analyses in industrialized countries. World Health Statistics Quarterly, 38:383-401.

Duncan, R., and L. Tisdell. 1971. Research and Technical Progress: The Returns to Producers. Economic Research, 4:124-129.

Ebel, E. D., R. H. Hornbaker, and C. H. Nelson. 1992. Welfare Effects of the National Pseudorabies Eradication Program. American Journal of Agricultural Economics, 74:638-645.

Economic Research Service, USDA. 1992. Agriculture in a North American Free Trade Agreement: Analysis of Liberalizing Trade Between the United States and Mexico. Foreign Agricultural Economic Report No. 246.

Eisenberg, J. M. 1996. Clinical Economics. A Guide to the Economic Analysis of Clinical Practices. Journal of the American Medical Association, 262(20):2879-2886.

Ellsberg, D.. 1961. Risk, Ambiguity, and the Savage Axioms. Quarterly Journal of Economics, 75:643-669.

Evangelou, P., P. Kemere, and C. E. Miller. 1993. Potential Economic Impacts of an Avocado Weevil Infestation in California. PPD/APHIS/USDA. 33 pages.

Falconi, C. and T. Roe. 1990. Economics of Food Safety: Risk, Information, and the Demand and Supply of Health. University of Minnesota, Economic Development Center. July 1990. Bulletin no. 90-1. 21 pages.

Farber, D. A. 1992. Politics and Procedure in Environmental Law. Journal of Law, Economics and Organization. 8(1):59-81.

FATUS (Foreign Agricultural Trade of the United States). Economic Research Service, USDA. 1994. Several Issues.

FDA - Food and Drug Administration. 1996. Medical Devices, Current Good Manufacturing Practice (CGMP). Final Rule. 21 CFR Parts 802, 812, and 820. Federal Register, October 7, 1996, 61(195):52601-52662.

FDA - Food and Drug Administration. 1997. Iron-Containing Supplements and Drugs: Label Warning Statements and Unit-Dose Packaging Requirements. Final Rule. 21 CFR Parts 101, 111, and 310. Federal Register, January 15, 1997, 62(10):2217-2250.

Featherstone, A. M., and C. B. Moss. 1990. Quantifying Gains to Risk Diversification Using Certainty Equivalence in a Mean-Variance Model: An Application to Florida Citrus. Southern Journal of Agricultural Economics, December 1990, 191-197.

Firko, M. J. 1995. Importation of Avocado Fruit (Persea Americana) From Mexico. Supplemental Pest Risk Assessment. APHIS/USDA, May 1995, 40 pages.

Fisher, A., L. G. Chestnut, and D. M. Violette. 1989. The Value of Reducing Risks of Death." A Note on New Evidence. Journal of Policy Analysis and Management, 8:88-100.

Flores, B. 1996a. Poultry Trade Issues in Mexico. FAS Attache Report. AGR Number: MX6953. American Embassy, Mexico City, Mexico. July 24, 1996.

Flores, B. 1996b. Mexican Weekly Highlights and Hot Bites (9). FAS Attache Report. AGR Number: MX6133. American Embassy, Mexico City, Mexico. September 27, 1996.

Flores, B. 1996c. Citrus Products Still Recovering From Drought. FAS Attache Report. AGR Number: MX6149. American Embassy, Mexico City, Mexico. November 8, 1996.

Flores, B., B. Juarez, and S. Trejo. 1997. Mexican Weekly Highlights and Hot Bites. Feb/Four. FAS Attache Report. AGR Number: MX7019. American Embassy, Mexico City, Mexico. February 26, 1997.

Forsythe, Jr., K. W., and B. Corso. 1994. Welfare Effects of the National Pseudorabies Eradication Program: Comment. American Journal of Agricultural Economics, 76:968-971.

Forsythe, Jr., K. W. 1997. Personal communication.

Frankhauser, S. 1994. The Social Cost of Greenhouse Gas Emissions: An Expected Value Approach. The Energy Journal, 15(2):157-184.

Freeman, A. M. 1984. The Sign and Size of Option Value. Land Economics, 60:1-13.

Freeman, A. M. 1991. Welfare Measurement and the Benefit-Cost Analysis of Projects Affecting Risks. Southern Economics Journal, 58:65-76.

French, M. T. 1994. An Efficiency Test for Occupational Safety Regulation. 675-693

Frend, D. A. 1996. Initial Development of the Australian Guidelines. Medical Care. 34(12):DS216-DS225.

Garoyan, L. 1995. Proposed Rule for the Importation of Fresh Hass Avocado Fruit Grown in Michoacan, Mexico. An Analysis of the Impact on California Avocado Commission. Monograph commissioned by the California Avocado Commission to Management Research Associates. Davis, CA. August 22, 1995. 25 pages.

Gelles, G. M. 1993. Cost and Benefits of HIV-1 Antibody Testing of Donated Blood. Journal of Policy Analysis and Management, 12(3):512-531.

Gilboa, I. and D. Schmeidler. 1997. Act Similarity in Case-Based Decision Theory. Economic Theory, 9:47-61.

Good Fruit Grower. 1996. California Soft Fruit Exports to Mexico Likely to Increase. Good Fruit Grower. July 1996.

Graham, D. A. 1981. Cost-benefit Analysis Under Uncertainty. American Economic Review, 71:715-725.

Graham, D. A. 1984. Cost-benefit Analysis Under Uncertainty. American Economic Review, 74:1100-1002.

Graef, J. 1995. World Market for Avocado. Regional Agribusiness Project (RAP). RAP Market Information Bulletin No 10, October 1995, 5 pages.

Grennes, T., J. Hernandez Estrada, B. Krissoff, J. Matus Gardea, J. Sharples, and C. Valdes. 1991. An Analysis of a United States-Canada-Mexico Free Trade Agreement. International Agricultural Trade Research Consortium (IATRC). Commissioned Paper Number 10. November 1991. St. Paul, MN, 67 pages.

Gutierrez, N. E. 1997. APHIS/PPQ. Phytosanitay Issues Management Team. Personal communication.

Hakim. S. and Y. Shachmurore. 1996. Social Cost Benefit Analysis of Commercial and Residential Burglar and Fire Alarms. Journal of Policy Modeling, 18(1):49-67.

Harding, J. 1990. Reactor Safety and Risk Issues. Contemporary Policy Issues. VIII:94-105.

Harrington, W. and V. McConnell. 1993. Cost-Effectiveness of remote Sensing of vehicle Emissions. Resources for the Future, Paper 93-24, September 1993, 37 pages.

Hayman, J., J. Weeks, and P. Mauch. 1996. Economic Analysis in Health Care. An Introduction to the Methodology With an Emphasis on Radiation Therapy. International Journal of Radiation Oncology, Biology, Physics, 35(4):827-841.

Heath, C. and A. Tversky. 1991. Preference and Belief: Ambiguity and Competence in Choice Under Uncertainty. Journal of Risk and Uncertainty, 4(1):5-28.

High, J. C., and C. A. Coppin. 1988. Wiley and the Whiskey Industry. Business History Review. 62:286-309.

Hillman, J. 1978. Nontariff Agricultural Trade Barriers. Lincoln: University of Nebraska Press.

Hillman, J. 1991. Technical Barriers to Agricultural Trade. Boulder: Westview Press.

Horwitz, J. 1997. U.S. Technical Measures for Agricultural Imports. Presented at Workshop on Technical Barriers to Trade, Market and Trade Economics Division, ERS/USDA, October 8-9, 1997.

House Committee on Agriculture. 1997. U.S. Mexico Show New Flexibility on Non-Tariff Trade Barriers, U.S. Citrus Gets New Access to Mexico. News Release, May 6, 1997. One page.

Johnson, R. W. M. 1997. Technical Measures for Meat and Other Products in Pacific Basin Countries. In: Understanding Technical Barriers to Agricultural Trade. Proceedings of a Conference of the International Agricultural Trade Research Consortium. David Orden and Donna Roberts, eds., January 1997., 79-98.

Jolicuer, L. M., A. J. Jones-Grizzle, and J. G. Boyer. 1992. Guidelines for performing a pharmacoeconomic analysis. American Journal of Hospital Pharmacy, 49:1741-1747.

Jones, B. and J. Redding. 1997. Mexico Market Opens to U.S. Cherries. Press Release. APHIS. February 20, 1997.

Juárez, B. 1996. Stone Fruits. FAS Attache Report. AGR Number: MX6013. American Embassy, Mexico City, Mexico. March 1, 1996.

Juárez, B. and S. Trejo. 1997. Grain and Feed Annual. FAS Attache Report. AGR Number: MX7021. American Embassy, Mexico City, Mexico. March 20, 1997.

Juárez, B. and D. Flores. 1997. Mexican Poultry Production Improves. FAS Attache Report. AGR Number: MX7014. American Embassy, Mexico City, Mexico. January 2, 1997.

Juárez, B., D.Flores, and S. Trejo. 1996. 1996 Mexico Agricultural Situation and Outlook. FAS Attache Report. AGR Number: MX6139. American Embassy, Mexico City, Mexico. May 10, 1996.

Juárez, B., S. Trejo, and L. Stockard. 1997. Mexican Weekly Highlights and Hot Bites. FAS Attache Report. AGR Number: MX7062. American Embassy, Mexico City, Mexico. July 3, 1997.

Kahneman, D. and A. Tversky. 1979. Prospect Theory: An Analysis of Decision Under Risk. Econometrica, 47(2):263-291.

Kalt, J. P. 1994. Precedent and Legal Argument in U.S. Trade Policy: Do They Matter to the Political Economy of the Lumber Dispute? Paper presented at the Political Economy of Trade Protection, National Bureau of economic Research, February 1994.

Kalt, J. P. And M. A. Zupan. 1984. Capture and Ideology in the Economic Theory of Politics. The American Economic Review. June 1984, 279-300.

Kataoka, S. 1963. A Stochastic Programming Model. Econometrica, 31:181-196.

Kelly, R. 1997. APHIS. Personal communication.

Kopp, R., A. Krupnick, and M. Toman. 1996. Cost-benefit Analysis and Regulatory Rreform. Resources for the Future, 4 pages.

Kravchuck, R.S. 1989. A Footnote to Cost-benefit Analysis Applied Under Conditions of Radical Ignorance. Public Studies Journal, 18(2):325-341.

Krissoff, B., L. Calvin, and D. Gray. 1997. Barriers to Trade in Global Apple Markets. Fruit and Tree Nuts Situation and Outlook, ERS/USDA, August 1997, pages 42-51.

Krupnick, A. J., M. A. Walls, and M. A Toman. 1990. The Cost-Effectiveness and Energy Security Benefits of Methanol Vehicles. Resources for the Future. Paper QE90-25, September 1990, 250 pages.

Lambert, C. 1995. Mexican Trade Data. National Cattlemen's Beef Association. November/December 1995.

Lambert, C. 1996. Mexican Trade Data. National Cattlemen's Beef Association. January/February 1996.

Larson, D. M., G. E. Helfand, and B. W. House. 1996. Second-Best Tax Policies to Reduce Nonpoint Source Pollution. American Journal of Agricultural Economics, 78:1108-1117.

Lave, L. 1981. The Strategy of Social Regulation: Decision Frameworks for Policy. Washington D.C.: Brookings Institution.

Ley Federal de Sanidad Animal, 1993, Title II, Article 13

Ley Federal de Sanidad Vegetal, 1994, Title II, Article 20.

Ley Federal de Procedimientos Administrativos, 1994. Title II, Article 4.

Lichtenberg, E., D. D. Parker, and D. Zilberman. 1988. Marginal Analysis of Welfare Costs of Environmental Policies: The Case of Pesticide Regulation. American Journal of Agricultural Economics, 70:867-874.

Lichtenberg, E., D. Zilberman, and K. Bogen. 1989. Regulating Environmental Health Risks under Uncertainty: Groundwater Contamination in California. Journal of Environmental Economics and Management, 17:22-34.

Lindner, R. K., and F. G. Jarrett. 1978. Supply Shifts and the Size of Research Benefits. American Journal of Agricultural Economics, 60:48-58.

Lindner, R. K., and F. G. Jarrett. 1980. Supply Shifts and the Size of Research Benefits: Reply. American Journal of Agricultural Economics, 62:841-844.

Loomes, G. and R. Sugden. 1982. Regret Theory: An Alternative Theory of Rational Choice under Uncertainty. Economic Journal, 92:805-824.

Lutter, R. and J. F. Morrall III. 1994. Health-Health Analysis: A New Way to Evaluate Health and Safety Regulations. Journal of Risk and Uncertainty, 8:43-66.

MacLaren, D. 1997. Uncertainty Aversion and Technical Barriers to Trade: An Australian Example. in: Understanding Technical Barriers to Trade. David Orden and Donna Roberts, eds. The International Agricultural Trade Research Consortium, 255-272.

Martínez, M. A. 1997. Embassy of Mexico to the United States. Deputy Agricultural Counselor. Personal communication.

McCubbins, M. D., R. G. Noll, and B. R. Weingast. 1987. Administrative Procedures as Instruments of Political Control. Journal of Law, Economics, and Organization. 3(2):243-277.

McGhan, W. F., and N. J. Lewis. 1992. Guidelines for Pharmacoeconomic Studies. Clinical Therapy, 14(3):486-494.

Meier, C. E., and A. Randall. 1991. Use Value Under Uncertainty: Is There a "Correct" Measure? Land Economics, 67(4):379-389.

Meier, K. J. 1985. Regulation: Politics, Bureaucracy, and Economics. St. Martin's Press. New York.

Mendelsohn, R. and W. J. Strang. 1984. Cost-benefit Analysis Under Uncertainty: Comment. American Economic Review, 74:1096-1100.

Merril, R. 1988. FDA's implementation of the Delaney Clause: Repudiation of Congressional Choice or Reasoned Adaption to Scientific Progress? Yale Journal of Regulation, 5(1), Winter 1988:1-88.

Miller, G. Y., J. M. Rosenblatt, and L. J. Hushak. 1988. The Effects of Supply Shifts on Producer's Surplus. American Journal of Agricultural Economics, 70:886-891.

Miller, C. E., A. S. Green, V. Harabin, and R. D. Stewart. 1995. A System Approach for Mexican Avocado. Risk Management Analysis. APHIS/USDA., May 1995, 27 pages.

Mitchell, A. 1996. Update and Evaluation of Australian Guidelines. Government Perspective. Medical Care. 34(12):DS216-DS225

Mitnick, B. 1975. The Theory of Agency: The Policy 'Paradox' and regulatory Behavior. Public Choice. 24:27-47.

Mitnick, B. 1980. Political Economy of Regulation. New York: Columbia University Press.

Moe, T. 1984. The New Economics of Organization. American Journal of Political Science. 28:739-777.

Moscardi, E., and A. de Janvry. 1977. Attitudes Toward Risk Among Peasants: An Econometric Approach, American Journal of Agricultural Economics, 59:710-716.

NCA - National Cattlemen's Association. 1997. Joint Declaration. U.S. National Cattlemen's Association (NCA). Mexican National Livestock Association (CNG). NCA Press Release. January 17, 1996. 1 page.

National Pork Board. 1996. U.S. Now World's Second Biggest Pork Export. News Release. December 11, 1996. 1 page.

Nelson, F. J., M. V. Simone, and C. M. Valdes. 1995. Comparison of Agricultural Support in Canada, Mexico, and the United States. Agriculture Information Bulletin Number 719. ERS/USDA. September 1995. 44 pages.

Nyrop, J. P. 1995. A Critique of the Risk Management Analysis for Importation of Avocados From Mexico. Document prepared under contract by the Florida Avocado and Lime Committee, to be presented at the Washington D.C. public hearing on APHIS rule on Mexican avocados. 26 pages.

Office of the United States Trade Representative. 1995. National Trade Estimate. Mexico. Executive Office of the President. Washington, D.C.

Office of the United States Trade Representative. 1996. 1996 National Trade Estimate Report on Foreign Trade Barriers. Executive Office of the President. Washington, D.C.

Olson, M. 1965. The Logic of Collective Action. Cambridge: Harvard University Press.

Orden, D. and E. Romano. 1996. The Avocado Dispute and Other Technical Barriers to Agricultural Trade Under NAFTA. Invited paper presented at the conference on NAFTA and Agriculture: Is the Experiment Working? San Antonio, Texas, November 1996.

Overton, B., J. Beghin, and W. Foster. 1995. Phytosanitary Regulation and Agricultural Flows: Tobacco Inputs and Cigarettes Outputs. Agricultural and Resource Economics Review, 221-231.

Osteen, C. 1994. Pesticide Regulation Issues: Living with the Delaney Clause. Journal of Agricultural and Applied Economics, (1):60-74.

Paarlberg, P. L., and J. G. Lee. 1997. Import Restrictions in the Presence of a Health Risk: An Illustration Using FMD. American Journal of Agricultural Economics, accepted.

Peltzman, S. 1976. Toward a More General Theory of Regulation. Journal of Law and Economics. 19:211-240.

Penar, P. L. 1996. Cost and Outcome Analysis. Neurosurgery Clinics of North America, 7(3):547-558.

Plummer, M. L. and R. C. Hartman. 1986. Option Value: A General Approach. Economic Inquiry, 24:455-472.

Plunkett, D. 1996, Mexico 2005. A Major Buyer of U.S. Agricultural Products. ERS-USDA. May 1996.

Pope, R. D. and J. P. Chavas. 1985. Producer Surplus and Risk. The Quarterly Journal of Economics, 100(Supp.):853-869.

Portney, P. R., and R. N. Stavins. 1994. Regulatory Review of Environmental Policy: The Potential Role of Health-Health Analysis. Journal of Risk and Uncertainty. 8:111-122.

Power, E. J. 1996. Current Efforts in Standards Development. United States. Medical Care, 34(12):DS200-DS203.

Pratt, J. W. 1964. Risk Aversion in the Small and the Large. Econometrica. 32:122-136.

Presidency of Mexico. 1995. Alianza Para el Campo. October 31, 1995.

Quiggin, J. 1982. A Theory of Anticipated Utility. Journal of Economic Behavior and Organization, 3:323-343.

Ramos, A., L. Llanos, F. Peña, and E. Santacruz. 1996. NAFTA's Regional Impact in Mexico Under the Context of Globalization. Agriculture in Soconusco. Chiapas. Presented at: NAFTA and Agriculture: Is the experiment Working? A Tri-National Research Symposium. San Antonio, TX, November 1-2, 1996.

Ready, R. C. 1993. The Choice of a Welfare Measure Under Uncertainty. American Journal of Agricultural Economics, 75:896-904.

Reagan, M. D. 1987. Regulation: the Politics of Policy. Boston: Little, Brown and Company.

Roberts, D. and D. Orden. 1997. Determinants of Technical Barriers to Trade: The Case of U.S. Phytosanitary Restrictions on Mexican Avocados, 1972-1995. in: Understanding Technical Barriers to Trade. David Orden and Donna Roberts, eds. The International Agricultural Trade Research Consortium, 117-160.

Roberts, D. and K. DeRemer. 1997. Overview of Foreign Technical Barriers to U.S. Agricultural Exports. ERS/USDA. taff Paper Number AGES-9705. March 1997. 26 pages.

Romano, E. 1995. The Political Economy of U.S. Phytosanitary Trade Restrictions: The Case of Nursery Stock and Ornamental Plants in Growing Media. M.S. Thesis. Department of Agricultural and Applied Economics. Virginia Polytechnic Institute and State University. Blacksburg. Virginia.

Romano, E. and D. Orden. 1997. The Political Economy of U.S. Import Restrictions on Nursery Stock and Ornamental Plants in Growing Media. in: Understanding Technical Barriers to Trade. David Orden and Donna Roberts, eds. The International Agricultural Trade Research Consortium, 99-116.

Rose-Ackerman, S. 1992. Rethinking the Progressive Agenda. The Reform of the American Regulatory State. Macmillan.

Rourke, F. E. 1984. Bureaucracy, Politics, and Public Policy. Boston: Little, Brown, and Company. Third Edition.

Roy, A. D. 1952. Safety First and the Holding of Assets. Econometrica, 20:431-449.

Rovira, J. 1996. Standardization of the Economic Evaluation of Health Technologies. European Developments. Medical Care, 34(12):DS182-DS188.

Russell. 1997. Mexican feed lot lobbying support (page 50)

Sachs, J., A. Tornell, and A. Velasco. 1995. The Real Story. The International Economy. March/April 1995.

SAGAR. 1991. Manual de Procedimientos Administrativos Para la Importacion y Exportacion de Productos Agropecuarios, Forestales y Agroquimicos. Diario Oficial. May 10, 1991.

Sagoff, M. 1996. On the Value of Endangered and Other Species. Environmental Management. 20(6):897-911.

Sallyards, M. 1995. Cotton Update. FAS Attache Report. AGR Number: MX4072. American Embassy, Mexico City, Mexico. Octubre 17, 1994.

Sallyards, M. 1997. FAS. personal communication

Savage, L. J. 1954. The Foundations of Statistics. Wiley, eds. New York.

Schmalensee, R. 1972. Option Demand and Consumer's Surplus: Valuing Price Changes Under Uncertainty. American Economic Review, 62:813-824.

Schulman, K. A., T. Ilana, and R. Yabroff. 1996. Economic Assessment Within the Clinical Development Program. Medical Care. 34(12):DS89-DS95.

Schumock, G. T., P. D. Meek, P. A. Ploetz, L. C. Vermeulen, and the Publications Committee of the American College of Clinical Pharmacy. 1996. Economic Evaluations of Clinical Pharmacy Services: 1988-1995. Pharmacotherapy. 16(6):1188-1208.

SECOFI. 1997. Tratados de Libre Comercio en Vigor. Secretaria de Comercio y Finanzas de Mexico. SECOFI's website: http://www.secofi-ssnci.gob.mx/proceso.htm. One page.

Shackley, P. 1996. Economic Evaluation of Prenatal Diagnosis: A Methodological Review. Prenatal Diagnosis. 16:389-395.

Sheesley, D. 1997. APHIS-Trade Support Team. Personal communication

Shoemaker, P. J. H. 1991. Choices Involving Uncertain Probabilities. Tests of Generalized Utility Models. Journal of Economic Behavior and Organization, 16:295-317.

Skully, D. 1994. Introduction. in: Global Review of Agricultural Policies. Western Hemisphere. Donna Roberts and David Skully (eds.). Economic Research Service, USDA. Statistical Bulletin No. 892. Washington, D.C., page:1-3.

Stallworth, H. 1994. The Cost-benefit Paradigm for Environmental Protection: An Economist's Perspective on the Methodological, Theoretical, and Ethical Problems. U.S. Environmental Protection Agency. Office of Strategic Planning & Environmental Data. Regional and State Planning Branch. Internal Document. Six pages.

Stanton, G. 1997. Implications of the WTO Agreement on Sanitary and Phyto-sanitary Measures. In: Understanding Technical Barriers to Agricultural Trade. Proceedings of a Conference of the International Agricultural Trade Research Consortium. David Orden and Donna Roberts, eds., January 1997., 75-78.

Stigler, G. 1971. The Theory of Economic Regulation. 2 Bell Journal of Economics & Management Science. 3.

Stockard, L. J., D. Flores, B. Juárez, and S. Trejo. 1996. Mexican Weekly Highlights and Hot Bites (21). FAS Attache Report. AGR Number: MX6170. American Embassy, Mexico City, Mexico. December 19, 1996.

Stockard, L. J., S. Trejo, D. Flores, and B. Juárez. 1997. Mexican Weekly Highlights and Hot Bites. FAS Attache Report. AGR Number: MX7622. American Embassy, Mexico City, Mexico. May 15, 1997.

Sumner, D. A., and H. Lee. 1997. Sanitary and Phytosanitary Trade Barriers and Empirical Trade Modelling. in: Understanding Technical Barriers to Trade. David Orden and Donna Roberts, eds. The International Agricultural Trade Research Consortium, 273-285.

Sunding, D. L. 1996. Measuring the Marginal Cost of Nonuniform Environmental Regulations. American Journal of Agricultural Economics, 78:1098-1107.

Swinnen, J. and F. A. van der Zee. 1983. The Political Economy of Agricultural Policies: a Survey. European Review of Agricultural Economics. 26:261.

Taylor, T. N., and E. A. Chrischilles. 1997. Economic Evaluation of Interventions in Endocrinology. Epidemiology and Clinical Decision Making. 26(1):67-87.

Telser, L. G. 1956. Safety First and Hedging. Review of Economic Studies, 23:1-16.

Texas Department of Agriculture. 1997. Federal Agreement Will Allow Texas to Ship Citrus to Mexico. Newsletter. Http://www.agr.state.tx.us/comm/mexcit.htm

Thiermann, A. 1997. Implementation of the WTO Agreement on Sanitary and Phytosanitary Measures: The U.S. Perspective. In: Understanding Technical Barriers to Agricultural Trade. Proceedings of a Conference of the International Agricultural Trade Research Consortium. David Orden and Donna Roberts, eds., January 1997., 63-68.

Thornsbury, S., D. Roberts, K. DeRemer, and D. Orden. 1997. A First Step in Understanding Technical Barriers to Agricultural Trade. Paper presented at the XXIII International Association of Agricultural Economists Meeting, Sacramento, CA, August 1997.

Tollison, R. D. 1991. Regulation and Interest Groups. In: Regulation, Economic Theory and History. Jack High ed. University of Michigan, 59:76.

Trejo, S. 1997. Mexican Hog Growers Against Imports. FAS Attache Report. AGR Number: MX6169. American Embassy, Mexico City, Mexico. December 17, 1996.

Trejo, S., B. Juárez, and D. Flores. 1997. Mexican Weekly Highlights and Hot Bites OCT/5. FAS Attache Report. AGR Number: MX7109. American Embassy, Mexico City, Mexico. October 30, 1997.

Udvarhelyi, I. S., G.A. Colditz, A. Rai, and A. Epstein. 1992. Cost-Effectiveness and Cost-benefit Analyses in the Medical Literature. Are the Methods Being Used Correctly? Annals of Internal Medicine, 116:238-244.

Urbanchuk, J. M. 1995. Economic Incentive to Transship Imported Mexican Avocados From Restricted Northern Markets. Document prepared for the California Avocado Commission, October 10, 1995. 12 pages.

Valdes, C. M. 1994a. Mexico. In: Estimates of Producer and Consumer Subsidy Equivalents. Government Intervention in Agriculture, 1982-92. Donna Roberts and Martin Johnson, eds. USDA-ERS. Washington, DC., page:221-240.

Valdes, C. M. 1994b. Mexico. in: Global Review of Agricultural Policies. Western Hemisphere. Donna Roberts and David Skully (eds.). Economic Research Service, USDA. Statistical Bulletin No. 892. Washington, D.C., page:58-62.

van Houtven G.L. and M.L. Cropper. 1996. When Is a Life Too Costly to Save? The Evidence from U.S. Environmental Regulations. Journal of Environmental Economics and Management, 30(3):348-368.

Viscusi, W. K. 1992. Fatal Tradeoffs. Public and Private Responsibilities for Risk. New York: Oxford University Press.

Viscusi, W. K. 1994. The Misspecified Agenda: The 1980s Reforms of Health, Safety, and Environmental Regulation. in: American Economic Policy in the 1980s. Martin Feldstein, ed. Chicago: The University of Chicago Press. Chapter 7. 453-504.

Von Neumann, J. and O. Morgensten. 1947. Theory of Games and Economic Behavior. Princeton University Press.

Warner, G. 1995. Mexican Export Protocol Means Added Costs. Good Fruit Grower, http://www.goodfruit.com/archive/1995/38other.html.

Webber, E. U. and B. Kirsner. 1997. Reasons for Rank-Dependent Utility Evaluation. Journal of Risk and Uncertainty, 14:41-61.

Weingast, B. R. 1981. Regulation, Reregulation, and Deregulation: The Political Foundations of Agency Clientele Relationships. Law and Contemporary Problems. 44(1):147.

Weisbrod, B. A. 1964. Collective Consumption Services of Individual Consumption Goods. Quarterly Journal of Economics, 78:471-477.

Wilson, J. Q. 1984. The Origins of Regulation. in: Federal Administrative Agencies: Essays on Power and Politics. Englewood Cliffs: Prentice-Hall. 124-143.

World Bank. 1994a. World Bank Relations With Mexico. Precis. Issue Number 71. June 1994.

World Bank. 1994b. Poverty, Deregulation, and Microfirms. Part II: The Case of Mexico. HCO Dissemination Notes. Human Capital Development and Operations Policy, The World Bank. Number 39. December 12, 1994.

World Bank. 1996. Agricultural Adjustment and Food Policy Reform in Mexico. Precis. Issue Number 117. June 1996.

Zertuche, C. 1994. Border Procedures for Exporting Product to Mexico. FAS Attache Report. AGR Number: MX4515. American Embassy, Mexico City, Mexico. October 28, 1994.

Zertuche, C. 1995a. The Mexican Market for Genetic Products. FAS Attache Report. AGR Number: MX5551. American Embassy, Mexico City, Mexico. August 22, 1995.

Zertuche, C. 1995b. The Mexican Market for Pork Products . FAS Attache Report. AGR Number: MX5552. American Embassy, Mexico City, Mexico. August 23, 1995.

Zertuche, C. 1995c. The Mexican Report for Christmas Trees Products . FAS Attache Report. AGR Number: MX5516. American Embassy, Mexico City, Mexico. July 27, 1995.

Zertuche, C. 1995d. The Mexican Market for Stone Fruit Products . FAS Attache Report. AGR Number: MX5548. American Embassy, Mexico City, Mexico. August 25, 1995.

Zertuche, C. 1995e. The Mexican Report for Apple and Pear Products . FAS Attache Report. AGR Number: MX5506. American Embassy, Mexico City, Mexico. July 20, 1995.

Zertuche, C. 1996. Mexican Weekly Highlights and Hot Bites (10) . FAS Attache Report. AGR Number: MX6527. American Embassy, Mexico City, Mexico. November 29, 1996.

Zinke, R. C. 1987. Cost-benefit Analysis and Administrative Legitimation. Public Studies Journal, 16(1):63-88.

# APPENDICES

# Appendix A1.

NOM-EMs, Proposed NOM, and Final NOMs published by DIGSA, DIGSV, and DIGF

from 1993 to October 1997

## Appendix 1a: Mexican SPS regulations published in the *Diario Oficial* by DIGSA (1993-1997)*

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Campaña Nacional contra la varroasis de las abejas (National Campaign Against Bee's Verroases) | | NOM-001-ZOO-1993 11/3/93 (4/11/94)<br>NOM-001-ZOO-1994 3/397 | NOM-001-ZOO-1994 4/28/94 |
| Actividades técnicas y operativas aplicables al programa nacional para el control de la abeja africana (National Campaign Against African Bees) | | NOM-002-ZOO-1993 11/3/93 (4/11/94) | NOM-002-ZOO-1994 4/28/94 |
| Criterios para la operación de laboratorios de pruebas aprobados en materia zoosanitaria. (Zoosanitary Tests Laboratories Operations Criteria) | | NOM-003-ZOO-1993 11/17/93 (3/20/94) | NOM-003-ZOO-1994 4/28/94 |
| Control de residuos toxicos en carne, grasa, higado, y rinion de bovinos, equinos, porcinos, y ovinos. (Toxid residues in animal fat, liver and muscle) | | NOM-008-ZOO-1993 1/26/94 (6/24/94) | NOM-004-ZOO-1994 8/11/94 (Amended: 10/25/96) |
| Campaña Nacional contra la Salmonela aviar (National Campaign against Avian Salmonellosis) | | NOM-004-ZOO-1993 1/21/94 (7/8/94) | NOM-005-ZOO-1993 9/1/94 (Amended: 2/10/95) |
| Requisitos de efectividad biologica para los ixodicidas de uso en bovinos y metodos de prueba (Lab Tests) | | NOM-011-ZOO-1993 2/22/94 (7/21/94) | NOM-006-ZOO-1993 9/21/94 |
| Campaña Nacional Contra la Enfermedad de Aujeszky. .Pseudorabies (National Campaign against Aujeszky's disease) | | NOM-006-ZOO-1993 1/20/94<br>NOM-007-ZOO-1994 2/6/95<br>11/6/95<br>NOM-007-ZOO-1997 8/27/97<br>(7/7/96) | NOM-007-ZOO-1994 9/19/94 (Amended: 6/12/95 8/15/96) |
| Especificaciones zoosanitarias para la construcción de equipamiento de establecimientos para sacrificio de animales y los dedicados a la industrialización de productos cárnicos (Instalations) | | NOM-010-ZOO-1994 2/5/94<br>NOM-010-ZOO-1997 2/6/96<br>(9/13/96) | NOM-008-ZOO-1994 11/16/94 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Proceso sanitario de la carne<br>(Processes for Meat Safety) | | NOM-009-ZOO-1994 3/7/94 (9/29/94) | NOM-009-ZOO-1994 11/16/94 |
| Determinación de cobre, plomo y cadmio en hígado, músculo y riñón de bovinos, equinos, porcinos, ovinos y aves por espectrometría de absorción atómica<br>(Lab Tests) | | NOM-015-ZOO-1994 9/7/94 | NOM-010-ZOO-1994 1/9/95 |
| Determinación de sulfonamidas en hígado y músculo de bovinos,ovinos, equinos, porcinos y aves por cromatografía capa fina-densitometria<br>(Lab Tests) | | NOM-016-ZOO-1994 9/7/94 (1/23/95) | NOM-011-ZOO-1994 2/28/95 |
| Especificaciones para la regulación de productos químicos, farmacéuticos, biológicos y alimenticios para uso en animales o consumo por estos<br>(Specifications for the Commercialization of Chemical Products) | | NOM-012-ZOO-1993 2/22/94 (11/10/94) | NOM-012-ZOO-1994 1/17/95 (Amended: 6/12/95) |
| Campaña Nacional contra la enfermedad del Newcastle<br>(National Campaign Against Newcastle) | NOM-EM-001-ZOO-1993 7/16/93, Established, 1/13/94, Extended | NOM-013-ZOO-1994 8/31/94 (1/23/95) | NOM-013-ZOO-1994 2/28/95 (Amended: 3/30/95) |
| Determinación de cloranfenicol en músculo de bovinos, equinos, porcinos, ovinos y aves por cromatografía de gases<br>(Lab Tests) | | NOM-019-ZOO-1994 9/30/94 (2/10/95) | NOM-014-ZOO-1994 3/17/95 |
| Análisis de arsénico en hígado, músculo y riñón de bovinos,equinos, porcinos, ovinos y aves por espectrometria de absorción atómica<br>(Lab Tests) | | NOM-018-ZOO-1994 9/30/94 (2/10/95) | NOM-015-ZOO-1994 3/8/95 |
| Análisis de mercurio en hígado, músculo y riñón de bovinos, equinos, porcinos, ovinos y aves, por espectrometría de absorción atómica<br>(Lab Tests) | | NOM-017-ZOO-1994 9/30/94 | NOM-016-ZOO-1994 3/9/95 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Análisis de bencimidazoles en hígado y músculo de bovinos,equinos, porcinos, ovinos y aves por cromatografía de líquidos alta resolución<br>(Lab Tests) | | NOM-021-ZOO-1994 11/10/94 (3/1/95) | NOM-017-ZOO-1994 3/27/95 |
| Médicos Veterinarios Aprobados como unidades de verificación facultados para prestar servicios oficiales en materia zoosanitaria<br>(Accredited veterinarians at verification units authorized to provide official services in zoosanitary matters) | | NOM-014-ZOO-1994 7/4/94 (3/24/95) | NOM-018-ZOO-1994 3/26/95 |
| Campaña Nacional contra la garrapata Boophilus spp (National campaign against ticks of genus Boophilus spp.) | NOM-EM-004-ZOO-1994 7/14/94, Established 1/13/95, Extended | NOM-020-ZOO-1994 11/10/94 (3/30/95) | NOM-019-ZOO-1994 5/19/95 |
| Determinación de ivermectinas en hígado de bovinos, equinos, porcinos, ovinos y aves por cromatografía de líquidos alta resolución<br>(Lab Tests) | | NOM-024-ZOO-1994 1/5/95 | NOM-020-ZOO-1995 5/22/95 |
| Análisis de residuos de plaguicidas organoclorados y bifenilos policlorados en grasa de bovinos, equinos, porcinos, ovinos y aves por cromatografía de gases<br>(Lab Tests) | | NOM-023ZOO-1994 1/3/95 | NOM-021-ZOO-1994 5/23/95 |
| Características y especificaciones zoosanitarias para las instalaciones, equipo y operación de establecimientos que comercializan productos químicos, farmacéuticos, biológicos y alimenticios para uso en animales o consumo por estos<br>(Instalations) | | NOM-026-ZOO-1994 1/31/95 (11/23/95) | NOM-022-ZOO-1995 1/4/96 |
| Identificación de especie animal en músculo de bovinos, ovinos,equinos, porcinos y aves, por la prueba de inmunodifusión en gel<br>(Lab Tests) | | NOM-025-ZOO-1995 1/4/95 (7/26/95) | NOM-023-ZOO-1995 9/14/95 |

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Especificaciones y características zoosanitarias para el transporte de animales, sus productos y subproductos, productos químicos,farmacéuticos, biológicos y alimenticios para uso en animales o consumo por estos (Lab Tests) | NOM-EM-010-ZOO-1995 | 4/10/95, Established | NOM-022-ZOO-1994 | 1/3/95 (9/13/95) | NOM-024-ZOO-1995 | 10/16/95 |
| Características y especificaciones zoosanitarias para las instalaciones, equipo y operacion de establecimientos que fabriquen productos alimenticios para uso en animales o consumo por estos (Instalations) | | | NOM-028-ZOO-1994 | 2/1/95 (9/25/95) | NOM-025-ZOO-1995 | 10/16/95 |
| Características y especificaciones zoosnaitarias para las instalaciones, equipo y operación de establecimientos que fabriquen productos químicos, farmacéuticos y biológicos para uso en animales (Instalations) | | | NOM-027-ZOO-1994 | 1/31/95 (9/25/95) | NOM-026-ZOO-1995 | 11/27/95 |
| Proceso zoosanitario del semen de animales domesticos (Safety Requisites for Collecting Semen ) | | | NOM-032-ZOO-1995 | 6/14/95 (12/8/95) | NOM-027-ZOO-1995 | 1/11/96 |
| Determinación de residuos de plaguicidas organofosforados, en hígado y músculo de bovinos, equinos, porcinos, ovinos, caprinos,cérvidos y aves, por cromatografía de gases (Lab Tests) | | | NOM-034-ZOO-1995 | 6/22/95 (11/27/95) | NOM-028-ZOO-1995 | 1/24/96 |
| Características y especificaciones para las instalaciones y equipo de laboratorios de pruebas y/o análisis en materia zoosanitaria (Instalations) | | | NOM-029-ZOO-1994 | 1/24/95 (12/8/95) | NOM-029-ZOO-1995 | 2/14/96 |
| Especificaciones y procedimientos para la verificación de carne,canales, visceras y despojos de importación en puntos de verificación zoosanitaria (Specifications to verify fresh meat imports) | NOM-EM-003-SARH2-1994[2] NOM-EM-008-ZOO-1994 | 3/27/94, Established 11/28/94 Established 7/5/95 Extended | NOM-030-ZOO-1994 | 3/1/95 (8/21/95) | NOM-030-ZOO-1995 | 4/17/96 |
| Campaña Nacional contra la tuberculosis bovina (National campaign against tuberculosis bovine-Mycobacterium boris) | NOM-EM-002-SARH-1994 | 3/18/94, Established 9/20/94, Extemded | NOM-031-ZOO-1995 NOM-031-ZOO-1995 | 4/28/95 1/8/96 (/27/97) | NOM-031-ZOO-1995 | 3/8/96 |

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Determinación de los antibióticos en hígado, músculo y riñon de bovinos, ovinos, equinos, porcinos, aves, caprinos y cervidos por laprueba de torunda y por bioensayo (Lab Tests) | | | NOM-035-ZOO-1995 | 9/13/95 | NOM-032-ZOO-1995 | 2/26/96 |
| Sacrificio humanitario de los animales domésticos y silvestres (Slaugther Procedures) | NOM-EM-009-ZOO-1994 | 12/22/94, Established, 2/7/95, Amended 4/24/95, Amended 7/4/95, Extemded | NOM-033-ZOO-1995 | 7/7/95 (5/22/96) | NOM-033-ZOO-1995 | 7/16/96 |
| Determinación de dietilestilbestrol, zeranol y taleranol en hígado y músculo de bovinos, equinos, porcinos, ovinos, aves, caprinos y cervidos, por cromatografía de gases - espectrometría de masas (Lab tests) | | | NOM-036-ZOO-1995 | 9/13/95 | NOM-034-ZOO-1995 | 2/27/96 |
| Requisitos mínimos para vacunas, antígenos y reactivos empleados en la prevención y control de la rabia en las especies domésticas (Requisites to approve the commercialization of medines against rabies ) | | | NOM-039-ZOO-1995 | 10/16/95 (4/15/96) | NOM-035-ZOO-1995 | 6/26/96 |
| Requisitos mínimos para las vacunas contra la Fiebre Porcina Clásica (Minimum requirements for classical swine fever-Hog cholera- vaccine) | | | NOM-043-ZOO-1995 | 11/29/95 | NOM-036-ZOO-1995 | 7/1/96 |
| Campaña Nacional Contra la Fiebre Porcina Clásica (National Campaign Against Hog Fever) | NOM-EM-012-ZOO-1994 | 1/25/95, Established 5/2/95, Amended, 7/20/95/ Extended | NOM-005-ZOO-1993<br>NOM-005-ZOO-1994<br>NOM-037-ZOO-1995 | 2/25/94<br>11/4/94<br>10/11/95<br>(8/26/96) | NOM-037-Z00-1995 | 10/29/96 |

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Requisitos minimos para las bacterinas empleadas en la prevención y control de la Leptospirosis bovina (Minimum requirements to be met in respect os bacterins used in the prevention and control of Bovine Leptospirosis) | | | NOM-038-ZOO-1995 | 9/28/95 (5/29/96) | NOM-038-ZOO-1995 | 8/5/96 |
| Especificaciones para la comercialización de sales puras antimicrobianas para uso en animales o consumo por estos (Specifications for the commercialization of salt) | | | NOM-040-ZOO-1995 | 10/10/95 (8/14/96) | NOM-040-ZOO-1995 | 10/4/96 |
| Campaña Nacional contra la Brucelosis en los Animales (National Campaign against Brucellosis) | NOM-EM-011-ZOO-1994 | 1/23/95, Established , 7/20/95, Extended | NOM-007-ZOO-1993<br>NOM-041-ZOO-1995 | 1/26/94<br>1/8/95 (1/1/96) | NOM-041-ZOO-1995 | 8/20/96 |
| Características y especificaciones zoosanitarias para las instalaciones, equipo y operación zoosanitaria para ganado bovino,equino, ovino y caprino (Zoosanitary characteristics and specifications for the facilities and equipment for bovine, equine, and goats) | NOM-EM-006-Z00-1994 | 10/26/94, Established 5/24/95, Extended | NOM-042-ZOO-1995 | 11/13/95 | NOM-042-ZOO-1995 | 3/7/97 |
| Requisitos minimos para las vacunas contra la fiebre porcina clasica (Minimum requirements to be met in respect os vaccines, used against swine fever-hog cholera classic) | | | NOM-043-ZOO-1995 | 11/29/95 | NOM-043-ZOO-1995 | 10/29/96 |
| Campaña Nacional Contra la Influenza aviar (National Campaign against Avian influenza) | NOM-EM-005-ZOO-1994 | 8/3/94, Established 1/3/95 Amended, 2/1/95, Extended | NOM-044-ZOO-1995 | 1/3/96 (7/25/96) | NOM-044-ZOO-1995 | 8/14/96 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Características zoosanitarias para la operación de establecimientos donde se concentren animales para ferias, exposiciones, subastas,tianguis y eventos similares (Zoosanitary characteristics for the facilities used in animal shows) | NOM-EM-007-ZOO-1994 11/28/94, Established 7/5/95 Amended, and Extended | NOM-045-ZOO-1995 12/1/95 (5/29/96) | NOM-045-ZOO-1995 8/5/96 |
| Sistema Nacional de Vigilancia Epizootiológica (National System for Epizootiology Surveillance) | | NOM-046-ZOO-1995 12/6/95 | NOM-046-ZOO-1995 2/19/97 |
| Requisitos mínimos para las vacunas, bacterinas y antígenos empleados en la prevención y control de la Salmonelosis aviar (Minimum requirements to be met in respect os vaccines, bacterins and antigens used in the prevention and control of Avian Salmonellosis) | | NOM-047-ZOO-1995 2/15/96 | NOM-047-ZOO-1995 3/11/97 |
| Requisitos mínimos para las vacunas contra la enfermedad de Aujeszky (Minimum requirements to be met in respect os the substance active in vaccines and vaccine against Aujesky's Disease). | | NOM-048-ZOO-1996 2/6/96 | NOM-048-ZOO-1995 3/12/97 |
| Requisitos mínimos para bacterinas empleadas en la prevención y control de la pasteurelosis neumónica bovina producida por Pasteurella multocida serotipos A y D (Minimum requirements for Bacterins use to prevent and control Bovine Pneumonic Pasteurellosis caused by Pasteurella Multocida, seotypes A and D) | | NOM-049-ZOO-1995 2/28/96 | NOM-049-ZOO-1995 3/3/97 |
| Características y especificaciones zoosanitarias para las instalaciones, equipo y operación de las unidades de producción controlada para ganado bovino (Zoosanitary characteristics and specifications for the facilities, equipment, and functions of the controlled production units (UPC) for bovine) | | NOM-050-ZOO-1995 1/1/96 | NOM-050-ZOO-1995 3/17/97 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Trato humanitario en la movilizacion de animales (Procedures to be used in Moving Animals) | | NOM-051-ZOO-1995 10/31/96 | NOM-051-ZOO-1995 |
| Requisitos mínimos para las vacunas empleadas en la prevención y control de la enfermedad de Newcastle (Minimum requirements for the preparation of vaccines used in the prevention and control of Newcastle Disease). | | NOM-052-ZOO-1995 10/17/96 (3/10/97) | NOM-052-ZOO-1995 |
| Requisitos mínimos para las vacunas empleadas en la prevención y control de la aftosa (Minimum requirements for vaccines, antigens, and reagents used in the prevention and control of Foot and Mouth Disease). | | NOM-053-ZOO-1995 11/16/96 | NOM-053-ZOO-1995 |
| Tratamiento, transporte, movilizacion, uso, almacenamiento y comercializacion de la gallinaza y pollinaza (Procedure for the treatment, transport, handling, use, storage, and marketing of hens and chicken in order to reduce the risk of pests and diseases) | NOM-EM-013-ZOO-1996 3/20/96, Established | NOM-054-ZOO-1995 3/10/97 | |

## Appendix 1b: Mexican SPS regulations published in the *Diario Oficial* by DIGSV (1993-1997)*

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Campaña contra el carbón parcial del trigo (Phytosanitary campaign against Karnal Bunt -Tilletia indica) | NOM-EM-001-FITO-1994 8/25/94, Established 2/23/95, Extended, 5/24/95, Amended | NOM-001-FITO-1995 8/4/95 (10/21/96) | NOM-001-FITO-1995 12/16/96 |
| Campaña contra la Broca del café (Campaign against coffee's diseases) | NOM-EM-002-FITO-1994 8/25/94, Established 2/23/95, Extended | NOM-002-FITO-1995 8/22/95 (8/30/96) | NOM-002-FITO-1995 1/8/97 |
| Campaña contra el amarillamiento letal del cocotero (Campaign against coconuts' diseases) | NOM-EM-003-FITO-1994 8/26/94, Established 11/4/94, Amended 2/23/95, Extended, | NOM-003-FITO-1995 7/28/95 (8/28/96) | NOM-003-FITO-1995 1/8/97 |
| Requisitos fitisanitarios para la movilizacion de frutos citricos para exportacion y mercado nacional (Interstate movement of citrus fruit) | NOM-EM-004-FITO-1994 8/26/94, Established 2/23/95, Extended, 4/13/95, Amended | NOM-004-FITO-1995 7/28/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The contents of this norm are now included in NOM-075-FITO-1997. |
| Cuarentena exterior para prevenir la introducción y diseminacion del gorgojo Khapra (Exterior quarantine to prevent the introduction of Khapra weevil) | NOM-EM-005-FITO-1994 10/27/94, Established 4/27/95, Extended | NOM-005-FITO-1995 8/2/95 (3/22/96) | NOM-005-FITO-1995 7/4/96 |

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Requisitos generales aplicables a situaciones generales que deberan cumplir los vegetales, sus productos y subproductos que se pretendan importar cuando éstos no esten establecidos en una norma oficial específica (General requirements for the importation of vegetables, vegetable products, and sub-products not regulated in a specific norm) | NOM-EM-006-FITO-1994 | 10/27/94, Established 4/27/95, Extended | NOM-006-FITO-1995 | 8/2/95 (1/30/96) | NOM-006-FITO-1995 | 2/26/96 |
| Requisitos fitosanitarios para la importación de material propagativo (Importation of Propagative Material) | NOM-EM-007-FITO-1994 | 10/24/94, Established 4/24/95, Extended | NOM-007-FITO-1995 | 8/11/95 | | |
| Requisitos fitosanitarios para la importacion de frutas y hortalizas para consumo humano (Phytosanitary requirements for the importation of fruits and vegetables for human consumption) | NOM-EM-008-FITO-1994 | 10/6/94, Established 4/5/95, Extended and Amended | NOM-008-FITO-1995 | 8/14/95 (3/25/96) | NOM-008-FITO-1995 | 7/8/96 |
| Requisitos fitosanitarios para la importacion de flor cortada y follaje fresco (Phytosanitary requirements and specifications for the importation of fresh flowers and foliage) | NOM-EM-009-FITO-1994 | 10/7/94, Established 4/6/95, Extended and Amended | NOM-009-FITO-1995 | 8/16/95 (6/18/96) | NOM-009-FITO-1995 | 9/18/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del platano (Exterior quarantine to prevent the introduction and propagation of banana diseases and pests) | NOM-EM-010-FITO-1994 | 10/12/94, Established 4/11/95, Extended | NOM-010-FITO-1995 | 8/23/95 (8/5/96) | NOM-010-FITO-1995 | 11/18/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas de los citricos (Exterior quarantine to prevent the introduction and propagation of Citrus Fruit diseases and pests) | NOM-EM-011-FITO-1994 | 10/12/94, Established 4/11/95, Extended | NOM-011-FITO-1995 | 8/28/95 (7/16/96) | NOM-011-FITO-1995 | 9/24/96 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas de la papa (Exterior quarantine to prevent the introduction and propagation of potatoes diseases and pest) | NOM-EM-012-FITO-1994 10/20/94, Established 4/13/95, Extended | NOM-012-FITO-1995 8/29/95 (1/29/96) | NOM-012-FITO-1995 2/13/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del arroz (Exterior quarantine to prevent the introduction and propagation of rice diseases and pests) | NOM-EM-013-FITO-1994 10/20/94 Established | NOM-013-FITO-1995 8/30/95 (9/4/96) | NOM-013-FITO-1995 12/2/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del algodonero (Exterior quarantine to prevent the introduction and propagation of cotton diseases and pests) | NOM-EM-014-FITO-1994 10/14/94, Established | NOM-014-FITO-1995 8/30/95 (10/7/96) | NOM-014-FITO-1995 12/21/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del cocotero (Exterior quarantine to prevent the introduction and propagation of cocconuts diseases and pests) | NOM-EM-015-FITO-1994 10/14/94, Established 4/13/95, Extended | NOM-015-FITO-1995 8/31/95 (10/30/96) | NOM-015-FITO-1995 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas de la Cania de azucar (Exterior quarantine to prevent the introduction and propagation of sugar cane diseases and pests) | NOM-EM-016-FITO-1994 10/17/94, Established , 4/13/95, Extended | NOM-016-FITO-1995 9/1/95 (9/6/96) | NOM-016-FITO-1995 12/2/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del trigo (Exterior quarantine to prevent the introduction and propagation of wheat diseases and pests) | NOM-EM-017-FITO-1994 10/21/94, Established 4/21/95, Amended and Extended | NOM-017-FITO-1995 9/1/95 (9/6/96) | NOM-017-FITO-1995 12/5/96 |
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del maiz (Exterior quarantine to prevent the introduction and propagation of corn diseases and pests) | NOM-EM-018-FITO-1994 10/21/94, Established 4/21/95, Amended and Extended | NOM-018-FITO-1995 9/1/95 (9/6/96) | NOM-018-FITO-1995 12/10/96 |

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Cuarentena exterior para prevenir la introduccion y diseminacion de plagas del cafeto (Exterior quarantine to prevent the introduction and propagation of coffee diseases and pest) | NOM-EM-019-FITO-1994 | 11/16/94, Established 4/29/95, Extended | NOM-019-FITO-1995 | 9/4/95 (9/6/96) | NOM-019-FITO-1995 | 12/10/96 |
| Campaña contra la mosquita blanca de la hoja plateada (Campaign agaisnt a banana disease) | NOM-EM-020-FITO-1994 | 11/17/94, Established | NOM-020-FITO-1995 | 9/8/95 | | |
| Campaña de prevencion y accion contra la plaga denominada Roya Blanca del Crisantemo (Exterior quarantine to prevent the introduction and propagation of chrysantemum diseases and pests) | NOM-EM-021-FITO-1994 | 10/25/94, Established 4/27/95, Extended | NOM-021-FITO-1995 | 9/11/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The comments received suggested there was no need for this regulation. | |
| Criterios para la aprobacion de personas morales interesadas en fungir como laboratorios de diagnostico fitosanitario y analisis de plaguicidas (Requeriment for Phytosanitary Technicians) | NOM-EM-022-FITO-1994 | 12/27/94, Established 7/26/95, Extended and Amended | NOM-022-FITO-1995 | 9/12/95 (9/25/96) | NOM-022-FITO-1995 | 1/2/97 |
| Campaña Nacional contra la mosca de la fruta (National Campaign against fruit fly) | NOM-EM-023-FITO-1995 | 7/24/95, Established 1/26/96, Extended | NOM-023-FITO-1995 | 9/6/95 | | |
| Requisitos y especificaciones necesarias para el establecimiento de zonas libres de moscas de las frutas (AreasFree of Fruit Flies) | NOM-EM-024-FITO-1995 | 7/25/95, Established 1/26/96, Extended | NOM-024-FITO-1995 | 9/6/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The contents of this norm are now included in NOM-023-FITO-1997. | |
| Establecimiento de zonas bajo proteccion de plagas de importancia cuarentenaria de la papa (Determination of Areas Protected against Potato Pests) | NOM-EM-025-FITO-1995 | 6/27/95, Established 1/8/96, Extended | NOM-025-FITO-1995 | 9/14/95 | | |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones necesarias para el control de plagas del algodon (Cotton Plant Pest Control) | NOM-EM-026-FITO-1995 8/23/95, Established 2/27/96, Extended | NOM-026-FITO-1995 9/8/95 (3/26/97) | |
| Campaña contra la Mosquita Blanca (Campaign against the white fly) | NOM-EM-027-FITO-1995 8/18/95, Established 2/27/96, Extended | NOM-027-FITO-1995 9/19/95 | |
| Requiaitos y especificaciones fitosanitarias para la importacion d granos y semillas excepto para siembra (Requirements for importation of grains, except seeds) | NOM-EM-028-FITO-1995 8/17/95, Established 2/22/96, Extended | NOM-028-FITO-1995 9/19/95 | |
| Requerimientos fitosanitarios y especificaciones para la importacion de semillas para siembra (Phytosanitary requirements and specifications for the importation of seeds) | | NOM-029-FITO-1995 9/20/95 | |
| Campaña contra la Sigatoka Negra del Platano (Campaign against Sigatoka) | | NOM-030-FITO-1995 9/20/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The comments received suggested there was no need for this regulation. |
| Campaña contra el virus Tristeza de los Citricos (Campaign against Citrus diseases) | NOM-EM-001-SARH1-1993 6/2/93, Established 2/24/94, Extended | NOM-031-FITO-1995 9/27/95 | |
| Requisitos y especificaciones fitosanitarios para la realización de estudios de efectividad biologica de plaguicidas agricolas y su dictamen tecnico (Pesticide Evaluation) | | NOM-032-FITO-1995 11/17/95 (10/22/96) | NOM-032-FITO-1995 1/8/97 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarias para el aviso de inicio de funcionamiento que deberan cumplir las personas fisicas o morales interesadas en comercializar plaguicidas agricolas (Requisites that individuals need to comply with to be allowed to Produce and Trade Pesticides) | | NOM-033-FITO-1995 9/27/95 (4/24/96) | NOM-033-FITO-1995 6/24/96 |
| Requisitos y especificaciones fitosanitarias para el aviso de inicio de funcionamiento que deberan cumplir las personas fisicas o morales interesadas en la fabricacion,formulacion, formulacion por maquila, formulacion y/o maquila e importacion de plaguicidas agricolas (Requisites to Produce and Trade Pesticides) | | NOM-034-FITO-1995 9/27/95 (4/24/96) | NOM-034-FITO-1995 6/24/96 |
| Requisitos y especificaciones fitosanitarias para la aprobacion de personas fisicas o morales interesadas en fungir como organismos de certificacion y/o unidades de verificacion (Phytosanitary requirements and specifications that individuals need to comply with to be certified as SAGAR Phyto-Sanitary Verification Officer) | | NOM-035-FITO-1995 11/29/95 (9/26/96) | NOM-035-FITO-1995 1/16/97 |
| Requisitos y especificaciones fitosanitarias para la aprobacion de personas fisicas o morales interesadas en fungir como laboratorio de diagnostico fitosanitario y analisis de plaguicidas (Phytosanitary requirements and specifications that individuals need to comply with to be allowed to install a phyto-sanitary laboratory) | | NOM-036-FITO-1995 10/5/95 (7/10/96) | NOM-036-FITO-1995 9/30/96 |
| Requisitos y especificaciones fitosanitarios del proceso de produccion y procesamiento de productos agricolas organicos (Phytosanitary requirements and specifications for the production of chemical products) | | NOM-037-FITO-1995 10/23/95 (1/20/97) | NOM-037-FITO-1995 4/23/97 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarios de los productos y subproductos vegetales que requieren del certificado fitosanitario para la movilizacion en el territorio nacional<br>(Phytosanitary requirements and specifications that plants and their parts have to comply with during transportation inside Mexico) | | NOM-038-FITO-1995 10/26/95 | |
| Requisitos y especificaciones para la proteccion fitosanitaria de la zona noreste<br>(Phytosanitary requirements and specifications for the protection of NE Mexico) | | NOM-039-FITO-1995 10/26/95 | |
| Cuarentena interior para el contol de plagas de la papa para consumo<br>(Domestic quarantine to control pests and diseases for potato destined to human consumption) | | NOM-040-FITO-1995 9/29/95 | |
| Requisitos y especificaciones fitosanitarios para la certificacion de semilla de papa<br>(Phytosanitary requirements and specifications for the importation and certification of potato seed) | | NOM-041-FITO-1995 1/3/96 | |
| Requisitos y especificaciones fitosanitarios para la importacion y movilizacion nacional de suelo<br>(Phytosanitary requirements and specifications for the importation and transportation of soil) | | NOM-042-FITO-1995 11/22/95 | |
| Requisitos y especificaciones fitosanitarios para la regulacion de malezas nocivas<br>(Phytosanitary requirements and specifications for the control of toxic weeds) | | NOM-043-FITO-1995 11/3/95 | |
| Requisitos y especificaciones fitosanitarios para la movilizacion de guayaba para exportacion y mercado nacional<br>(Phytosanitary requirements and specifications for the transportation of guayaba) | | NOM-045-FITO-1995 1/9/96 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The contents of this norm are now included in NOM-075-FITO-1997. |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarios para la movilizacion de mango para exportacion y mercado nacional<br>(Phytosanitary requirements and specifications for the transportation of mango) | | NOM-046-FITO-1995 1/10/96 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The contents of this norm are now included in NOM-075-FITO-1997. |
| Campaña contra la Roya del cafeto<br>(Campaign against coffee rust) | | NOM-047-FITO-1995 12/1/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. This norm was considered redundant, since the pests of concern are also covered by NOM-002-FITO-1997. |
| Campaña contra la Roya amarilla linear de la cebada<br>(Campaign against the Yellow Leaf Rust -Puccinia striiformis f. Sp. Hordei- of barley) | | NOM-048-FITO-1995 11/22/95 | |
| Campaña contra la langosta<br>(Campaign against grasshoper) | | NOM-049-FITO-1995 12/4/95 | |
| Requisitos y especificaciones fitosanitarios para efectuar ensayos de campo para el establecimiento de limites maximos de residuos de plaguicidas en productos agricolas (Phytosanitary requisites and specifications established to regulate field trials to establish maximum pesticide residues allowed in agricultural products) | | NOM-050-FITO-1995 12/4/95 (9/9/96) | NOM-050-FITO-1995 11/21/96 |
| Requisitos y especificaciones fitosanitarios para el manejo de plaguicidas agricolas restringidos<br>(Phytosanitary requisites and specifications established to regulate the application of restricted pesticides) | | NOM-051-FITO-1995 2/12/96 | |
| Requisitos y especificaciones fitosanitarios para presentar el aviso de inicio de funcionamiento por las personas fisicas y morales quese dediquen a la aplicacion area de plaguicidas<br>(Phytosanitary requisites and specifications required to announce that an individual or firm has been allowed to applypesticides) | | NOM-052-FITO-1995 8/26/96 (3/10/97) | NOM-052-FITO-1995 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarios para presentar el aviso de inicio de funcionamiento por las personas fisicas y morales quese dediquen a la difusion de publicidad de insumos fitosanitarios (Phytosanitary requisites and specifications required to announce that an individual or firm has been allowed to advertise pesticides) | | NOM-053-FITO-1995 2/14/96 (7/16/96) | NOM-053-FITO-1995 10/4/96 |
| | | NOM-054-FITO-1995 | |
| Requisitos y especificaciones fitosanitarios para emitir el dictamen de diagnostico fitosanitario (Phytosanitary requirements and specifications togive a phyto-sanitary opinion). | | NOM-055-FITO-1995 12/13/95 | |
| Requisitos y especificaciones fitosanitarias para la movilizacion e importacion de organismos manipulador por ingenieria genetica ( Phytosanitary requirements for the importation, domestic shipment, and establishment of field trials with organisms that have been manipulated by genetic engineering) | | NOM-056-FITO-1995 12/20/95 | NOM-056-FITO-1995 7/11/96 |
| Requisitos y especificaciones fitosanitarias para el analisis de residuos de plaguicidas (Phytosanitary requisites and specifications required to analyze pesticide residues) | | NOM-057-FITO-1995 1/22/96 | NOM-057-FITO-1995 7/30/96 |
| Requisitos y especificaciones fitosanitarias para la certificacion fitosanitaria de ajo en Mexico (Phytosanitary requirements and specifications for the certification of garlic in the country) | | NOM-058-FITO-1995 12/20/95 | The proposed rule was canceled (removed from publication as a final rule) on October 27, 1997. The comments received suggested there was no need for this regulation. |
| Especificaciones para la inspeccion y certificacion fitosanitaria para la exportacion de productos y subproductos agricolas (Phytosanitary requisites and specifications required for the inspection and certification of agricultural products for exportation) | | NOM-059-FITO-1995 1/15/96 | |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Aviso de inicio de funcionamiento de huertos, invernaderos, viveros, predios, empacadoras, industrializadoras, despepitadoras, centro de acopio y beneficiadoras; para vegeta, productos y subproductos sujetos a regulaciones fitosanitarias (Phytosanitary requisites and specifications required to announce that an individual or firm has been allowed to start a nursery, greenhouse, or storehouse) | | NOM-060-FITO-1995 1/15/96 | |
| Caracteristicas y especificaciones que deben reunir las estaciones cuarenenarias (Phytosanitary requisites and specifications for quarentine stations) | | NOM-061-FITO-1995 2/21/96 | |
| Requisitos y especificaciones fitosanitarios para la importacion de vegetales, sus productos y subproductos, por medio de correo o servicio de mendajeria (Phytosanitary requirements and specifications for the importation of vegetables, vegetable products and subproducts by mail or international carriers) | | NOM-062-FITO-1995 9/9/96 | |
| Cuarentena exterior para prevenir la introduccion y diseminacion del picudo del nogal (Exterior quarantine against a nuts disease) | | NOM-063-FITO-1995 | |
| Requisitos y especificaciones fitosanitarios para el transpore de vegetales productos y subproductos en transito internacional por territorio mexicano (Phytosanitary requirements and specifications for the transportation of international shipments of vegetable products and by-products through Mexico) | | NOM-064-FITO-1995 1/22/96 | |
| Curentena exterior para prevenir la introduccion de plagas del tabaco (Exterior quarantine to prevent the introduction of tobacco pests and diseases) | | NOM-065-FITO-1995 1/22/96 | |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarias para la movilizacion de frutos de aguacate para exportacion y mercado nacional (Phytosanitary requirements and specifications for the transporting of avocado for export and domestic markets) | | NOM-066-FITO-1995 9/13/95 (7/31/96) | NOM-066-FITO-1995 8/26/96 |
| Requisitos y especificaciones fitosanitarios para la produccion y certificacion de semilla hibrida de cocotero tolerante al amarillamiento letal (Phytosanitary requirements and specifications for the production and certification that cocconuts hybrid seeds are free of yellow disease) | | NOM-067-FITO-1995 2/20/96 | |
| Establecimiento de medidas fitosanitarias a fin de evitar la diseminacion del Moko del platano (Phytosanitary measures against a banana disease) | | NOM-068-FITO-1995 | |
| Establecimiento de areas libres de plagas (Establishment and recognition of areas free of pests and diseases) | | NOM-069-FITO-1995 11/14/96 | |
| Requisitos y especificaciones fitosanitarios para la importacion, introduccion, movilizacion y liberacion de agentes de control biologico (Phytosanitary requirements and specifications for the importation, introduction , transportation, and disemination of biological pest-control agents) | | NOM-070-FITO-1995 4/25/96 | |
| Requisitos y especificaciones fitosanitarios para la proteccion de agentes de control biologico en sitios de agregacion (Phytosanitary requirements and specifications for the protection of biological pest-control agents during storage) | | NOM-071-FITO-1995 1/18/96 | |
| Requisitos y especificaciones fitosanitarios para la importacion, introduccion, movilizacion y liberacion de agentes de control biologico de malezas (Phytosanitary requirements and specifications for the importation, introduction , transportation, and disemination of biological weed-control agents) | | NOM-072-FITO-1995 1/18/96 | |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Requisitos y especificaciones fitosanitarios para la utilizacion de la tecnica serologica ELISA en los laboratorios de diagnostico fitosanitario (Phytosanitary requirements and specifications for the realization of ELISA tests) | | NOM-073-FITO-1995 1/18/96 | |
| Establecimiento de caracteristicas de la instalacion y operacion de los puntos de verificacion interna en materia de sanidad vegetal (Phytosanitary requirements and specifications for the instalation and operation of phytosanitary verification ports inside Mexico) | | NOM-074-FITO-1995 1/22/96 | |
| Requisitos y especificaciones fitosanitarios para la movilizacion y de frutas consideradas potenciales huespedes de la mosca de la fruta (Phytosanitary requirements and regulations for transportation of fruits that are hosts to fruit fly)<br>NOTE: This regulation replaces NOMs: 004, 045, and 046, which were considered too similar. | NOM-EM-029-FITO-1996 12/12/96, Established | NOM-075-FITO-1995 1/9/97 | |

# Appendix 1c: Mexican SPS regulations published in the *Diario Oficial* by DIGF (1993-1997)*

| Issue | Emergency Rule | | Proposed Rule | | Final Rule | |
|---|---|---|---|---|---|---|
| Asignacion, uso y control de claves y medios de marqueo de la madera en rollo<br>(Procedures for Wood Measuerement) | NOM-EM-001-SARH3-1993 | 7/16/93, Established<br>1/22/94, Extended | NOM-001-SARH3-1994 | 7/12/94 | NOM-001-RECNAT-1995 | 3/17/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de resina de pino<br>(Requirements, criteria, and specifications for the harvesting, movilization, and storage of pine resins) | NOM-EM-001-SARH3-1994 | 2/16/94, Established<br>11/4/94 | NOM-002-SARH3-1994 | 7/12/94 | NOM-002-RECNAT-1996 | 5/30/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de tierra de monte<br>(Requirements, criteria, and specifications for the harvesting, movilization, and storage of soil) | NOM-EM-002-SARH3-1994 | 12/20/94, Established | NOM-003-SARH3-1994 | 1/12/95 | NOM-003-RECNAT-1996 | 6/5/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de raices y rizomas de vegetacion forestal<br>(Requirements, criteria, and specifications for the harvesting, movilization, and storage of roots) | NOM-EM-003-SARH3-1994 | 5/20/94, Established<br>11/4/94, Amended<br>12/9/94 | NOM-004-SARH3-1994 | 1/5/95 | NOM-004-RECNAT-1996 | 6/6/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de corteza, tallos, y plantas completas de vegetacion forestal<br>(Requirements, criteria, and specifications for the harvesting, movilization, and storage of trees and forest products) | NOM-EM-004-SARH3-1994 | 5/20/94, Established<br>12/9/94 | NOM-005-SARH3-1994 | 1/12/95<br>(12/16/96) | NOM-005-RECNAT-1997 | 5/20/97 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de hojas de palma de vegetacion forestal (Requirements, criteria, and specifications for the harvesting, movilization, and storage of palm leaves) | NOM-EM-005-SARH3-1994 5/20/94, Established 12/9/94 | NOM-006-SARH3-1994 1/13/95 (10/23/95) | NOM-006-RECNAT-1997 5/28/97 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de ramas, hojas o pencas, flores, frutos, y semillas de vegetacion forestal (Requirements, criteria, and specifications for the harvesting, movilization, and storage of fruits) | NOM-EM-006-SARH3-1994 4/13/94, Established 12/20/94 | NOM-007-SARH3-1994 1/13/95 (10/23/95) | NOM-007-RECNAT-1997 5/30/97 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de cogollos de vegetacion forestal para la obtencion de ixtles (Requirements, criteria, and specifications for the harvesting, movilization, and storage of plantings) | NOM-EM-007-SARH3-1994 6/24/94 Established 12/9/94 | NOM--008-SARH3-1994 1/13/95 | |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de latex de vegetacion forestal (Requirements, criteria, and specifications for the harvesting, movilization, and storage of latex) | NOM-EM-008-SARH3-1994 5/20/94, Established 12/9/94 | NOM-009-SARH3-1994 1/16/95 (10/23/95) | NOM-009-RECNAT-1996 6/26/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de hongos (Requirements, criteria, and specifications for the harvesting, movilization, and storage of fungui) | NOM-EM-009-SARH3-1994 5/20/94, Established , 6/20/94, Amended 12/9/94 | NOM-010-SARH3-1994 1/16/95 (10/23/95) | NOM-010-RECNAT-1996 5/28/96 |
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento, transporte, y almacenamiento de musgo, heno, y doradia (Requirements, criteria, and specifications for the harvesting, movilization, and storage of lichen) | NOM-EM-010-SARH3-1994 4/13/94, Established 12/20/94 | NOM-011-SARH3-1994 1/17/95 (10/23/95) | NOM-011-RECNAT-1996 6/26/96 |

| Issue | Emergency Rule | Proposed Rule | Final Rule |
|---|---|---|---|
| Procedimientos, criterios, y especificaciones para realizar el aprovechamiento de lenia para uso domiciliario (Requirements, criteria, and specifications for the harvesting, movilization, and storage of fire wood) | NOM-EM-011-SARH3-1994 4/13/94, Established | NOM-012-SARH3-1994 1/17/95 (10/23/95) | NOM-012-RECNAT-1996 6/26/96 |
| Procedimientos, criterios, y especificaciones que regulan sanitariamente la importacion de arboles de navidad de las especies Pinus sylvestris, Pseudotsuga menziesii, y del genero Abes (Requirements, criteria, and specifications to regulate the importation of Christmas trees, species Pinus sylvestris, and Pseudotsuga menziesii, and generus Abes) | NOM-EM-012-SARH3-1994 1/4/95, Established | NOM-013-RECNAT-1997 7/7/97 | |
| Procedimientos, criterios, y especificaciones que regulan sanitariamente la importacion de paletas (tarimas), paletas-cargas, otras plataformas para carga y diversos envases de madera nueva usada (Requirements, criteria, and specifications for the harvesting, movilization, and storage of pallets) | | NOM-014-RECNAT-1997 8/11/97 | |

* The only rules appearing in this Appendix are those published by DIGSA (NOM-ZOO), DIGSV (NOM-FIT), and DIGF (NOM-RECNAT). Technical measures like labeling or those affecting food safety are not included in this list. Rules appearing under the denomination NOM-SARH were enacted when SAGAR was still known as *Secretaria de Agricultura y Recursos Hidricos*.

Source: The Mexican *Diario Oficial*.

# Appendix A2

Estimated Welfare Impact of Alternative Regulations

# Appendix A2-1

Estimated Welfare Impact When Imports Are Prohibited After Infestation

## Table A2-1. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S1 and D1. Free Trade. Short Run

| | | Domestic Price * ($/Short ton) | Domestic Output (Short tons) | Domestic Consumption (Short tons) | Import Value ($) | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain ($) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total | Change | Total | Change | |
| Autarchy | | 1,416 | 128,406 | 128,406 | | 130,329,276 | | 159,120,090 | | |
| Free Trade (no risk) | | 878 | 116,223 | 222,723 | 93,507,000 | 221,930,370 | 91,601,094 | 93,314,846 | -65,805,244 | 25,795,850 |
| Free Trade (and risk) (60-20) | NM (π=1) | 1,718 | 96,226 | 96,226 | 0 | 96,625,087 | -33,704,189 | 148,635,901 | -10,484,189 | -44,188,378 |
| | Nm (π=.05) | 920 | 115,233 | 216,398 | 88,831,650 | 215,665,106 | 85,335,830 | 96,080,899 | -63,039,191 | 22,296,639 |
| | AM (π=.00345) | 881 | 116,154 | 222,287 | 93,184,401 | 221,498,067 | 91,168,791 | 93,505,704 | -65,614,386 | 25,554,404 |
| | Am (π=1.35E-06) | 878 | 116,223 | 222,273 | 93,506,874 | 221,930,201 | 91,600,925 | 93,314,921 | -65,805,169 | 25,795,756 |
| Free Trade (and risk) (40-10) | NM (π=1) | 1,583 | 109,407 | 109,407 | 0 | 110,546,999 | -19,782,277 | 154,927,660 | -4,192,430 | -23,974,707 |
| | Nm (π=.05) | 913 | 115,882 | 217,057 | 88,831,650 | 216,361,201 | 86,031,925 | 96,395,487 | -62,724,603 | 23,307,322 |
| | AM (π=.00345) | 880 | 116,199 | 222,332 | 93,184,401 | 221,546,097 | 91,216,821 | 95,527,410 | -63,592,680 | 25,624,142 |
| | Am (π=1.35E-06) | 878 | 116,223 | 222,723 | 93,506,874 | 221,930,220 | 91,600,944 | 93,314,929 | -65,805,161 | 25,795,783 |
| Free Trade (and risk) (20-0) | NM (π=1) | 1,457 | 123,451 | 123,451 | 0 | 125,204,976 | -5,124,300 | 159,800,091 | 680,001 | -4,444,299 |
| | NM (π=.05) | 907 | 116,584 | 217,759 | 88,831,650 | 217,094,100 | 86,764,824 | 96,639,108 | -62,480,982 | 24,283,843 |
| | AM (π=.00345) | 880 | 116,248 | 222,381 | 93,184,401 | 221,596,667 | 91,267,391 | 93,544,220 | -65,575,870 | 25,691,521 |
| | Am (π=1.35E-06) | 878 | 116,223 | 222,273 | 93,506,874 | 221,930,239 | 91,600,963 | 93,314,936 | -65,805,154 | 25,795,809 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Free Trade (and no risk) denotes imports are not harmful for the U.S. Free Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

# Table A2-2. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S1 and D1. Limited Trade. Short Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,416 | 128,406 | 128,406 | | 130,329,276 | | 159,120,090 | | |
| Limited Trade (no risk) | | 1,390 | 127,824 | 131,644 | 3,353,082 | 136,948,358 | 6,619,082 | 155,828,508 | -3,291,582 | 3,327,500 |
| Limited Trade (and risk) (60-20) | NM (π=1) | 1,718 | 96,226 | 96,226 | 0 | 96,625,087 | -33,704,189 | 148,635,901 | -10,484,189 | -44,188,378 |
| | Nm (π=.05) | 1,406 | 126,244 | 129,873 | 3,185,428 | 134,932,194 | 4,602,918 | 155,468,878 | -3,651,212 | 951,706 |
| | AM (π=.00345) | 1,391 | 127,715 | 131,522 | 3,341,514 | 136,809,243 | 6,479,967 | 155,803,694 | -3,316,396 | 3,163,571 |
| | Am (π=1.35E-06) | 1,390 | 127,824 | 131,644 | 3,353,082 | 136,948,304 | 6,619,028 | 155,828,498 | -3,291,592 | 3,327,436 |
| Limited Trade (and risk) (40-10) | NM (π=1) | 1,583 | 109,407 | 109,407 | 0 | 110,546,999 | -19,782,277 | 154,927,660 | -4,192,430 | -23,974,707 |
| | Nm (π=.05) | 1,400 | 126,903 | 130,532 | 3,185,428 | 135,628,290 | 5,299,014 | 155,783,466 | -3,336,624 | 1,962,390 |
| | AM (π=.00345) | 1,391 | 127,760 | 131,567 | 3,341,514 | 136,857,273 | 6,527,997 | 155,825,400 | -3,294,690 | 3,233,307 |
| | Am (π=1.35E-06) | 1,390 | 127,824 | 131,644 | 3,353,082 | 136,948,342 | 6,619,066 | 155,828,507 | -3,291,583 | 3,327,483 |
| Limited Trade (and risk) (20-0) | NM (π=1) | 1,457 | 123,451 | 123,451 | 0 | 125,204,976 | -5,124,300 | 159,800,091 | 680,001 | -4,444,299 |
| | NM (π=.05) | 1,393 | 127,605 | 131,234 | 3,185,428 | 136,361,189 | 6,031,913 | 156,027,087 | -3,093,003 | 2,938,910 |
| | AM (π=.00345) | 1,390 | 127,809 | 131,616 | 3,341,514 | 136,907,843 | 6,578,567 | 155,842,210 | -3,277,880 | 3,300,687 |
| | Am (π=1.35E-06) | 1,390 | 127,824 | 131,644 | 3,353,082 | 136,948,358 | 6,619,082 | 155,828,513 | -3,291,577 | 3,327,505 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

Table A2-3. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S1 and D2. Free Trade. Short Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,950 | 149,496 | 149,496 | | 189,071,119 | | 230,894,674 | | |
| Free Trade (no risk) | | 878 | 116,223 | 196,445 | 70,434,916 | 369,643,632 | 180,572,513 | 93,314,846 | -137,579,828 | 42,992,685 |
| Free Trade (and risk) (60-20) | NM (π=1) | 2,605 | 106,272 | 106,272 | 0 | 108,180,386 | -80,890,733 | 238,450,328 | 7,555,654 | -73,335,079 |
| | Nm (π=.05) | 964 | 115.725 | 191,936 | 184,914,745 | 356,570,470 | 167,499,351 | 100,571,620 | -130,323,054 | 37,176,297 |
| | AM (π=.00345) | 884 | 116,189 | 196,134 | 70,671,380 | 368,741,584 | 179,670,465 | 93,815,563 | -137,079,111 | 42,591,354 |
| | Am (π=1.35E-06) | 878 | 116,223 | 196,445 | 70,434,916 | 369,643,279 | 180,572,160 | 93,314,921 | -137,579,753 | 42,992,407 |
| Free Trade (and risk) (40-10) | NM (π=1) | 2,335 | 120,367 | 120,367 | 0 | 138,771,957 | -50,299,162 | 241,349,020 | 10,454,346 | -39,844,816 |
| | Nm (π=.05) | 951 | 116,430 | 192,641 | 72,476,661 | 358,100,048 | 169,028,929 | 100,716,555 | -130,178,119 | 38,850,810 |
| | AM (π=.00345) | 883 | 116,237 | 196,183 | 70,592,318 | 368,847,125 | 179,776,006 | 93,825,564 | -137,069,110 | 42,706,896 |
| | Am (π=1.35E-06) | 878 | 116,223 | 196,445 | 70,434,916 | 369,643,320 | 180,572,201 | 93,314,929 | -137,579,745 | 42,992,456 |
| Free Trade (and risk) (20-0) | NM (π=1) | 2,059 | 134,814 | 134,814 | 0 | 174,085,394 | -14,985,725 | 237,544,393 | 6,649,719 | -8,336,006 |
| | NM (π=.05) | 937 | 117,153 | 193,363 | 71,408,770 | 359,865,720 | 170,794,601 | 100,526,323 | -130,368,351 | 40,426,250 |
| | AM (π=.00345) | 882 | 116,287 | 196,232 | 70,511,490 | 368,968,956 | 179,897,837 | 93,812,438 | -137,082,236 | 42,815,601 |
| | Am (π=1.35E-06) | 878 | 116,223 | 196,445 | 70,434,916 | 369,643,368 | 180,572,249 | 93,314,936 | -137,579,738 | 42,992,511 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Free Trade (and no risk) denotes imports are not harmful for the U.S. Free Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

**Table A2-4. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S1 and D2. Limited Trade. Short Run**

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,950 | 149,496 | 149,496 | | 189,071,119 | | 230,894,674 | | |
| Limited Trade (no risk) | | 1,899 | 139,340 | 143,159 | 3,353,082 | 204,904,046 | 15,832,927 | 223,755,404 | -7,139,270 | 8,693,657 |
| Limited Trade (and risk) (60-20) | NM (π=1) | 2,605 | 106,272 | 106,272 | 0 | 108,180,386 | -80,890,733 | 238,450,328 | 7,555,654 | -73,335,079 |
| | Nm (π=.05) | 1,934 | 137,687 | 141,315 | 3,185,428 | 200,067,863 | 10,996,744 | 224,490,150 | -6,404,524 | 4,592,220 |
| | AM (π=.00345) | 1,901 | 139,226 | 143,032 | 3,341,514 | 204,570,349 | 15,499,230 | 223,806,101 | -7,088,573 | 8,410,657 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | 3,353,082 | 204,904,046 | 15,832,927 | 223,755,424 | -7,139,250 | 8,693,677 |
| Limited Trade (and risk) (40-10) | NM (π=1) | 2,335 | 120,367 | 120,367 | 0 | 138,771,957 | -50,299,162 | 241,349,020 | 10,454,346 | -39,844,816 |
| | Nm (π=.05) | 1,921 | 138,391 | 142,019 | 3,185,428 | 201,597,442 | 12,526,323 | 224,635,085 | -6,259,589 | 6,266,734 |
| | AM (π=.00345) | 1,901 | 139,275 | 143,080 | 3,341,514 | 204,675,890 | 15,604,771 | 223,816,102 | -7,078,572 | 8,526,199 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | 3,353,082 | 204,904,046 | 15,832,927 | 223,755,428 | -7,139,246 | 8,693,681 |
| Limited Trade (and risk) (20-0) | NM (π=1) | 2,059 | 134,814 | 134,814 | 0 | 174,085,394 | -14,985,725 | 237,544,393 | 6,649,719 | -8,336,006 |
| | NM (π=.05) | 1,907 | 139,114 | 142,742 | 3,185,428 | 203,363,113 | 14,291,994 | 224,444,853 | -6,449,821 | 7,842,173 |
| | AM (π=.00345) | 1,900 | 139,324 | 143,130 | 3,341,514 | 204,797,722 | 15,726,603 | 223,802,976 | -7,091,698 | 8,634,905 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | 3,353,082 | 204,904,046 | 15,832,927 | 223,755,423 | -7,139,251 | 8,693,676 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

## Table A2-5. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S2 and D1. Free Trade. Short Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,448 | 124,492 | 124,492 | | 126,278,165 | | 132,732,851 | | |
| Free Trade (no risk) | | 878 | 103,997 | 222,723 | 104,241,428 | 221,930,370 | 95,652,205 | 67,388,100 | -65,344,751 | 30,307,454 |
| Free Trade (and risk) (60-20) | NM (π=1) | 1,781 | 90,720 | 90,720 | 0 | 90,770,852 | -35,507,313 | 119,243,485 | -13,489,366 | -48,996,679 |
| | Nm (π=.05) | 964 | 103,333 | 220,873 | 99,029,357 | 215,372,394 | 89,094,229 | 69,980,869 | -62,751,982 | 26,342,247 |
| | AM (π=.00345) | 884 | 103,951 | 227,250 | 103,881,795 | 221,477,870 | 95,199,705 | 67,567,001 | -65,165,850 | 30,033,855 |
| | Am (π=1.35E-06) | 878 | 103,997 | 227,723 | 104,241,428 | 221,930,193 | 95,652,028 | 67,388,170 | -65,344,681 | 30,307,347 |
| Free Trade (and risk) (40-10) | NM (π=1) | 1,637 | 103,867 | 103,867 | 0 | 104,715,448 | -21,562,717 | 125,526,114 | -7,206,737 | -28,769,454 |
| | Nm (π=.05) | 916 | 103,991 | 221,530 | 99,029,357 | 216,069,624 | 89,791,459 | 70,295,001 | -62,437,850 | 27,353,609 |
| | AM (π=.00345) | 904 | 103,997 | 227,296 | 103,881,795 | 221,525,979 | 95,247,814 | 67,588,676 | -65,144,175 | 30,103,639 |
| | Am (π=1.35E-06) | 878 | 103,997 | 227,723 | 104,241,428 | 221,930,212 | 95,652,047 | 67,388,178 | -65,344,673 | 30,307,374 |
| Free Trade (and risk) (20-0) | NM (π=1) | 1,502 | 118,211 | 118,211 | 0 | 109,735,364 | -16,542,801 | 131,050,322 | -1,682,529 | -18,225,330 |
| | NM (π=.05) | 909 | 104,708 | 222,247 | 99,029,357 | 216,320,620 | 90,042,455 | 70,571,211 | -62,161,640 | 27,880,815 |
| | AM (π=.00345) | 900 | 104,046 | 227,345 | 103,881,795 | 221,543,297 | 95,265,132 | 67,607,735 | -65,125,116 | 30,140,016 |
| | Am (π=1.35E-06) | 878 | 103,997 | 227,723 | 104,241,428 | 221,930,219 | 95,652,054 | 67,388,186 | -65,344,665 | 30,307,389 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Free Trade (and no risk) denotes imports are not harmful for the U.S. Free Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

**Table A2-6. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S2 and D1. Limited Trade. Short Run**

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,448 | 124,492 | 124,492 | | 126,278,165 | | 132,732,851 | | |
| Limited Trade (no risk) | | 1,425 | 123,493 | 127,312 | 3,353,082 | 132,595,056 | 6,316,891 | 129,884,972 | -2,847,879 | 3,469,012 |
| Limited Trade (and risk) (60-20) | NM (π=1) | 1,781 | 90,720 | 90,720 | 0 | 90,770,852 | -35,507,313 | 119,243,485 | -13,489,366 | -48,996,679 |
| | Nm (π=.05) | 1,966 | 121,854 | 125,482 | 3,185,428 | 130,503,846 | 4,225,681 | 129,352,898 | -3,379,953 | 845,728 |
| | AM (π=.00345) | 1,955 | 123,380 | 127,186 | 3,341,514 | 132,450,762 | 6,172,597 | 129,848,259 | -2,884,592 | 3,288,005 |
| | Am (π=1.35E-06) | 1,425 | 123,493 | 127,312 | 3,353,082 | 132,595,000 | 6,316,835 | 129,884,958 | -2,847,893 | 3,468,942 |
| Limited Trade (and risk) (40-10) | NM (π=1) | 1,637 | 103,867 | 103,867 | 0 | 104,715,448 | -21,562,717 | 125,526,114 | -7,206,737 | -28,769,454 |
| | Nm (π=.05) | 1,436 | 122,512 | 126,140 | 3,185,428 | 131,201,076 | 4,922,911 | 129,667,029 | -3,065,822 | 1,857,089 |
| | AM (π=.00345) | 1,432 | 123,425 | 127,231 | 3,341,514 | 132,498,871 | 6,220,706 | 129,869,934 | -2,862,917 | 3,357,789 |
| | Am (π=1.35E-06) | 1,425 | 123,493 | 127,312 | 3,353,082 | 132,595,018 | 6,316,853 | 129,884,966 | -2,847,885 | 3,468,968 |
| Limited Trade (and risk) (20-0) | NM (π=1) | 1,502 | 118,211 | 118,211 | 0 | 109,735,364 | -16,542,801 | 131,050,322 | -1,682,529 | -18,225,330 |
| | NM (π=.05) | 1,938 | 123,229 | 126,857 | 3,185,428 | 131,452,071 | 5,173,906 | 129,943,240 | -2,789,611 | 2,384,295 |
| | AM (π=.00345) | 1,936 | 123,475 | 127,281 | 3,341,514 | 132,516,190 | 6,238,025 | 129,888,992 | -2,843,859 | 3,394,166 |
| | Am (π=1.35E-06) | 1,932 | 123,493 | 127,312 | 3,353,082 | 132,595,025 | 6,316,860 | 129,884,974 | -2,847,877 | 3,468,983 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

# Table A2-7. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S2 and D2. Free Trade. Short Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,982 | 138,836 | 138,836 | | 184,629,490 | | 203,049,288 | | |
| Free Trade (no risk) | | 878 | 103,997 | 196,445 | 81,169,344 | 369,643,632 | 185,014,142 | 67,388,100 | -135,661,188 | 49,352,954 |
| Free Trade (and risk) (60-20) | NM (π=1) | 2,646 | 104,161 | 104,161 | 0 | 103,925,755 | -80,703,735 | 203,403,084 | 353,796 | -80,349,939 |
| | Nm (π=.05) | 966 | 104,005 | 191,831 | 84,839,916 | 356,357,738 | 171,728,248 | 74,188,849 | -128,860,439 | 42,867,809 |
| | AM (π=.00345) | 884 | 103,998 | 196,127 | 81,442,036 | 368,726,905 | 184,097,415 | 67,857,352 | -135,191,936 | 48,905,479 |
| | Am (π=1.35E-06) | 878 | 103,997 | 196,445 | 81,169,344 | 369,643,273 | 185,013,783 | 67,388,284 | -135,661,004 | 49,352,779 |
| Free Trade (and risk) (40-10) | NM (π=1) | 2,376 | 118,261 | 118,261 | 0 | 133,963,151 | -50,666,339 | 207,360,593 | 4,311,305 | -46,355,034 |
| | Nm (π=.05) | 953 | 104,710 | 192,536 | 83,698,178 | 357,859,608 | 173,230,118 | 74,386,725 | -128,662,563 | 44,567,555 |
| | AM (π=.00345) | 883 | 104,046 | 196,175 | 81,349,907 | 368,830,534 | 184,201,044 | 67,871,005 | -135,178,283 | 49,022,761 |
| | Am (π=1.35E-06) | 878 | 103,997 | 196,445 | 81,169,344 | 369,643,314 | 185,013,824 | 67,388,289 | -135,660,999 | 49,352,825 |
| Free Trade (and risk) (20-0) | NM (π=1) | 2,097 | 132,788 | 132,788 | 0 | 168,894,803 | -15,734,687 | 205,559,407 | 2,510,119 | -13,224,568 |
| | NM (π=.05) | 939 | 105,437 | 193,262 | 82,467,675 | 359,606,191 | 174,976,701 | 74,296,665 | -128,752,623 | 46,224,078 |
| | AM (π=.00345) | 882 | 104,096 | 196,225 | 81,257,778 | 368,951,049 | 184,321,559 | 67,864,791 | -135,184,497 | 49,137,062 |
| | Am (π=1.35E-06) | 878 | 103,997 | 196,445 | 81,169,344 | 369,643,361 | 185,013,871 | 67,388,287 | -135,661,001 | 49,352,870 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Free Trade (and no risk) denotes imports are not harmful for the U.S. Free Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

# Table A2-8. Estimated Economic Impact if Mexican Imports are Prohibited After a pest infestation. S2 and D2. Limited Trade. Short Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Change | Total | Change | ($) |
| Autarchy | | 1,982 | 138,836 | 138,836 | | 184,629,490 | | 203,049,288 | | |
| Limited Trade (no risk) | | 1,932 | 137,599 | 141,418 | 3,353,082 | 194,907,682 | 10,278,192 | 196,188,747 | -6,860,541 | 3,417,651 |
| Limited Trade (and risk) (60-20) | NM (π=1) | 2,646 | 104,161 | 104,161 | 0 | 103,925,755 | -80,703,735 | 203,403,084 | 353,796 | -80,349,939 |
| | Nm (π=.05) | 1,968 | 135,927 | 139,555 | 3,185,428 | 190,358,586 | 5,729,096 | 196,549,464 | -6,499,824 | -770,728 |
| | AM (π=.00345) | 1,934 | 137,484 | 141,289 | 3,341,514 | 194,593,794 | 9,964,304 | 196,213,636 | -6,835,652 | 3,128,652 |
| | Am (π=1.35E-06) | 1,932 | 137,599 | 141,418 | 3,353,082 | 194,907,559 | 10,278,069 | 196,188,757 | -6,860,531 | 3,417,538 |
| Limited Trade (and risk) (40-10) | NM (π=1) | 2,376 | 118,261 | 118,261 | 0 | 133,963,151 | -50,666,339 | 207,360,593 | 4,311,305 | -46,355,034 |
| | Nm (π=.05) | 1,954 | 136,632 | 140,260 | 3,185,428 | 191,860,455 | 7,230,965 | 196,747,339 | -6,301,949 | 929,016 |
| | AM (π=.00345) | 1,934 | 137,532 | 141,338 | 3,341,514 | 194,697,423 | 10,067,933 | 196,227,290 | -6,821,998 | 3,245,935 |
| | Am (π=1.35E-06) | 1,932 | 137,599 | 141,418 | 3,353,082 | 194,907,600 | 10,278,110 | 196,188,762 | -6,860,526 | 3,417,584 |
| Limited Trade (and risk) (20-0) | NM (π=1) | 2,097 | 132,788 | 132,788 | 0 | 168,894,803 | -15,734,687 | 205,559,407 | 2,510,119 | -13,224,568 |
| | NM (π=.05) | 1,940 | 137,358 | 140,987 | 3,185,428 | 193,607,038 | 8,977,548 | 196,657,280 | -6,392,008 | 2,585,540 |
| | AM (π=.00345) | 1,933 | 137,582 | 141,388 | 3,341,514 | 194,817,938 | 10,188,448 | 196,221,076 | -6,828,212 | 3,360,236 |
| | Am (π=1.35E-06) | 1,932 | 137,599 | 141,418 | 3,353,082 | 194,907,647 | 10,278,157 | 196,188,760 | -6,860,528 | 3,417,629 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets.

## Appendix A2-2

Estimated Welfare Impact When Imports Are Not Prohibited After Infestation

# Table A2-9. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D1. Free Trade. Long Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Gain | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1385 | 132,340 | 132,430 | | 134,382,870 | | 91,636,967 | | | |
| Free Trade (no risk) | | 878 | 83,904 | 222,723 | 121,882,204 | 221,930,370 | 87,547,500 | 36,833,761 | 55,189,763 | 0 | 32,357,737 |
| Free Trade (and risk) (60-20) | NM ($\pi$=1) | " | 41,952 | " | 158,716,060 | " | " | 18,416,881 | " | 18,416,881 | 13,940,856 |
| | Nm ($\pi$=.05) | " | 79,905 | " | 125,393,326 | " | " | 35,079,772 | " | 1,753,990 | 30,603,747 |
| | AM ($\pi$=.00345) | " | 83,615 | " | 122,135,946 | " | " | 36,707,122 | " | 126,640 | 32,231,097 |
| | Am ($\pi$=1.35E-06) | " | 83,904 | " | 121,882,204 | " | " | 36,833,711 | " | 51 | 32,357,686 |
| Free Trade (and risk) (40-10) | NM ($\pi$=1) | " | 53,938 | " | 148,192,352 | " | " | 23,678,846 | " | 13,154,916 | 19,202,821 |
| | Nm ($\pi$=.05) | " | 81,636 | " | 123,873,508 | " | " | 35,838,254 | " | 995,500 | 31,362,237 |
| | AM ($\pi$=.00345) | " | 83,743 | " | 122,023,562 | " | " | 36,763,298 | " | 70,464 | 32,287,273 |
| | Am ($\pi$=1.35E-06) | " | 83,904 | " | 121,882,204 | " | " | 36,833,734 | " | 28 | 32,357,709 |
| Free Trade (and risk) (20-0) | NM ($\pi$=1) | " | 69,920 | " | 134,160,156 | " | " | 30,694,801 | " | 6,138,961 | 26,218,796 |
| | NM ($\pi$=.05) | " | 83,073 | " | 122,611,822 | " | " | 36,469,070 | " | 364,692 | 31,993,045 |
| | AM ($\pi$=.00345) | " | 83,846 | " | 121,933,128 | " | " | 36,808,363 | " | 25,399 | 32,332,338 |
| | Am ($\pi$=1.35E-06) | " | 83,904 | " | 121,882,204 | " | " | 36,833,751 | " | 11 | 32,357,726 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

# Table A2-10. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D1. Limited Trade. Long Run

| | | Domestic Price * | Domestic Output | Domestic Consumption | Import Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain (- impies loss) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ($/Short ton) | (Short tons) | (Short tons) | ($) | Total | Gain | Loss | Total | Gain | Loss | ($) |
| Autarchy | | 1385 | 132,340 | 132,340 | | 134,382,820 | | | 91,636,912 | | | |
| Limited Trade (no risk) | | 1368 | 130,725 | 134,544 | 3,353,082 | 139,048,901 | 4,666,081 | - | 89,412,656 | - | 2,224,256 | 2,441,825 |
| Limited Trade (and risk) (60-20) | NM (π=1) | 1795 | 85,753 | 89,572 | " | 91,946,755 | 2,408,488 | 44,844,553 | 76,951,094 | 31,132,088 | 45,817,906 | -57,121,883 |
| | Nm (π=.05) | 1396 | 127,071 | 130,890 | " | 135,297,116 | 2,408,488 | 1,494,192 | 88,708,792 | 1,434,495 | 4,362,615 | -2,013,824 |
| | AM (π=00345) | 1370 | 130,464 | 134,283 | " | 139,080,001 | 4,697,181 | - | 89,363,780 | - | 2,273,132 | 2,424,049 |
| | Am (π=1.35E-06) | 1368 | 130,725 | 134,544 | " | 139,048,901 | 4,666,081 | - | 89,412,535 | - | 2,224,377 | 2,441,704 |
| Limited Trade (and risk) (40-10) | NM (π=1) | 1634 | 100,385 | 104,204 | " | 107,478,698 | 2,408,488 | 29,312,610 | 82,017,567 | 23,107,417 | 32,726,762 | -36,523,467 |
| | Nm (π=.05) | 1384 | 128,663 | 132,482 | " | 136,934,286 | 2,551,466 | - | 89,020,949 | - | 2,615,963 | -64,497 |
| | AM (π=.00345) | 1369 | 130,580 | 134,399 | " | 138,901,044 | 4,518,224 | - | 89,385,222 | - | 2,251,690 | 2,266,534 |
| | Am (π=1.35E-06) | 1368 | 130,725 | 134,544 | " | 139,048,901 | 4,666,081 | - | 89,412,559 | - | 2,224,323 | 2,441,758 |
| Limited Trade (and risk) (20-0) | NM (π=1) | 1475 | 117,464 | 121,283 | " | 125,374,232 | 2,408,488 | 11,417,076 | 86,631,104 | 10,266,095 | 15,271,902 | -14,014,395 |
| | Nm (π=05) | 1374 | 129,973 | 133,792 | " | 138,279,296 | 3,896,476 | - | 89,271,005 | - | 2,365,907 | 1,530,569 |
| | AM (π=00345) | 1368 | 130,673 | 134,492 | " | 138,998,033 | 4,615,213 | - | 89,402,802 | - | 2,234,110 | 2,381,103 |
| | Am (π=1.35E-06) | 1368 | 130,725 | 134,544 | " | 139,048,901 | 4,666,081 | - | 89,412,632 | - | 2,224,280 | 2,418,801 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

**Table A2-11. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D2. Free Trade. Long Run**

| | | Domestic Price (\$/Short ton) | Domestic output (Short tons) | Domestic consumption (Short tons) | Import Value (\$) | Consumer Surplus (\$) | | Preoducer Surplus (\$) | | | Net Welfare Gain (\$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total | Gain | Total | Transfer to Consumers | Infestation Loss | |
| Autarchy | | 1640 | 156,688 | 156,688 | | 235,163,594 | | 128,455,753 | | | |
| Free Trade (no risk) | | 878 | 83,904 | 196,445 | 98,811,539 | 369,643,632 | 134,480,038 | 36,833,761 | 91,621,991 | 0 | 42,858,047 |
| Free Trade and risk) (60-20) | NM (π=1) | " | 41,952 | " | 135,644,854 | " | " | 18,416,881 | " | 18,416,881 | 24,441,166 |
| | Nm (π=.05) | " | 79,908 | " | 102,319,486 | " | " | 35,077,772 | " | 1,753,990 | 41,104,057 |
| | AM (π=.00345) | " | 83,615 | " | 99,064,818 | " | " | 36,707,122 | " | 126,640 | 42,731,407 |
| | Am (π=1.35E-06) | " | 83,904 | " | 98,811,638 | " | " | 36,833,761 | " | 1 | 42,858,046 |
| Free Trade and risk) (40-10) | NM (π=1) | " | 53,938 | " | 125,121,363 | " | " | 23,678,846 | " | 13,154,915 | 29,703,131 |
| | Nm (π=.05) | " | 81,636 | " | 100,802,553 | " | " | 35,838,254 | " | 995,508 | 41,862,539 |
| | AM (π=.00345) | " | 83,743 | " | 98,952,465 | " | " | 36,763,298 | " | 70,469 | 42,787,578 |
| | Am (π=1.35E-06) | " | 83,904 | " | 98,811,594 | " | " | 36,833,761 | " | 1 | 42,858,046 |
| Free Trade and risk) (20-0) | NM (π=1) | " | 69,920 | " | 111,089,459 | " | " | 30,694,081 | " | 6,139,681 | 36,718,366 |
| | NM (π=.05) | " | 83,073 | " | 99,540,920 | " | " | 36,469,070 | " | 364,692 | 42,493,355 |
| | AM (π=.00345) | " | 83,846 | " | 98,862,334 | " | " | 36,808,363 | " | 25,399 | 42,838,648 |
| | Am (π=1.35E-06) | " | 83,904 | " | 98,811,539 | " | " | 36,833,761 | " | 1 | 42,858,046 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

# Table A2-12. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D2. Limited Trade. Long Run

| | | Domestic Price* | Domestic output | Domestic consumption | Import Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain (- implies loss |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Loss | Total | Gain | Loss | ($) |
| Autarchy | | 1640 | 156,688 | 156,688 | - | 235,163,594 | | | 128,455,753 | | | |
| Limited Trade (and no | | 1614 | 154,218 | 158,037 | 3,353,082 | 243,794,198 | 8,630,230 | 0 | 124,437,988 | - | 4,017,765 | 4,612,465 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 2385 | 113,959 | 117,778 | " | 137,434,931 | 4,563,486 | 102,292,149 | 135,898,343 | 71,670,466 | 64,227,877 | -90,286,074 |
| | Nm (p=.05) | 1665 | 151,541 | 155,360 | " | 235,758,899 | 4,563,486 | 3,968,181 | 126,163,546 | 3,824,734 | 6,116,941 | -1,696,902 |
| | AM (p=.00345) | 1617 | 154,030 | 157,849 | " | 243,226,180 | 8.062,586 | 0 | 124,563,482 | - | 3,892,271 | -3,892,263 |
| | Am (p=1.35E- | 1614 | 154,218 | 158,037 | " | 243,793,975 | 8,630,381 | 0 | 124,438,037 | - | 4,017,716 | 4,612,665 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 2098 | 128,917 | 132,736 | " | 173,325,514 | 4,563,486 | 66,401,566 | 135,265,361 | 52,686,662 | 45,877,055 | -51,611,847 |
| | Nm (p=.05) | 1642 | 152,719 | 156,538 | " | 239,278,527 | 4,563,486 | 448,553 | 125,420,995 | 437,019 | 3,471,777 | 1,080,175 |
| | AM (p=.00345) | 1615 | 154,114 | 157,933 | " | 243,478,378 | 8,314,784 | 0 | 124,507,828 | - | 3,947,925 | 4,366.859 |
| | Am (p=1.35E- | 1614 | 154,218 | 158,037 | " | 243,794,074 | 8,630,480 | 0 | 124,438,015 | - | 4,017,738 | 4,612,742 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 1809 | 144,041 | 147,860 | " | 213,974,927 | 4,563,486 | 25,752,153 | 130,267,465 | 23,221,004 | 21,409,292 | -15,960,329 |
| | NM (p=.05) | 1624 | 153,675 | 157,494 | " | 242,153,413 | 6,989,819 | 0 | 124,799,055 | - | 3,656,698 | 3.333,121 |
| | AM (p=.00345) | 1614 | 154,180 | 157,999 | " | 243,680,429 | 8,516,835 | 0 | 124,463,165 | - | 3,992,698 | 4,524,137 |
| | Am (p=1.35E- | 1614 | 154,218 | 158,037 | " | 243,794,153 | 8,630,559 | 0 | 124,437,997 | - | 4,017,756 | 4,612,803 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D2 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

Table A2-13. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D1. Free Trade. Long Run

| | | Price | Domestic output | Domestic consumption | Imports Value | Consumer Surplus ($) | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1472 | 121,637 | 121,637 | - | 123,331,983 | | 68,726,799 | | | |
| Free Trade (and no risk) | | 878 | 53,069 | 222,723 | 148,956,212 | 221,931,912 | 98,59,929 | 17,885,390 | 50,841,409 | 0 | 47,758,520 |
| Free Trade (and risk) (60-20) | NM (p=1) | * | 19,965 | * | 178,021,524 | * | * | 6,728,726 | * | 11,156,664 | 36,601,856 |
| | Nm (p=.05) | * | 49,682 | * | 151,929,998 | * | * | 16,743,973 | * | 1,141,417 | 46,617,103 |
| | AM (p=.00345) | * | 52,823 | * | 149,172,200 | * | * | 17,802,391 | * | 82,999 | 47,675,521 |
| | Am (p=1.35E-06) | * | 53,069 | * | 148,956,212 | * | * | 17,885,390 | * | 0 | 47,758,520 |
| Free Trade (and risk) (40-10) | NM (p=1) | * | 27,831 | * | 171,115,126 | * | * | 9,379,438 | * | 8,505,952 | 39,252,568 |
| | Nm (p=.05) | * | 51,026 | * | 150,749,966 | * | * | 17,197,343 | * | 688,047 | 47,070,473 |
| | AM (p=.00345) | * | 52,925 | * | 149,082,644 | * | * | 17,836,535 | * | 48,855 | 47,709,665 |
| | Am (p=1.35E-06) | * | 53,069 | * | 148,956,212 | * | * | 17,885,390 | * | 0 | 47,758,520 |
| Free Trade (and risk) (20-0) | NM (p=1) | * | 39,604 | * | 160,778,482 | * | * | 13,347,382 | * | 4,538,008 | 43,220,512 |
| | NM (p=.05) | * | 52,228 | * | 149,694,610 | * | * | 17,601,847 | * | 283,543 | 47,474,977 |
| | AM (p=.00345) | * | 53,009 | * | 149,008,892 | * | * | 17,865,467 | * | 19,923 | 47,738,597 |
| | Am (p=1.35E-06) | * | 53,069 | * | 148,956,212 | * | * | 17,885,390 | * | 0 | 47,758,520 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (*) denotes a cell with identical value than the cell located above.

# Table A2-14. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D1. Limited Trade. Long Run

| | | Domestic Price * $ /Short tons) | Domestic output (Short13 tons)3 | Domestic consumption (Short tons) | Import Value ($) | Consumer Surplus ($) Total | Consumer Surplus ($) Gain | Consumer Surplus ($) Loss | Producer Surplus ($) Total | Producer Surplus ($) Transfer to Consumers | Producer Surplus ($) Infestation Loss | Net Welfare Gain (- implies Loss) ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Autarchy | | 1,472 | 121,637 | 121,637 | - | 123,331,983 | | | 68,726,799 | | | |
| Limited Trade (and no risk) | | 1,457 | 119,618 | 123,437 | 3,353,082 | 125,401,901 | 2,069,918 | - | 17,885,390 | 0 | 1,808,450 | 261,468 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 1,964 | 72,676 | 76,495 | " | 75,730,491 | 221,952 | 47,823,444 | 6,728,726 | 48,077,913 | 61,998,073 | -61,521,652 |
| | Nm (p=.05) | 1,488 | 115,915 | 119,734 | " | 121,620,629 | 221,952 | 1,933,306 | 16,743,973 | 49,437,297 | 51,982,826 | -4,256,883 |
| | AM (p=.00345) | 1,459 | 119,355 | 123,174 | " | 125,136,908 | 1,804,925 | - | 17,802,391 | 0 | 1,878,993 | -74,068 |
| | Am (p=1.35E-06) | 1,457 | 119,618 | 123,437 | " | 125,401,901 | 2,069,918 | - | 17,885,390 | 0 | 1,808,450 | 261,468 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 1,783 | 86,756 | 90,575 | " | 90,809,278 | 221,952 | 32,744,657 | 9,379,438 | 50,004,754 | 59,347,361 | -41,865,312 |
| | Nm (p=.05) | 1,475 | 117,404 | 121,223 | " | 123,192,419 | 221,952 | 361,516 | 17,197,343 | 0 | 51,534,456 | -51,674,020 |
| | AM (p=.00345) | 1,458 | 119,463 | 123,282 | " | 125,260,238 | 1,928,255 | - | 17,836,535 | 0 | 1,873,173 | 55,082 |
| | Am (p=1.35E-06) | 1,457 | 119,618 | 123,437 | " | 125,401,901 | 2,069,918 | - | 17,885,390 | 0 | 1,808,450 | 261,468 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 1,600 | 103,790 | 107,609 | " | 108,899,335 | 221,952 | 14,654,600 | 13,347,382 | 50,387,087 | 55,379,417 | -19,424,978 |
| | NM (p=.05) | 1,464 | 118,714 | 122,533 | " | 124,522,798 | 1,190,815 | - | 17,601,847 | 0 | 2,041,589 | -850,774 |
| | AM (p=.00345) | 1,457 | 119,555 | 123,374 | " | 125,383,598 | 2,051,615 | - | 17,865,467 | 0 | 1,882,677 | 168,938 |
| | Am (p=1.35E-06) | 1,457 | 119,618 | 123,437 | " | 125,401,901 | 2,069,918 | - | 17,885,390 | 0 | 1,808,173 | 261,745 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S2 and demand D1 are specified in text. Autarchy denotes an scenario where there is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports limited to the North East of the U.S which are not harmful for the U.S.. Limited Trade (and risk) denotes such trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

# Table A2-15. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D2. Free Trade. Long Run

| | | Price | Domestic output | Domestic consumption | Imports Value | Consumer Surplus ($) | | Producer Surplus ($) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Total | Transfer to Consumers | Infestation Loss | |
| Autarchy | | 1710 | 153,030 | 153,030 | 0 | 224,312,737 | | 100,485,857 | | | |
| Free Trade (and no risk) | | 878 | 52,555 | 196,445 | 126,335,881 | 369,643,632 | 145,330,895 | 17,721,873 | 82,763,984 | 0 | 62,566,911 |
| Free Trade (and risk) (60-20) | NM (p=1) | " | 19,786 | " | 155,107,388 | " | " | 6,671,804 | " | 11,050,069 | 51,516,842 |
| | Nm (p=.05) | " | 49,204 | " | 155,107,388 | " | " | 16,591,767 | " | 1,130,105 | 61,436,805 |
| | AM (p=.00345) | " | 52,312 | " | 129,278,331 | " | " | 17,639,929 | " | 81,944 | 62,484,967 |
| | Am (p=1.35E-06) | " | 52,555 | " | 126,549,192 | " | " | 17,721,840 | " | 32 | 62,566,879 |
| Free Trade (and risk) (40-10) | NM (p=1) | " | 27,574 | " | 126,335,914 | " | " | 8,265,089 | " | 9,456,783 | 53,110,127 |
| | Nm (p=.05) | " | 50,534 | " | 148,268,857 | " | " | 16,859,541 | " | 832,332 | 61,734,579 |
| | AM (p=.00345) | " | 52,411 | " | 128,110,291 | " | " | 17,662,321 | " | 59,552 | 62,507,359 |
| | Am (p=1.35E-06) | " | 52,515 | " | 126,461,943 | " | " | 17,721,849 | " | 23 | 62,566,887 |
| Free Trade (and risk) (2062,566,-0) | NM (p=1) | " | 34,231 | " | 126,335,880 | " | " | 13,228,881 | " | 4,492,992 | 58,073,919 |
| | NM (p=.05) | " | 51,723 | " | 138,034,433 | " | " | 17,441,315 | " | 280,557 | 62,286,353 |
| | AM (p=.00345) | " | 52,487 | " | 127,066,331 | " | " | 17,702,280 | " | 19,593 | 62,544,318 |
| | Am (p=1.35E-06) | " | 52,555 | " | 126,386,846 | " | " | 17,721,865 | " | 8 | 62,566,903 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotessuch a tr,ade involves a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

# Table A2-16. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D2. Limited Trade. Long Run

| | | Domestic Price * | Domestic output | Domestic consumption | Import Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain (- implies loss) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short13 tons)3 | (Short tons) | ($) | Total | Gain | Loss | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1,710 | 150,030 | 153,030 | - | 224,312,737 | | | 100,486,062 | | | |
| Limited Trade (and no risk) | | 1,690 | 150,212 | 154,031 | 3,353,082 | 231,196,089 | 6,860,529 | 0 | 97,519,884 | 0 | 2,966,178 | 3,894,351 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 2,517 | 107,094 | 110,913 | " | 121,686,051 | 3,857,243 | 106,483,929 | 103,509,314 | 65,679,040 | 62,655,788 | -99,603,434 |
| | Nm (p=.05) | 1,741 | 147,558 | 151,377 | " | 223,343,888 | 3,857,243 | 4,826,092 | 98,688,738 | 4,610,568 | 6,407,892 | -669,907 |
| | AM (p=.00345) | 1,694 | 150,048 | 153,867 | " | 230,621,299 | 6,308,562 | 0 | 97,606,042 | 0 | 2,880,020 | 3,428,542 |
| | Am (p=1.35E-06) | 1,690 | 150,233 | 154,052 | " | 231,173,266 | 6,860,529 | 0 | 97,519,749 | 0 | 2,966,313 | 3,894,216 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 2,224 | 122,385 | 126,204 | " | 156,416,223 | 3,857,243 | 71,753,757 | 104,518.854 | 51,796,318 | 47,763,527 | -63,863,723 |
| | Nm (p=.05) | 1,721 | 148,646 | 152,465 | " | 226,513,682 | 3,857,243 | 1,656,298 | 98,225,318 | 1,603,497 | 3,864,241 | -59,799 |
| | AM (p=.00345) | 1,692 | 150,123 | 153,942 | " | 230,847,915 | 6,535,178 | 0 | 97,570,249 | 0 | 2,915,813 | 3,619,365 |
| | Am (p=1.35E-06) | 1,690 | 150,233 | 154,052 | " | 231,173,266 | 6,860,529 | 0 | 97,519,822 | 0 | 2,966,241 | 3,894,288 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 1,924 | 138,035 | 141,854 | " | 196,595,678 | 3,857,243 | 31,574,302 | 101,991,133 | 26,981,104 | 25,476,034 | -26,211,989 |
| | NM (p=.05) | 1,702 | 149,589 | 153,408 | " | 229,277,270 | 4,964,533 | 0 | 97,810,308 | 0 | 2,675,754 | 2,288,779 |
| | AM (p=.00345) | 1,691 | 150,189 | 154,008 | " | 231,042,056 | 6,729,319 | 0 | 97,539,996 | 0 | 2,946,066 | 3,783,253 |
| | Am (p=1.35E-06) | 1,690 | 150,234 | 154,053 | " | 231,173,266 | 6,860,529 | 0 | 97,519,884 | 0 | 2,966,178 | 3,894,351 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotes trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol " denotes a cell with identical value than the cell located above. Symbol (*) denotes average national domestic price excluding North Eastern winter regional market

# Table A2-17. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D1. Free Trade. Short Run

| | | Price | Domestic output | Domestic consumption | Imports Value | Consumer Surplus ($) | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1,416 | 128,406 | 128,406 | - | 130,329,276 | | 159,120,090 | | | |
| Free Trade (and no risk) | | 878 | 116,223 | 222,722 | 93,506,315 | 221,930,370 | 91,601,094 | 93,314,846 | 65,805,244 | 0 | 25,795,850 |
| Free Trade (and risk) (60-20) | NM (p=1) | " | 87,013 | " | 119,152,288 | " | " | 72,033,251 | " | 21,281,595 | 2,397,725 |
| | Nm (p=.05) | " | 113,441 | " | 95,948,718 | " | " | 91,288,028 | " | 2,026,818 | 23,769,725 |
| | AM (p=.00345) | " | 116,022 | " | 93,682,600 | " | " | 93,165,508 | " | 149,338 | 25,645,572 |
| | Am (p=1.35E-06) | " | 116,223 | " | 93,506,122 | " | " | 93,314,789 | " | 57 | 25,795,793 |
| Free Trade (and risk) (40-10) | NM (p=1) | " | 99,488 | " | 108,199,452 | " | " | 81,738,825 | " | 11,576,021 | 14,271,681 |
| | Nm (p=.05) | " | 114,956 | " | 94,618,548 | " | " | 92,438,823 | " | 876,023 | 24,919,827 |
| | AM (p=.00345) | " | 116,133 | " | 93,585,142 | " | " | 93,252,841 | " | 62,005 | 25,733,845 |
| | Am (p=1.35E-06) | " | 116,223 | " | 93,506,122 | " | " | 93,314,822 | " | 24 | 25,795,826 |
| Free Trade (and risk) (20-0) | NM (p=1) | " | 112,909 | " | 96,415,814 | " | " | 91,316,987 | " | 2,000,402 | 23,795,448 |
| | NM (p=.05) | " | 116,026 | " | 93,679,088 | " | " | 93,228,423 | " | 86,434 | 25,709,416 |
| | AM (p=.00345) | " | 116,209 | " | 93,518,414 | " | " | 93,308,828 | " | 6,018 | 25,789,837 |
| | Am (p=1.35E-06) | " | 116,223 | " | 93,506,122 | " | " | 93,314,844 | " | 2 | 25,795,848 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotessuch a tr,ade involves a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

# Table A2-18. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D1. Limited Trade. Short Run

| | | Domestic Price * | Domestic output | Domestic consumption | Imports Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Loss | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1,416 | 128,406 | 128,406 | - | 130,329,276 | | | 159,120,090 | | | |
| Limited Trade (and no risk) | | 1,390 | 127,824 | 131,644 | 3,353,082 | 136,948,358 | 6,619,082 | - | 155,828,508 | - | 3,291,582 | 3,327,500 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 1,679 | 96,083 | 99,902 | " | 103,801,571 | 3,284,769 | 29,812,474 | 145,363,298 | 24,878,278 | 38,635,020 | -40,284,447 |
| | Nm (p=.05) | 1,413 | 124,980 | 128,799 | " | 134,017,944 | 3,688,668 | - | 155,065,528 | - | 4,054,562 | -365,894 |
| | AM (p=.00345) | 1,392 | 127,620 | 131,439 | " | 136,736,555 | 6,407,279 | - | 155,773,125 | - | 3,346,964 | 3,060,315 |
| | Am (p=1.35E-06) | 1,390 | 127,824 | 131,643 | " | 136,948,358 | 6,619,082 | - | 155,828,406 | - | 3,291,684 | 3,327,398 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 1,548 | 109,242 | 113,061 | " | 117,676,342 | 3,284,769 | 15,937,703 | 151,663,147 | 14,293,068 | 21,750,010 | -20,109,876 |
| | Nm (p=.05) | 1,401 | 126,478 | 130,297 | " | 135,564,488 | 5,235,212 | - | 155,559,582 | - | 3,560,508 | 1,674,704 |
| | AM (p=.00345) | 1,391 | 127,730 | 131,549 | " | 136,848,277 | 6,519,001 | - | 155,810,411 | - | 3,309,678 | 3,209,323 |
| | Am (p=1.35E-06) | 1,390 | 127,825 | 131,644 | " | 136,948,358 | 6,619,082 | - | 155,828,463 | - | 3,291,626 | 3,327,456 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 1,427 | 123,263 | 127,082 | " | 131,612,958 | 3,284,769 | 2,001,987 | 156,646,510 | 1,310,310 | 2,473,588 | 119,504 |
| | NM (p=.05) | 1,392 | 127,559 | 131,378 | " | 136,673,129 | 6,343,853 | - | 155,876,011 | - | 3,244,079 | 3,099,774 |
| | AM (p=.00345) | 1,390 | 127,806 | 131,625 | " | 136,910,635 | 6,581,359 | - | 155,832,185 | - | 3,287,905 | 3,293,454 |
| | Am (p=1.35E-06) | 1,390 | 127,825 | 131,644 | " | 136,948,358 | 6,619,082 | - | 155,828,502 | - | 3,291,588 | 3,327,494 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotes trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol " denotes a cell with identical value than the cell located above. Symbol (*) denotes average national domestic price excluding North Eastern winter regional market

# Table A2-19. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D2. Free Trade. Short Run

| | | Domestic Price ($/Short ton) | Domestic output (Short tons) | Domestic consumption (Short tons) | Import Value ($) | Consumer Surplus ($) | | Preoducer Surplus ($) | | | Net Welfare Gain ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total | Gain | Total | Transfer to Consumers | Infestation Loss | |
| Autarchy | | 1,950 | 140,496 | 140,496 | | 189,071,119 | | 230,894,674 | | | |
| Free Trade (no risk) | | 878 | 116,223 | 196,445 | 70,435,460 | 369,643,632 | 180,572,513 | 93,314,846 | 137,579,827 | 0 | 42,992,685 |
| Free Trade (and risk) (60-20) | NM ($\pi$=1) | " | 87,013 | " | 96,081,433 | " | " | 72,033,251 | " | 21,281,596 | 21,711,090 |
| | Nm ($\pi$=.05) | " | 113,441 | " | 72,877,934 | " | " | 91,288,028 | " | 2,026,819 | 40,965,867 |
| | AM ($\pi$=.00345) | " | 116,022 | " | 70,611,809 | " | " | 93,168,508 | " | 146,338 | 42,846,347 |
| | Am ($\pi$=1.35E-06) | " | 116,223 | " | 70,435,530 | " | " | 93,314,789 | " | 57 | 42,992,628 |
| Free Trade (and risk) (40-10) | NM ($\pi$=1) | " | 99,488 | " | 85,128,894 | " | " | 81,738,825 | " | 11,576,021 | 31,416,664 |
| | Nm ($\pi$=.05) | " | 114,956 | " | 71,547,396 | " | " | 92,438,823 | " | 876,023 | 42,116,662 |
| | AM ($\pi$=.00345) | " | 116,133 | " | 70,514,164 | " | " | 93,252,841 | " | 62,006 | 42,930,679 |
| | Am ($\pi$=1.35E-06) | " | 116,223 | " | 70,435,491 | " | " | 93,314,822 | " | 24 | 42,992,661 |
| Free Trade (and risk) (20-0) | NM ($\pi$=1) | " | 112,909 | " | 73,345,045 | " | " | 91,860,054 | " | 1,454,792 | 41,537,893 |
| | NM ($\pi$=.05) | " | 116,026 | " | 70,608,307 | " | " | 93,228,423 | " | 86,423 | 42,906,262 |
| | AM ($\pi$=.00345) | " | 116,209 | " | 70,447,498 | " | " | 93,308,828 | " | 6,019 | 42,986,667 |
| | Am ($\pi$=1.35E-06) | " | 116,223 | " | 70,435,465 | " | " | 93,314,844 | " | 2 | 42,992,683 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotessuch a tr,ade involves a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

Table A2-20. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S1 and D2. Limited Trade. Short Run

| | | Domestic Price * ($/Short ton) | Domestic Output (Short tons) | Domestic Consumption (Short tons) | Import Value ($) | Consumer Surplus ($) Total | Consumer Surplus ($) Gain | Consumer Surplus ($) Loss | Producer Surplus ($) Total | Producer Surplus ($) Gain | Producer Surplus ($) Loss | Net Welfare Gain (- implies loss) ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Autarchy | | 1,950 | 140,496 | 140,496 | | 189,071,119 | | | 230,894,674 | | | |
| Limited Trade (no risk) | | 1,899 | 139,340 | 143,159 | 3,353,082 | 204,904,046 | 15,832,927 | 0 | 223,755,404 | 0 | 7,139,269 | 8,693,658 |
| Limited Trade (and risk) (60-20) | NM (π=.1) | 2,540 | 105,839 | 109,658 | " | 123,776,814 | 8,596,226 | 73,890,531 | 232,350,839 | 60,549,671 | 59,093,506 | -63,838,140 |
| | Nm (π=.05) | 1,951 | 136,593 | 140,412 | " | 197,441,319 | 8,596,226 | 226,026 | 225,486,505 | 219,785 | 5,627,953 | 2,962,032 |
| | AM (π=.00345) | 1,902 | 139,144 | 142,963 | " | 204,367,657 | 15,296,538 | 0 | 223,885,011 | 0 | 7,009,663 | 8,286,875 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | " | 204,903,836 | 15,832,717 | 0 | 223,755,455 | 0 | 7,139,218 | 8,693,499 |
| Limited Trade (and risk) (40-10) | NM (π=.1) | 2,273 | 119,799 | 123,618 | " | 154,969,318 | 8,596,226 | 42,698,027 | 234,709,251 | 37,973,676 | 34,159,100 | -30,287,225 |
| | Nm (π=.05) | 1,924 | 138,010 | 141,829 | " | 194,060,919 | 8,596,226 | 3,606,426 | 224,776,576 | 0 | 6,118,097 | -1,128,297 |
| | AM (π=.00345) | 1,901 | 139,247 | 143,066 | " | 204,647,939 | 15,576,820 | 0 | 223,828,474 | 0 | 7,066,200 | 8,915,199 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | " | 204,903,946 | 15,832,827 | 0 | 223,755,433 | 0 | 7,139,241 | 9,098,165 |
| Limited Trade (and risk) (20-0) | NM (π=.1) | 2,000 | 134,076 | 137,895 | " | 190,733,486 | 8,596,226 | 6,933,859 | 230,375,353 | 6,655,440 | 7,174,549 | 1,143,258 |
| | Nm (π=.05) | 1,904 | 139,042 | 142,861 | " | 204,088,114 | 15,016,995 | 0 | 224,144,126 | 0 | 6,750,549 | 8,671,025 |
| | AM (π=.00345) | 1,899 | 139,319 | 143,138 | " | 204,947,326 | 15,876,207 | 0 | 223,782,455 | 0 | 7,112,219 | 9,068,567 |
| | Am (π=1.35E-06) | 1,899 | 139,340 | 143,159 | " | 204,904,024 | 15,832,905 | 0 | 223,755,415 | 0 | 7,139,259 | 9,098,225 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotes trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol " denotes a cell with identical value than the cell located above. Symbol (*) denotes average national domestic price excluding North Eastern winter regional market

Table A2-21. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D1. Free Trade. Short Run

| | | Price | Domestic output | Domestic consumption | Import Value | Consumer Surplus ($) | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ($ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | )Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1448 | 124,492 | 124,492 | - | 126,278,165 | | 132,732,851 | | | |
| Limited Trade (and no risk) | | 878 | 103,997 | 222,723 | 104,241,428 | 221,930,379 | 95,642,637 | 67,545,549 | 65,187,302 | 0 | 30,455,335 |
| Limited Trade (and risk) (60-20) | NM (p=1) | " | 70,413 | " | 133,728,180 | " | " | 45,626,670 | " | 21,918,879 | 8,536,456 |
| | Nm (p=.05) | " | 100,537 | " | 107,279,308 | " | " | 65,146,294 | " | 2,399,255 | 28,056,080 |
| | AM (p=.00345) | " | 103,743 | " | 104,464,440 | " | " | 67,223,810 | " | 321,739 | 30,133,596 |
| | Am (p=1.35E-06) | " | 103,997 | " | 104,241,428 | " | " | 67,542,467 | " | 3,082 | 30,452,253 |
| Limited Trade (and risk) (40-10) | NM (p=1) | " | 83,060 | " | 122,624,114 | " | " | 53,821,539 | " | 13,724,040 | 16,731,325 |
| | Nm (p=.05) | " | 102,413 | " | 105,632,180 | " | " | 66,361,648 | " | 1,183,901 | 29,271,434 |
| | AM (p=.00345) | " | 103,885 | " | 104,339,764 | " | " | 67,315,315 | " | 230,234 | 30,255,101 |
| | Am (p=1.35E-06) | " | 103,997 | " | 104,241,428 | " | " | 67,546,321 | " | 228 | 30,455,107 |
| Limited Trade (and risk) (20-0) | NM (p=1) | " | 97,480 | " | 109,963,354 | " | " | 63,165,078 | " | 4,380,401 | 26,074,864 |
| | NM (p=.05) | " | 103,630 | " | 104,563,654 | " | " | 67,150,507 | " | 395,042 | 30,060,293 |
| | AM (p=.00345) | " | 103,971 | " | 104,264,256 | " | " | 67,371,603 | " | 173,946 | 30,281,389 |
| | Am (p=1.35E-06) | " | 103,997 | " | 104,241,428 | " | " | 67,545,545 | " | 4 | 30,455,331 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotessuch a tr,ade involves a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

**Table A2-22. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D1. Limited Trade. Short Run**

| | | Domestic Price * | Domestic output | Domestic consumption | Import Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain (- implies loss |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Loss | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1448 | 124,492 | 124,492 | - | 126,278,165 | | | 132,732,851 | | | |
| Limited Trade (and no risk) | | 1425 | 123,493 | 127,312 | 3,353,082 | 132,595,056 | 6,317,140 | 0 | 129,884,972 | 0 | 2,847,879 | 3,469,041 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 1747 | 89,883 | 93,702 | " | 83,914,285 | 3,510,430 | 45,874,310 | 115,899,835 | 41,093,331 | 57,926,347 | -59,196,896 |
| | Nm (p=.05) | 1452 | 120,189 | 124,008 | " | 127,914,828 | 3,510,430 | 1,873,767 | 128,799,069 | 60,950,728 | 64,884,510 | -2,297,119 |
| | AM (p=.00345) | 1427 | 123,253 | 127,072 | " | 132,349,356 | 6,071,191 | 0 | 128,815,945 | 0 | 2,916,906 | 3,154,285 |
| | Am (p=1.35E-06) | 1425 | 123,493 | 127,312 | " | 132,595.305 | 6,317,140 | 0 | 129,884,752 | 0 | 2,848,099 | 3,469,041 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 1608 | 102,965 | 106,784 | " | 98,215,011 | 3,510,430 | 31,573,584 | 122,189,093 | 49,312,948 | 59,856,706 | -38,606,912 |
| | Nm (p=.05) | 1437 | 121,984 | 125,803 | " | 129,438,054 | 3,510,430 | 350,541 | 129,369,264 | 61,591,290 | 64,954,877 | -203,698 |
| | AM (p=.00345) | 1426 | 123,386 | 127,205 | " | 132,474,284 | 6,196,119 | 0 | 129,868,507 | 0 | 2,864,344 | 3,331,775 |
| | Am (p=1.35E-06) | 1425 | 123,493 | 127,312 | " | 132,595,056 | 6,317,140 | 0 | 129,884,752 | 0 | 2,848,099 | 3,469,041 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 1477 | 117,241 | 121,060 | " | 115,596,294 | 3,510,430 | 14,192,301 | 127,805,059 | 54,692,314 | 59,620,106 | -15,609,663 |
| | NM (p=.05) | 1428 | 123,144 | 126,963 | " | 132,224,526 | 5,946,361 | 0 | 129,796,820 | 0 | 2,936,031 | 3,010,330 |
| | AM (p=.00345) | 1425 | 123,469 | 127,288 | " | 132,595,234 | 6,317,069 | 0 | 129,854,393 | 0 | 2,878,458 | 3,438,611 |
| | Am (p=1.35E-06) | 1425 | 123,493 | 127,312 | " | 132,595,056 | 6,317,140 | 0 | 129,884,752 | 0 | 2,848,099 | 3,469,041 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotes trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol " denotes a cell with identical value than the cell located above. Symbol (*) denotes average national domestic price excluding North Eastern winter regional market

## Table A2-23. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D2. Free Trade. Short Run

| | | Price | Domestic output | Domestic consumption | Imports Value | Consumer Surplus ($) | | Producer Surplus ($) | | | Net Welfare Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short tons) | (Short tons) | ($) | Total | Gain | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1982 | 138,836 | 138,836 | - | 184,629,490 | | 203,349,288 | | | |
| Free Trade (and no risk) | | 878 | 103,997 | 196,445 | 81,169,836 | 369,643,632 | 185,014,412 | 67.545.549 | 135,661,188 | 0 | 49,353,224 |
| Free Trade (and risk) (60-20) | NM (p=1) | " | 70,413 | " | 110,656,041 | " | " | 45,626,670 | " | 21,918,879 | 27,434,345 |
| | Nm (p=.05) | " | 100,537 | " | 84,207,428 | " | " | 65,146,294 | " | 2,399,255 | 46,953,969 |
| | AM (p=.00345) | " | 103,743 | " | 81,392,445 | " | " | 67,223,810 | " | 321,739 | 49,031,485 |
| | Am (p=1.35E-06) | " | 103,997 | " | 81,169,924 | " | " | 67,542,467 | " | 3,082 | 49,350,142 |
| Free Trade (and risk) (40-10) | NM (p=1) | " | 83,060 | " | 99,552,194 | " | " | 53,821,539 | " | 13,724,040 | 35,629,184 |
| | Nm (p=.05) | " | 102,413 | " | 82,560,654 | " | " | 66,361,648 | " | 1,183,901 | 48,169,323 |
| | AM (p=.00345) | " | 103,885 | " | 81,268,459 | " | " | 67,315,315 | " | 230,234 | 49,122,990 |
| | Am (p=1.35E-06) | " | 103,997 | " | 81,169,875 | " | " | 67,546,321 | " | 228 | 49,352,996 |
| Free Trade (and risk) (20-0) | NM (p=1) | " | 97,480 | " | 86,891,928 | " | " | 63,165,078 | " | 4,380,401 | 44,972,823 |
| | NM (p=.05) | " | 103,630 | " | 81,491,769 | " | " | 67,150,507 | " | 395,042 | 48,958,182 |
| | AM (p=.00345) | " | 103,971 | " | 81,192,189 | " | " | 67,371,603 | " | 173,946 | 49,179,278 |
| | Am (p=1.35E-06) | " | 103,997 | " | 81,169,845 | " | " | 67,545,545 | " | 4 | 49,353,220 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotessuch a tr,ade involves a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol (") denotes a cell with identical value than the cell located above.

**Table A2-24. Estimated Economic Impact if Mexican Imports are Not Prohibited After a pest infestation. S2 and D2. Limited Trade. Short Run**

| | | Domestic Price * | Domestic output | Domestic consumption | Import Value | Consumer Surplus ($) | | | Producer Surplus ($) | | | Net Welfare Gain (- Implies Loss) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ /Short tons) | (Short13 tons)3 | (Short tons) | ($) | Total | Gain | Loss | Total | Transfer to Consumers | Infestation Loss | ($) |
| Autarchy | | 1982 | 138,836 | 138,836 | - | 184,629,490 | | | 203,049,288 | | | |
| Limited Trade (and no risk) | | 1932 | 137,599 | 141,418 | 3,353,082 | 194,907,682 | 10,278,192 | - | 196,188,747 | 0 | 6,860,542 | 3,417,650 |
| Limited Trade (and risk) (60-20) | NM (p=1) | 2588 | 103,351 | 107,170 | " | 116,183,557 | 3,510,430 | 71,956,363 | 197,418,229 | 59,939,519 | 65,570,078 | -74,076,492 |
| | Nm (p=.05) | 1992 | 134,471 | 138,290 | " | 186,726,000 | 3,510,430 | 1,413,920 | 197,404,245 | 1,409,815 | 6,754,858 | -3,248,533 |
| | AM (p=.00345) | 1937 | 137,372 | 141,191 | " | 194,285,073 | 9,655,583 | - | 196,331,970 | 0 | 6,717,318 | 2,938,365 |
| | Am (p=1.35E-06) | 1932 | 137,599 | 141,418 | " | 194,878,713 | 10,249,223 | - | 196,217,526 | 0 | 6,831,762 | 3,417,461 |
| Limited Trade (and risk) (40-10) | NM (p=1) | 2321 | 117,291 | 121,110 | " | 145,397,519 | 3,510,430 | 42,742,401 | 200,929,950 | 38,758,510 | 40,877,848 | -41,351,309 |
| | Nm (p=.05) | 1959 | 136,177 | 139,996 | " | 191,153,577 | 6,524,087 | - | 196,924,203 | 0 | 6,125085 | 399,002 |
| | AM (p=.00345) | 1934 | 137,499 | 141,318 | " | 194,615,253 | 9,985,763 | - | 196,268,969 | 0 | 6,780,319 | 3,205,444 |
| | Am (p=1.35E-06) | 1932 | 137,599 | 141,418 | " | 194,878,713 | 10,249,223 | - | 196,217,631 | 0 | 6,831,657 | 3,417,566 |
| Limited Trade (and risk) (20-0) | NM (p=1) | 2046 | 131,634 | 135,453 | " | 179,497,591 | 3,510,430 | 8,642,329 | 198,812,123 | 8,487,360 | 12,724,526 | -9,369,065 |
| | NM (p=.05) | 1938 | 137,272 | 141,091 | " | 194,017,197 | 9,387,707 | - | 196,385,495 | 0 | 6,663,793 | 2,723,914 |
| | AM (p=.00345) | 1933 | 137,576 | 141,395 | " | 194,818,883 | 10,189,393 | - | 196,229,471 | 0 | 6,819,818 | 3,369,575 |
| | Am (p=1.35E-06) | 1932 | 137,599 | 141,418 | " | 194,878,713 | 10,249,223 | - | 196,217,695 | 0 | 6,831,593 | 3,417,630 |

Source: From data and models applied by Carman and Cook (1996) and Evangelou et al. (1993). Functional forms for supply S1 and demand D1 are specified in text. Autarchy denotes an scenario where t,here is no entry of avocados from Mexico. Limited Trade (and no risk) denotes imports Limited to the North East of the U.S with are not harmful for the U.S.. Limited Trade (and risk) denotes trade involving a certain probability of pest outbreak. Numbers between brackets,e.g. (60-20), denote the percent of increase in cost and percent of reduction in yield, respectively, as a consequence of the pest outbreak. Acronyms NM, Nm, AM, and Am denote maximum (M) and minimum (m) probabilities of outbreak during a year as estimated by Nyrop (1995) and APHIS (Firko, 1995). Thus, NM, Nm, AM, and Am stand for "Nyrop Maximum", "Nyrop minimum" estimates, and so for. Estimated probabilities appear between brackets. Symbol " denotes a cell with identical value than the cell located above. Symbol (*) denotes average national domestic price excluding North Eastern winter regional market

# Appendix A3

Data

| Year | Production sh.tons | Price T $/sh.ton | Consumption lbs/capita | Real Income $/capita | Real Adv/Cap $/1000 |
|---|---|---|---|---|---|
| 1962 | 56,200 | 526 | 0.61 | 3662 | 1.7259 |
| 1963 | 51,700 | 592 | 0.56 | 3741 | 4.0756 |
| 1964 | 60,700 | 586 | 0.65 | 3953 | 4.5784 |
| 1965 | 36,750 | 1031 | 0.39 | 4145 | 2.8174 |
| 1966 | 61,250 | 666 | 0.62 | 4307 | 6.6267 |
| 1967 | 80,900 | 467 | 0.82 | 4417 | 6.3366 |
| 1968 | 52,500 | 927 | 0.54 | 4533 | 4.4354 |
| 1969 | 73,950 | 683 | 0.74 | 4568 | 5.7344 |
| 1970 | 46,450 | 1213 | 0.48 | 4640 | 5.1376 |
| 1971 | 85,800 | 779 | 0.85 | 4768 | 7.7616 |
| 1972 | 45,400 | 1483 | 0.46 | 4936 | 6.7527 |
| 1973 | 89,300 | 967 | 0.87 | 5190 | 7.3580 |
| 1974 | 73,700 | 924 | 0.70 | 5070 | 7.8908 |
| 1975 | 127,400 | 581 | 1.22 | 5088 | 10.8972 |
| 1976 | 87,400 | 1073 | 0.84 | 5204 | 10.5672 |
| 1977 | 141,100 | 718 | 1.30 | 5344 | 14.3731 |
| 1978 | 117,700 | 926 | 1.09 | 5504 | 11.8863 |
| 1979 | 146,100 | 735 | 1.34 | 5461 | 6.9817 |
| 1980 | 102,300 | 1261 | 0.91 | 5246 | 7.7889 |
| 1981 | 268,800 | 366 | 2.35 | 5595 | 16.5300 |
| 1982 | 182,800 | 629 | 1.58 | 5570 | 9.3266 |
| 1983 | 236,700 | 463 | 2.03 | 5749 | 11.7211 |
| 1984 | 274,000 | 370 | 2.34 | 6045 | 7.6080 |
| 1985 | 229,500 | 528 | 1.95 | 6170 | 8.5154 |
| 1986 | 188,500 | 1002 | 1.61 | 6387 | 10.5713 |
| 1987 | 302,700 | 370 | 2.53 | 6415 | 9.7400 |
| 1988 | 209,000 | 1079 | 1.72 | 6585 | 6.2419 |
| 1989 | 192,600 | 1087 | 1.59 | 6642 | 12.4659 |
| 1990 | 139,050 | 1623 | 1.18 | 6671 | 10.4156 |
| 1991 | 156,050 | 1176 | 1.33 | 6623 | 11.4928 |
| 1992 | 184,720 | 1003 | 1.64 | 6764 | 12.9514 |
| 1993 | 291,550 | 391 | 2.42 | 6759 | 9.8259 |
| 1994 | 143,650 | 1662 | 1.19 | 6899 | 7.0990 |

Price, income and advertising is in real terms (1975=1.00). Consumption, income and advertising are in per capita terms.

# VITA

Eduardo Romano was born on September 5, 1955 in Buenos Aires, Argentina. After he graduated from high school (*Colegio Nacional de Buenos Aires*) he pursued a career in agronomy at the University of Buenos Aires. In college he was interested in both agricultural economy and genetics. After graduation in 1982, he took some job opportunities and pursued a career in quantitative genetics. He became an assistant professor in animal breeding at the University of Buenos Aires. Although he earned a graduate degree in animal breeding at Virginia Tech, he realized his true love was for economics and decided it was never late for a switch. He has earned a Master Degree in Agricultural Economics at Virginia Tech (1995). His research has focused on the evaluation of technical barriers to trade. He is married to Daniela Verthelyi and has a 5 years-old daughter, Ari. His second daughter is due on June.