# MEXICAN AGRICULTURAL AND FOOD EXPORT COMPETITIVENESS

Jaime E. Málaga
Gary W. Williams*

*TAMRC International Market Research Report No. IM-01-06*

February 2006

* Jaime E. Malaga is Assistant Professor, Department of Agricultural and Applied Economics, Texas Tech University, Lubbock, Texas 79409 and Gary W. Williams is Professor of Agricultural Economics and Director, Texas Agricultural Market Research, Department of Agricultural Economics, Texas A&M University, College Station, Texas 77843-2124.

# MEXICAN AGRICULTURAL AND FOOD EXPORT COMPETITIVENESS

Texas Agribusiness Market Research Center (TAMRC) International Market Research Report No. IM-01-06, February 2006 by Dr. Jaime E. Málaga and Dr. Gary W. Williams.

**Abstract:** This report analyzes the export performance of the Mexican agricultural and food sector in recent years with a particular emphasis on the changing competitiveness of those exports in the U.S. and world markets. The report includes an examination of the general trends in Mexican agricultural and food exports, an analysis of the international competitiveness of the major subgroups of Mexican agriculture based on the Revealed Comparative Advantage methodology, an assessment of the competitiveness of Mexican exports of specific agricultural and food products to the United States, a consideration of the effectiveness of Mexico's agricultural and food export market diversification efforts, a discussion of the main factors likely to affect the long-term competitiveness of Mexican agriculture, and policy recommendations for enhancing the competitiveness of Mexican agricultural and food exports.

**Acknowledgements:** The research reported here was conducted under contract with the World Bank (International Bank for Reconstruction and Development, International Development Association), Latin America and the Caribbean Region Agriculture and Rural Development, 1818 H St., Washington, D.C. Thanks are due to Yurie Tanimichi Hoberg and José Maria Caballeros of The World Bank for their support, guidance and comments on earlier drafts. Any errors and missions, however, are those of the authors. The conclusions reached and any views expressed in this report are also those of the authors and may not represent those of The World Bank or of Texas A&M University.

# MEXICAN AGRICULTURAL AND FOOD EXPORT COMPETITIVENESS

## Executive Summary

This report analyzes the export performance of the Mexican agricultural and food sector in recent years with a particular emphasis on the changing competitiveness of Mexican agricultural and food exports in the U.S. and world markets. The report begins with an examination of general trends in Mexican agricultural exports and then continues with an analysis of the international competitiveness of the major subgroups of Mexican agriculture based on the Revealed Comparative Advantage methodology. The focus then turns to an assessment of the competitiveness of Mexican exports of specific agricultural and food products to the United States, Mexico's principal export market, followed by a consideration of the effectiveness of Mexico's agricultural export market diversification efforts. Following a discussion of the main factors likely to affect the long-term competitiveness of Mexican agriculture, the main conclusions of this report are summarized and policy recommendations for enhancing the competitiveness of Mexican agricultural and food exports are offered.

Despite growth in the absolute value of Mexican agricultural and food exports since the mid-1980s, the report concludes that the share of total Mexican exports accounted for by agricultural and food products is declining. A Revealed Comparative Analysis (RCA) of Mexican agricultural and food exports confirms that Mexico does not have a clear comparative advantage in the production and export of agricultural and food products in general. When the RCA analysis is performed at the commodity subgroup level, however, the results suggest that Mexico may have a clear comparative advantage in vegetables and fruits but not in other major export categories like animals and animal products or processed food. While Mexico's comparative disadvantage in animal products appears to be growing, its comparative advantage in vegetables has been eroding over the last decade. Mexican fruit exports appear to be maintaining their comparative advantage level while the dynamic processed food sector appears to be gaining comparative advantage as indicated by a doubling of their RCA index since 1995.

U.S. imports of most agricultural and food products have been increasing since the early 1990s. Not surprisingly, the U.S. currently accounts for 86% of the value of all Mexican agricultural and food exports. Although growing in absolute value, however, Mexican vegetable exports to the U.S. have been losing their share of total U.S. vegetable imports over the last two decades despite the implementation of NAFTA in 1994. The story for livestock and livestock products is similar. On the other hand, the Mexican share of U.S. fruit imports is growing but at a slower rate than is the case for processed foods which doubled their share of U.S. imports of those products since 1995, reaching almost 18% of total U.S. imports.

Also, with few exceptions, the share of U.S. imports accounted for by the top 24 individual Mexican agricultural and food exports has been declining especially in recent years. These are the commodities where investments to increase the levels of productivity and efficiency in

production, marketing, and transportation and to eliminate institutional, administrative, and political barriers to trade would have the highest payoff for Mexico. The clear exceptions to this case are avocados and malt beverages (beer) which continue to experience market share gains in continuously growing U.S. import markets. While some Mexican exports like tomatoes and peppers have shown some capacity to recover from market share erosions, other products like non-malt beverages and grapes have allowed early market share gains to turn into heavy market share losses in recent years. Some Mexican exports that have been growing in absolute value like asparagus, mangoes, melons, cauliflower/broccoli, eggplants, and cucumbers have experienced almost continual losses in their shares of U.S. imports. On the other hand, traditional Mexican export products like bananas, coffee, and live cattle have been losing share in markets where U.S. imports have been declining as well.

In the only other major markets for Mexican exports, the European Union (EU) and Canada, the consistently competitive Mexican products have been beer and to a lesser extent avocados, tomatoes, peppers, and grapes. The Mexican shares of EU and Canadian imports of most other Mexican agricultural food exports have been declining. In contrast, Mexico's share of Japanese agricultural and food imports has been increasing over the last decade reaching a high of just over 1% in 2004. Mexico accounts for 2% of Japanese fruit and vegetable imports, nearly 3% of Japanese meat imports (mainly pork), and over 8% of Japanese alcoholic beverage imports.

The growing liberalization of world agricultural and food markets may contribute to further erosion of Mexican export competitiveness in its major markets in favor of new suppliers (particularly Central and South America). A number of other factors that have the potential to affect the long-run competitiveness of Mexican agricultural exports are analyzed in the report. Among them, none have received more U.S. media and policy attention than food safety (FS) and sanitary and phytosanitary (SPS) issues related to imported Mexican agricultural and food products. The actual impact of those issues on Mexican export competitiveness is likely much smaller than the attention they receive however. In terms of FS issues, strawberries, cantaloupes, and green onions have generated most of the attention since the mid-1990s. Despite efforts of Mexican producers, shippers, and government agencies to resolve the problems and mitigate the economic effects of outbreaks of foodborne illnesses in the U.S. caused by imported Mexican produce, the food safety scares created by the outbreaks have caused significant economic damage to Mexican exporters independent of their involvement in any particular case of food contamination. Because these three products represent less than 3% of the total annual value of Mexican agricultural exports to the U.S., however, the FS issue poses a relatively low level of threat to the current and future competitiveness of Mexican agricultural and food exports. The situation is similar for SPS problems where avocados and oranges have received much of the attention. Again, however, avocados and oranges represent around only 2% of the value of Mexican agricultural exports to the U.S. From an animal health perspective, cattle tuberculosis appears to have been the most prevalent SPS problem affecting Mexican exports to the U.S.

Four other factors were also found to pose medium to high limitations to the current and future export competitiveness of the top 24 Mexican agricultural and food exports to the U.S.: (1) problems in the distribution and availability of water in Mexico; (2) an underdeveloped transportation infrastructure; (3) underinvestment in the development, diffusion, and adoption of new technology; and (4) the potential growth in Mexican incomes as economic development

proceeds. The first three factors imply particular limitations for growth of the Mexican fruit and vegetable industry, less so perhaps for tomatoes but particularly for other vegetables that tend to be residual claimants of water and are more likely to be grown in the eastern and central regions of Mexico on small and medium farms. The growth of income in Mexico becomes a limit to Mexico's ability to export if the consequent growth in domestic demand limits the availability of domestic production for export. This outcome is more likely to be the case if the limitations imposed by the other three factors effectively prohibit domestic supply from expanding sufficiently to meet any domestic growth in demand.

The most effective strategy for Mexico to further enhance its agricultural and food export competitiveness is to focus on removing internal constraints. While some specific export promotion efforts will need to be included in the policy mix, the key component of any successful strategy to enhance Mexican agricultural and food export competitiveness must be a substantial increase in public investments in several critical areas, including the expansion of irrigation water supplies and delivery systems, transportation infrastructure, and technology development, diffusion, and adoption. Of course, the public investment required to successfully relieve these constraints could be enormous. Nevertheless, such investments are critically needed if any real improvement in export competitiveness is to be achieved.

At a minimum, a successful strategy to achieve a substantial and sustained expansion of Mexican agricultural and food exports will need to incorporate at least some features of the following policy alternatives at some level of investment (in no particular order): (1) targeted export promotion to diversify and expand Mexican export markets particularly for products that have found niches in overseas markets (such as beer, avocadoes, mangoes, guava, peppers, dried legumes, and possibly grapes) and possibly products currently experiencing a downward trend in their share of growing U.S. imports (such as cucumbers, asparagus, broccoli, squash, strawberries, eggplant, and cut flowers); (2) production conversion assistance, including programs designed to encourage acreage currently devoted to export crops that are losing shares of declining U.S. imports (such as coffee, sugar, bananas, and melons) to be converted to the production of commodities whose shares of growing U.S. imports are growing (such as tomatoes, peppers, avocadoes, onions, pecans, citrus, and other fruits, vegetables, and nuts); (3) increased public investments in irrigation water storage and delivery systems, particularly in the eastern and central regions of Mexico characterized by a large number of small farms with limited access to resources to expand production; (4) increased public investments in trade-related transportation infrastructure; (5) increased public investments in agricultural research to boost agricultural production efficiency and reduce production costs and to adapt and commercialize technologies available in other countries for use in Mexico; (6) the establishment of an effective system for technology and information diffusion, including training programs for *ejidatarios* and agribusiness owners and re-training programs for agricultural labor displaced by growing agricultural imports; (7) an enhanced market intelligence system to support informed and efficient decision-making in the Mexican agriculture and agribusiness sectors; and (8) additional resources to improve the efficiency and effectiveness of SENASICA, the Mexican government agency responsible for both food safety and sanitary/phytosanitary programs.

## TABLE OF CONTENTS

## TABLE OF FIGURES



TABLE OF TABLES

## MEXICAN AGRICULTURAL AND FOOD EXPORT COMPETITIVENESS

Before the mid-1980s, Mexico was one of the most closed economies of the world with import tariffs of 100% and higher on many products as part of an overall economic development strategy of import substitution. Mounting external debt, a sharp devaluation of the Mexican Peso, and the ensuing economic crisis of the early 1980s, however, forced Mexico to abandon import substitution and institute an historic process of sweeping economic reforms.

As one part of that adjustment, Mexico acceded to the General Agreement on Tariffs and Trade (GATT) in 1986. As a condition of GATT membership, Mexico agreed to reduce its average import tariff level from around 80% to about 50% (Williams 2001). In the agricultural sector, Mexico went much further than required, unilaterally reducing the average tariff level to between 10% and 20% much before the implementation of NAFTA in 1994. Mexico also unilaterally eliminated the import licensing requirement for most agricultural products. In addition, Mexico initiated the privatization of the many government-owned enterprises through a process of mergers, liquidation, and sales, reduced the growth rate of the money supply in an attempt to curb inflation, brought the peso more in line with the U.S. dollar through foreign exchange operations, and forced the Mexican farm sector towards greater market determination of prices, production, and marketing by eliminating the producer price support program as well as subsidies for all agricultural production inputs, including credit, fertilizer, electricity, irrigation, and water (Grennes, et al. 1991).

The dramatic turnaround in Mexican trade policy and the accompanying Mexican economic reforms generated an impressive surge in Mexican trade in both agricultural and non-agricultural products over the last two decades linking the performance of the overall Mexican economy, and the agricultural sector in particular, closely to its competitiveness in world markets. Of particular importance to Mexican agricultural export performance is the competitiveness of those exports in U.S. markets. Spurred by the signing of NAFTA and benefiting from geographic proximity, the U.S. has become Mexico's primary agricultural export market, accounting for over 86% of Mexican agricultural exports in 2004 (USDAa). Following the implementation of NAFTA, however, Mexico aggressively sought to diversify its export markets through bilateral trade agreements, signing 11 other free trade agreements since NAFTA was implemented with 18 countries and the European Union.

This report analyzes the export performance of the Mexican agricultural sector in recent years with a particular emphasis on the changing competitiveness of Mexican agricultural exports in the U.S. and world markets. The analysis begins with an examination of the general trends in Mexican agricultural exports and then continues with an analysis of the international competitiveness of the major subgroups of Mexican agriculture based on the Revealed Comparative Advantage methodology developed by Balassa (1965). The focus then turns to an assessment of the competitiveness of Mexican exports of specific agricultural and food products to the United States, Mexico's principal export market followed by a consideration of the

effectiveness of Mexico's agricultural export market diversification efforts. Following a discussion of the main factors likely to affect the long-term competitiveness of Mexican agriculture, the main conclusions of this report are summarized and policy recommendations for enhancing the competitiveness of Mexican agricultural and food exports are offered.

## Trends in Mexican Agricultural and Food Exports[1]

After the unilateral opening of Mexican markets began in 1985, Mexican exports of agricultural and non-agricultural products increased rapidly even before the implementation of NAFTA in 1994. In the five years prior to NAFTA, Mexican exports of all products increased by over 72% from $US 35.2 billion in 1989 to $US 60.6 billion in 1994, an annual average increase of $US 5.1 billion (Figure 1). Over that same period, Mexican agricultural exports grew by over 48% from $US 3.0 billion to $US 4.5 billion, an annual average increase of $US 290.4 million (Figure 2). In contrast, Mexican exports of petroleum declined by nearly 6.5% over that period while exports of all other non-agricultural products grew by over 100%, more than double the rate of growth in agricultural exports (Figure 2).

In the five years following the implementation of NAFTA, the annual rate of growth in Mexican exports of both agricultural and non-agricultural goods increased substantially. Between 1994 and 1999, total Mexican exports grew by an annual average of $US 15.1 billion, 3 times the rate in the previous five years before NAFTA. Over the same period, Mexican agricultural exports increased by nearly 71%, an average annual increase of $US 632 million, more than double the annual rate of increase in the 5 years before NAFTA (Figure 2). At the same time, Mexican exports of both petroleum and other non-petroleum exports both registered substantial increases as well. In the most recent period of 1999 to 2004, agricultural and other non-petroleum exports continued to increase but at substantially lower rates (38% and 30%, respectively) while the rate of growth in petroleum exports continued to increase (Figure 2).

Despite the almost continual growth in the level of Mexican agricultural exports since 1985, petroleum and other non-agricultural exports have tended to grow even more rapidly resulting in an almost continual decline in the share of total Mexican exports accounted for by agriculture from over 8% in the pre-NAFTA years to 5.6% in 2004 (Figure 3). The declining agricultural share of Mexican exports since the 1980s has coincided with a declining agricultural share of national GDP and a declining share of the Mexican agricultural GDP accounted for by exports over the same period (Figure 4). Liberalization of Mexican markets and economic reforms in the

[1] Trade data in this section were obtained from the UN Commodity Trade Statistics (COMTRADE) database (http://unstats.un.org/unsd/comtrade/) under the SITC Rev. 3 classification. "Agricultural" trade was defined using the trade data for the following commodity codes: 0 (Food and Live animals after subtracting out commodity code 03 for Fish/Shellfish/etc.); 1 (Beverages and Tobacco); 21 (Hides/Skins/Fur, Raw); 22 (Oilseeds/Oil Fruits); 261 (Silk); 263 (Cotton); 264 (Jute and Other Textile Fibers); 265 (Other Vegetable Textile Fibers); 268 (Wool/Animal Hair); 29 (Crude Animal/Vegetable Matter NES); and 4 (Animal/ Vegetable Oils/Fats). Other data were obtained from the Bank of Mexico, the Mexican National Institute for Statistics, Geography and Information (INEGI), and the U.S. Trade Internet System maintained by the Foreign Agriculture Service of the U.S. Department of Agriculture.

pre-NAFTA years boosted agricultural GDP by nearly 76% from $US 13.3 billion in 1988 to $US 23.3 billion in 1993 (Figure 4). Even so, the agricultural share of Mexican GDP declined from 7.3% to 5.8% over the same pre-NAFTA period as growth primarily in the non-petroleum industrial sector outstripped the growth in the agricultural sector. Even as the agricultural share of Mexican GDP declined during that pre-NAFTA period, the Mexican agricultural sector became less dependent on agricultural exports as the export share of the agricultural GDP declined from 19% in 1989 to 12.9% in 1993 (Figure 4).

In late 1994 and early 1995, the Mexican Peso devaluation and the ensuing economic crisis dropped Mexican agricultural GDP (in US$) by nearly 40% between 1993 and 1995, back to pre-liberalization levels (Figure 4). At the same time, however, the Peso devaluation removed the implicit export tax of the previously overvalued Peso and led to a 45% jump in Mexican agricultural exports between 1994 and 1995 (see Figure 3) and greater dependence of the agricultural sector on exports once again. The export share of Mexican agricultural GDP temporarily rebounded from the 1993 low of 12.9% to a high of 21% in 1994 (Figure 4). The recovery of the Mexican economy since 1995, however, returned both the Mexican agricultural GDP and the export share of the Mexican agricultural GDP back to their pre-crisis levels of about $US 23 billion and 13%, respectively, by 2001 while the agricultural share of Mexican GDP continued sliding to a low of 3.5% by 2003 (Figure 4).

Since the early days of Mexican trade liberalization in the mid-1980s, the United States has been the primary destination for Mexican agricultural exports. From just over $US 1 billion in the early 1980s, Mexican exports to the United States have grown almost continually, reaching $US 9.1 billion and accounting for over 86% of all Mexican agricultural exports in 2004 (Figure 5). The average annual rate of growth in Mexican agricultural exports to the United States jumped substantially after the implementation of NAFTA from $US 233.6 million between 1989 and 1994 to nearly $US 530 million between 1994 and 2004. Despite the rapid growth in U.S. agricultural imports from Mexico, the U.S. share of Mexican agricultural exports has remained fairly stable at between about 80% and 90% over the years despite Mexico's efforts to expand its export customer base (Figure 6).

While the European Union (EU) has been the only other major market for Mexican agricultural exports over the years, the EU share of Mexican agricultural exports has been declining from about 6.5% in the years just before the implementation of NAFTA to only 3.7% in 2004 (Figure 7). In contrast, Mexican agricultural exports to Canada have been growing steadily from only $US 7.1 million in 1989 (0.2% of Mexican agricultural exports) to just over $US 130 million in 2004 (1.3% of Mexican agricultural exports). Other minor markets for Mexican agricultural exports, individually accounting for 1% or less of those exports, include various countries in Central and South America and Asia.

For most countries other than the United States, the agricultural share of total Mexican exports has been increasing. In 1989, agricultural goods accounted for 16% of Mexican exports to the United States but only 5.4% in 2004 (Figure 8). In contrast, the agricultural share of Mexican exports to Canada increased from 2.6% in 1989 to 4.8% in 2004. The agricultural share of Mexican exports to the European Union has fluctuated considerably, increasing from 7.2% in 1989 to 15.7% in 1997 and then back down to 5.9% in 2004. Mexican exports to other countries

have also been increasingly composed of agricultural goods. The agriculture share of Mexico's exports to those other countries increased from just over 1% in 1989 to nearly 8% in 2004.

## Measuring Mexican Agricultural and Food Export Competitiveness

This section of the report provides an analysis of the export competitiveness of Mexican agriculture in general and for four major subgroups of Mexican agricultural and food exports using the Revealed Comparative Advantage (RCA) measure developed by Balassa (1965). The analysis then turns to a consideration of the competitiveness of the four major agricultural subgroups of Mexican agricultural and food exports in U.S. markets. Finally, attention is focused on the competitiveness of those exports outside the United States as Mexico has attempted to diversify its agricultural and food export markets

### *Revealed Comparative Advantage of Mexican Agriculture*

The Revealed Comparative Advantage (RCA) measure developed by Balassa (1965) is based on the notion that even though the theoretical comparative advantage of a country cannot be directly measured since relative prices in autarky are not observable, a country's observable pattern of trade "reveals" its comparative advantage. Thus, observable trade data can be used to infer a country's comparative advantage. Balassa's RCA measure has been widely used to analyze comparative advantage primarily because it is relatively simple to calculate and explain. Balassa's RCA measure is calculated as the ratio of a country's export share of world trade in a specific commodity or group of commodities to its overall contribution to world trade. As applied in this analysis, Balassa's index is calculated as:

(1) $(X_{mk}/X_{wk})/(X_{ma}/X_{wa})$

where, for a given year, X represents exports; m is for Mexico; k is the commodity of interest (in this case, all agricultural and food exports or one of the four major subgroups of Mexican agricultural and food exports); w is the world; and a is all agricultural and non-agricultural goods.

An RCA greater than 1 indicates that Mexico's share of world exports of the commodity of interest is greater than its share of world exports of all goods and, thus, Mexico's trade would "reveal" a comparative advantage in the export of that particular commodity. On the other hand, an RCA of less than 1 indicates that Mexico's share of world exports of the commodity of interest is less than its share of world exports of all goods implying that Mexico's trade "reveals" a comparative disadvantage in the export of that commodity.

Applying the index to all Mexican agricultural exports (where k is the total value of Mexican agricultural and food exports as defined earlier) using the U.N. COMTRADE data, the calculated RCA suggests that as Mexico was unilaterally opening its markets in the pre-NAFTA years the

country was losing its comparative advantage in agriculture as the RCA declined from almost 2.5 in 1989 to 0.7 in 1992 (Figure 9). However, caution should be used in interpreting this result in this way since the number of countries included in the COMTRADE data used in this analysis after 1991 was different than the number included before 1991. Nevertheless, the result is consistent with the fact that Mexico began removing the high level of support provided to its agricultural sector in the mid-1980s and early 1990s through trade liberalization and dramatic changes in domestic support policy, removing the restrictions on imports and the incentives to produce and export. In any case, since 1992, the Mexican RCA has fluctuated only slightly between about 0.7 and 0.8 implying that Mexico has a comparative disadvantage in agriculture in general. Interestingly, the RCA for Mexican agricultural exports climbed slightly between 2002 and 2004 suggesting some improvement in competitiveness. A few more years of data will be needed to determine if the upward movement is the start of a long-run trend or simply a statistical anomaly.

Primary Mexican agricultural and food exports include: (1) vegetables (fresh, chilled, and frozen); (2) fruit (fresh, chilled, frozen); (3) animal products (livestock, meat, livestock products, and dairy products); and (4) processed food (processed consumer oriented products, normally differentiated or branded, including malt and spirit beverages, processed and preserved fruits and vegetables, fruit juices, bakery products, and confectionary products). Calculation of the RCA index for each of these four groups suggests that Mexico has a clear comparative advantage in vegetables with an RCA in excess of 4 in all years and in fruits with an RCA in excess of 1 in all years (Figure 10). Between 1991 and 2002, the RCA for both groups trended downward from 6.8 to 4.4 for fruits and from 3.1 to 1.5 for vegetables. Between 2002 and 2004, however, increases in the RCAs for both groups suggest a possible reversal to the long-run downward trends.

The calculated RCAs for animal products and processed foods, on the other hand, clearly indicate a comparative disadvantage in Mexican production and export of both groups of commodities but also steady improvement in competitiveness of both groups since the lows of the early to mid-1990s (Figure 10). The relatively stronger improvement in the competitiveness of the processed foods group is likely due to the strong export performance of Mexican malted beverages (beer). If the trend continues, the RCA for this group could increase to over 1 suggesting that Mexico has gained a comparative advantage in processed food exports.

In summary, the analysis suggests that Mexico has a strong comparative advantage in fresh vegetables and relatively weaker advantage in fresh fruits with the competitiveness of each declining slightly during the 1990s and some recovery in recent years. Also, while the RCA calculation suggests that Mexico does not have a comparative advantage in either animal or processed food products, the latter group shows a dynamic growth in competitiveness moving closer to the neutral benchmark of comparative advantage (RCA =1).

As discussed earlier, the U.S. is the major market for Mexican agricultural and food products, currently accounting for about 86% of all Mexican agricultural exports (USDAa). That the U.S. is such a dominant customer for Mexican agricultural and food products should not be surprising since Mexico has several advantages over its export competitors in access to U.S. markets. Of course, no other country except Canada is closer to major U.S. food consumption centers. Just as important, however, is that a growing U.S. population of Mexican origin along with economic and cultural integration is rapidly introducing Mexican foods and cuisine to a large non-Hispanic population. At the same time, NAFTA has provided a clear trade policy advantage to Mexico in access to U.S. markets.

The future viability and profitability of the Mexican agricultural sector will depend largely on the extent to which Mexico is able to defend its share of U.S. markets as the U.S. enters into its own set of bilateral trade agreements and as the Doha Round of trade negotiations results in further multilateral liberalization of trade. Consequently, the trends in the Mexican share of U.S. imports of agricultural and food products are calculated and analyzed as indicators of the competitiveness of Mexican exports in U.S. markets.

First, changes over time in the Mexican shares of U.S. imports of the four major commodity groups defined earlier are examined[2]. Then changes in the Mexican shares of the U.S. market for 24 of the top individual commodities Mexico exports to the United States are examined. The 24 commodities selected account for 85% of the value of all Mexican agricultural exports to the United States. In 2004, the processed food products group represented almost 38% of the total value of Mexican agricultural and food exports to the U.S. overtaking vegetables, traditionally the largest Mexican export category to the U.S. by value, at 35%. The fruits and animal and products categories accounted for 15% and 10%, respectively, of Mexican agricultural and food exports to the U.S. in 2004.

Despite an almost continual increase in the value of Mexican exports of vegetables to the United States since pre-NAFTA years, Mexico's share of all U.S. imports of vegetables has declined almost continually to 55% in 2004 after reaching a high of 75% in 1990 (Figure 11). The decline in the Mexican share of U.S. vegetable imports since 1990 may be due in large part to two recent market phenomena. First, competition for Mexican vegetable exports to the United States from Canadian and European exports of vegetables grown in greenhouses (particularly tomatoes and bell peppers) has grown dramatically in the last 5 years or so (Cook and Calvin 2005). Also, the opening of the U.S. market to imports from Central and South America through bilateral preferential trade treatments (Caribbean Basin and Andean initiatives) has created growing competition in U.S. markets for Mexican vegetables, particularly asparagus, melons, and broccoli/cauliflower.

The Mexican share of all U.S. imports of processed foods doubled between 1990 and 2004 from 9% to 18% (Figure 11). This steady and impressive growth trend is closely related to the strong

[2] The market shares are calculated using FATUS data from the Foreign Agriculture Service, U.S. Department of Agriculture (USDAa).

export performance of Mexican beer in U.S. markets but also to increases in Mexican exports of other beverages, processed vegetables, and bakery and confectionary products to the United States.

The Mexican export share of U.S. fruit imports has also grown rapidly over time, jumping from 14% in 1990 to a high of 25% in 1999 before sliding back to 20% in 2000 followed by gradual growth back to 23.7% in 2004 (Figure 11). The growth in the Mexican share of U.S. fruit imports has been the result of a surge in Mexican grape and avocado exports to the U.S. associated with the lifting of some U.S. phytosanitary barriers.

After registering a steady increase between 1989 and 1995 from 6% to 10%, the Mexican share of U.S. animal and animal products imports dropped sharply to 2.8% during the height of the Mexican economic recession in 1996 and then recovered slowly in the post-recession years back to a little over 5% in 2000 (Figure 11). A recent increase in the Mexican market share back to about 6.5% in 2004 was mainly due to the U.S. ban on imports of Canadian cattle. Nevertheless, the generally downward trend in the Mexican share of U.S. animal and animal product imports is related to the stagnant trend in U.S. per capita beef consumption and increasing U.S. imports of fed cattle from Canada and of meat products from several other countries, including New Zealand, Brazil, and Argentina.

This analysis of the Mexican shares of U.S. agricultural and food imports, however, only tells part of the story of Mexican exports to the United States. A successful international business strategy calls for the positioning of a product in a growing market. Achieving an increasing share of a declining import market is not a formula for long-term export growth and competitiveness. On the other hand, achieving growing shares of foreign growth markets is the basis for not only the long-term growth of a country's exports but also for the economic viability and welfare of the country's export-dependent industries. At the same time, a growing export share of a growing foreign import market suggests gains in the competitiveness of a country's exports not only in relation to those of its export competitors but also in relation to domestic producers in the importing country.

Changing consumer preferences have led the way to profitable and expanding food markets in developed countries. In recent years, demographic changes, health concerns, evolving convenience and variety requirements, and changing marketing strategies by food service providers and retailers in the U.S. are inducing important adjustments in consumer food demands. U.S. per capita consumption of some traditional products is declining and is rapidly expanding in others. As a consequence, U.S. agricultural and food markets are under growing internal and external pressure for market access by foreign exporters through trade agreement arrangements and aggressive marketing strategies.

To gain some insight on the implications of the changing Mexican shares of U.S. agricultural and food imports for the Mexican export potential over the long run and what that may mean for the development of Mexican agriculture over time, changes in those shares since 1989 for the 24 top Mexican agricultural exports to the U.S. are compared to the growth of U.S. imports of those same commodities. The analysis considers three time periods: (1) the pre-NAFTA period of 1989 to 1994, (2) the early stage of NAFTA from 1994 to 1999 during which most U.S. tariffs

on Mexican agricultural and food products were eliminated and during which Mexico began signing free trade agreements with other countries, and (3) the second stage of NAFTA from 1999 through 2004 during which the U.S. began to provide other countries with increased access to U.S. markets through negotiating bilateral free trade agreements with those countries.

The results are illustrated in Figure 12. The upper right quadrant of Figure 12 includes commodities with positive Mexican share changes and positive U.S. import growth during each of the three periods. These are the commodities for which Mexico gained a larger share of a growing market in the indicated time period. The upper left quadrant of Figure 12 includes commodities with negative Mexican share changes but positive U.S. import growth during each of the three periods. These are the commodities for which Mexico was losing share of growing U.S. imports. The bottom right quadrant of Figure 12 includes commodities with positive Mexican share changes but negative U.S. import growth during each of the three periods. These are commodities for which Mexico gained a larger share of declining U.S. imports. Finally, the bottom left quadrant of Figure 12 includes commodities with negative Mexican share changes and negative U.S. import growth during each of the three periods. These are the commodities for which Mexico was losing share of declining U.S. imports.

From a long-run strategic point of view, the optimal scenario for Mexico would be for all commodities, particularly in recent years (the triangles △ in Figure 12), to be in the top right quadrant. For these commodities, continuing investments to increase the levels of productivity and efficiency in production, marketing, and transportation and to eliminate institutional, administrative, and political barriers to trade are required to maintain market share and realize the long-run export potential. The long-run strategic implications of commodities being in any other quadrant are negative for the Mexican agricultural export industry. For commodities in the top left quadrant, Mexico is losing market share of U.S. growth markets to other countries. These are the commodities where investments to increase productivity and efficiency and to eliminate remaining barriers to trade could have the highest payoff for Mexico. For commodities in the bottom right quadrant, Mexico is gaining share of declining U.S. markets suggesting a need to shift resources out of the production of those commodities into those in the top right quadrant. For those commodities in the bottom left quadrant, Mexico is losing market share in a declining U.S. import market. These may be commodities where profitability signals have already begun shifting resources to other more profitable alternatives for export to the United States. They are also the commodities where investments in increased efficiency and productivity would have the lowest payoff.

Figure 12 illustrates clearly that for most of its top agricultural and food exports to the United States, Mexico is exporting into growth markets. In recent years, Mexico has been gaining market share of growing U.S. imports of avocados, citrus, malt beverages (beer), onions, and pecans. For most other commodities in most time periods, however, Mexico has lost market share of growing U.S. markets (Figure 12). In recent years, Mexico has been losing market share of growing U.S. imports of grapes, eggplant, strawberries, cauliflower/broccoli, other beverages, squash, and cut flowers.

Mexican tomatoes, the top Mexican agricultural export to the United States, lost market share of growing U.S. imports in the pre-NAFTA years but experienced an even greater loss of market

share in the years immediately following the implementation of NAFTA (Figure 12). In recent years, Mexico has rebounded and has held its own in the U.S. tomato market against it export competitors. Commodities for which Mexico has lost market share of declining U.S. imports in recent years include coffee, sugar, bananas, and melons.

Table 1 highlights the detailed results for each of the top 24 commodities that Mexico exports to the United States. The last three columns show that of those 24 commodities, total U.S. imports from all sources experienced a decline in only 5 cases in the most recent period of 1999-2004, including coffee, bananas, melons, sugar, and cattle. The first three columns show that most of Mexico's top agricultural and food exports lost shares of U.S. imports of those commodities in the recent period of 1999-2004. Along with Figure 12, Table 1 serves to demonstrate that changes in export value or market share alone are unreliable indicators of the competitiveness of a country's exports.

For example, note that while Mexican exports of cucumbers, mangoes, asparagus, and cauliflower/broccoli to the United States have all been growing in recent years, Mexico has been losing U.S. import share of each rather consistently over time. In the case of Mexican exports of tomatoes, peppers, and onions to the United States, all of which have also been growing consistently over the years, Mexico has been able to prevent a further erosion of its market share. Mexican tomato exports, for example, were losing market share to Canadian greenhouse-produced tomatoes until 2000 when the Mexican tomato industry began adopting similar technologies and recapturing some of its lost market (Cook and Calvin 2005). The opposite is the case for Mexican exports of grapes and "other beverages" both of which experienced impressive growth in the pre-NAFTA years and in the immediate post-NAFTA years. Despite continued strong growth in U.S. imports of both grapes and "other beverages" in recent years, however, the Mexican shares of those growing U.S. imports have eroded substantially. Squash, melons, strawberries, eggplant, and cut flowers are also showing signs of losing their competitive advantage.

The success stories of Mexican competitiveness in agricultural exports to U.S. markets are clearly avocados and malt beverages. Mexico's growing share of U.S. beer imports has been at the expense primarily of Canadian and European beers. The poorest Mexican export performers are coffee, bananas, cattle, sugar, grapes, asparagus, melons, and mangoes, each of which experienced sizable U.S. import share loses between 1999 and 2004. Mexican asparagus, mangoes, bananas, and grapes have all lost U.S. import shares to South American exporters (Chile, Peru, Ecuador, Brazil). Mexican melons, cauliflower/broccoli, strawberries, and coffee have all lost U.S. import shares to Central American and Caribbean exporters.

## Mexican Export Market Diversification: The Competitiveness of Mexican Agricultural and Food Exports in Canada, the European Union, and Japan

While the U.S market absorbs 86% of the total value of Mexican agricultural and food exports, Mexico has been attempting to diversify its export market base since the implementation of NAFTA as a means of gaining competitiveness and reducing dependence on U.S. markets. As

indicated earlier, the European Union is the only major market for Mexican agricultural products besides the United States. Despite signing a free trade agreement with the EU in 2000, however, Mexico continues to lose its overall share of EU agricultural and food imports. Mexican agricultural and food exports to Canada are growing but from an extremely small base.

According to Eurostat data, major Mexican agricultural and food exports to the EU include vegetables and fruits, coffee, beer, and legumes. Mexican beer is the star performer on a market share basis, reaching nearly 30% of the EU-15 imports of beer in 2000-2002 (Figure 13). Only two other groups of Mexican products (dried legumes and avocados/mangoes) have achieved more than 5% of EU-15 imports of those products since 1995. The Mexican export share of EU dried legume exports has hovered between 5% and 10% since 1995 with a slight downward trend since 2001. Whether the decline in the Mexican share of EU dried legume imports represents a long-term downward trend is not yet clear. The Mexican share of EU avocado/mango imports, on the other hand, has exhibited a consistent downward trend from 8% in 1995 to 4% in 2004. The Mexican shares of EU imports of grapes, citrus, onions, and coffee have generally been in decline since at least 1999. Mexican shares of EU agricultural and food product imports have been lost primarily to Middle Eastern and African countries with which the EU has preferential trade arrangements.

Only about 4% of the total value of Mexican agricultural and food exports is directed to the EU despite the EU-Mexico free trade agreement signed in 2000. A substantial penetration of EU markets by Mexico will be difficult to achieve over time primarily due to transport distances and fierce competition from Eastern European, African, Middle Eastern, and even South American countries. The main opportunity for export growth to the EU for the Mexican agricultural and food sector will likely continue to be beer.

According to official Canadian data, fresh vegetables, fresh fruit, and beer currently represent 45%, 25%, and 20% of the total value of Canadian imports of each respective group of products. Mexican avocados have demonstrated a spectacular performance in the Canadian market with the Mexican share of Canadian avocado imports increasing from 6% in 1989 to 95% in 2004 (Figure 14). The Mexican share of Canadian beer imports also increased rapidly from 7% in 1989 to 25% in 1999 but since has declined to just under 23% in 2004. The Mexican share of Canadian guava and mango imports also rocketed from 40% in 1989 to 78% in 1997 but dropped substantially to 54% by 2004 under pressure from South American exporters. Mexican tomato exports to Canada staged a dramatic comeback beginning in 2000 after losing ground to the United States in the 1990s following the implementation of the U.S-Canada Free Trade Agreement (CUSTA). Mexican tomato exports accounted for 30% of Canadian imports in 2004 after dropping from 24% to 3% between 1990 and 1992. Mexican peppers experienced a similar export performance and recovery in Canadian markets and currently account for 25% of Canadian pepper imports. The Mexican share of Canadian grape imports is about 10% while that of bananas, coffee, and melons have decline almost continuously since 1989.

Mexico has also attempted to expand its food exports to the profitable Japanese market with relative success. According to COMTRADE data, Japanese imports of food and live animals (SITC rev 3, group 0) from Mexico grew from US $ 185 in 1994 to US$ 485 million in 2004, achieving a 1.1% share of total Japanese imports of that category. At the subgroup level, the

Mexican share of Japanese imports of fruits and vegetables (STIC rev 3, group 05) grew slightly from 2% in 1994 to 2.3% in 2004 while the Mexican share of Japanese imports of meat (mainly pork) increased from a low of 0.4% in 1994 to 2.7% in 2002 only to decline again slowly to 2.1% by 2004. The value of Mexican pork exports to Japan grew consistently from US$ 25 million in 1994 to US $ 204 million in 2001 but afterward declined to US$ 182 million by 2004. Not surprisingly, alcoholic beverages (SITC rev 3 group 112) is the only other category in which Mexico has gained a noticeable share of Japanese imports. The Mexican share of Japanese alcoholic beverage imports grew from 6.4% in 1994 to 8.3% in 2004 although total Japanese imports declined slightly over that period.

## Main Factors Affecting the Long-Run Competitiveness of Mexican Agriculture

Over the last two decades, the growth and competitiveness of Mexican agriculture have been determined by a few key factors, including the unilateral liberalization of Mexican markets, the implementation of NAFTA, fluctuations in the value of the Mexican Peso, and internal economic reforms including changes in domestic agricultural policy. In the future, however, the marginal effects of the factors that have impacted Mexican agriculture in the past will diminish relative to the likely effects of a host of other factors that are already beginning to set the direction and shape the pattern of those exports. Among the factors most likely to impact the long-run competitiveness of Mexican agriculture include: (1) the growing number of bilateral trade agreements between Mexico and its trade partners; (2) food safety and sanitary/phytosanitary issues; (3) limitations imposed by the distribution and availability of water in Mexico; (4) changes in Mexican agriculture-related infrastructure; (5) Mexican land reform, land tenure laws, and the implications for Mexican farm size and productivity; (6) technology adoption and the implications for Mexican agricultural productivity; (7) growth in Mexican per capita incomes and domestic demand; (8) structural change in the Mexican food distribution system; (9) changes in domestic agricultural and trade policies; and (10) several other potentially important factors.

### *Mexican Free Trade Agreements*

Following the successful negotiation of NAFTA, Mexico embarked on a global strategy of expanding exports by diversifying its set of export customers through aggressive negotiation of numerous bilateral free trade agreements. Since the implementation of NAFTA, Mexico has effected 12 FTAs including agreements with Bolivia (1995); Costa Rica (1995); Colombia and Venezuela (G-3, 1995); Nicaragua (1998); Chile (1999); Israel (2000); the European Union (2000); Iceland, Norway, Liechtenstein, and Switzerland (EFTA, 2001); Guatemala, Honduras, and El Salvador (North Triangle, 2001), Uruguay (2003); and Japan (2005).

According to Luis Ernesto Derbez (2002), formerly the Mexican Secretary of Economy and currently the Mexican Secretary of Foreign Affairs: “Mexico's FTAs are a vital component of its economic strategy to improve global competitiveness and ensure long-term growth.” Nevertheless, a common perception in the Mexican agriculture sector is that such agreements

have primarily enhanced the competitiveness of Mexico's trading partners in Mexico and reduced the competitiveness of Mexican agriculture. For example, U.S. agricultural exports to Mexico have increased rapidly since the implementation of NAFTA generating a negative Mexican agricultural balance of trade as opposed to the positive balance of trade with the U.S. enjoyed by Mexico in non-agricultural goods.

Williams (2001) argues, however, that NAFTA has had little direct effect on U.S. agricultural and food exports to Mexico. The primary impacts of NAFTA, he contends, have been to stimulate an increase in Mexican agricultural exports to the United States and to lock in trade gains achieved as a result of the decade long process of unilateral liberalization of Mexican agricultural and food trade. He concludes that changes in the composition of U.S. exports to Mexico to include a larger share of higher value food products and an increase in capital investments and joint ventures by U.S. firms in Mexican agricultural and food industries have been more related to economic growth in Mexico and changes in Mexican investment laws than to the specific provisions of NAFTA. He conducts a trend and structural change analysis of U.S.-Mexico agricultural trade and finds no significant change in the trend growth in the value of U.S. agricultural exports to Mexico before and after NAFTA. The implication is that U.S. agricultural exports to Mexico in the post-NAFTA years are following a trend established during the decade prior to NAFTA as Mexico unilaterally liberalized its trade. On the other, hand, he finds that NAFTA increased both the level and the rate of growth in Mexican agricultural and food exports to the United States. This result makes sense, of course, because while Mexico had already eliminated most of its trade barriers over the decade prior to NAFTA, the U.S. only began eliminating its existing barriers to Mexican imports with the implementation of NAFTA.

By maintaining more open borders among all three countries, NAFTA will also insure greater direct interaction and response of the agricultural markets in each country to changes in market and economic conditions in any of the other member countries. As a result, the pattern, composition, and growth in U.S. agricultural trade with its NAFTA partners will be increasingly determined by the underlying comparative advantage in each country as affected by a broad range of forces external to those markets, many of which may be more important to future U.S. agricultural trade with Canada and Mexico than the provisions of NAFTA.

Little research has yet been done on the effects of the other Mexican FTAs on Mexican agricultural trade. In general, however, the effects would likely be similar to those of NAFTA although much smaller in magnitude. In essence, through its efforts to establish FTAs with its current and potential trading partners, Mexico is seeking trade reciprocity. In other words, having unilaterally opened its own markets to the benefit of other countries, Mexico is intending to benefit from negotiating greater access to international markets. This report provides little evidence that Mexico has made any particular headway in diversifying and developing its agricultural export markets through the many FTAs that it has negotiated. Nevertheless, the potential remains and could help provide some cushion for Mexico against recently declining market shares for many of its agricultural products in the United States.

*Food Safety and Sanitary/Phytosanitary Issues*

As bilateral, regional, and multilateral trade negotiations remove conventional barriers to trade among countries like tariffs and quotas, globalization is rapidly linking the economies of trading countries and internationalizing what were once only domestic issues such as food safety (FS) concerns and sanitary and phytosanitary (SPS) problems. Appropriate strategies to prevent or mitigate the impacts of SPS and FS problems are now key components of most countries' domestic policies and have potentially important effects on trade. In the U.S., for example, despite having one of the safest food distribution systems in the world, outbreaks of foodborne illnesses over the last decade have induced increasing concerns about food safety which have been compounded since September 11, 2001 and subsequent bioterrorism scares. The sensitivity of U.S. markets to FS concerns has been heightened over the last 10 years by the strong increase in the U.S. per capita consumption of fresh produce and the growing import component of that consumption (almost 20% in fresh fruits other than bananas and 14% in fresh vegetables).

Because Mexico is the largest supplier of fresh produce to the U.S. market, concerns about food safety related to fruits and vegetables naturally focus on imported Mexican produce. While there is little evidence that imports are more likely to involve FS problems than domestic U.S. production, media reports related to potential foodborne illnesses such as the Alar scare of the early 1990s have helped create a consumer perception that such is the case. When outbreaks of foodborne illnesses are traced back to foreign food producers, not only do those producers feel the market effects but also importers, shippers, wholesalers, processors, and retailers all the way along the supply chain from the foreign producers to U.S. consumers. The consequence has been increasing sensitivity to and reporting of even minor FS problems related to imported food products.

The case of trade-related SPS issues is somewhat different than that of food safety issues but no less important. The main SPS problems have long been identified and are related primarily to the potential for imported animal and plant pests or diseases that can affect U.S. domestic production. The most challenging phytosanitary issue related to U.S.-Mexico trade has been the fruit fly which has been under control in the U.S. but not in most Latin American countries. In the case of animal sanitary issues, tuberculosis, brucellosis, and foot and mouth disease have been the main targets but recent serious problems include bovine spongiform encephalopathy (BSE), more popularly known as mad cow disease, and avian influenza.

The responsibility for U.S. food safety issues related to imported food belongs to the USDA Food Safety and Inspection Service (FSIS) and the U.S. Food and Drug Administration (FDA) of the U.S. Department of Health and Human Services. The former covers meat, poultry, and eggs while FDA deals with all other products including fresh fruits and vegetables. When an FS outbreak is detected, the problem is traced back to specific producers. If repeated cases are found, entire regions and even a whole exporting country can be affected through import prohibitions that can be highly costly. The responsibility for plant and animal health issues related to imports is the purview of the U.S. Animal and Plant Health Inspection Service (APHIS) in the U.S. Department of Agriculture.

In Mexico, SENASICA is the government agency responsible for both FS and SPS programs. SENASICA coordinates with FDA, FSIS, and APHIS whenever an FS or SPS problem arises with Mexican agricultural or food exports to the U.S. A recent evaluation of SENASICA by the Inter-American Institute for Cooperation in Agriculture (IICA) concluded that the agency's budget as a percent of national GDP is quite low compared to the budgets of similar agencies in other countries like Argentina, New Zealand, and Australia (IICA 2004). The IICA report also concluded that SENASICA lacks personnel with solid expertise in critical areas of operation, has a weak and ineffective system of interaction with the private sector, and is in need of an improved system of traceability related to animal health issues.

***Food Safety Issues Related to Mexican Food Exports to the U.S.***

In general, Mexican producers and shippers attempt to follow U.S. SPS and FS regulations closely to keep U.S. import channels open and their products flowing to U.S. markets. The general feeling among Mexican produce exporters persists that their products are subject to stricter controls and more inspections than equivalent domestic U.S. produce. Nevertheless, only three major cases of food safety problems involving U.S. food imports from Mexico have been reported since the implementation of NAFTA in the mid 1990s: (1) strawberries, (2) cantaloupes, and (3) green onions. All three cases have caused substantial losses not only to Mexican exporters but also to U.S. shippers and producers.

Strawberries

In March 1997, an outbreak of hepatitis A was reported in Michigan and later in other states. (Hutin et al. 1999). The cause was rapidly traced back to frozen strawberries from a firm in California that used Mexican strawberries. Although most Mexican strawberries are sold in the fresh market, a small portion is sold for processing. The FDA determined that the source of the contamination was not California strawberries but failed to determine if the Mexican strawberries were contaminated in Mexico or at the processor in California. The public concern affected all berries leading to a 40% drop in monthly grower prices between March to April 1997 and a 47% drop in Mexican strawberry exports to the U.S. that year. The cost to U.S. strawberry producers has been estimated in the range of $15 to $40 million (Richards and Patterson 1999). The FDA subsequently provided training in GAP (Good Agricultural Practices) to California strawberry processors. Mexican agricultural agencies also disseminated information about FDA's GAP program among Mexican growers (Calvin 2003). By the following year (1998), Mexican strawberry exports had recovered somewhat. By 1999, U.S consumer and shipper confidence in Mexican strawberries rebounded pushing Mexican exports of strawberries to record levels that year. No subsequent FS problems related to Mexican strawberries have been reported.

Cantaloupes

The case of Mexican cantaloupe exports was different and more serious than that of strawberries. Contamination with salmonella was detected in the three consecutive years of 2000, 2001, and 2002. In all cases, the contamination was traced back to a single region of Southern Mexico. The spring 2000 outbreak of *Salmonella Poona* was found to be caused by imported Mexican

cantaloupes and traced back to a single producer in Southern Mexico and to a shipper in Arizona (Anderson et al. 2002). The FDA issued import alerts for the both the shipper and producer. Because the Mexican export season was at an end at the time the salmonella problem was reported, the economic impact that year was not too serious for Mexico. U.S.-produced cantaloupes and imports from Central America bore the brunt of the market reaction to the report.

In the spring of 2001, another two cases of salmonella outbreaks associated with cantaloupes were reported (*Salmonella poona* and *salmonella anatum).* The FDA traced the source of contamination to the same grower in Mexico and the same shipper in Arizona implicated in the previous year's outbreak. The FDA requested cantaloupes from those firms to be removed from sales in the U.S. and again issued an import alert for the grower and shipper. Later that year, SENASICA, the Mexican agency in charge of food safety issues, launched a program intended to eliminate the food safety hazards for cantaloupes. The program included planting permits, a GAP program and a Good Management Practices (GMP) program for growers and packing houses along with sophisticated traceback capabilities. The program was implemented on a voluntary basis in some Mexican states. In the following year, the FDA and SENASICA launched a joint training program for government inspectors and cantaloupe growers (Calvin 2002).

Despite the many efforts to eliminate the problem, an additional outbreak of *Salmonella Poona* was reported in the U.S. and in Canada in May 2002. Again, the problem was traced back to imported cantaloupes from Mexico. This time, however, the cantaloupes were shipped through McAllen, Texas (Anderson et al., 2002) from two states in Mexico (Michoacan and Guerrero). The FDA subsequently issued an import alert for all cantaloupe imports from Mexico based on the concern that produce from restricted regions could be mingled with those from non-restricted areas. In November of that year, Canada also issued an import alert for all Mexican cantaloupes (CFIA, 2002). The economic impact from this third outbreak was widespread in Mexico. The Mexican states of Sonora, Jalisco, Colima, and Tamaulipas were about to begin or at the peak of their respective harvesting seasons when prices began to tumble and exports dropped precipitously. The FDA announced that individual Mexican producers could petition to be removed from the import alert if they provided sufficient documentation regarding their food safety practices. U.S. imports of Mexican melons declined by $40-45 million in 2002 and 2003 from pre-outbreak levels. U.S. imports of Mexican cantaloupes rebounded in 2004 and 2005 back to the 2000-2001 average. Although no official estimates of the economic impact of the salmonella outbreak on the Mexican cantaloupe industry are available, assuming the drop in Mexican exports in 2002 and 2003 was mainly due to the salmonella outbreak, the overall cost for Mexico could be conservatively placed at around $70-80 million.

Green Onions

In November of 2003, FDA announced that an outbreak of hepatitis A in Tennessee had been traced back to undercooked green onions imported from Mexico (FDA 2003). Later FDA announced that the source of contamination was four specific firms that grow green onions in Mexico and issued an import alert ordering border inspectors to reject shipments from those firms (Calvin, Avendaño, and Schwentesius 2004).

The hepatitis A virus causes a liver disease that occasionally can be severe and is mainly transmitted by the fecal-oral route. Contaminated green onions have been associated with previous illness outbreaks in the U.S. (including domestic production). They are susceptible to contamination because the plant surfaces are particularly adherent to fecal particles (Dato et al 2003). Mexico supplies most of the U.S demand for green onions (87% in 2003) primarily from the states of Baja California and Sonora. The harvesting and packing of green onions are both highly labor-intensive because they are bunched by hand so that the likelihood of microbial contamination is high. In a typical operation, up to nine persons might handle a green onion (Calvin, Avendaño, and Schwentesius 2004).

In recent years, Mexican growers of green onions have adopted strong and expensive food safety programs to comply with the U.S. GAP and GMP guidelines (Avendaño and Schwentesius 2003). Although Mexican officials inspected the firms identified by FDA as the source of the contamination and claimed that no evidence of contamination was found, the damage caused to the Mexican green onion industry by the FDA alert was severe. In the two weeks after the FDA announced that the source of the illness outbreak had been traced to Mexican green onions, the price per box dropped from $18.30 to $7.23 while shipments to the U.S. declined 42%. The loss just to Mexican growers was estimated to be about $10 million (Calvin, Avendaño, and Schwentesius 2004).

As the major U.S. supplier of many fresh fruits and vegetables, Mexico will be prone to suffer economic losses if strong FS programs are not developed and enforced. Just one case of a food-related illness can cause serious damage to the reputation of producers in both contaminated and non-contaminated areas or products. Take the case of Guatemala in 1996 when foodborne illness outbreaks were associated with raspberries imported from that country. At the time, Guatemala was the largest exporter of raspberries to the United States. The FDA issued successive import alerts that devastated the Guatemalan raspberry industry from which it has never fully recovered despite having implemented new FS programs. With better FS programs in place at the time of the outbreak, Mexican growers have been able to capture and hold onto much of the Guatemalan share of U.S. raspberry imports.

***Sanitary/Phytosanitary Issues Related to Mexican Food Exports to the U.S.***

SPS problems refer to sanitary issues associated specifically with plant and animal health. Mexican exporters to the U.S. have learned from long experience to comply strictly with U.S. SPS standards as the only way maintain their share of U.S. markets. Two major plant health issues related to Mexican exports concern avocados and citrus. The situation is more complicated in the animal health area with new diseases like BSE and avian influenza which are imposing severe restrictions on trade in many countries but currently are not affecting Mexican exports to any extent.

<u>Avocados</u>

Avocado exports from Mexico were banned in 1914 due to concerns over avocado weevils and fruit flies (Orden, 2002; Pacheco 2004). Over the following decades, the Mexican government, pushed by Mexican avocado producers, lobbied the U.S. Department of Agriculture for access to

U.S. markets to no avail. In the early 1990s, a plan filed with the U.S. by the Mexican government to grow avocados for export in the state of Michoacan, Mexico's principal avocado producing state, under strict conditions, including complying with U.S. phytosanitary rules, restricting the exports to specific months, and only selling the avocados in specific U.S. states met with little response. Although the NAFTA negotiations pushed the avocado controversy to the forefront, avocados were eventually excluded from the agreement. In 1995, APHIS proposed a rule to allow imports of Mexican avocados under certain specific conditions. APHIS concluded that although Mexican avocados are susceptible to some pests, the likelihood of pest introduction to the U.S. is extremely low if strict phytosanitary procedures and standards are followed (Bredahl et al, 2001). In 1997, the U.S. government ruled that Mexican avocados could be sold in 19 states, located in cooler climates and far away from the U.S.-Mexico border. Avocado imports were limited to only four months out of the year. Four years later, 12 more states were put on the list, and the window of importation was stretched to six months. As NAFTA began opening markets between the U.S. and Mexico, U.S. firms began establishing growing and packing operations in the large avocado producing states of Michoacan and Sinaloa (Pacheco 2004). U.S. firms began to ship avocados from Mexico back into the U.S. just as the U.S. government started allowing in Mexican imports. In November 2004, the USDA issued a ruling to allow Mexican-grown avocados to be sold year-round in 47 states (excluding the avocado producing state of California, Florida, and Hawaii) starting on January 31, 2005. The USDA based its decision on findings that the avocado pests from Mexico are no longer a major threat.

Following the 1997 decision to open U.S. markets to increased imports of Mexican avocados, Mexican exports doubled from about 5,000 metric tons (mt) to 10,000 mt. By 2001, exports had jumped to 25,000 mt and then soared to 75,000 mt in 2003 and 130,000 mt in 2005 from an increasing number of municipalities to an increasing number of U.S. states through extended export windows. The value of Mexican avocado exports to the U.S. passed the $200 million mark in 2005 and the volume is expected to grow an additional 9% by 2007 but with a 12% decline in price (Zahniser et al. 2005). By that time, Mexico will have captured an estimated one third of U.S. avocado consumption and may need to consider restraining exports to avoid oversupply problems in the U.S. avocado market. This is an obvious case where relieving an SPS constraint has had a substantial impact on Mexican export competitiveness.

Citrus and Other Commodities

The only other major concern related to Mexican exports and plant health issues involves Mexican citrus exports and infestations of fruit flies. In Mexico, the Mexican fruit fly is a major pest of mangos, grapefruits, tangerines, and oranges but also attacks apples, apricots, avocados, nectarines, peaches, pears, plums, and prunes as well as other fruits. Certain areas of Mexico are not generally infested but experience sporadic outbreaks (APHIS 1993). When outbreaks of fruit flies occur in Mexico, the U.S. quarantines those areas. APHIS and the Mexican government cooperate in a program to suppress Mexican fruit flies and prevent their spread. Activities include monitoring traps, releasing sterile flies, checking fruit at road stations, treating fruit imports, and regulating fruit shipments from quarantined areas. The northeast regions of Mexico have been declared fruit fly free zones but at times lose that designation when fruit flies are detected in the area. Mexican citrus producers are currently pushing for USDA recognition of northern Tamaulipas and Nuevo Leon as low prevalence fruit-fly areas. This will enable orange

exports from those areas to have market access to certain U.S. states. Currently, Nuevo Leon exports treated citrus to the U.S. under a pre-clearance program.

Sanitary issues related to livestock have likewise limited exports from Mexico. For example, Mexico historically has been unable to export poultry products to the United States because of problems with Exotic New Castle Disease (END) in some regions of Mexico. Mexico has contended, however, that not all Mexican states have END and have petitioned the U.S. to recognize those areas as END-free zones and allow imports of poultry from those areas. In 1997, APHIS amended its regulations to recognize disease-free regions or zones within a country. After evaluating the Mexican states of Sonora and Sinaloa under the new regulations, USDA determined that the risk from END transmission from those regions was relatively low (Salin, Hahn, and Harvey 2002). The rules subsequently issued to allow poultry imports from Mexico, however, are specific and confine the rearing of birds destined for the United States, as well as their slaughter, to Sinaloa and Sonora. If those regions comply with APHIS restrictions and Mexico becomes eligible to export fresh poultry to the United States, Mexican processors in these two states will be able to export fresh, chilled, and frozen poultry meat to the United States for the first time. Mexico has also requested that USDA consider additional states to be declared low risk for transmitting END. Although the U.S. is currently a net exporter of chicken to Mexico, Salin, Hahn, and Harvey (2002) suggest that changes in the eligibility of Mexico poultry exports to enter U.S. markets could result in highly different poultry trade patterns between the United States and Mexico in the future.

According to Hahn et al. (2005) sanitary barriers related to potentially high-impact animal diseases, such as Bovine Spongiform Encephalopathy (BSE), bovine tuberculosis and brucellosis, Classical Swine Fever (CSF), Exotic Newcastle Disease (END), and Avian Influenza (AI) are now the major factors limiting further integration of the North American livestock and meat products industries. Restrictions at the U.S. border with Mexico require that cattle must be certified free of brucellosis and tuberculosis. Most Mexican feeder cattle destined for the U.S. market are steers. A requirement that heifers be spayed keeps their numbers relatively low. Cattle must be free of ticks and are dipped in insecticide baths. Hahn et al. (2005) cite studies concluding that the typical basis for refused entry of Mexican cattle into the U.S. is failure to comply with regulations, such as ear tags and records that are not consistent, dipping certificates that are not in order, improper branding, evidence of open wounds (such as from recent castration) or live ticks, or suspicions that the cattle in question may have been stolen in Mexico. Before entering the United States, cattle are given a bill of health by the veterinarian-in-charge and are then transported to their destination pasture or feedlot by truck.

In pork trade, U.S. regulations concerning Classical Swine Fever (CSF) effectively prevent U.S. imports of live hogs and fresh, chilled, or frozen pork from most parts of Mexico. Since 1995, the Mexican Government has worked to secure the regionalization of U.S. restrictions concerning CSF (Hahn et al. 2005). USDA first recognized the Mexican States of Baja California, Baja California Sur, Chihuahua, and Sinaloa as being free of CSF and then extended similar recognition to the Mexican states of Campeche, Quintana Roo, Sonora, and Yucatán in March of 2005. Even so, Mexican pork exports to the United States remain negligible. Mexico is becoming a supplier of pork to Japan, however, competing with both the United States and Canada in that export market.

*Water Issues*

Although Mexico has abundant water supplies, the distribution of water in Mexico is a major problem limiting potential growth in Mexican agricultural production and exports. About 20% of the water in Mexico is located where 75% of the population resides and where 80% of the industrial activity takes place. Agriculture is the largest user of water in Mexico, accounting for 83% of the total water consumed. Because of the maldistribution of the water supply, however, only 6.1 million hectares or 24.4% of the agricultural land in Mexico is irrigated (INEGI). At the same time, inefficient irrigation practices result in a 65% loss of irrigation water and poor crop productivity levels due to the flooding of crops, land salinity, and erosion.

Mexico's groundwater aquifers are also being severely depleted. The aquifers that support agriculture in the Comarca Lagunera, a major cotton and dairy production area of Mexico, for example, are being depleted at rates between 2 and 7 meters per year. The depletion of these aquifers not only has resulted in increased pumping costs to Mexican agricultural producers but also has led to the presence of arsenic in the water due to the geological configuration of the region (World Bank 1999). The recharge rate of the aquifers which support the Valle de Santo Domingo in the state of Baja California is below 50%. Also, the aquifers in the Valle de León, Río Turbio, and Silao in the state of Guanajuato are being depleted at rates of 1, 2.5, and 3 meters per year, respectively. These depletion rates have also led to the intrusion of salt water rendering the groundwater unfit for agriculture or human consumption (World Bank 1999).

The agricultural use of water containing effluents or industrial residuals in Mexico is also problematic and is creating severe soil degradation and crop contamination problems (World Bank 1999). This is a serious problem given that pathogenic agents and heavy metals such as lead, mercury, zinc, and cadmium contained in these waters enter the food chain and cause human health problems. The misuse of pesticides, produced in Mexico or are imported, in Mexican agriculture has led to the contamination of groundwater and surface water which has negatively impacted aquatic life, wildlife, and human health.

Less than 16% of sewage from Mexico's cities and towns receives any sort of treatment. The rest runs directly into waterways. Many towns have wastewater treatment plants which were constructed through development programs but have now fallen into disrepair. As a result, the water is too contaminated to be used for domestic purposes by downstream communities. Instead, farmers often divert untreated wastewater flows to irrigate their fields, exposing both farmworkers and consumers to a host of health risks.

As a consequence, the future growth potential of Mexican agriculture is in serious doubt. Even if the huge needed investments to clean up Mexican water supplies were made, the limited availability of water in the main production areas of central and northern Mexico will continue to limit the expansion of Mexican agricultural production and exports. The adoption of water-saving technologies is helping to mitigate the limiting effects of the growing water crisis on Mexican agricultural production and export competitiveness. Nevertheless, such technologies are expensive and, thus, tend to further concentrate Mexican agriculture toward areas of large-scale commercial agriculture.

*Mexican Agriculture-Related Infrastructure*

Despite notable improvements since the implementation of NAFTA, the Mexican production, transportation, marketing, storage, distribution, and communication infrastructure remains underdeveloped relative to those of the U.S. and other developed countries and largely insufficient for the growing requirements of the Mexican economy to facilitate the continuing transition to more open markets. Despite growing public and private investments, the inefficient Mexican infrastructure continues to constrain the growth of the Mexican economy and the global competitiveness of the Mexican agricultural sector.

Not all regions of Mexico face the same level of agriculture-related infrastructure problems that plague Mexico in general and not all areas of agriculture-related infrastructure are underdeveloped to the same degree. For example, tomato producers in the Mexican state of Sinaloa have the necessary infrastructure in place, including irrigation, reliable transportation from Sinaloa to Nogales on the U.S. border, and dependable U.S. marketing channels, to respond to the export incentives of NAFTA. Nevertheless, in most areas of Mexico, underdeveloped infrastructure represents a significant obstacle to efficient operation and growth in agricultural production, processing, and marketing. For example, current growth in Mexican fruit and vegetable production is placing tremendous pressure on the outdated and inadequate level of irrigation water storage and delivery systems in many production areas (World Bank 1999).

Perhaps the major infrastructure restriction to Mexico's long-run competitiveness in international agricultural markets is the Mexican transportation system (Barkema and Drabenstott 1996). Even though shipments by truck are more expensive in Mexico than in the United States, truck traffic accounts for about 80% of Mexico's food and agricultural shipments (Barkema and Drabenstott 1996). Mexico has built nearly 3,400 miles of four-lane highways between its major cities since 1990 but much more is needed particularly to handle the growing truck traffic (NATSDB 2005). Many of the new highways are toll roads so many trucks resort to public roads to avoid paying the toll which leads to further deterioration of already poor public highways. In the late 1990s, 61% of Mexican roads were in poor condition, 29% in fair condition, and only 10% in good condition (Barkema and Drabenstott 1996).

Continuing congestion and delays at U.S. land border crossings with Mexico are a major constraint on the flow of agricultural goods from Mexico to the United States. Major problems include "inadequate or dated transportation facilities; inadequate staffing; incomplete, inaccurate and delayed paperwork; inefficient inspection procedures; the lack of coordinated infrastructure planning; and traffic peaking at particular times of the day" (Klindworth 1998). Needed infrastructural improvements at the border include more bridges, access roads and rail lines to cross the border as well as additional commercial inspection facilities (Klindworth 1998).

Although shipping by rail is generally a costly alternative in Mexico, improvements to Mexico's railways since the Mexican railroad industry was privatized in the mid-1990s have occurred in several areas including track and structures; signaling, dispatching, and communications systems; car and locomotive fleet modernization; information technology; and car billing, inspection and repair (*Railway Age* 2000). Nevertheless, the Mexican rail system continues to

face many challenges, including a shortage of intermodal facilities throughout Mexico, the continuing inability of Mexican tracks in many areas to handle the weight of standard U.S. rail cars, requiring smaller cars at higher total cost, and complicated, lengthy, and cumbersome customs clearance procedures at U.S. border crossing points. Major additional investments will be needed to continue upgrading Mexico's tracks and rail equipment.

Maritime shipping to and from Mexico is also costly and inefficient (Barkema and Drabenstott 1996). Poor Mexican port facilities, especially for accommodating intermodal grain transshipments, lengthy delays in unloading and customs clearance, and poorly developed overland routes from Mexican ports to inland distribution points are major constraints to growth in Mexican agricultural exports and Mexico's efforts to diversify its global export customer base. The Mexican government has made intermodal transportation a priority and is expanding the capacity to handle and distribute container shipments. Although inland intermodal terminals and many ports are now privately operated, they are far from being fully automated and internationally competitive. Enormous resources will be necessary to provide these terminals with the modern automated equipment needed to achieve a high level of efficiency but container movement is still too low to justify the large investment required.

### *Mexican Land Reform, Land Tenure Laws, and Farm Size and Productivity*

Without question, one of the principal factors that will determine the future ability of Mexico to compete in international agricultural markets is the extent to which recent changes in Mexican land tenure laws impact the productivity of Mexican agriculture. The basis for the current land tenure system, known as the *ejido* system, was established through the land reform movement of the Mexican revolution of 1910-17.

The initial motive for land reform was to restore land to the people from whom it had been taken as well as to create and protect small agricultural property holdings. Between 1856 and 1910, the Mexican government had helped the *hacendados* (land owners) and foreigners to accumulate large land holdings by taking land away from the peasants and selling it at bargain prices to Spanish nobility, rich Spaniards and foreigners, and others. By 1910, only 830 *hacendados* owned 97% of the land in Mexico while 410,345 farmers owned the other 3%. At the same time, more than 3 million *campesinos* or peasants (97% of rural households) owned no land at all (Zaragoza and Macías 1980).

The process of land expropriation and distribution began in 1915 but massive redistribution of land to landless peasants did not begin until the mid-1930s. The process created a large number of small, inefficient farms, known as the *ejidos.* Although popular in Mexico among the rural poor, the *ejido* system has been widely blamed for the poor performance of the Mexican agricultural sector (Johnson 1998). Many experts have concluded that the *ejido* system has been the principal constraint to growth in the Mexican agricultural sector. When the *ejido* system was first established, the goal was not economic efficiency but rather social equity. Originally intended as a temporary means of dealing with the problem of land tenure, the *ejido* system evolved into a rigid "mechanism for permanent state control of the farmers" (Grennes *et al.*,

1991). As a consequence, the *ejido* system introduced tremendous economic inefficiency into the Mexican agricultural sector in several ways, including (1) creating a large number of extremely small farms, (2) forcing huge tracts of marginal land into production, (3) preventing adequate agricultural production and resource adjustments to changing economic signals, and (4) severely limiting the access of the majority of Mexican farmers to agricultural credit.

Until recently, Mexican land laws required that the Mexican government provide at least 4 hectares (about 10 acres) of irrigated land or its equivalent in rainfed land to each landless peasant (Grennes, et.al. 1991). Rapid population growth in Mexico has forced the Mexican government to shift huge amounts of land into the *ejido* system in compliance with the land tenure laws. Currently, *ejidos* account for about 95 million hectares (235 million acres) or about 49% of the total Mexican land area. The 3.1 million *ejidatarios* represent about 70% of all Mexican farmers. The average *ejido* is only about 9.5 hectares (23.5 acres) but 64% of *ejidos* average less than 5 hectares (12.4 acres). The majority of the *ejidos* are worked on an individual basis (80%) and the remainder in a collective or semi-collective system (Schulthies and Williams 1992).

Due to their small size, about 70% of the *ejidos* operate at a subsistence level in the sense that they do not generate enough income to support a family. *Ejido* families earn only about 40% of the minimum wage, forcing many to seek off-farm employment. The consequence is that *ejidos* lack modern technology and are characterized by extremely low output per acre. In the early 1990s, most *ejidos* did not have access to tractors (57%) or industrial equipment (90%). Also, 33% of *ejidos* lacked electricity, over 50% did not have running water, 80% lacked paved roads, and 40% used wood as the main fuel source (Morett 1991). Little has changed for many *ejidos* in recent years despite extensive economic and political change in Mexico.

The *ejido* system has also forced huge tracts of highly marginal land into agricultural use. As much as 21% of *ejido* land is not considered arable and only 16% of *ejido* land is irrigated. Because of the subsistence nature of the *ejidos*, however, over 90% of them produce at least some corn, the main crop of 65% of *ejidos*, and other food crops despite the unsuitability of the soils and/or climate in many areas. *Ejidatarios* have also faced restrictions on improving marginal lands. If the crop acreage limits of the small property owner restriction were exceeded by converting pasture to crops, for example, the land was subject to seizure by the government (Schulthies and Williams 1992). Farmers have been reluctant to invest in their land over the years for fear of losing both the land and the improvements. A consequence has been a poor average yield performance on large a portion of Mexican crop farmland.

Together with the existing agrarian law, the *ejido* system prevented adequate agricultural production and resource adjustments to changing economic signals. The Mexican land tenure laws imposed a number of restrictions on the use of *ejido* land in an attempt to prevent the land from again becoming concentrated in the hands of a few large land owners. Among others, the restrictions included prohibitions on the selling, renting, or mortgaging of *ejido* land since the land still legally belonged to the Mexican government, the hiring of paid labor to work on *ejido* land, and the conversion of crop land to pasture. At the same time, the small property owner provision of the existing agrarian law resulted in rigid resource and output adjustments to market signals in Mexican agriculture particularly because *ejidos* constituted such a large percentage of

Mexican agricultural land area. Many of these restrictions were reportedly violated routinely in Mexico, limiting but not eliminating the inefficiencies caused by the restrictions (Grennes, et.al 1991).

The Mexican land tenure system also limited the access of *ejidatarios* to credit because the law prevented them from using their land as collateral for loans. To finance production each year, *ejidatarios* had to rely on state credit banks which traditionally restricted the availability of financing and the range of crops for which state credit was available (Heath 1990). The consequence was a limitation of both the level and diversification of agricultural production in Mexico as well as a constraint on the responsiveness of production to market signals (Heath 1990).

In 1991, Mexican President Salinas de Gortari pushed historic land reform legislation through the Mexican Congress in the form of an amendment to Article 27 of the Mexican constitution to help eliminate inefficiencies and promote growth in the Mexican agricultural sector. The amendment allowed *ejjidatarios* to receive the title to the lands they occupy and to be able to sell, lease, or mortgage their land with some restrictions. Foreign ownership of Mexican land was allowed with some restrictions. Also, the new law eliminated penalties for improving marginal lands. Analyses of Article 27 reforms predicted that the legal changes, along with other national privatization efforts, would result in the mass sale of *ejido* lands, create efficient, larger-scale farms, and heighten poverty in *ejido* communities (Bartra 1991; Schulthies and Williams 1992; Collier 1994; Stanford 1994). According to Lewis (2002), however, these predictions have not played out over the years. Although the Mexican government launched an aggressive government program of land rights certification and titling (known as PROCEDE) in 1993, a majority of studies to date conclude that the anticipated impacts of the legal reforms have yet to materialize (Lewis 2002).

Various hypotheses for the failure of the change in Mexican land tenure laws to bring about the anticipated large-scale improvement in Mexican agricultural productivity and competitiveness have been put forward. Bresciani (2004), for example, argues that although PROCEDE helped *ejido* land markets to work better, the change in land tenure laws has promoted increased participation by *ejido* households in local agricultural labor markets and non-farm activities and, thus, "a diversification of household income sources, thereby leading to more adaptable livelihood strategies, and … new channels through which credit constrained households may accumulate enough liquidity to finance accumulation of capital and smoothen [sic] the adverse effects of income shocks." Whatever the reasons, the sweeping changes to Mexican land tenure laws as yet have had little of the anticipated impact on Mexican agricultural efficiency and output and, therefore, little effect on the competitiveness of Mexican agricultural products in world markets.

### *Technology and Growth in Mexican Agricultural Productivity*

In the absence of appropriate labor-using, land-saving technologies, Mexico has historically opted for a political solution to the land constraint problem through land reform. The *ejido*

system was an attempt to allow a more intensive use of labor per unit of land in Mexico. Efforts by the Mexican government over the last decade to reform the land tenure system suggest that the lost economies of size and other sacrifices of efficiency from the *ejido* system have finally outweighed the social welfare benefits of the system as perceived, at least, by the government. If the land tenure reform in Mexico is having any lasting impact on farm productivity, investments to develop and adapt technologies to promote labor-intensive activities in Mexico will be critically needed.

The most highly labor-intensive agricultural activities in Mexico include horticultural crop production and processing, livestock raising and processing, dairy production and processing, and a large number of various low-level processing activities such as corn milling and tortilla manufacturing, bread baking, meat packing, fluid milk bottling, and ice cream manufacturing characterized by small, family-controlled businesses. Mexican corn, bean, and other basic commodity sectors are also still highly labor-intensive as well because of Mexican land tenure laws and agricultural policies that have encouraged a relatively high labor-to-land ratio in their production. The technologies utilized by a large portion of small and medium-sized Mexican agribusiness firms are fairly labor-intensive and typical of those used by the U.S. food processing industry 25 years or more ago.

Four problems generally characterize current investments in technology for the Mexican agricultural and agribusiness sector. First, most of the investments are in capital-intensive technologies of types developed and in use in developed countries rather than more labor-intensive types. The consequence is that the labor intensity of Mexican agricultural and food processing industries is likely lower than might otherwise be the case, contributing to the already high level of unemployment in Mexico.

The second problem is that inadequate investments in public agricultural research and development, irrigation systems, transportation infrastructure, distribution, storage, and marketing systems, and agricultural credit and related institutions create serious bottlenecks to the full realization of the productive potential of new or adopted technologies. These bottlenecks also reduce the profit potential of additional investments in technology transfer and development. At the same time, however, such bottlenecks create increased social pay-off to investment in the development of technologies to relieve the cause of the bottlenecks. For example, the current Mexican infrastructure bottleneck resulting from rapid growth in U.S.-Mexico agricultural trade implies that the pay-off to investment in transportation and other infrastructure technology is increased by investments in modern food processing technology in Mexico. If investment in infrastructure technology is induced by the increase in pay-off, the infrastructure bottleneck will be eased and additional employment opportunities will be created for displaced agricultural labor.

The third problem created by current investments in agricultural and food processing technology in Mexico is a widening income disparity among Mexican farmers and agribusiness operators. Small and medium-sized farms and agribusinesses in Mexico often have much less access to new technologies than large multinational food corporations because of a lack of investment capital. New-technology-based increases in production by the large commercial farms and agribusinesses in Mexico lead to a drop in market prices and incomes of small and medium-sized producers.

For example, investments in fruit and vegetable processing technology that allow large Mexican producers and packers to take advantage of the export opportunities created by NAFTA also put small and medium-sized fruit and vegetable processors in Mexico at a competitive disadvantage.

Finally, much of the technology in which domestic and foreign firms are investing is being transferred from other countries and adapted for use in Mexico rather than being developed within the Mexican public/private research sector. The U.S. has been the major foreign source of new technology development in Mexico, accounting for 56% of all technology patents granted by the Mexican government in 2003 (INEGI 2005). Consequently, the increasing trade and investment in Mexico may not be creating the basis for the development of a strong public/private research and extension system to service the growing needs of small and medium-sized Mexican agricultural and agribusiness firms.

The percentage of total Mexican public expenditures on science and technology invested in agricultural research declined substantially between 1990 and 2003 from 13.4% to 6.9% (INEGI 2005). Consequently, although foreign capital is being increasingly invested in technology for the development of certain Mexican agricultural and agribusiness activities, increasingly less is being done by the public sector to adapt and commercialize that technology for the Mexican agricultural industry in general. Also, only limited research is being done to develop technologies to assist small and medium-sized firms to compete in an increasingly international Mexican agricultural marketplace.

The declining investment of public funds in agricultural research in Mexico is a major constraint to growth, development, and competitiveness in Mexico. Investments in technology development and diffusion are critically needed in at least four areas to facilitate development of the Mexican agricultural sector, mitigate the structural effects of more open trade, and strengthen Mexico's agricultural export competitiveness: (1) the adaptation and commercialization of technology developed in other countries, particularly for small and medium-sized Mexican agricultural and agribusiness firms; (2) the development of new technology adapted to the conditions of Mexican resource endowments; (3) the training of *ejidatarios* and agribusiness owners on the purpose and use of new technology; and (4) the re-training of displaced agricultural labor.

Without a significant increase in public sector investment in technology research and development in Mexico in real terms in these areas, the consequence will likely be little technology transfer or development in Mexico beyond that which is needed to support investment of specific agribusiness operations in specific locations. In such cases, the returns to those investments in technology either will be largely expropriated by foreign investors or will create little new growth and employment in Mexico. A study by Málaga, Williams, and Fuller (2001) concludes that Mexican investments in yield-enhancing technologies relative to such investments in the U.S. could have a greater impact on the future level of Mexican exports of tomatoes and other fresh vegetables to the United States than the elimination of U.S. vegetable import tariffs under NAFTA.

The Mexican tomato industry provides a clear example of what appropriate levels of investments in technology could mean for the export competitiveness of the rest of the Mexican agricultural sector. In the 2002/03 marketing year, Mexico exported nearly 50% of its fresh tomato

production, most of which was produced in Sinaloa and Baja California where the tomato production technology differs substantially from the rest of the country. Most of the field tomato producers in those states use modern technology, including drip irrigation, fertigation, plastic mulch, planed stakes, and, most importantly, extended shelf-life (ESL) varieties (Plunkett 1996). Florida uses essentially the same technology, except ESL varieties grow well in Mexico but not in Florida. Mexican ESL tomatoes are vine ripened and considered by U.S. buyers to be qualitatively different from Florida's mature green tomatoes. The primary benefit of the vine-ripened ESL tomatoes is their bright, red appearance and firmness, a key factor in consumer purchasing decisions. With the advantage of ESL varieties and the use of the same technology as its U.S. competitors, Mexico increased its market share of U.S. tomato imports sales in the early to mid-1990s.

At the same time in Canada, however, rapid development and adoption of greenhouse technology allowed Canadian tomato production and exports to the United States to grow dramatically and substantially reduce Mexico's share of U.S. tomato markets in the late 1990s. In response, Mexican tomato producers began adopting the same greenhouse technology. By 1995, the Mexican greenhouse tomato industry had overtaken the U.S. industry in area planted to greenhouse tomatoes and surpassed the Canadian greenhouse industry in 1999 (Cook and Calvin 2005). Because Mexican greenhouse yields are lower than those of Canada, total Mexican greenhouse tomato production is still lower than Canada's. Nevertheless, ongoing investments in yield-enhancing technology in Mexican greenhouse tomato production could allow Mexico to "eclipse" both Canadian and U.S. greenhouse production soon (Cook and Calvin 2005).

### *Mexican Income Growth and Domestic Demand*

Growth in Mexican per capita incomes could have a key impact on the ability of Mexico to expand its agricultural and food exports. Mexican real per capita GDP has increased by an average annual rate of 1.6% since 1988, hitting a high of 5.0% growth from 1999 to 2000 and registering 3.1% growth between 2003 and 2004 after two years of negative growth. The result has been growing domestic demand for agricultural and food products in Mexico over the last two decades along with a shift in Mexican diets away from staple foods like corn and beans toward higher value and more processed foods like fruits and vegetables (Tropp et al. 2002).

Sustained economic growth in Mexico would boost Mexican purchasing power and intensify Mexican consumer demand not only for imported agricultural and food products but also for products Mexico currently produces and exports northward, like fruits and vegetables. Because the income elasticities of high value foods like fruits and vegetables tend to be fairly high, continued growth in Mexican incomes could result in exports accounting for an increasingly smaller share of the production of many agricultural and food products that Mexico currently exports. In fact, given the limited land area and water resources available for agricultural production in Mexico along with the continuing inefficiencies of the *ejido* system, infrastructure problems, and other restrictions, Mexico could well find it increasingly difficult to fill its own food needs as a result of growing consumer incomes much less generate sufficient surpluses to meet growing international agricultural and food demand.

### *Structural Change in the Mexican Food Distribution System*

The Mexican food distribution system is experiencing rapid structural change as traditional open air markets and small, specialized food stores are being increasingly replaced by large, efficient supermarket chains (Tropp et al. 2002). The growing network of modern supermarket chains in Mexico is challenging the capacity of Mexico's outdated distribution system particularly for perishable products like produce, meats, and other products that require refrigeration as they move through the system from producers to consumers (Tropp et al. 2002). In turn, these changes are forcing changes in the way the Mexican agriculture and food system interact with and impacts international agriculture and food markets.

The growth of supermarkets is forcing improvements in services and modernization throughout the Mexican retail grocery sector and is reinforcing the trend toward increased consumption of fruits, vegetables, and meats in Mexico by providing consumers access to a greater array of food products at lower costs. An important consequence is that the domestic market is rapidly becoming a more important competitor for domestically produced agricultural and food products than in the past.

For example, growth in Mexican per capita vegetable consumption, the increased demand for quality in Mexico, and the improvement in Mexican food distribution system together have generated conditions that appear to be changing the traditional "residual" market characteristic of Mexican domestic vegetable markets (Málaga 1997). During the 1970s, Mexico shipped 20%-30% of its total tomato production to domestic markets. In the 2003/04 season, however, about 55% of Mexico's fresh tomato production was shipped to Mexican domestic markets (USDAa).

### *Domestic Agricultural and Trade Policies*

Although NAFTA contains no commitments on changes in domestic farm policies, the more open borders among the three countries as a result of NAFTA means that domestic farm policy changes particularly in the U.S. and Mexico have the potential for greater impact on the agricultural sectors and trade of each member country than was the case before the implementation of NAFTA. Before the 1990s, Mexico supported its agriculture through an extensive and complex system of subsidized inputs, guaranteed producer prices, subsidized retail food sales, and high import barriers. Beginning in 1991, Mexico began reducing its support to the agricultural sector and the direct role of the government in purchasing, storing and distributing agricultural commodities.

The implementation of NAFTA in 1994 meant that import barriers could no longer be used as a means of farm support. To help the Mexican farm sector transition to more open markets, Mexico adopted the PROCAMPO program in October of 1993 (Williams 2001). PROCAMPO replaced high support prices for crops with decoupled direct payments to producers making Mexican farm crop allocation decisions more dependent on relative market prices than government policies. PROCAMPO provides direct income support payments based on historical

acreage planted to nine eligible crops: corn, beans, wheat, cotton, safflower, soybeans, sorghum, rice, and barley. The program was phased in during 1993-1995 and fully implemented in early 1996. PROCAMPO payments have been extended over time from covering primarily grains and legumes to all commodities. Total program funding for 2004 was $1.3 billion or $83 per hectare ($34/acre) for producers with more than five hectares and about $99 per hectare ($40/acre) for producers with 1-5 hectares (Zahniser, Young, and Wainio 2005). For fall 2004 and spring 2005 the payment rate is $83 per hectare for all producers.

Although most experts agree that PROCAMPO has had little impact on the structure of agriculture in Mexico (e.g., Rosenzweig 2003), various studies have concluded that the program payments have cushioned the effects of economic downturns on Mexican farm income and provided liquidity to poor rural households to finance production or invest in human or physical capital (de Ferranti et al. 2005; Sadoulet, de Janvry, and Davis 2001). PROCAMPO reportedly has had other income distribution effects on Mexico's rural economy as well. For example, PROCAMPO has tended to "overcompensate" small farmers and "undercompensate" large, commercial farmers for the negative price effects of freer trade because the subsidy has been the same per hectare in each year for all farms greater than 5 hectares no matter how large the farm and even higher for the smallest farms (de Ferranti et al. 2005). Nevertheless, because large farms account for a larger percentage of agricultural land area than small farms in Mexico, a small number of large farms have received the largest proportion of PROCAMPO payments. About 45% of small farms (less than 5 hectares) receive only about 10% of total PROCAMPO payments (de Ferranti et al. 2005).

PROCAMPO is the largest of the three Mexican "core" programs designed to support Mexican farm incomes (Zahniser, Young, and Wainio 2005). The Mexican federal government also provides income support and other benefits primarily to commercial producers through the "Program of Direct Supports to the Producer through Marketable Surpluses." The key feature of this program is a type of deficiency payment or counter cyclical program in which producers with "marketable surpluses" of ten specific crops receive income support equal to the difference between some per unit income target and the market price. The Mexican government also operates a rural development program designed to enhance the adoption and development of new technology in production agriculture primarily through cost-sharing projects with Mexican state governments.

Over the last few years, the Mexican government has launched a series of national agricultural programs and policies intended to bring Mexican agricultural policy more in the line with developed country agricultural policies through evolutionary adjustments in existing programs rather than through revolutionary shifts in policy. In 2002, for example, a comprehensive agricultural program known as "Agri-food Armor" was replaced the next year by a new program called the "National Agreement on Agriculture" following severe criticism of the 2002 program by many producer groups and rural organizations (Zahniser, Young, and Wainio 2005). The National Agreement incorporates the 3 core Mexican income support programs.

Perhaps as important for Mexican competitiveness as its own evolving agricultural policy are recent changes in U.S farm policy and their effects on the ability of Mexico to compete in U.S. markets. U.S. agricultural policy changes introduced in the 1996 U.S. farm bill marked a

substantial change from previous legislation. The elimination of acreage reduction programs, the decoupling of income support from production decisions, and the introduction of nearly full planting flexibility considerably increased the market orientation of U.S. agriculture. A new counter cyclical income support program in the 2002 U.S. Farm Act, however, signaled some retrenchment from a commitment to reduce government intervention in U.S. agricultural markets. In general, recent changes in U.S. farm policy have reduced U.S. farm subsidies and, therefore, provide more opportunities for Mexican producers to compete in U.S. markets.

### *Other Potential Limiting Factors*

Among other specific factors likely to have an impact on the future composition and level of Mexican agricultural and food product exports, the following are perhaps the most important:

- *Credit Availability* - Poor availability of credit continues to plague Mexican agriculture. Agricultural loans were hard hit by the 1994-95 peso crisis. Many private banks now view agricultural lending, particularly to smaller producers, as too risky. In 2003, Mexico reformed its public lending system, creating Financiera Rural, a public bank with the objective of improving the supply of agricultural credit.

- *Macroeconomic linkages*: The 1994-95 devaluation of the Mexican Peso also emphasized the importance of the macroeconomic linkages between Mexico and its trading partners. Freer trade under NAFTA implies that the effects of changes in monetary, fiscal, or exchange rate policy by Mexico or the other member countries will be more widely shared among all three countries than before NAFTA was implemented (Williams 2001).

- *Foreign direct investment*: Recent strong growth in foreign direct investments by the U.S. and other countries in Mexican productive capacity, technology, and infrastructure are an important potential source of growth in employment and incomes in Mexico as well as increased efficiencies and competitiveness in world markets. Although much of the foreign capital flowing to Mexico in the early years of NAFTA was short-term, highly mobile portfolio investments, foreign capital investment in Mexican food production, processing, and distribution is growing and transforming the Mexican agricultural and food sector.

- *Mexican labor markets and wage rates*: The relatively low cost of Mexican labor provides Mexico with a relative advantage in labor-intensive industries like agriculture. One effect of Mexican trade liberalization may be downward pressure on Mexican wage rates as increased agricultural imports displace Mexican labor in the import-competing agricultural sector. The consequence could be an increased competitive advantage of Mexican labor-intensive sectors like fruits and vegetables and greater pressure for migration of undocumented labor to the United States. Over the longer run, given sufficient economic growth in Mexico to absorb the displaced labor, wage rates could recover and eliminate the short-run Mexican gains from low-cost labor.

- *Mexican environmental practices and laws*: Over the years, Mexican agricultural and livestock practices, such as unwise use of available water supplies, inefficient land use practices, poor farm and livestock management practices, overuse of pesticides and agricultural chemicals, and overgrazing, have contributed significantly to the degradation of the natural resource base of Mexico. As part of the extensive reforms that began in the mid-1980s, Mexico enhanced its environmental protection efforts with the passage of the General Law on Ecological Balance and Environmental Protection (the General Law) in 1988. This wide-ranging law addressed a number of environmental issues such as air, water, and soil pollution; management of hazardous waste and materials, pesticides and toxic substances; and conservation of wildlife, habitats and natural resources. Difficulties in monitoring pollution and enforcing the General Law, however, have limited the effectiveness of Mexican environmental protection efforts and generated severe criticism during the NAFTA negotiations. In response, Mexico extensively revised the General Law in December 1996 to clarify the powers of the federal government in environmental matters and to emphasize the concept of sustainable development as opposed to "rational development" that previously was the theme of Mexican environmental laws. Mexico also has made a significant effort to improve the enforcement of those laws and has substantially increased funding for enforcement and inspection programs. Even so, continuing environmental degradation and problems in enforcing environmental laws continue to limit both Mexican productive potential and agricultural export opportunities. Growing awareness among Mexican producers that they must manage their use of agricultural chemicals more efficiently and effectively to ensure entry of their products through inspection points into U.S. markets, however, is prompting Mexican producers to conform their use of agricultural chemicals to U.S. standards in the production of commodities planned for export to the United States.

## Relative Importance of the Mexican Agricultural Export Competitiveness Factors

As demonstrated in the previous section, a large number of factors impinge on the competitiveness of Mexican agricultural and food exports. Which likely has the greatest impact on Mexico's ability to compete in export markets? What is the current and potential impact of those factors on the leading Mexican agricultural and food exports? Most of the factors considered do not impact Mexico's agricultural and food trade directly. Rather, the trade impact in most cases is indirect through the factor's impact on one or more segments of Mexican agricultural and food markets - production, processing, marketing, or consumption. In the case of production, the trade impact of each factor could originate from an initial impact on either the efficiency of production or the area under production. Consequently, to determine the relative influence of the various factors identified on Mexican agricultural and food exports, the first task is to consider the primary segment of Mexican agricultural and food markets that each factor impacts and the likely level or intensity of that impact. Given the factors judged to have relatively high potential to impact Mexican agricultural and food markets, the next task is to identify the key export competitiveness factors defined as those likely to have a medium to high effect on Mexican agricultural and food trade. Once the key export competitiveness factors are determined, the final task is to determine the likely current and future potential impact of those factors on the leading Mexican agricultural and food exports.

*The Primary Market Segment Impacted by the Mexican Agricultural and Food Export Competitiveness Factors*

Among the 15 or so factors identified in the previous section as potential export competitiveness factors, a few are likely to have direct impacts on Mexican agricultural and food trade, including bilateral trade agreements, food safety, sanitary and phytosanitary (SPS) issues, infrastructure, and linkages with the macroeconomy (Table 2). Using a scale of high (H), medium (M), and low (L) impact, bilateral trade agreements currently have and may be expected to continue to have a relatively low impact on Mexican agricultural and food trade with all of that impact the result of NAFTA (Table 2).

As discussed earlier, NAFTA is in its final 5-year period during which the trade barriers of the most important agricultural and food products traded by the U.S. and Mexico will be eliminated, including corn and beans. Also, Mexico's attempts to diversify its export markets beyond the United States through bilateral trade agreements or through other means were shown to have been rather unsuccessful to date. Thus, once NAFTA has been fully implemented, the likelihood of much additional impact on Mexico's trade from more bilateral trade agreements is quite low.

The earlier discussion also indicated that food safety and SPS issues are likely to have important direct impacts on Mexican trade in specific agricultural and food products (Table 2). At the same time, limitations in Mexican transportation infrastructure are likely to continue imposing limitations on U.S.-Mexico agricultural and food trade (Table 2). On the other hand, while Mexican foreign exchange policy and other macroeconomic policies and events have the potential for serious negative impacts on Mexican agricultural and food trade, the impacts are periodic and not likely to have the lasting effects that many of the other factors could have on trade. Málaga, Williams, and Fuller (2001), for example, demonstrate that the 1994-95 peso devaluation had a large immediate impact on Mexican agricultural trade that dissipated quickly while changes in Mexican production yields and other factors have had a more lasting effect on Mexican trade.

The impact of many of the export competitiveness factors identified in the preceding section on Mexican agricultural and food trade originates from their impacts on Mexican agricultural production (Table 2). To the extent that these factors constrain production, the ability of Mexico to expand exports to meet new opportunities will be limited while the need to allow greater imports to meet growing market demand will be enhanced. Both water issues and land tenure problems in Mexico have substantial potential to impact the efficiency and the level of agricultural production in Mexico as discussed earlier. Also, problems regarding current investments in technology were identified as having potential to limit the growth in Mexican agricultural productivity. Several other factors are likely to impact the productivity and level of Mexican agricultural production, including agricultural policy, agricultural credit, foreign direct investment, labor and environmental laws, but at a much lower level (Table 2).

The potential trade impact of a few of the export competitiveness factors identified earlier derives from their impacts on either the marketing or consumer segments of Mexican food and agricultural markets, including infrastructure problems, income growth, and changes in the

Mexican food distribution system (Table 2). In each case, substantial impact on Mexican agricultural and food trade is likely. In the case of infrastructure, the Mexican transportation system is the primary limitation on Mexican trade. To the extent that Mexico achieves lasting real income growth, Mexican agricultural and food imports will grow while growth in export surpluses will be limited. At the same time, rapid changes in the Mexican food distribution system is enhancing the competitiveness of the domestic market for Mexican-produced agricultural and food products and limiting availability of those products for export.

*The Key Export Competitiveness Factors and Their Effects on Trade*

Based on the analysis in the previous section, the factors likely to have the greatest impact on the Mexican agricultural sector include NAFTA; food safety and SPS issues; water issues; infrastructure constraints; land tenure problems; inadequate investments in new technology development, dissemination, and adoption; growth in real incomes; rapid changes in the Mexican food distribution system; and the availability of agricultural credit (Table 3). The primary trade effect of several of those factors, however, will likely be on Mexican imports rather than exports of agricultural and food products. As discussed in the preceding section of this report, NAFTA has stimulated an increase in Mexican exports of fruits, vegetables, and beverages to the U.S. While NAFTA will likely provide some additional boost to Mexican exports of those products over the next few years, the most important effects will likely be on Mexican imports of U.S. commodities like corn and beans.

Likewise, if changes in Mexican land tenure laws eventually bring about the expected large-scale improvements in Mexican agricultural productivity and competitiveness, the primary impact likely would be on Mexican imports rather than exports of agricultural and food products. In large part, land tenure problems affect the non-commercial sector of Mexican agriculture which by and large produces commodities like corn and beans that compete with imports. While some of that land could well convert to the production of export crops like fruits and vegetables with significant resolution of land tenure issues, persistent problems related to technology, water, infrastructure and other issues would continue to limit the ability of those landowners to effectively compete in export markets. For the same reason, resolution of agricultural credit availability problems in Mexico would likely affect the production of import-competing crops in Mexico to a much greater extent than that of export crops. Also, the sweeping changes taking place in the Mexican food distribution system have more to do with imports of agricultural commodities and food products than they do with Mexican exports.

Consequently, the key factors likely to impact Mexican agricultural and food export competitiveness include food safety and SPS issues; water issues; infrastructure problems; issues in technology development and adoption; and income growth (Table 3). Among those factors, the ones likely to have the greatest impact on Mexican export competitiveness over the long-run include water and technology issues. Significant progress in relieving constraints on water availability and on the investments in technology development, diffusion, and adoption would likely have more impact on Mexico's ability to compete in world export markets than efforts to eliminate the constraints imposed by any other factor.

*Effects of the Key Export Competitiveness Factors on Specific Agricultural and Food Products*

To get a sense of the likely impact of the key export competitiveness factors on Mexican exports of specific commodities, the top 24 Mexican agricultural and food exports to the United States first were grouped according to the 4 categories identified earlier: (1) commodities demonstrating positive growth in both U.S. imports and the Mexican share of those imports; (2) commodities demonstrating positive U.S. import growth but negative growth in the Mexican share of those imports; (3) commodities demonstrating negative U.S. import growth but positive growth in the Mexican share of those imports; and (4) commodities demonstrating negative growth in both U.S. imports and the Mexican share of those imports. Combining the last two groups which include those commodities with the least future export potential for Mexico, the specific commodities in each group most affected by the key export competitiveness factors are then identified along with an assessment of the levels of the current and likely future impacts of each factor (Table 4).

Based on the discussion in previous sections, the commodities most likely to be impacted by food safety concerns include green onions (Group 1), strawberries (Group 2), and cantaloupes (Groups 3/4). While food safety concerns impact the export of all three commodities, based on the discussion in preceding section of the report, eliminating food safety concerns for green onions would be most likely to have a positive long-run effect on Mexican export competitiveness (Table 4).

While SPS concerns limit Mexican exports of livestock to the United States, given that livestock fall into Group 3/4a, large investment in relieving those constraints is unlikely to produce substantial export growth opportunities for Mexico (Table 4). On the other hand, avocados and oranges are Mexican commodities whose exports have steadily gained increasing shares of growing U.S. imports but have also faced severe SPS constraints in the past. Investments in removing remaining SPS constraints to those products could pay greater dividends in terms of export growth than similar investments in removing SPS constraints on livestock exports. Nevertheless, the current and future potential impact of the existing SPS constraints on Mexican avocado and orange exports is judged to be "low" since much progress has already been achieved in removing those constraints.

Again, based on the discussion in previous sections, in terms of the constraints on production and export of Mexican agricultural commodities imposed by the availability of water, vegetable crops are the most obvious Mexican export commodities that would benefit from an increase in water for irrigation. Mexican tomato production tends to suffer relatively less from water issues since much of the investments in water and irrigation infrastructure in northwest Mexico over the years have been made to support the expansion of that industry. Although many other vegetable crops are grown in that area, they tend to be residual claimants for water and would be the principal beneficiaries of any investment in water and irrigation infrastructure. The irrigation infrastructure is much less developed in other regions of the country like the northern and central Gulf coast areas where vegetable and fruit crops are grown primarily on small and medium-sized operations. Consequently, as indicated in Table 4, the impact of current and future water

limitations on production and export competitiveness is estimated to be less severe for tomatoes than for other fruits and vegetables.

Although the Mexican melon industry would also benefit from additional water availability, U.S. imports of melons have declined over the years along with the Mexican share of U.S. melon imports implying relatively little return to investments in relieving water constraints for melon production and export to the United States. The production of most of the commodities in Group 2 would benefit from additional water for production, including cucumbers, grapes, squash, broccoli, strawberries, mangoes, asparagus, eggplant, and cut flowers. In fact, investments in water and irrigation infrastructure could move a number of those commodities from Group 2 (declining Mexican market shares of growing U.S. imports) to Group 1 (growing Mexican market shares of growing U.S. imports).

The conclusions are basically the same for public investments in both transportation infrastructure and technology development, dissemination, and adoption. While additional investments in these two areas are and will continue to be needed in the Mexican tomato industry, as has been demonstrated clearly by the rapid shift to greenhouse tomato production technology in recent years, the other fruit and vegetable industries in Groups 1 and 2 represent the greatest opportunities for enhancing Mexican export competitiveness through the adoption of new technology.

On the other hand, Mexican export competitiveness across all commodities, particularly those in Groups 1 and 2, could be negatively impacted by strong growth in Mexican per capita incomes that would create demand for imports in competition with domestic production and compete with exports for the available export supply. This is particularly the case if needed investments in new technology, irrigation, and infrastructure are not made, limiting the growth potential of domestic production in response to growth in domestic demand.

## Conclusions

Despite growth in the absolute value of Mexican agricultural and food exports since the mid-1980s, the share of total Mexican exports accounted for by agricultural and food products is declining. A Revealed Comparative Analysis of Mexican agricultural exports confirms that Mexico does not have a clear comparative advantage in the production and export of agricultural and food products in general. When the RCA analysis is performed at the commodity subgroup level, however, the results suggest that Mexico may have a clear comparative advantage in vegetables and fruits but not in other major export categories like animals and animal products or processed food. While Mexico's comparative disadvantage in animal products appears to be growing, its comparative advantage in vegetables has been eroding over the last decade. Mexican fruit exports appear to be maintaining their comparative advantage level while the dynamic processed food sector appears to be gaining comparative advantage as indicated by a doubling of their its index since 1995.

The U.S market absorbs 86% of all Mexican agricultural and food exports. For most U.S. agricultural and food product imports, the level of those imports has been increasing in general since the early 1990s at least. Although growing in absolute value, Mexican vegetable exports to the U.S. have been almost continually losing their share of total U.S. vegetable imports despite the implementation of NAFTA in 1994. The story for animals and animal products is similar. On the other hand, the Mexican share of U.S. fruit imports is growing but at a slower rate than is the case for processed foods which doubled their share of U.S. imports of those products since 1995, reaching almost 18% of total U.S. imports.

The analysis of the performance of major individual Mexican agricultural and food product exports to the U.S. suggests that, with few exceptions, most of those exports have been losing market share in growing U.S. import markets, especially in recent years. These are the commodities where investments to increase the levels of productivity and efficiency in production, marketing, and transportation and to eliminate institutional, administrative, and political barriers to trade would have the highest payoff for Mexico. The clear exceptions to this case are avocados and malt beverages (beer) which continue to experience market share gains in continuously growing U.S. import markets. While some Mexican exports like tomatoes and peppers have recently shown some capacity to recover from market share erosions, other products like non-malt beverages and grapes appear to have allowed early market share gains to turn into heavy market share losses in more recent years. Some Mexican exports that have been growing in absolute value like asparagus, mangoes, melons, cauliflower/broccoli, eggplants, and cucumbers have experienced almost continual market share loses. Not surprisingly, traditional Mexican export products like bananas, coffee, and live cattle have been losing share in markets where U.S. imports have been declining as well.

In EU and Canadian markets, the consistently competitive Mexican exports have been beer and to a lesser extent avocados, tomatoes, peppers, and grapes. The Mexican shares of EU and Canadian imports of most other Mexican agricultural food exports have been declining. In contrast, Mexico's share of Japanese agricultural and food imports has been increasing over the last decade reaching a high of just over 1% in 2004. Mexico accounts for 2% of Japanese fruit and vegetable imports, nearly 3% of Japanese meat imports (mainly pork), and over 8% of Japanese alcoholic beverage imports.

In an increasingly global market, the future competitiveness of Mexican agricultural and food exports appears to depend on the export potential of those few products for which new technologies can be rapidly adopted (tomatoes and peppers), sanitary/phytosanitary barriers can be successfully removed (avocados, citrus, grapes, poultry, pork), and clear marketing strategies can be developed to take advantage of worldwide trends in consumer preferences for specific product characteristics (beer, other beverages, and some processed foods). Most of these latter products are associated with the "modern" sector of the Mexican agriculture. The primary strategic Mexican export concern will be developing measures to reverse the slow erosion in export competitiveness of products for which Mexico traditionally has been thought to have a comparative advantage like melons, mangoes, broccoli, cauliflower, cucumbers, eggplant, cattle, bananas, and coffee. Many of these products are relatively more associated with small, labor-intense farms in economically depressed regions of Mexico. The loss of Mexican export

competitiveness in these commodities could well have important social implications for Mexico and its neighboring countries.

The rapid evolution of trade liberalization in Mexico's major food markets (the U.S. and Canada) through bilateral and regional trade agreements, and eventually through WTO negotiations, may contribute to a further erosion of the relative Mexican competitiveness in those countries in favor of new suppliers (particularly Central and South America). In a highly globalized, competitive and evolving food market, just maintaining its share of those two markets, much less achieving greater shares, will likely require Mexico to adopt a more aggressive export marketing strategy. Particularly needed is an enhanced market intelligence capability to identify emerging opportunities quickly, particularly those related to changing consumption preferences, and to convey that information all along the supply chain from foreign market consumers back to Mexican producers and exporters.

Many factors have the potential to affect the long-run competitiveness of Mexican agricultural exports. For example, sanitary and phytosanitary issues related to Mexican imports receive a great deal of media and policy attention. The actual impact of those issues on Mexican export competitiveness, however, is likely much smaller than the attention those issues receive. In terms of food safety issues, three products have generated most of the attention since the mid-1990's: (1) strawberries, (2) cantaloupes, and (3) green onions. Various strains of salmonella and the hepatitis A virus have been traced to imports of these three products from Mexico, leading to numerous FDA import alerts over the last decade. Despite efforts of Mexican producers, shippers and government agencies to resolve the problems and mitigate the economic effects of outbreaks of foodborne illnesses caused by imported Mexican produce, the food safety scares created by the outbreaks have caused significant economic damage to Mexican exporters independent of their involvement in any particular case of food contamination. Evaluations of the strawberry and green onion cases suggest that the cost to the respective Mexican industries has been somewhere between $15 million and $40 million for strawberries and about $10 million for green onions. In the case of cantaloupes, the various foodborne disease outbreaks in the U.S. may have caused a drop in Mexican export value of between $60 million and $80 million. However, since these three products represent less than 3% of the total annual value of Mexican agricultural exports to the U.S., the issue of food safety poses a relatively low level threat to the current and future competitiveness of Mexican agricultural and food exports.

With respect to SPS problems, Mexico has demonstrated both the desire and ability to resolve such issues affecting exports to the U.S. For example, in a coordinated effort with U.S. government agencies, Mexico has effectively opened the U.S. market for avocados. In 2005 alone, the value of Mexican avocado exports to the U.S. reached $200 million although future growth is expected to be slower than in the past few years. Other more minor opportunities for growth of Mexican exports include oranges and some tropical fruits if the fruit fly threat can be brought under control. Again, however, avocados and oranges represent around only 2% of the value of Mexican agricultural exports to the U.S. An important potential market for Mexican grapes in China might depend on a phytosanitary protocol to be signed between the two countries. From an animal health perspective, cattle tuberculosis appears to have been the most prevalent SPS problem affecting Mexican exports to the U.S. Swine diseases may also have some impact in other markets like Japan. Although at the forefront of all FS and SPS challenges

facing Mexican agricultural exports, SENASICA needs a substantial increase in its operating budget, technical assistance, and personnel to continue working effectively to maintain and expand Mexican export competitiveness.

Four other factors were also considered to pose medium to high limitations to the current and future export competitiveness of the top 24 Mexican agricultural and food exports to the U.S.: (1) problems in the distribution and availability of water in Mexico; (2) an underdeveloped transportation infrastructure; (3) underinvestment in the development, diffusion, and adoption of new technology; and (4) the potential growth in Mexican incomes as economic development proceeds. The first three of those factors imply particular limitations for growth of the Mexican fruit and vegetable industry, less so perhaps for tomatoes but particularly for other vegetables that tend to be residual claimants of water and are more likely to be grown in the eastern and central regions of Mexico on small and medium farms. On the other hand, the growth of income in Mexico becomes a limit to Mexico's ability to export if the consequent growth in domestic demand limits the availability of domestic production for export. This outcome is more likely to be the case if the limitations imposed by the other three factors effective prohibit domestic supply from expanding sufficiently to meet any domestic growth in demand.

## Policy Recommendations to Enhance Mexican Export Competitiveness

Policy recommendations to boost exports and enhance exports often focus on trade policies that limit a country's access to foreign markets. Mexico, however, has already tackled the foreign market access problem through its aggressive bilateral trade negotiation strategy. For Mexico, then, the most effective strategy to further enhance the competitiveness of its agricultural and food exports involves removing internal constraints to taking advantage of the greater foreign market access that Mexico has achieved. While some specific export promotion efforts will need to be included in the policy mix, the key general component of any successful strategy to enhance the export competitiveness of Mexican agricultural and food products must be a substantial increase in public investments in several critical areas, including the expansion of irrigation water supplies and delivery systems, transportation infrastructure, and technology development, diffusion, and adoption. Of course, the public investment required to successfully relieve these constraints could be enormous. That does not change the fact that such investments are critically needed if any real improvement in export competitiveness is to be achieved. At a minimum, a successful strategy to achieve a substantial and sustained expansion of Mexican agricultural and food exports will need to incorporate at least some features of the following policy alternatives at some level of investment (in no particular order):

- *Targeted export promotion to diversify and expand Mexican export markets*

  In general, exports of Mexican agricultural and food products to markets other than the United States are small and not growing substantially. Consequently, the marginal return to increased investments to promote Mexican exports in the EU, Canada, and Japan is likely to be quite low. Nevertheless, a few specific Mexican products have found niches in those markets which might be exploited by targeted export promotion efforts intended to develop

strong relationships with specific foreign buyers and to brand Mexican products. Specific products that might benefit from such promotion efforts include beer, avocadoes, mangoes, guava, peppers, dried legumes, and possibly grapes. Similar targeted export promotion programs could be developed to reverse the downward trend of the Mexican export share of growing U.S. imports of specific products, including cucumbers, asparagus, broccoli, squash, strawberries, eggplant, and cut flowers. Such targeted assistance efforts include export credit guarantee programs; export incentive programs for specific high priority products and markets; market research assistance; product and market-specific export counseling; and assistance with documentation and other export requirements. The exporter assistance and market development programs of the USDA Foreign Agriculture Service could serve as a useful guide in developing such programs (see their website at http://www.fas.usda.gov /agx/exporter_assistance.asp).

- *Production conversion assistance*

  Several products are identified in this report as those whose exports are losing shares of declining U.S. imports (Group 4), including coffee, sugar, bananas, and melons. Mexico's export competitiveness could be greatly enhanced through programs designed to encourage the conversion of acreage currently devoted to these crops to the production of commodities whose shares of growing U.S. imports are also growing (Group 2). These commodities include tomatoes, peppers, avocadoes, onions, pecans, citrus, and other fruits, vegetables.

- *Increased public investments in irrigation water storage and delivery systems*

  The development of additional irrigation water storage and delivery systems is a critical need if a substantial increase in the production of export crops is to be achieved. The need is particularly critical in the eastern and central regions of Mexico characterized by a large number of small farms with limited access to resources to expand production. The lack of water and irrigation facilities could well be the key limiting factor in Mexico's ability to significantly expand its export markets.

- *Increased public investments in trade-related transportation infrastructure*

  The particular targets of such investments would need to include additional bridges, access roads, and rail lines to cross the border; additional commercial inspection facilities; the modernization and expansion of Mexican port facilities; updating and expansion of intermodal transportation facilities; and improved highways to handle the rapidly growing truck traffic. In addition, significant attention must be given to reducing the time and cost of currently lengthy and cumbersome customs clearance procedures at U.S. border crossing points.

- *Increased public investments in agricultural research*

  If Mexico is to be able to successfully compete in international markets, the continual downward slide in public investments in agricultural research and development must be turned around. Critically needed are investments in research not only to develop new

technology to boost agricultural production efficiency and reduce production costs but also to adapt technologies available in other countries for use in Mexico. Particularly needed are investments in research to adapt and commercialize technology developed in other countries and the development of new technologies adapted to the conditions of Mexican resource endowments, particularly for small and medium-sized Mexican agricultural and agribusiness firms. Besides the development of new technology, research is needed on a broad range of topics related to economic, animal, and plant systems; business and risk management; resource management; and a host of other topics to enhance and support decision-making all along the Mexican supply chain.

- *An effective system for technology and information diffusion*

  If needed investments in agricultural research is to provide an effective base for enhancing the competitiveness of the Mexican agricultural sector in international markets, an effective system for diffusing the research results must be put in place. Particularly important components of that system would be programs for the training of *ejidatarios* and agribusiness owners regarding the purpose and use of new technology and for the re-training of agricultural labor displaced by growing agricultural imports.

- *An enhanced market intelligence system*

  The growing openness of world agricultural and agribusiness markets is creating dramatic pressure to globalize agricultural and food markets and spawning new ways of doing business, new opportunities for growth, new problems to be resolved, and new issues and concerns for producers, processors, and many others along the supply chain. Because globalization is forcing markets to operate in fundamentally different ways, agricultural producers and agribusinesses will need to function in different ways as well. Globalization is forcing marketing and distribution systems to be more tightly aligned with producers being raw material suppliers for manufacturers and food processors that will need to be better, faster, and cheaper to maintain a sustainable competitive advantage. As a consequence, to be competitive, Mexican producers and agribusinesses will need to be better informed about consumer buying habits, preferences, and other purchasing behavior as well as the potential effects of myriad domestic and global market forces. They will require broader and more detailed information relating to not only how to produce but also what to produce to meet increasingly global consumer demands, how to promote and position their products in the global market, how to manage resources to minimize costs and maximize profits, how to utilize the new information technology to support informed and efficient decision-making, how to analyze and interpret the implications of world events and polices for their business operations, how to adjust production, marketing, distribution, and financial operations to remain competitive as global markets trends change, and much more. Unfortunately, in Mexico the generation and flow of information needed by agricultural producers and agribusinesses is not keeping pace with the growth of globalization. Significant improvements in market information systems in Mexico are critically needed to meet the rapidly growing information needs of producers and agribusinesses. Although much has been done to enhance the market information available in Mexico, a large segment of Mexican agricultural producers and agribusinesses still lack access to critically needed

information to manage their risks and make sound production and marketing decisions. The highly successful market intelligence system developed by Chile could be used as a model. Fundación Chile works with both private and public sector entities to develop and expand foreign markets for small scale producers. Highly trained and appropriately compensated professionals are the key to the Fundación Chile strategy in which modern marketing and supply chain management are critical components. Another example of advancements in the development of information systems to support agricultural decision-making in Latin America is the Ecuador Ministry of Agriculture's *Proyecto Servicio de Información y Censo Agropecuario* (P-SICA) or *Agricultural Census and Agricultural Information Service Project* which could also serve as a model for the Mexican Ministry of Agriculture (SAGARPA) and other public and private agricultural information providers in Mexico (see their website at http://www.sica.gov.ec/).

- *Additional resources to improve the efficiency and effectiveness of SENASICA*

  Additional resources to support the operations of SENASICA would greatly improve Mexico's effectiveness in responding to food safety (FS) and SPS problems as well as to more effectively prevent occurrences through appropriate Training on Good Practices (GAP) and other technical support oriented to small and medium-sized farmers and agribusinesses. The 2004 report of IICA could serve to guide any necessary institutional changes and the allocation of new funds to support SENASICA in dealing with FS and SPS problems particularly as they apply to exports. Resources are particularly needed to acquire personnel with solid expertise and experience in critical areas of operation; enhance the coordination and interaction of SENASICA with private sector entities; and develop an improved system of traceability related to animal health issues.

## References


Anderson, S.M. et al., "Multistate Outbreaks of Salmonella Serotype Poona Infections Associated with Eating Cantaloupe from Mexico-United States, and Canada 2000-2002," *Morbidity and Mortality Week Report* 51(46): 1044-1047, Centers for Disease Control and Prevention, Department of Human Health and Services, Washington D.C., November 2002.

Avendaño B., and R. Schwentesius, "Factores de competitividad en la producción y exportación de hortalizas: el valle de Mexicali, Baja California, México," CIESTAAM, Universidad Autónoma de Chapingo, Texcoco, México, Unpublished Ph. D. Dissertation, 2004.

Balassa, B., "Trade Liberalisation and 'Revealed' Comparative Advantage," *The Manchester School* 33: 99-123, 1965.

Barkema, A. and M. Drabenstott, "The U.S. Farm Export Boom: How Will It Be Shaped by Global Infrastructure?" *Economic Review*, Federal Reserve Bank of Kansas City, third quarter, 1996, pp. 77-91.

Bartra, A., "Debate Sobre el Ejido," *Cuadernos Agrarios No. 3, Nueva Epoca*, September–December 1991, Mexico.

Bredahl. M.E., "Trade in Avocados," in Lyons, et al. "eds." *Trade Liberalization Under NAFTA: Report Card on Agricultur*e, Guelph: University of Guelph, January 2001.

Bresciani, F., "Tenure Security, Land Markets, and Household Income: PROCEDE and the Impact of the 1992 Reform in Mexico," Unpublished Ph.D. dissertation, University of Maryland, College Park, Maryland, 2004.

Calvin, L., "Produce, Food Safety, and International Trade: Response to U.S. Foodborne Illness Outbreaks Associated with Imported Produce," in J.C. Buzby, ed., *International Trade and Food Safety: Economic Theory and Case Studie*s, Agricultural Economic Report No. 828, Economic Research Service, U.S. Department of Agriculture, 2003.

Calvin, L., B. Avendaño, and R. Schwentesius, "The Economics of Food Safety: The Case of Green Onions and Hepatitis A Outbreaks," Electronic Outlook Report No. VGS-305-01, Economic Research Service, U.S. Department of Agriculture, December 2004.

Canadian Food Inspection Agency (CFIA), "Import Requirements for Mexican Cantaloupes," March 9, 2004. On-line at: h*ttp://www.inspection.gc.ca/english/plaveg/fresh/mexcane.shtml.*

Collier, G.A., "Reforms on Mexico's Agrarian Code: Impacts on the Peasantry," *Research in Economic Anthropology* 15: 105–28, 1994.

Cook, R. and L. Calvin, "Greenhouse Tomatoes Change the Dynamics of the North American Fresh Tomato Industry," Economic Research Report ERR-2, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., April 2005.

Dato, V., et al., "Hepatitis A Outbreak Associated with Green Onions at a Restaurant-Monaca, Pennsylvania, 2003," *Morbidity and Mortality Week Report* 52(47): 1155-1157, Centers for Disease Control and Prevention, Department of Human Health and Services, Washington D.C., November 2003.

Derbez, L.E., "Mexico and the Free Trade Area of the Americas," *Economic Perspectives*, Electronic Journal of the U.S. Department of State 73(3), October 2002.

Foster, W. and A. Valdés, "Chapter 8: Promoting Economic and Social Development in Poor Regions: Direct Income Supports, Environmental Services, and Tourism," in de Ferranti, D., G.E. Perry, W. Foster, D. Lederman, and A. Valdés, eds., *Beyond the City: The Rural Contribution to Development*, Latin American and Caribbean Studies, The World Bank, Washington, D.C., 2005.

Grennes, T., J. Hernández, E. B. Krissoff, J. Matus, G. J. Sharples, and C. Valdes. "An Analysis of a United States-Canada-Mexico Free Trade Agreement," Commissioned Paper No. 10, International Agricultural Trade Research Consortium, November 1991.

Hahn, W.F., M. Haley, D. Leuck, J.J. Miller, J. Perry, F. Taha, and S. Zahniser, "Market Integration of the North American Animal Products Complex," Report No. LDP-M-131-01, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., May 2005.

Heath, J.R., "Enhancing the Contribution of Land Reform to Mexican Agricultural Development," Working Paper No. WPS 285, The World Bank, Washington, D.C., February 1990.

Hutin, Y.J., V. Pool, E.H. Cramer, O.V. Nainan, J. Weth, I.T. Williams, S.T. Goldstein, K.F. Gensheimer, B.P. Bell, C.N. Shapiro, M.J. Alter, and H.S. Margolis, "A Multistate Foodborne Outbreak of Hepatitis A," *New England Journal of Medicine* 340(8): 595-602, 1999.

Instituto Interamericano de Cooperación para la Agricultura (IICA), Oficina México, "Revisión Institucional Externa del Servicio Nacional de Sanidad e Inocuidad Agroalimentaria SENASICA," October 2004.

Instituto Nacional de Estadística, Geografía e Informática (INEGI), *Sistema Nacional Estadístico y de Información Geográfica* (National Statistical and Geographic Information System), Mexico City, 2005. On-line at: http://www.inegi.gob.mx.

Johnson, N., "Land and Credit Reform in Mexico: Implications for *Ejido* Credit Use, Investment, and Production," paper presented at the XXI International Congress of the Latin American Studies Association, Chicago, Illinois, September 24-26, 1998.

Klindworth, K., "NAFTA-Related Transportation and Infrastructure Needs," *Agricultural Transportation Challenges for the 21st Century*, Agricultural Marketing Service, U.S. Department of Agriculture, Washington, D.C., July 1998.

Lewis, J., “Agrarian Change and Privatization of Ejido Land in Northern Mexico,” *Journal of Agrarian Change* 2(3):402-420, July 2002.

Málaga, J.E, “Effects of the North American Free Trade Agreement on the U.S. and Mexican Fresh Vegetable Industries and Trade,” Ph.D. dissertation, Texas A&M University, 1997.

Málaga, J.E., G. Williams, and S. Fuller, "U.S.-Mexico Fresh Vegetable Trade: The Effects of Trade Liberalization and Economic Growth," *Agricultural Economics* 26(1):45-55, October 2001.

Morett S., J.C., *Alternativas de Modernización del Ejido*, 1st ed., Mexico City: Instituto de Proposiciones Estratégicas, 1991.

North American Transportation Statistics Database (NATSDB), online at http://nats.sct.gob.mx /nats/, 2005.

Orden, D., “Mexico-US Avocado Trade Expansion,” Paper presented at the Eighth Agricultural and Food Policy Information Workshop, Puerto Vallarta, Mexico, March 2002, on-line at: http://pdic.tamu.edu/flags/orden.pdf.

Pacheco, J., “Avocados,” The International Business Accelerator, New Mexico Small Business Development Center Network, Santa Teresa, New Mexico, January 6, 2004.

Plunkett, D.J., “Mexican Tomatoes--Fruit of New Technology,” Report No. VGS-268, *Vegetables and Specialties Situation and Outlook*, Economic Research Service, U.S. Department of Agriculture, Washington, DC, April 29, 1996.

*Railway Age*, “Progress and Problems - Progress for Mexico's Railroad Infrastructure,” February 2000. On-line at: http://www.findarticles.com/p/articles/mi_m1215/ is_2_201/ai_60087599.

Richards T. and P. Patterson, “The Economic Value of Public Relations Expenditures: Food Safety and the Strawberry Case,” *Journal of Agriculture and Resource Economics* 24: 440-462, 1999.

Rosenzweig, A., “Changes in Mexican Agricultural Policy, 2001-2003,” Presentation at the Policy Disputes Information Consortium’s Ninth Agricultural and Food Policy Information Workshop *Farm Policy Developments and Policy Tensions under NAFTA*, Montreal, Quebec, Canada, April 23-26, 2003. Online at: http://www.farmfoundation.org/pdic/ farmpolicy/ rosenzweig.pdf.

Sadoulet, E., A. de Janvry, and B. Davis, “Cash Transfer Programs with Income Multipliers: PROCAMPO in Mexico,” Discussion Paper No. 99, Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C., January 2001.

Salin, D.L., W.F. Hahn, and D.J. Harvey, "U.S.-Mexico Broiler Trade: A Bird's Eye View," ERS Report No. LDP-M-102-01, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., December 2002.

Schulthies, B.K. and G.W. Williams, *Agricultural Issues in U.S.-Mexico Economic Integration*, TAMRC Report No. CR-1-92, Texas Agricultural Market Research Center, Texas A&M University, College Station, Texas, April 1992.

Stanford, L., "Ejidal Organization and the Mexican State: Confrontation and Crisis in Michoacán," Department of Sociology and Anthropology, New Mexico State University, Las Cruces, New Mexico, 1994.

Tropp, D., D. Skully, J. Link, and J. Málaga, "Mexico's Changing Marketing System for Fresh Produce: Emerging Markets, Practices, Trends, and Issues," Agricultural Marketing Service, U.S. Department of Agriculture, October 2002.

United Nations, "Commodity Trade Statistics. (COMTRADE)." Available on-line at: http://unstats.un.org/unsd/comtrade/.

U.S. Animal and Plant Health Inspection Service (APHIS), "Mexican Fruit Fly," Plant Protection and Quarantine Fact Sheet, U.S. Department of Agriculture, April 1993, on-line at: http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phmexfly.html.

U.S. Department of Agriculture (USDAa),"FAS online: U.S. Trade Internet System." Available on-line at: http://www.fas.usda.gov/ustrade/.

U.S. Department of Agriculture (USDAb), "Mexico Avocado Annual," GAIN report, Foreign Agriculture Service, Washington D.C., 1997-2005 (various issues).

U.S. Food and Drug Administration (FDA), "FDA Update on Recent Hepatitis A Outbreaks Associated with Green Onions from Mexico," Center for Food Safety and Applied Nutrition, Dec. 9, 2003, on-line at: *www.fda.gov/bbs/topics/NEWS/2003/NEW00993.html*.

Williams, G.W., "The North American Free Trade Agreement: Effects on U.S. Agriculture and Trade," International Market Research Report No. IM-04-01, Texas Agricultural Market Research Center, Texas A&M University, College Station, Texas, Nov. 2001.

World Bank, "The Sustainability and Productive Management of Mexico's Aquifers," 4th Draft for Comisión Nacional del Agua, Guanajuato, Mexico, June 1999, on-line at: *lnweb18.worldbank.org/ESSD/ardext.nsf/18ByDocName/...+draft+to+CNA.pdf* .

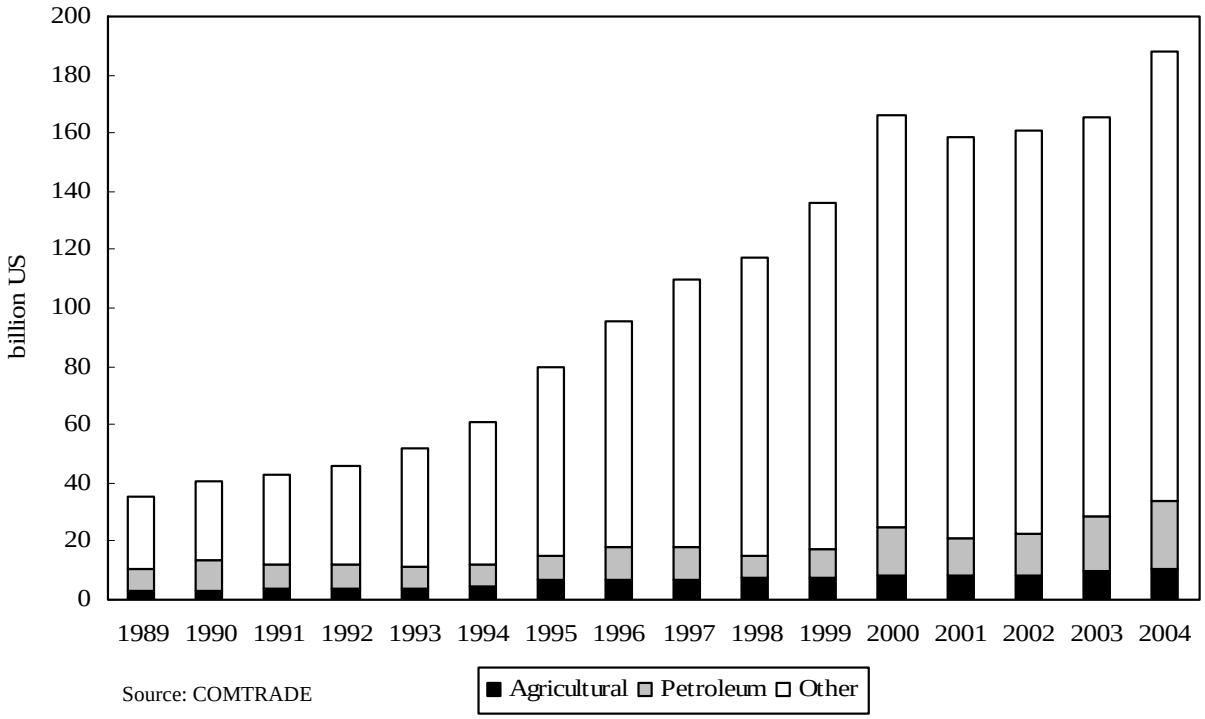
Zanhiser, S., T. Green, L. Hanson, L. Lee, and H. Fanghanel, "North American Approaches to Regulatory Coordination," Paper presented at Second Workshop of the North American Agri-Food Market Integration Consortium (NAAMIC), San Antonio, Texas, May 2005.

Zahniser, S., E. Young, and J. Wainio, “Recent Agricultural Policy Reforms in North America,” Report No. WRS-05-03, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., April 2005.

Zaragoza, J.L. and R. Macías, "El Desarrollo Agrario de México y su Marco Jurídico," Centro Nacional de Investigaciones Agrarias, Mexico, 1980.

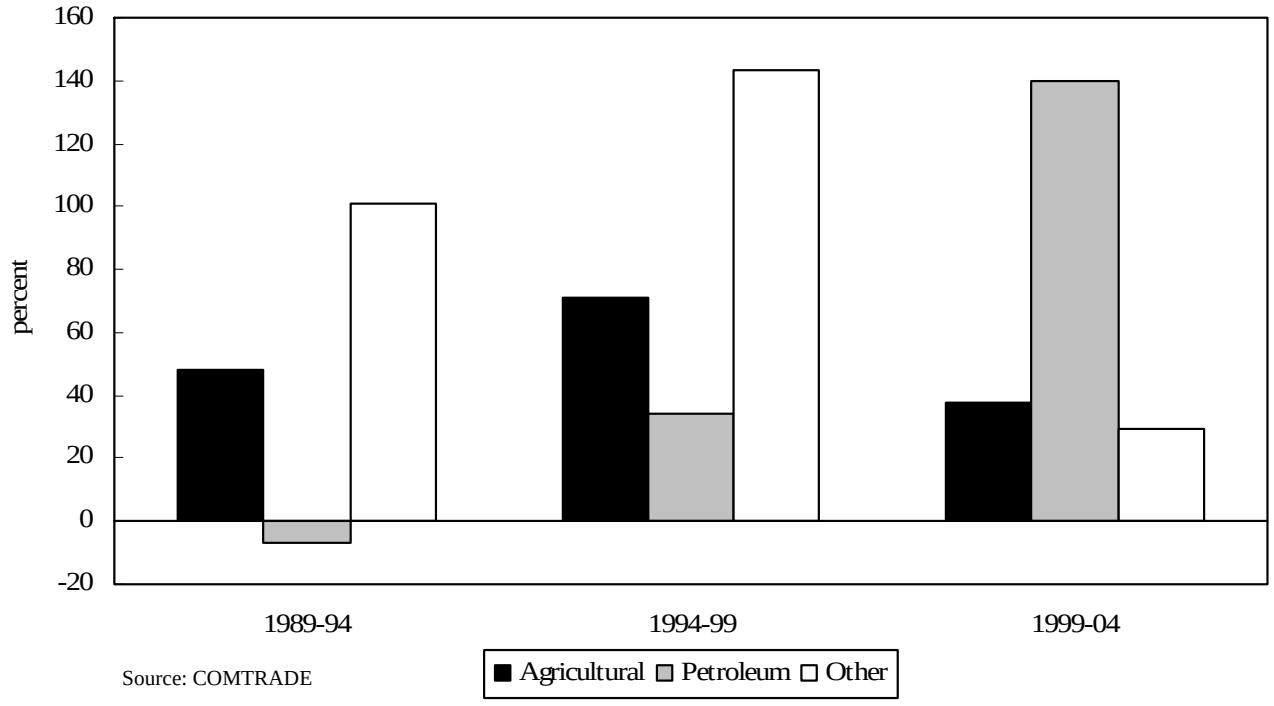
**Tables and Figures**

**Figure 1 – Mexico: Agricultural and Non-Agricultural Exports, 1989-2004**




Source: COMTRADE

**Figure 2 – Mexico: Percent Change in Agricultural and Non-Agricultural Export Value, 1989-2004**




Source: COMTRADE

**Figure 3 – Mexico: Agricultural Export Value and Share of Total Exports, 1989-2004**

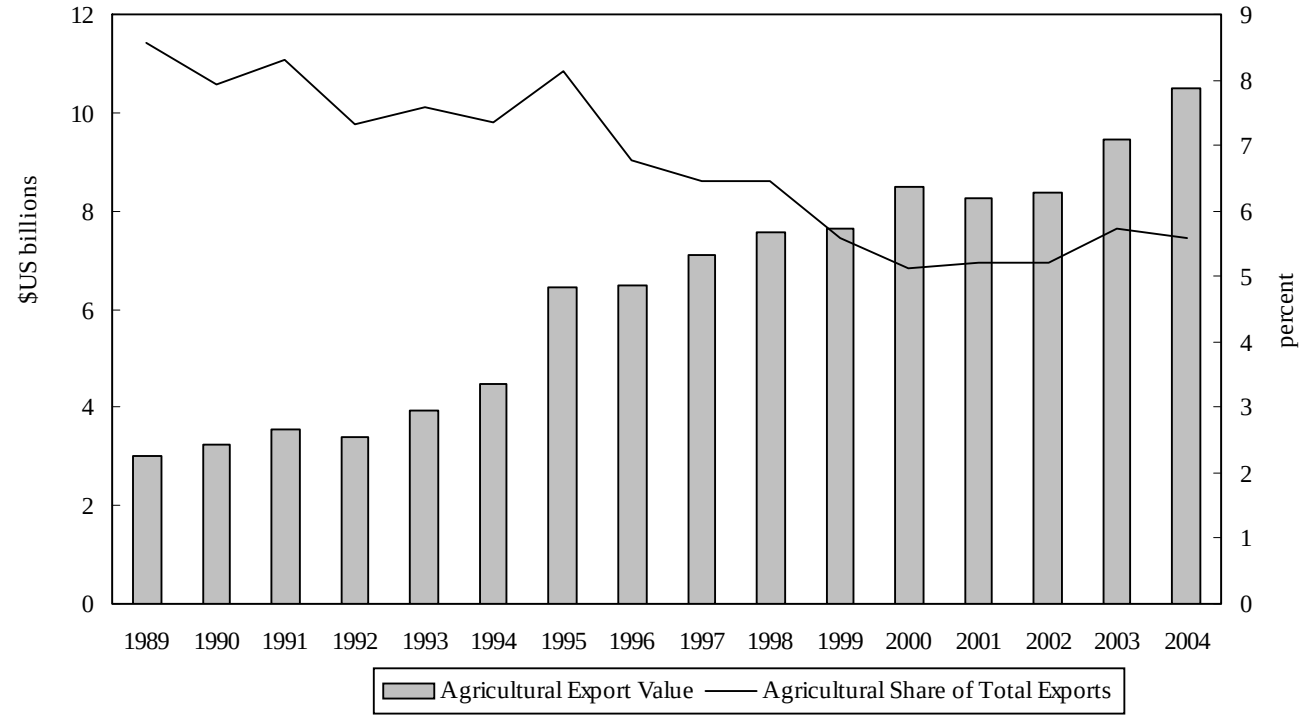



**Figure 4 – Mexico: Agricultural GDP and Export Share of Agricultural GDP, 1989-2003**

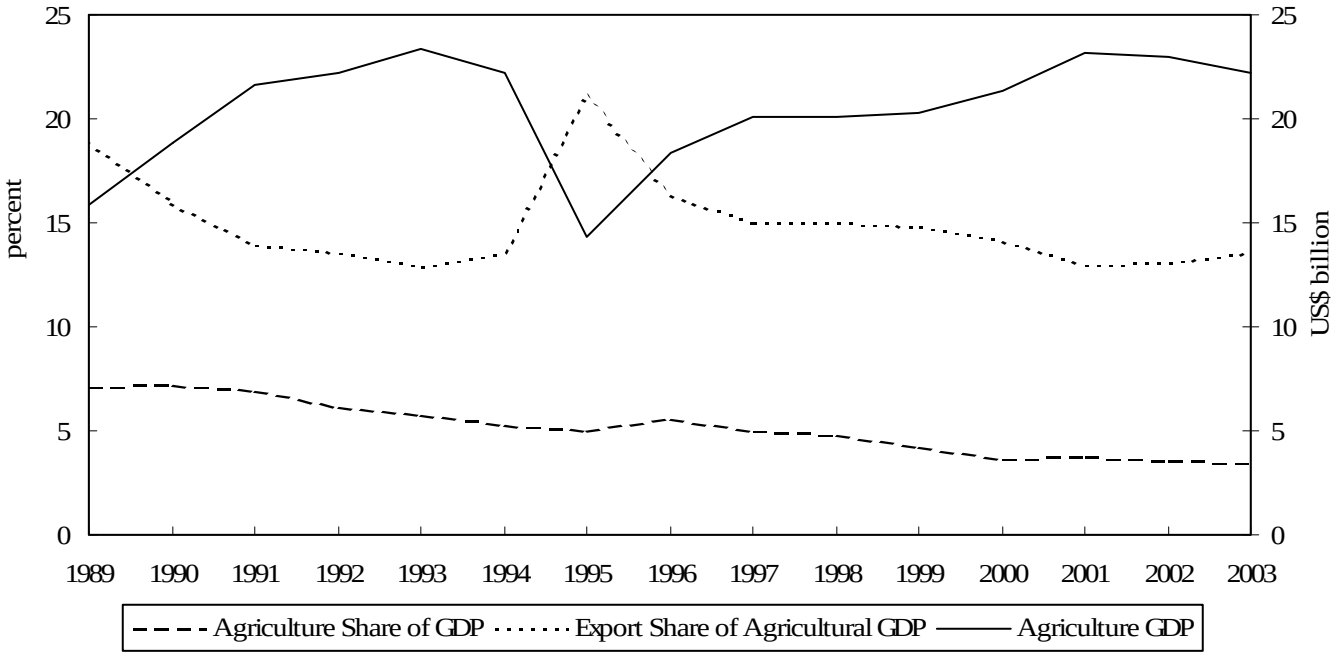
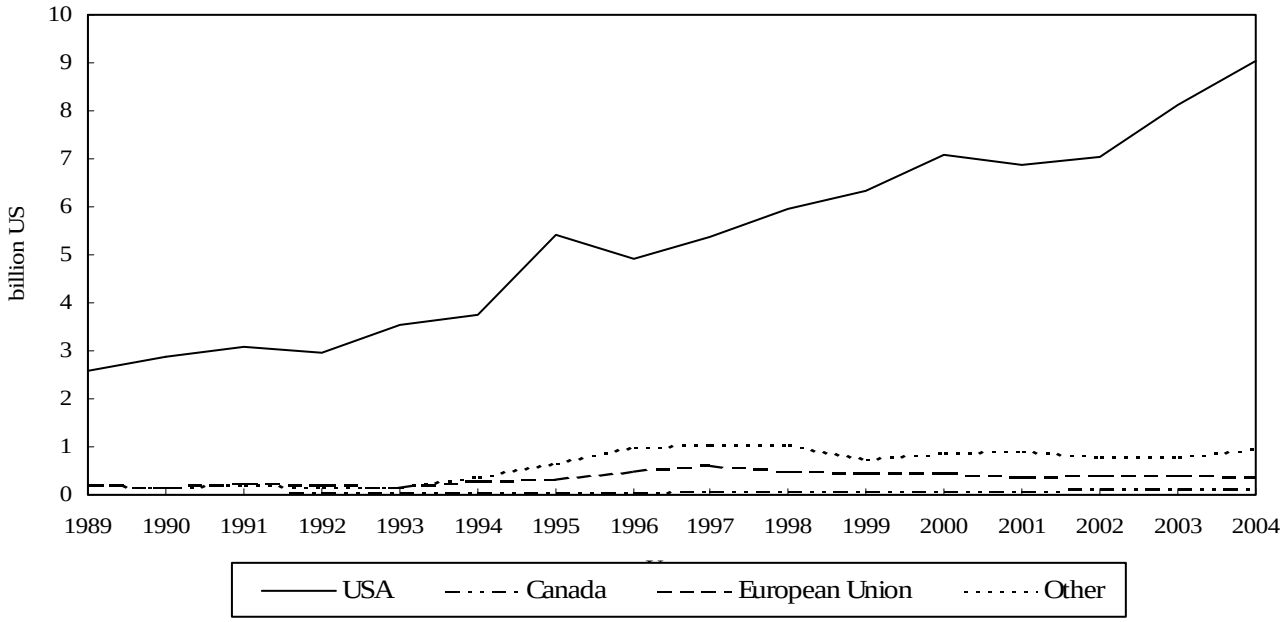
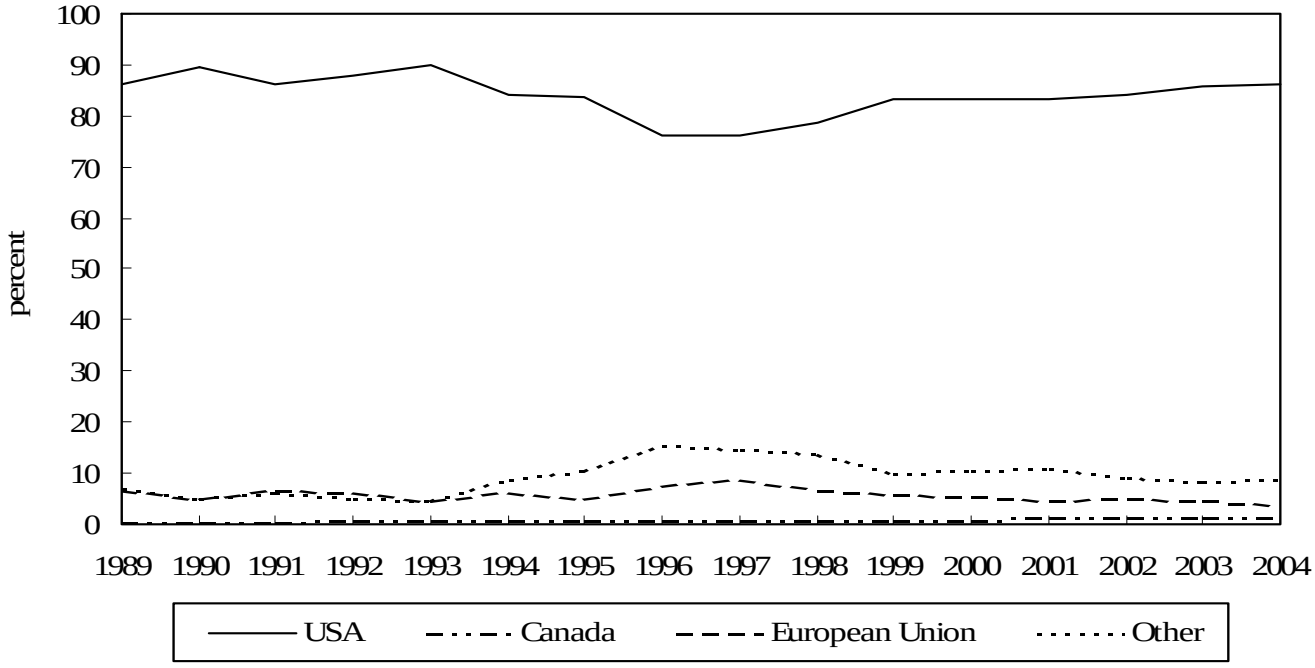


**Figure 5 – Mexico: Agricultural Exports by Country, 1989-2004**




Source: COMTRADE

**Figure 6 – Mexico: Share of Agricultural Exports by Country, 1989-2004**




Source: COMTRADE

**Figure 7 – Mexico: Share of Agricultural Exports by Selected Countries, 1989-2004**

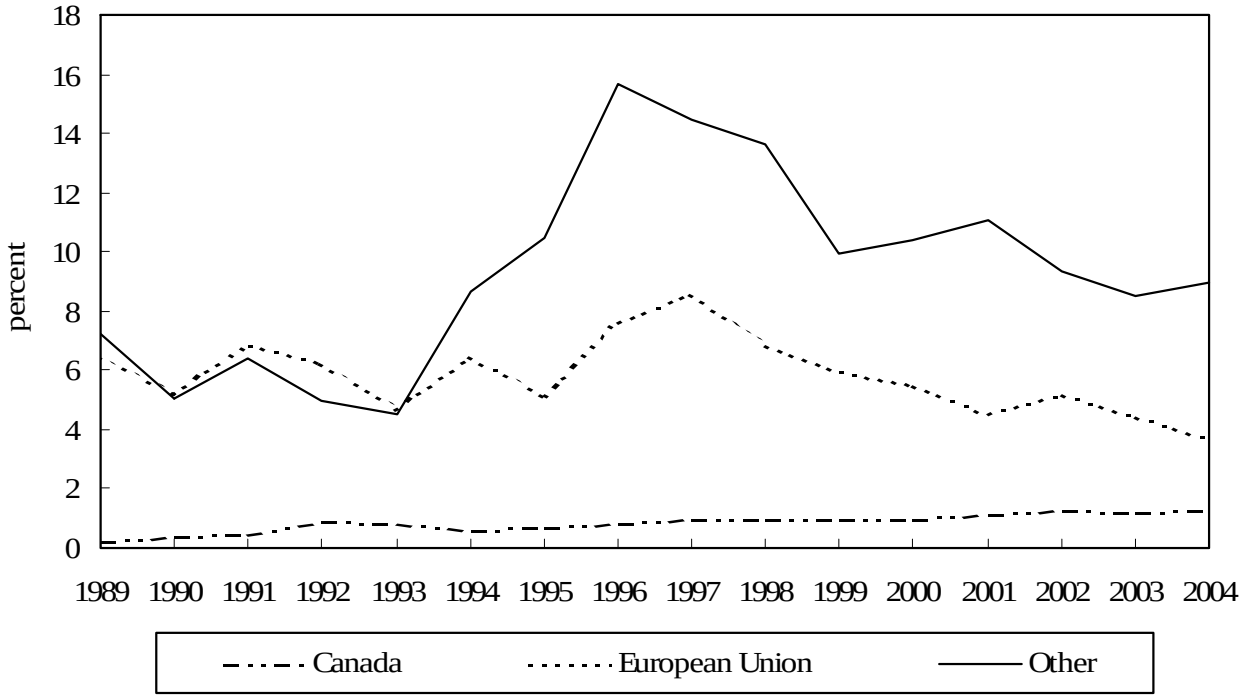



**Figure 8 – Mexico: Agricultural Share of Total Exports by Country, 1989-2004**

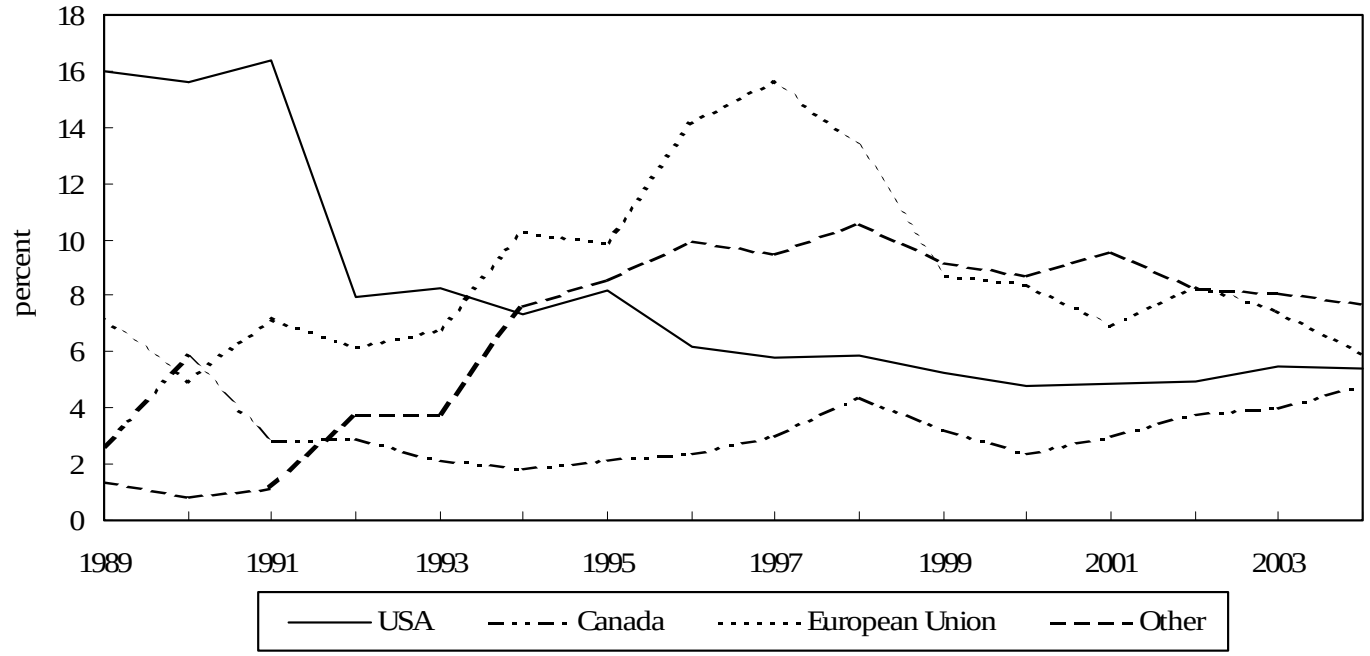


**Figure 9 – Revealed Comparative Advantage (RCA) Index for Mexican Agricultural Exports, 1989-2004**

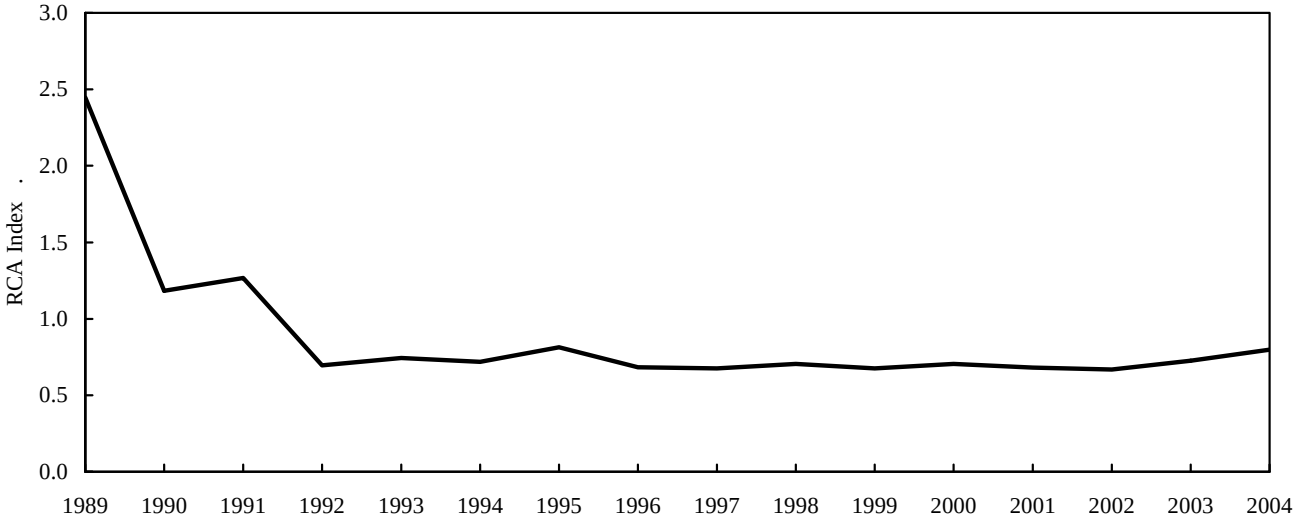



**Figure 10 – Revealed Comparative Advantage (RCA) Index for Four Major Agricultural Export Groups, 1989-2004**

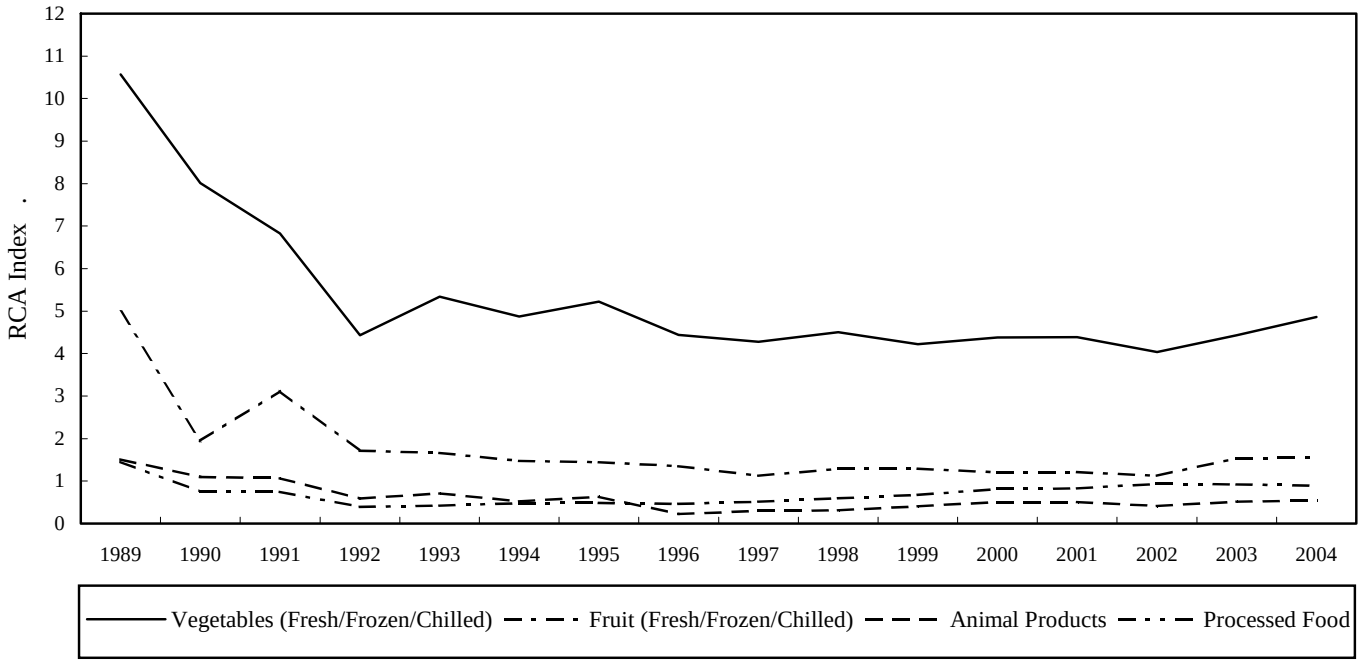


**Figure 11 – Mexican Market Share of U.S. Agricultural Imports by Four Major Product Groups, 1989-2004**

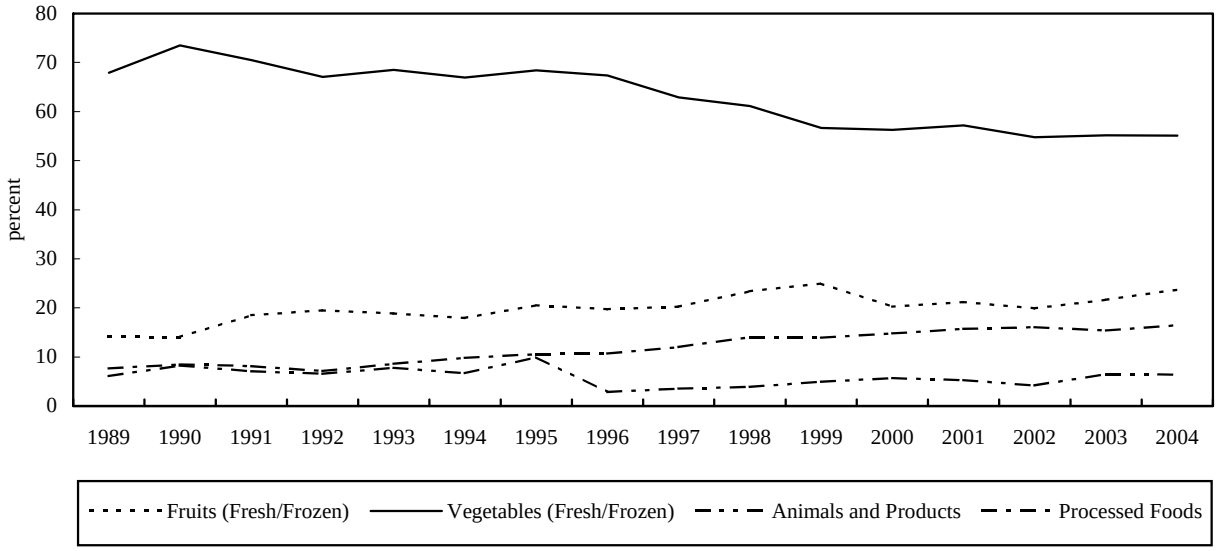



**Figure 12 – Mexican Market Share Change vs. U.S. Import Growth for Major Mexican Agricultural and Food Exports to the U.S., 1989-94, 1994-99, and 1999-04**

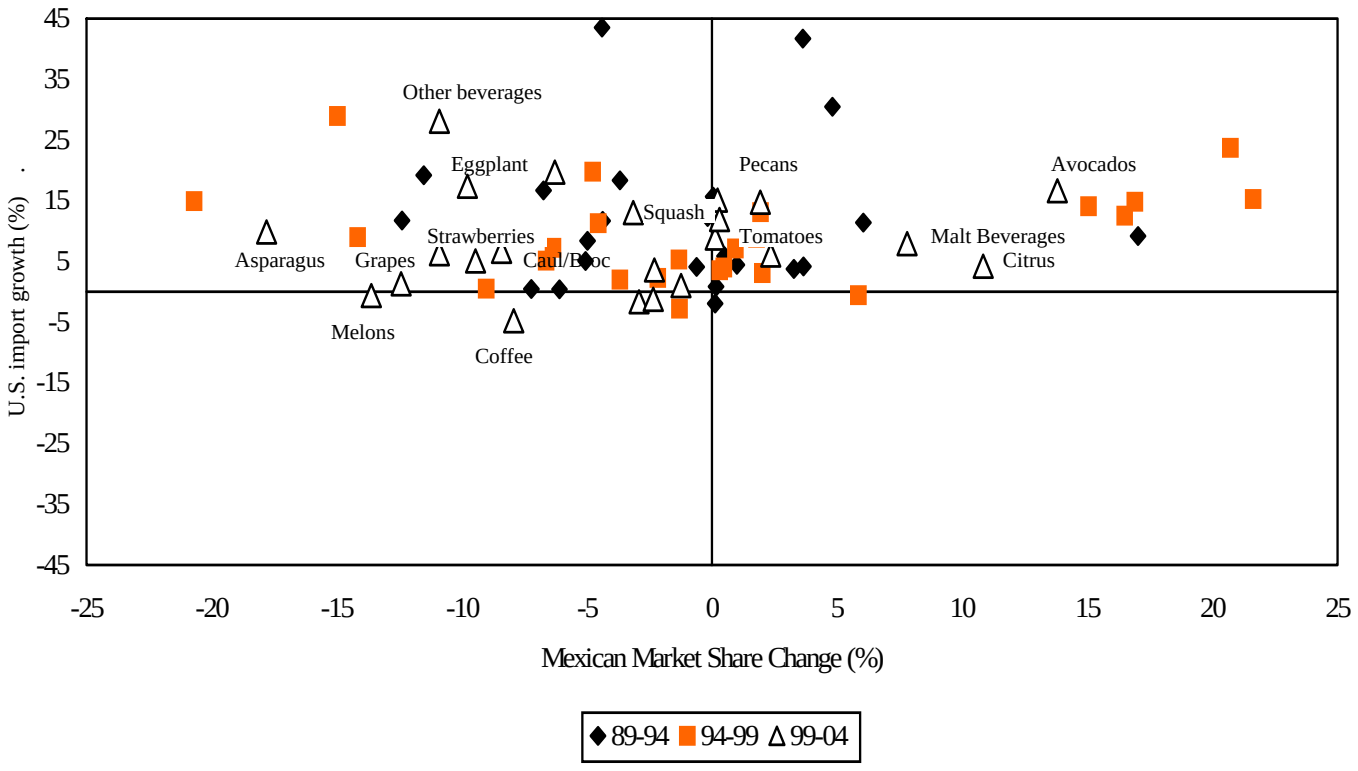


**Figure 13 – Mexican Share of EU Major Agriculture and Food Imports, 1995-2004**

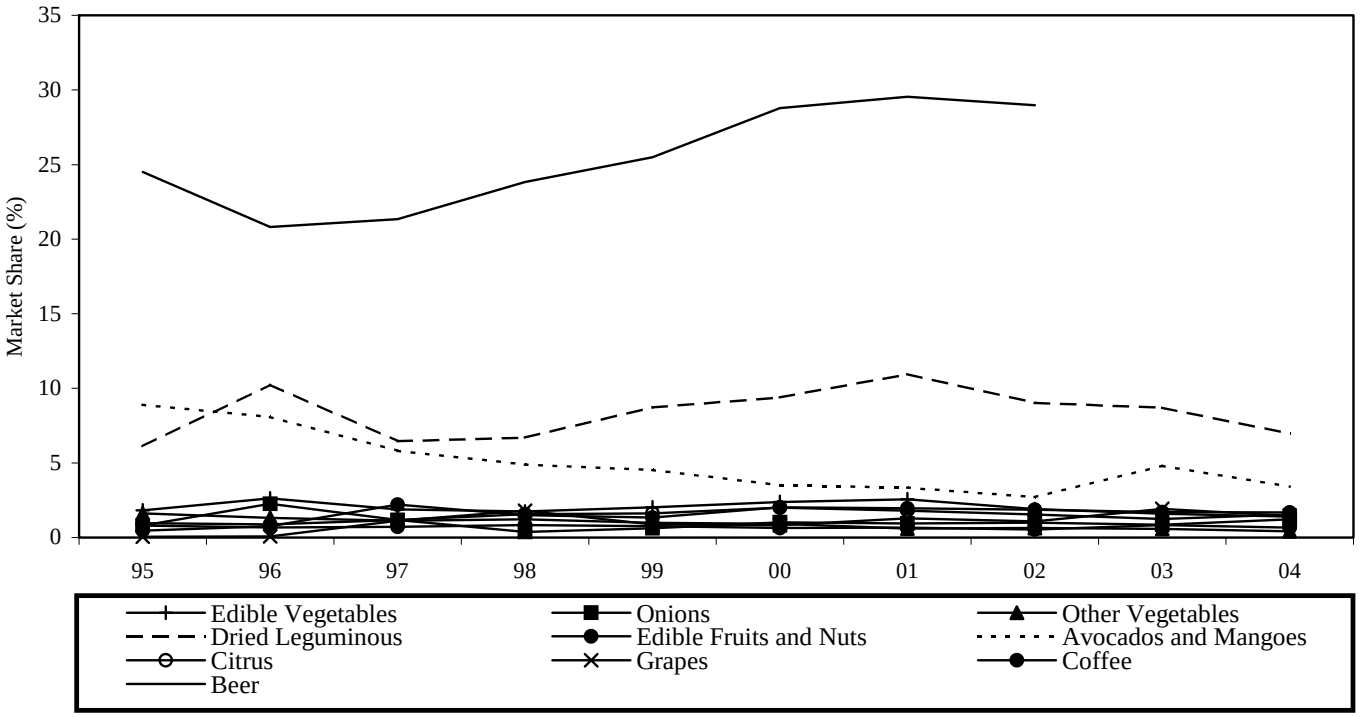



**Figure 14 – Mexican Market Shares of Selected Canadian Agriculture and Food Imports, 1989-2004**

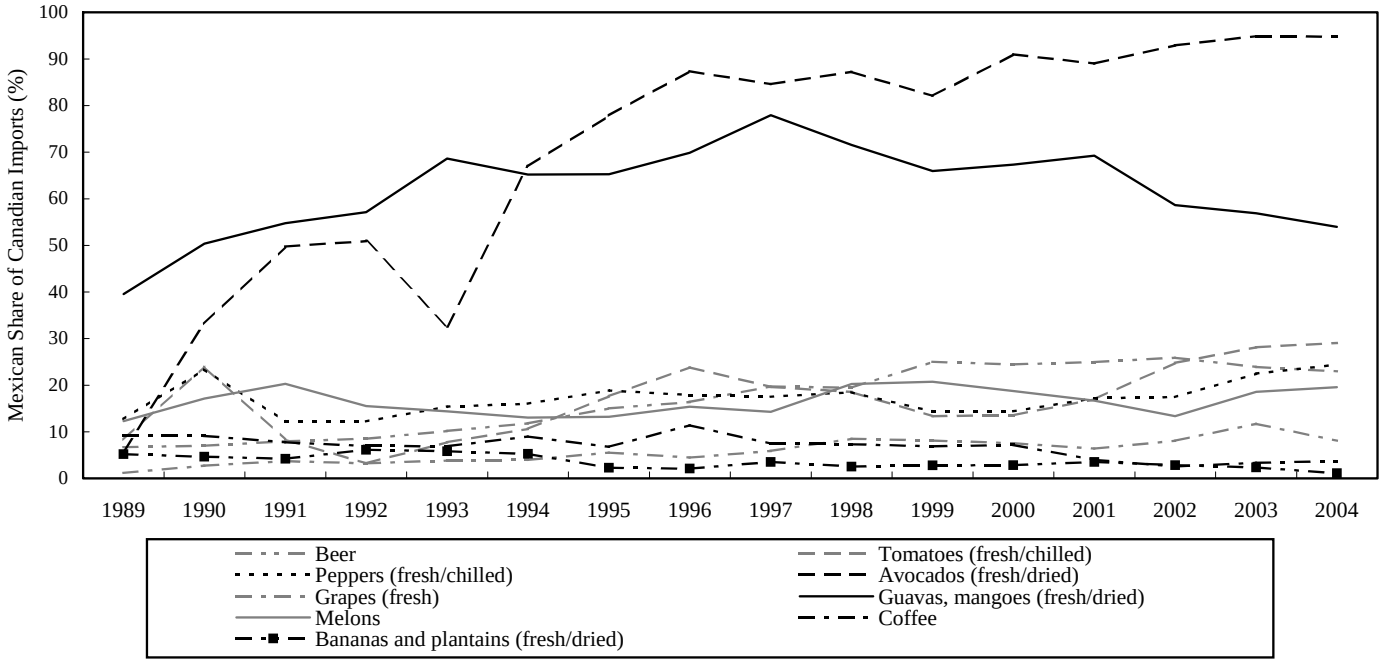


**Table 1 – Change in Mexican Share of U.S. Imports and U.S. Import Growth Rate for Top 24 Agricultural and Food Commodities Exported by Mexico to the United States, 1989-94, 1994-99, and 1999-2004**

| | Change in Mexican Share of U.S. Imports | | | U.S. Import Growth | | |
|---|---|---|---|---|---|---|
| | 1989-94 | 1994-99 | 1999-04 | 1989-94 | 1994-99 | 1999-04 |
| | ---------- percent ---------- | | | | | |
| TOTAL AGRICULTURE | 0.3 | 2.2 | 0.5 | 4.3 | 6.9 | 7.5 |
| Tomatoes | -5.0 | -20.7 | 0.1 | 8.4 | 14.9 | 8.9 |
| Cattle and calves | -12.4 | -1.3 | 70.7 | 11.7 | -2.8 | -11.5 |
| Peppers | -4.4 | -4.5 | 0.2 | 11.7 | 11.3 | 15.1 |
| Cucumbers | -0.6 | -6.6 | -6.3 | 4.1 | 5.1 | 19.7 |
| Grapes, fresh | 3.3 | 21.6 | -10.9 | 3.8 | 15.3 | 6.2 |
| Squash | -0.2 | 1.8 | -3.1 | 12.3 | 8.9 | 13.0 |
| Cauliflower/Broccoli | -5.1 | -6.3 | -8.4 | 5.0 | 7.3 | 6.6 |
| Coffee | -7.2 | 2.0 | -7.9 | 0.4 | 3.1 | -4.8 |
| Onions | -6.7 | -9.0 | 2.3 | 16.7 | 0.5 | 6.1 |
| Pecans | -4.4 | -1.3 | 1.9 | 43.5 | 5.3 | 14.8 |
| Citrus, fresh | 4.8 | -15.0 | 10.8 | 30.4 | 28.9 | 4.2 |
| Melons | -26.9 | 15.1 | -13.6 | 3.1 | 14.1 | -0.6 |
| Strawberries | 17.0 | 1.9 | -9.5 | 9.2 | 13.1 | 5.1 |
| Mangoes | -3.7 | -14.2 | -12.4 | 18.3 | 9.0 | 1.3 |
| Asparagus, fresh | -11.5 | -4.8 | -17.8 | 19.2 | 19.8 | 9.8 |
| Fruit Juices | 0.1 | 0.3 | -1.2 | -1.9 | 3.5 | 1.0 |
| Avocados | 3.6 | 20.7 | 13.8 | 41.7 | 23.7 | 16.7 |
| Red meat and products | 0.2 | 0.5 | 0.3 | 0.8 | 4.0 | 11.9 |
| Eggplant | 0.0 | -3.7 | -9.8 | 15.6 | 2.0 | 17.4 |
| Sugar | -6.1 | 5.9 | -2.9 | 0.4 | -0.6 | -1.7 |
| Cut flowers | 0.5 | 0.9 | -2.3 | 5.9 | 7.1 | 3.6 |
| Bananas/plantains | 3.7 | -2.2 | -2.4 | 4.2 | 2.3 | -1.3 |
| Malt beverages | 1.0 | 16.5 | 7.8 | 4.4 | 12.5 | 7.9 |
| Other beverages | 6.1 | 16.9 | -10.9 | 11.4 | 14.8 | 28.1 |

**Table 2 – Primary Market Segment and Intensity of Impact by the Mexican Agricultural and Food Export Competitiveness Factors[1]**

| Main Competitiveness Factors | Production | | Processing | Marketing | Consumption | Trade |
|---|---|---|---|---|---|---|
| | efficiency | area | | | | |
| Bilateral trade agreements | | | | | | L |
| Food Safety | | | | | | M |
| SPS issues | | | | | | M |
| Water issues | H | H | | | | |
| Infrastructure | | | | H | | M |
| Land tenure | H | H | | | | |
| Technology | H | | | | | |
| Income growth | | | | | H | |
| Food distribution | | | | H | | |
| Policy issues | L | L | | | | |
| Ag Credit | | M | | | | |
| Macro linkages | | | | | | L |
| FDI | L | L | L | | | |
| Labor issues | L | L | | | | |
| Environment laws | L | | | | | |

[1] H = High impact; M = Medium impact; L = Low impact; and a blank space indicates that the area is not where the primary impact of the main competitiveness is felt.

**Table 3 – Potential Trade Effects of the Factors Most Likely to Impact Mexican Export Competitiveness[1]**

| Key Competitiveness Factors | Exports | Imports |
|---|---|---|
| NAFTA | L | M |
| Food Safety | M | L |
| SPS issues | M | M |
| Water issues | H | L |
| Infrastructure | M | H |
| Land tenure | L | H |
| Technology | H | H |
| Income growth | M | H |
| Food distribution | L | H |
| Ag Credit | L | M |

[1] H = High impact; M = Medium impact; and L = Low impact.

**Table 4 – Effects of the Key Mexican Agricultural and Food Export Competitiveness Factors by Export Group[1]**

| Key Export Competitiveness Factors | Group 1 | | | Group 2 | | | Group 3/4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Impact | | | Impact | | | Impact | |
| | Products | Current | Future | Products | Current | Future | Products | Current | Future |
| Food Safety | Green Onions | L | H | Strawberries | L | L | Cantaloupes | L | H |
| SPS issues | Avocados | L | L | | | | Cattle | M | M |
| | Oranges | L | L | | | | Swine | M | M |
| | | | | | | | Poultry | M | M |
| Water issues | Tomatoes | L | M | All except fruit juices & other beverages) | M | H | Melons | M | H |
| | Other Vegetables | M | H | | | | | | |
| Infrastructure | Tomatoes | L | M | All | M | M | All | H | H |
| | Other Vegetables | M | H | | | | | | |
| Technology | Tomatoes | L | M | All | H | H | All | H | H |
| | Other Vegetables | M | H | | | | | | |
| Income growth | All | M | H | All | M | H | All | L | L |

[1] Group 1 includes those products among the top 24 Mexican exports to the U.S. that are experiencing positive U.S. import growth and positive growth in the Mexican share of U.S. imports; Group 2 includes those products among the same top 24 Mexican exports to the U.S. experiencing positive U.S. import growth but negative growth in the Mexican share of U.S. imports; and Group 3/4 includes all other products among the same top 24 Mexican exports to the U.S. H = High impact; M = Medium impact; L = Low impact; and blank space indicates a small or no impact.