

SP 2002-04
October 2002



Staff Paper

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Impacts of Trade Liberalization on the New York Horticultural Sector

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by

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Introduction¹

Growers of horticultural products in New York State have become increasingly concerned about their position in the global marketplace and the effects of trade policy on the economic vibrancy of their businesses. Although competitive issues with Canadian producers of like commodities have drawn attention in New York State for many years, the interest has become more intense in the last two decades. Trade liberalization on a worldwide scale in recent decades has offered opportunities, but challenges as well, for a number of commodities produced on New York farms.

The purpose of this report is to discuss these matters in a systematic way. First, we place trade in horticultural products in a broad national and international perspective, noting recent trends and identifying key elements of trade policy for New York growers. We emphasize movements in trade during the 1990 decade, in the aftermath of concluding the North American Free Trade Agreement (NAFTA). This descriptive task is complicated in several ways. Horticultural production encompasses a broad array of commodities; trade issues often differ depending on the commodity under discussion. Another complication is the availability of data; statistical agencies limit their reports to “principal crops” and the data needed to accurately trace commodity trade channels—foreign or domestic—do not exist.

Problems with data, unfortunately, are especially acute at the state and regional levels because shipments abroad are tallied at point of shipment rather than at point of origin.² This geographic distinction is absolutely critical when sales of raw or nonmanufactured farm commodities are in question. One wants to associate onfarm production with an export sale rather than the last transshipment point in the US for the commodity.

Our second task is to discuss current and emerging concerns with trade relationships at the state level on a commodity case basis. Some examples of recent concerns are alleged dumping of Canadian greenhouse tomatoes in the US market, the impact of inexpensive floriculture products imported from Canada into the state, and the dumping of Chinese apple juice concentrate. Going back a couple of decades, issues included the strong market penetration of imported wine from the European Union and the rapid growth of imported apple juice concentrate in the mid-1980s. Trade issues between New York producers and Canadian producers surrounding important commodities such as potatoes, onions and apples have been recurring over the past 30 years.

The North American Free Trade Agreement between the United States, Canada, and Mexico took effect on January 1, 1994. NAFTA implementation has progressively eliminated most barriers to trade and investment between the

¹ Partly based on Donovan and Krissoff (2001).

² Several Federal agencies disseminate export-import data that often give a conflicting picture of trade flows for individual, nonmanufactured agricultural commodities. For the purposes of this report, we rely on the USDA-ERS FATUS data series (USDA, 2002a). The FATUS data are widely cited in the economic literature and help insure that this report is compatible with allied studies in the trade area.

signatory countries in a process that will be completed by January 1, 2008. Since most tariffs have already been eliminated, current trade effects are a good indication of the likely total impacts on freer trade between the three countries.

Overview of Trade under NAFTA

Before turning to trade under NAFTA with Canada and Mexico, it is useful to look at the larger national picture. Aggregate US trade volume for all exports and for agricultural commodities is shown in Figure 1, while Figure 2 shows long-term trends in US imports of farm and food commodities. The numbers underscore the common perception that the US is a major player in world markets, and that the farm sector is a big piece of the export-import puzzle. Glancing back a quarter century to the late 1970s, farm exports accounted for about one-fifth of all US exports; this was a time when American farmers were encouraged to “...plant fence row to fence row” to meet burgeoning export demand for farm commodities—bulk food and feed grain, oilseed,

and fiber crops in particular. Those bulk commodity markets softened in the early 1980s, and by the early 1990s the agricultural share of US world trade was down from 20 percent and approaching 10 percent. Presently, the farm share of all US exports is hovering in the 7-8 percent range (Figure 1).

The dollar value of agricultural imports has systematically increased over the last quarter century as well. Two classes of import transactions must be recognized. Noncompetitive imports are commodities—coffee, tea, bananas, etc.—that are not well suited to domestic production. In the late 1970s, imports were evenly split between noncompetitive and competitive imports, the latter representing trade in commodities that are produced in quantity by US farms and firms. Over the last 25 years, import growth has been concentrated in commodities classified as competitive imports. Today, competitive imports account for roughly 80 percent of the total import trade in farm and food products.

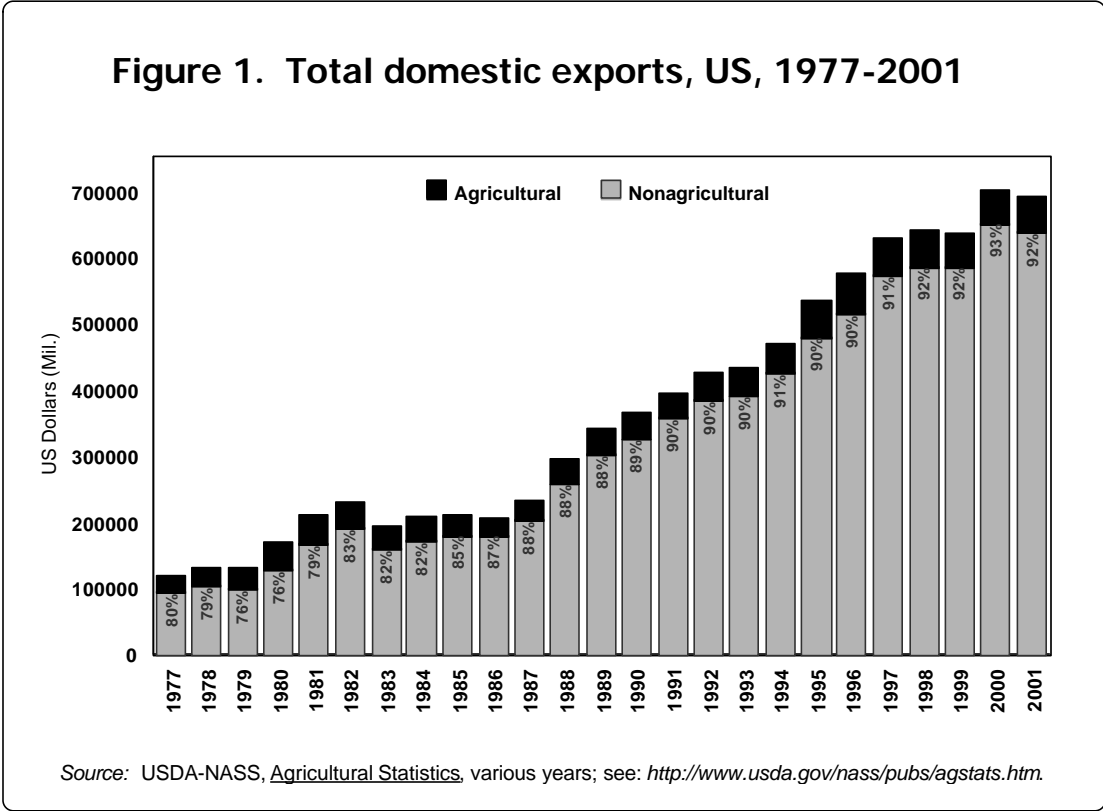
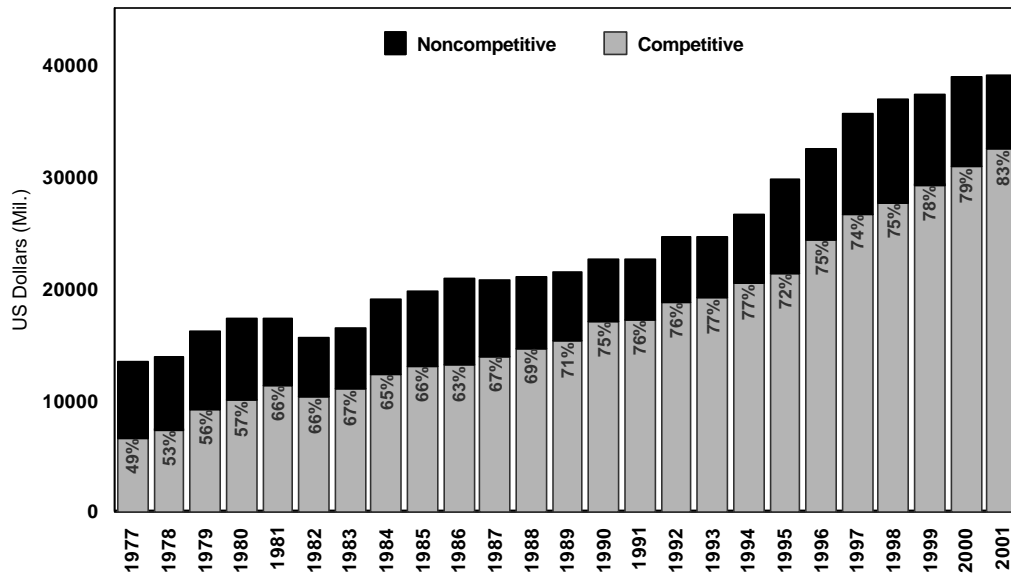


Figure 2. Value of agricultural imports for consumption, US, 1977-2001



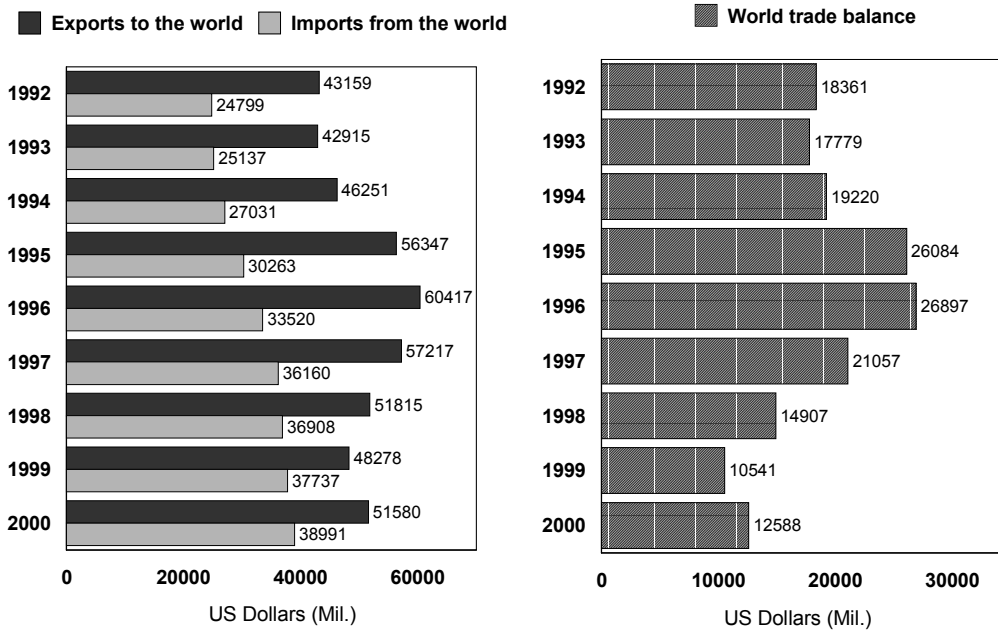
Source: USDA-NASS, *Agricultural Statistics*, various years; see: <http://www.usda.gov/nass/pubs/agstats.htm>.

As noted above, the dollar volume of US agricultural sales abroad has increased since the late 1980s (Figures 1 and 3). Agricultural exports of all kinds have been as high as \$60 billion US dollars (USD) during the banner 1996 calendar year, with a range from \$43 billion USD in the early 1990s to something over \$50 billion USD in 2000 (Figure 3). Offshore markets are extremely important to American farm and food producers. Sales abroad accounted for between 23 to 29 percent of gross domestic product (GDP) originating in farm and food industries during the 1990 decade (USDA (2002d); US Department of Commerce (2002)). Although food imports have increased appreciably in recent years, as shown in Figures 2 and 3, the US has maintained a favorable overall balance of trade in world farm and food markets. That positive trade balance was as high as \$27 billion USD in calendar 1996, but by 2000 the excess of export sales over the value of imported agriculture and food commodities had eroded to about \$10.5 billion USD (Figure 3).

Reference to trade balances is a useful entry point for discussing NAFTA. The US entered the NAFTA implementation period with a favorable trade balance with both Canada and Mexico (Figure 4). Considering both countries, the balance of trade in 1992 stood at about \$2.2 billion. That trade balance deteriorated throughout the mid-to-late 1990s; the balance went negative in 1995 and again in 1999. In 2000, the balance was favorable, but only at about \$450 million USD. The trade balance has been positive with Mexico for most years after the inception of NAFTA, but negative with Canada since 1996. The positive balance for Canada is driven primarily by livestock and nondairy livestock products.

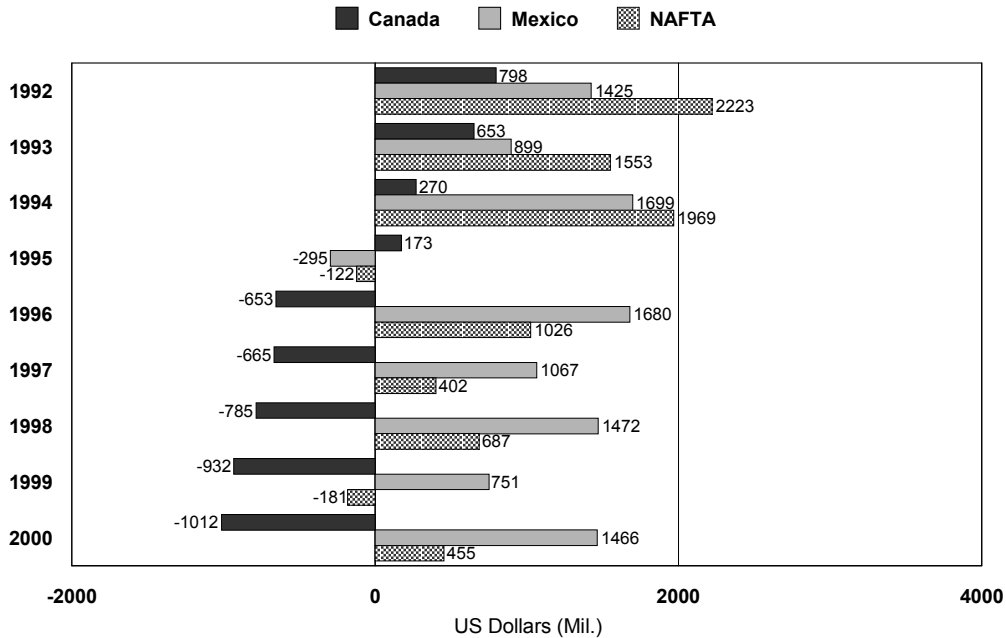
Movements in trade balances highlight the broad effects of NAFTA on trade within member countries, as shown in Figure 5. In 1992 the value of total agricultural exports to Canada and Mexico was approaching \$9.0 billion USD. That trade increased appreciably during the post-NAFTA years, and by 2000 the value of exports had increased to \$14.2 billion USD. Imports, however,

Figure 3. Volume of US agricultural exports and imports, 1992-2000



Source: Zahniser and Link.

Figure 4. Balance of US trade with NAFTA countries in agriculture and food products, 1992-2000



Source: Zahniser and Link.

increased as well and even more rapidly in some years. As one might expect, export-import trends under NAFTA vary appreciably by commodity. The most noticeable changes center on higher valued horticultural crops. The US has maintained a highly favorable trade balance in fruit juices (including frozen juices) with these two countries. A large portion of the US exports of juice is citrus, especially orange juice (about 55 percent of all juice exports to NAFTA). But, for both fresh and processed fruit commodities—referred to in USDA data series as “fruits and preparations”—both imports and exports increased during the post-NAFTA years. The balance of trade has been approximately even in this category since 1998.

A similar pattern has prevailed for fresh and processed vegetables—shown in Figure 5 as vegetables and preparations—but with an even more abrupt change in trade balance. Commodities with the largest share of US exports are lettuce and tomatoes. With vegetable commodities, very modest increases in export sales contrast sharply with abrupt increases in the value of vegetables and vegetable imports. Among these products, tomato imports are particularly striking as evidenced in Figure 5. According to USDA statistics, tomato imports ramped up from about \$130 million USD in 1992 to \$680 million USD in 1996. Even more dramatic increases in imports were realized for the green industries. The charge was led by nursery stock, bulbs and allied products; the value of imports for these products increased more than three-fold between 1992 and 2000 to about \$280 million. Imports of cut flowers increased dramatically as well but from a small base. In 2000, imports of cut flowers from Canada and Mexico approached \$50 million.

Shifts in trade patterns vary within NAFTA—see the highlights in Figures 6 and 7. For Mexico, agricultural exports grew from \$3.6 to \$6.5 billion USD, while for Canada the growth was from \$5.3 billion USD to \$7.7 billion. The overall agricultural trade balance with these two countries

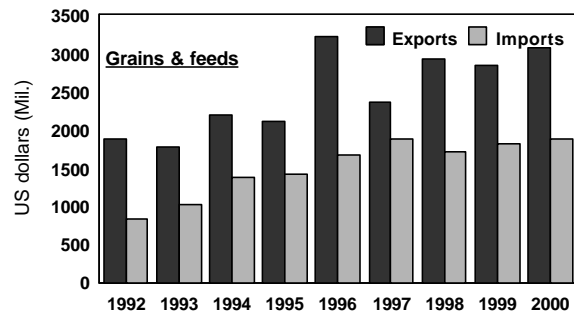
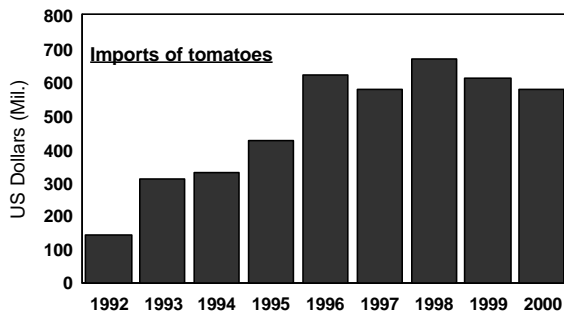
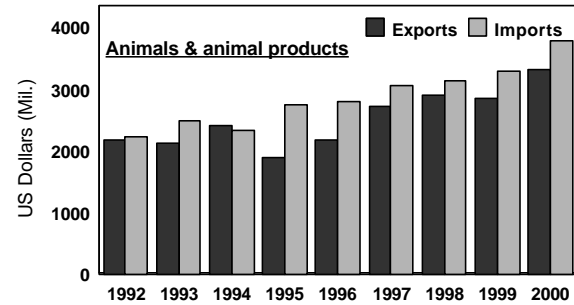
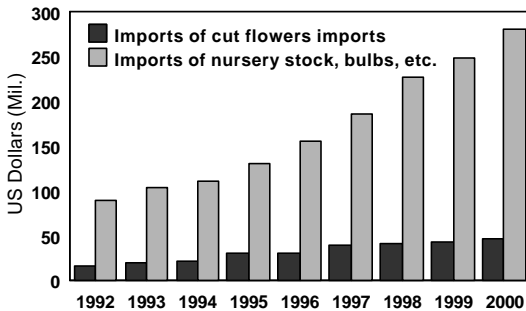
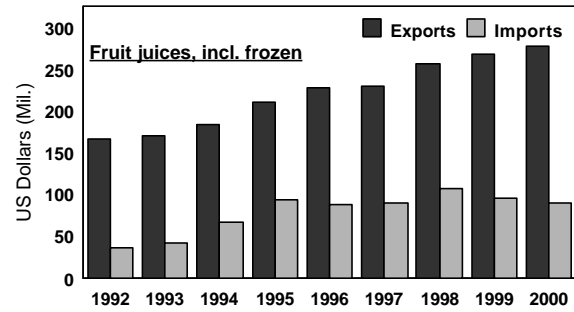
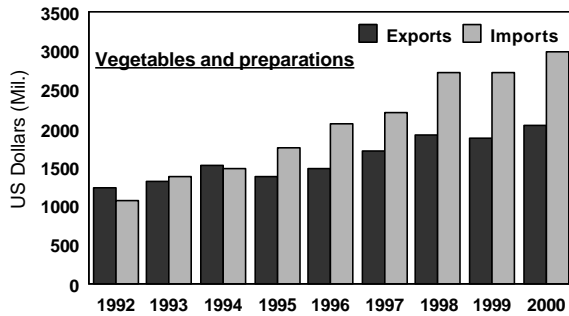
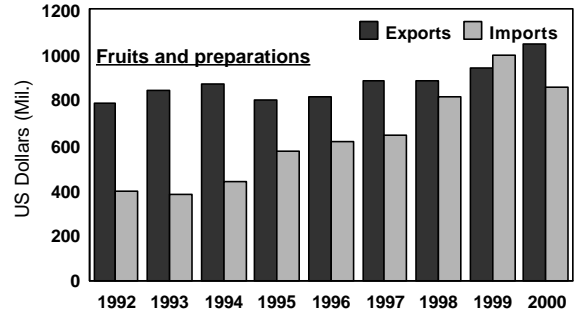
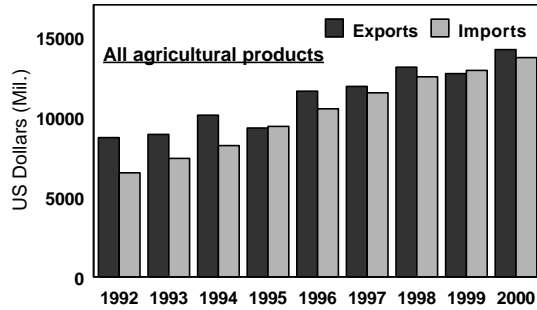
combined has been nearly in balance with a small surplus of usually under \$1 billion USD. It is rather astounding that Canada, with an agriculture sized at little more than one-tenth that of the US, has achieved a positive trade balance with the US, in terms of the USD, in the last five years that data are available!³

These yearly movements in trade volume have caused many in New York to raise the question: Is trade in agricultural commodities good for the New York agricultural industry? This is a complex issue because it involves some producers who clearly feel threatened by gains of imported products, while others have seen exports contribute positively to their earnings (for example, juice grapes and fresh apples). It is generally accepted by economists that liberalized trade improves the overall economic welfare of a country, but it is conceded that there will be winners and losers, especially in the short run.

These issues are not only complex but, as mentioned above, they are also far from being transparent. Surprisingly, despite all the concern and the occasional hyperbole about the global marketplace, one cannot really obtain information on farm and food exports (or imports) at the state level. The statistics reported above are not available for individual states, and published estimates are either crude or nonexistent. Bills (2001) recently reported on available input-out data at the state level that suggests that exports of crops and livestock/livestock products by New York farmers approached \$300 million USD in calendar 1996. This amounted to about 18 percent of in-state crop and livestock production. The USDA calculates some crude state export estimates by assuming that state shares of export sales are proportional to the share of total commodity production. Using this first approximation, and considering both raw and some processed agricultural commodities, the USDA suggests that New York agricultural exports topped \$450 million USD in calendar 2000 (USDA, 2002b). This is a significant

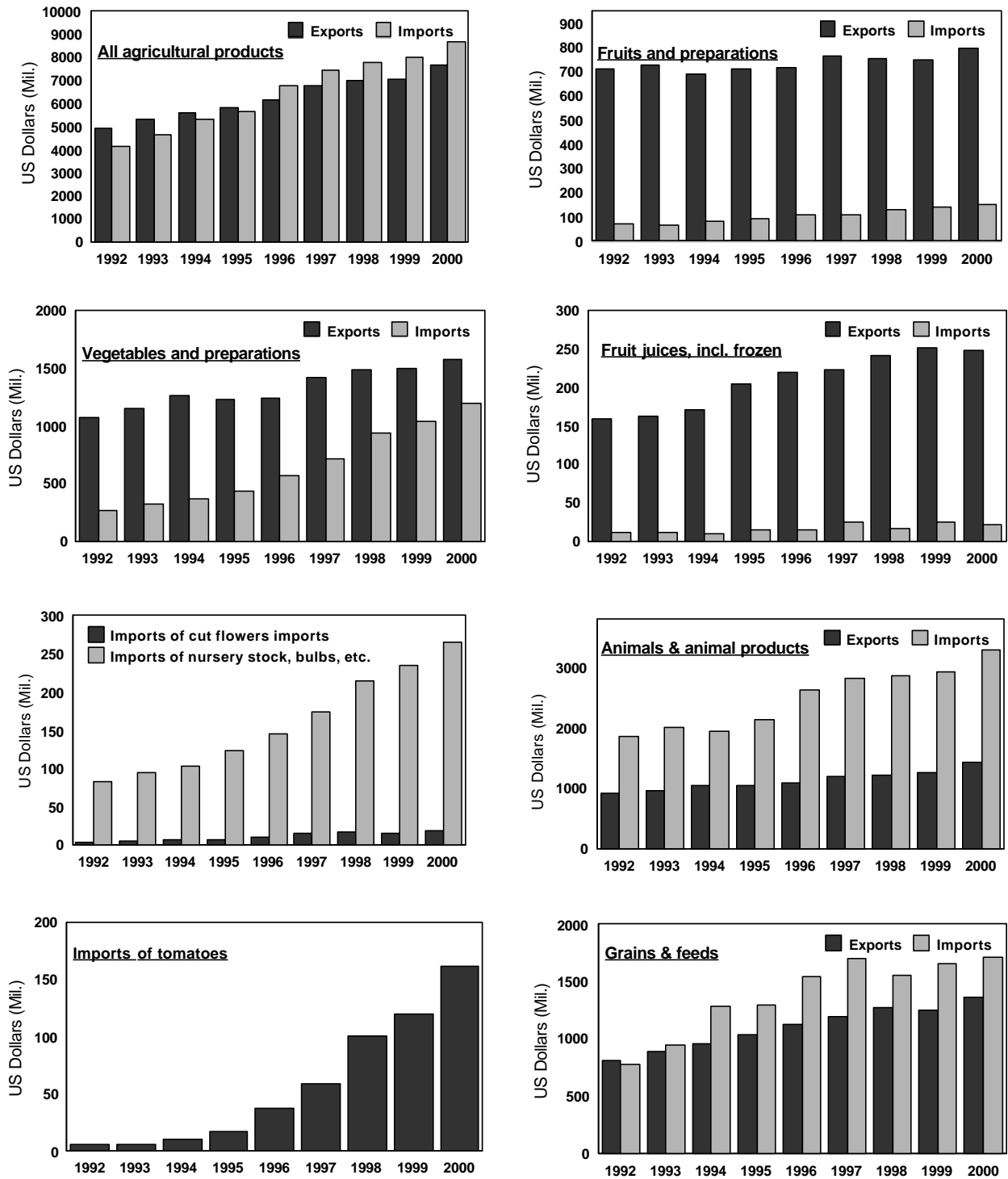
³ A USDA study published in the early 1990s showed that Canada’s gross output of farm commodities was about 12 percent of US farm gross output (USDA, 1993).

Figure 5. US agricultural trade with NAFTA countries, total and selected products, 1992-2000



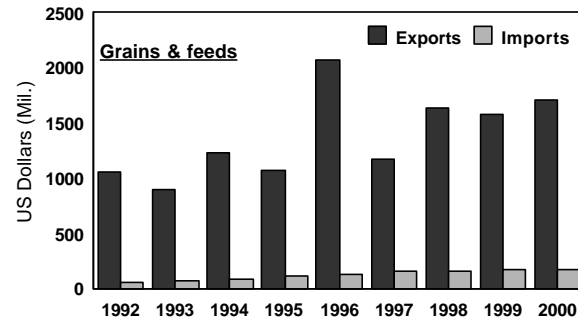
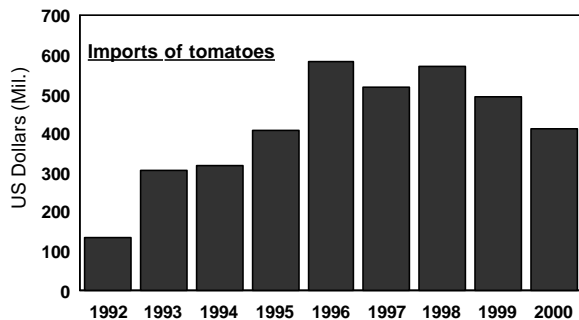
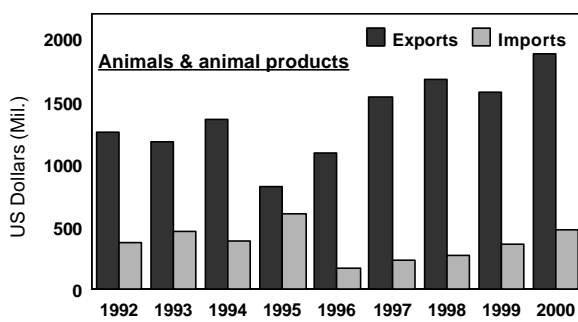
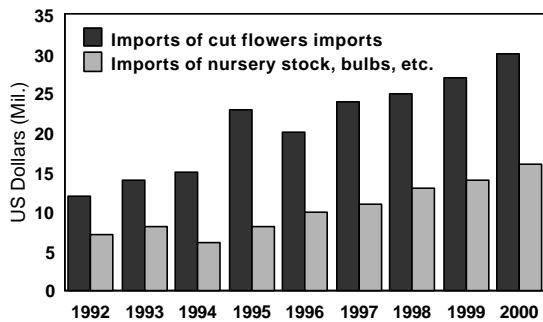
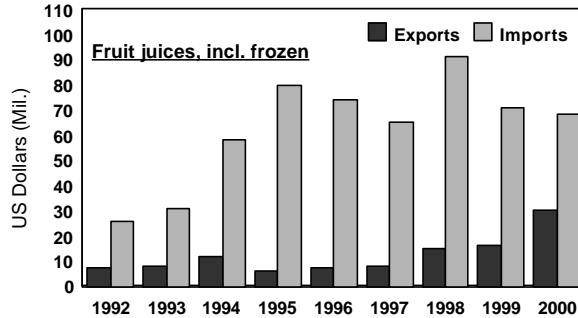
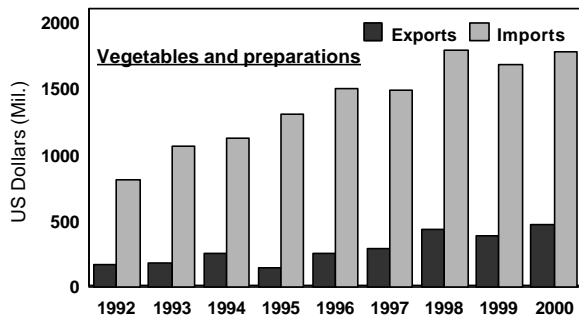
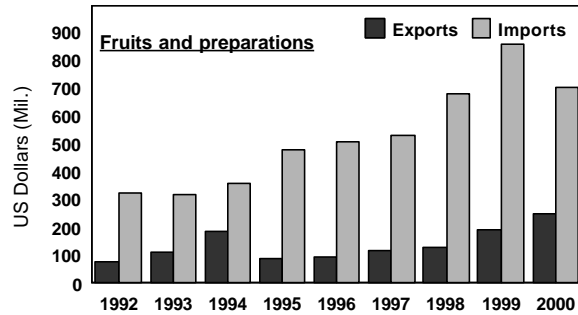
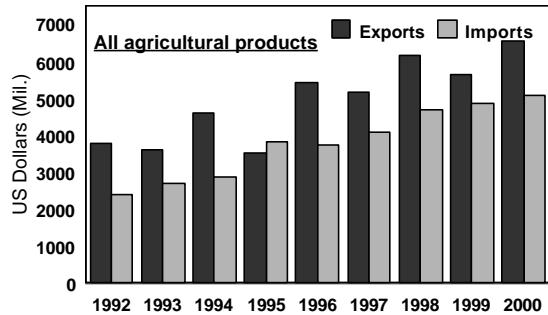
Source: Zahniser and Link.

Figure 6. US agricultural trade with Canada, total and selected products, 1992-2000



Source: Zahniser and Link.

Figure 7. US agricultural trade with Mexico, total and selected products, 1992-2000



Source: Zahniser and Link.

number, if true, and amounts to roughly 14 percent of New York's \$3.2 billion USD in cash receipts from commodity sales (NYASS, 2002a).

Implications for New York Food and Agriculture

Because of this information vacuum, much of the discussion of trade and its implications for the New York farm sector is fueled by anecdotal information for one or a handful of growers. The discussion can and does go in several directions, but most commentators concerned with trade usually point out that results are very uneven for the State. Although the New York agricultural industry has an advantage in being close to the major markets on the east coast and the Midwest, growers and processors are challenged by climate, soils, and relatively high costs for labor, taxes, and land.

Furthermore, the general perception seems to be that, in the case of high value horticultural commodities, these challenges for New Yorkers have been exacerbated by NAFTA. Again, there are no incisive data to shed light on this issue, nor are we aware of any quantitative estimates of NAFTA impacts at the state level. A national assessment recently published by the USDA indicates that, for several fruit and vegetable crops, NAFTA has generally had only a marginal impact on the volume of trade with Canada and Mexico. Their results for Canada are summarized in Figure 8 for the vegetable and fruit trade. On the imports side, low-to-medium positive effects attributable to NAFTA (defined as a marginal change in trade volume of 2-5 percent and 6-15 percent, respectively, over the interval 1994-2000) were estimated for several key fresh vegetable commodities. Medium positive impacts were reported for both fresh and processed potatoes.

Figure 8. Estimated change in the volume of US vegetable trade with Canada due solely to CFTA and NAFTA, 1994-2000

Commodity	Exports to Canada	Imports from Canada
Fresh tomatoes	Negligible effect	Increase -- low
Processed tomatoes	Increase -- medium	Increase -- low
Bell peppers	Increase -- low	Increase -- low
Cucumbers	Negligible effect	Increase -- low
Squash	Increase -- low	Negligible effect
Eggplant	Increase -- low	Little to no trade
Snap beans	Increase -- low	Increase -- low
Fresh potatoes	Increase -- low	Increase -- medium
Processed potatoes	Increase -- low	Increase -- medium
Frozen broccoli and cauliflower	Little to no trade	Increase -- low

Medium = A change of 6 to 15%
 Low = A change of 2 to 5 %
 Negligible effect = Less than 2%

Source: Zahniser and Link.

Figure 8 (continued). Estimated change in the volume of U.S. fruit trade with Canada due solely to CFTA and NAFTA, 1994-2000

Commodity	Exports to Canada	Imports from Canada
Fresh citrus	Negligible effect	Little to no trade
Orange juice	Increase -- low	Little to no trade
Apples	Negligible effect	Negligible effect
Pears	Negligible effect	Little to no trade
Peaches	Negligible effect	Little to no trade
Grapes	Negligible effect	Little to no trade
Cantaloupe	Negligible effect	Little to no trade
Watermelon	Negligible effect	Little to no trade

Medium = A change of 6 to 15%
 Low = A change of 2 to 5 %
 Negligible effect = Less than 2%

Source: Zahniser and Link.

The USDA concluded that NAFTA, to date, has exerted little or no effect on fruit imports from Canada (Figure 8).

Broader Influences: The Value of the US Dollar

In our view, several other broader factors have shaped the debate on agricultural trade in New York. Not the least of these is movements in currency exchange rates. There have been two periods in the most recent decade in which the value of the dollar had increased dramatically leading to increased market penetration of imports from NAFTA partners—in the mid-1980s, and the most recent decade until a few months ago when the trade-weighted value of the dollar was relatively strong. In the early 1970s the US and the Canadian dollar traded virtually at par; however, beginning in 1977 the US dollar started strength-

ening against the Canadian currency (see Figure 9). A decade later, the dollar weakened during the run-up to a recession in the US macro economy in the late 1980s and early 1990s. Continual increases in the value of the US dollar against the Canadian dollar have been a hallmark of the NAFTA years. A similar pattern has prevailed in currency relations between the US and Mexico during the post-NAFTA period. The strength of the US dollar has further exacerbated farm and food trade issues between the US and its NAFTA partners.

Broader Influences: Shifts in Consumer Demand and Preferences⁴

Fresh fruit and vegetable per capita consumption in the United States increased from 254 lbs. in 1980 to 328.2 lbs. in 2000. The annual growth rate for fresh vegetables and fruit was 1.4 percent

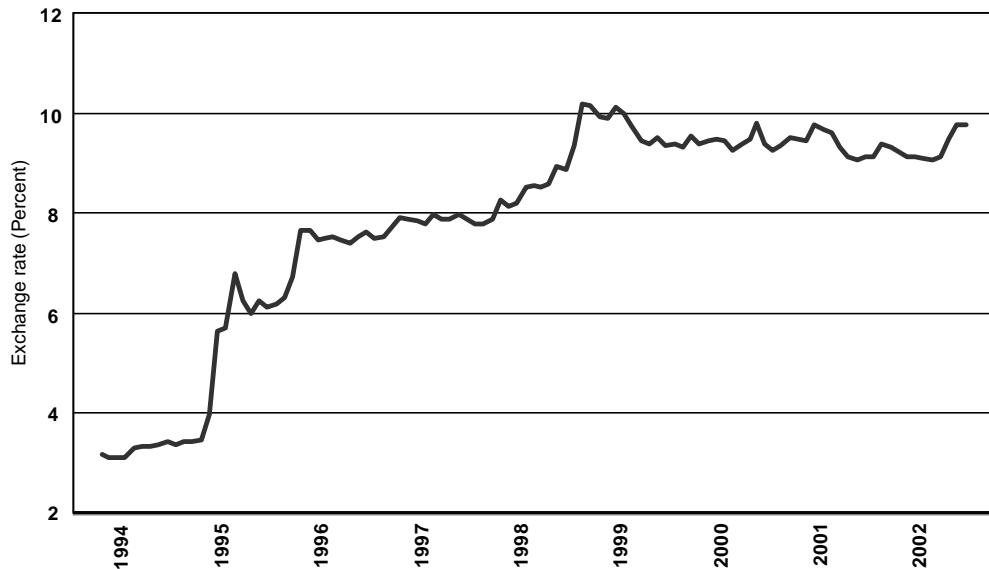
⁴ This section is based on Cuellar (2002).

Figure 9. Canada/US foreign exchange rate (Canadian dollars to one US dollar), 1977-July 2002



Source: Federal Reserve Bank of St. Louis.

Figure 10. Mexico/US foreign exchange rate (new Mexican pesos to one US dollar), November 1993-July 2002



Source: Federal Reserve Bank of St. Louis.

per year; fresh vegetable consumption has increased at 1.6 percent per year, faster than fruit. Imports' share of consumption has been increasing significantly for fruits and vegetables in recent years. While the average imports' share of overall US food consumption remains below 10 percent, imports' share of consumption for fresh fruits increased from 24.2 percent in 1980 to 39.6 percent in 1999 and for fresh vegetables from 5.4 percent to 10.9 percent.

Changes in consumption of fresh fruits and vegetables in the United States can be explained by several factors. Publication of the Food Pyramid Guidelines in the mid-80s, and the implementation of the "5 a Day Program", along with an increasing consumer awareness of the benefits of consumption of fruits and vegetables for health, particularly among the aging population, have all played a key role. Recent research results indicating the positive effects of consumption of specific fresh fruits and vegetables on the prevention of certain diseases such as cancer and heart conditions have created an increased demand for products such as broccoli, tomatoes and blueberries.

The present size and growth of the Hispanic and Asian populations in the United States, along with their increasing buying power, have also had a significant impact on food consumption trends. Fresh fruits and vegetables are an important part of the traditional consumption habits of these population groups. Since these groups spend more than the average US consumer spends on these types of products, particularly on tropical and specialty produce, they have a significant impact on their demand and sales in the United States.

The increasing use of fruits and vegetables in foodservice (particularly pre-cut vegetables), the popularity of cooking shows on television and the incorporation of unique ingredients in recipes by innovative chefs have also contributed to generating a higher consumption of fruits and vegetables, particularly for new and exotic products.

Imports of fruits and vegetables have also contributed significantly to the observed trend.

Imports of off-season fruits and vegetables to complement domestic production have allowed for year-round availability of many products with a positive impact on per capita consumption. Imports of tropical and specialty products have helped the US industry in targeting ethnic consumer groups within the country while, at the same time, allowing them to diversify and innovate the produce department for traditional consumer targets. This innovation and diversification can dampen interest in more traditional domestic fruit and vegetable products as consumers rearrange their selections in the produce department.

Many fresh varieties, such as grapes and melons, are now available year-round through import of good quality fruit during the off-season, mainly from Chile in the case of grapes, and from Mexico and Central America in the case of melons. The role of imports in boosting consumption of these two products has been widely acknowledged by the US industry. Additionally, melon consumption has also been impacted by its success in the pre-cut fruit market, where consumers' desire for healthy foods that are convenient has been addressed.

The growth in consumption of mango and papaya is directly linked to the expansion of the Asian and Hispanic populations in the United States. Increased availability and improved quality of these fruits have contributed to increasing demand among mainstream consumers too. Nearly all mangoes and a significant percentage of papayas are supplied from foreign sources.

In the case of pineapple, the introduction to the market in 1996 of the Del Monte Gold, a new variety totally imported from Costa Rica, was the main factor in boosting per capita consumption of this product in the United States after a period of relative stagnation. The improved eating quality and more attractive external appearance of this new variety, along with its incorporation into the pre-cut fruit category, have been the keys to its increased consumption despite a much higher price.

Imports of fresh vegetables from Mexico have

for many years played an important role in the US vegetable supply during the off-season. However, more recently, imports of greenhouse vegetables from Canada and Holland and the introduction of new varieties to the market have contributed significantly to boost vegetable consumption in the United States. This has been particularly true in the case of tomatoes, bell peppers and cucumbers.

Consumption of tomatoes has seen important increases with the introduction of many new varieties to the market as well as through the success of hothouse tomatoes, which are valued by consumers for their better taste, higher and more consistent quality, improved food safety, and year-round availability. Therefore, diversification of the category, wider availability and better overall quality, where imports are playing a key role, are driving the trend of increasing tomato consumption in the United States.

The increase in consumption of peppers has been fueled by the introduction to the US market of bell peppers in different colors and in mini-varieties in recent years, as well as by the popularity of a significant variety of hot peppers, mainly imported from Mexico. Imports of hothouse-grown bell peppers from Canada and Holland have played a significant role in the supply of these products in the US market. Once again, variety, quality and a year-round supply, aided by imports, have been the major driving forces in increasing per capita consumption of peppers in the US market.

Likewise, consumption of cucumbers has been strongly influenced by the introduction of the hothouse-grown seedless variety, which has a totally edible bitterless peel with no wax. As with tomatoes and peppers, better and consistent flavor and overall quality, along with wider availability, have contributed to the increasing demand for this product.

Imports' share of consumption for asparagus, which increased the most during the period under study, is the direct result of the increase in its consumption in the United States. Domestic

production and exports of this product haven't changed much during the last decade, while per capita consumption increased from 0.6 lbs. in 1990 to 1.0 lbs. in 2000. The increasing demand, therefore, has been satisfied with increased imports.

In the case of broccoli, the increase of its imports' share of consumption from 0.2 percent in 1980 to 6.1 percent in 1999 has resulted from the impressive increase in overall consumption during the past decade, as well as due to the rapidly increasing export business. Increase in per capita consumption in the United States is strongly related to the discovery of broccoli's cancer prevention properties. In spite of domestic production in 1999 having grown to twice that in 1990, imports increased almost as much during this period.

Sweet onions, for which consumers have developed a particular interest in the last few years, have had a significant overall contribution to increasing consumption of onions in the United States. They are produced domestically and, in order to supply them on a year-round basis, they are imported from the Southern Hemisphere countries during the US off-season.

Specific Issues/Commodities

Apples: Chinese Concentrate

Imports of Chinese concentrate increased by more than 1,200 percent between 1995 and 1998, from 3,000 metric tons to 40,000 metric tons, according to the US Census Bureau. During that same period, the average price of Chinese concentrate imports declined by more than 53 percent, from \$7.65 per gallon in 1995 to \$3.57 per gallon in 1998. China's share of the US concentrate market has increased from 1 percent in 1995 to 18 percent in 1998. Meanwhile, the average price for US-made apple juice concentrate fell by 50 percent since 1995, while the average price US growers received for juice apples declined by 64 percent — from \$153 per ton in 1995 to \$55 per ton in 1998 — as a result of below-cost Chinese concentrate imports. Apple growers lost more

than \$135 million in revenue from 1995 to 1998, from a decline in juice-apple prices, according to the US Department of Agriculture.

The US government levied antidumping duties of up to 52 percent on Chinese concentrate imports in June 2000, following the Commerce Department and US International Trade Commission's rulings that Chinese concentrate was sold in the US market at prices below production costs causing economic harm to US concentrate producers — a practice called dumping. While the volume of imported Chinese concentrate through June 2001 declined only slightly (7 percent) compared with the previous year, the value of Chinese concentrate imports increased by nearly 94 percent — reflecting the duties' upward impact on price — according to the US Customs Service.

Efforts to circumvent the imposition of tariffs began, exploiting a loophole that allowed Chinese suppliers and some US importers to evade the US government's antidumping duties on nonfrozen Chinese apple juice concentrate by chilling the concentrate to a semi-frozen state and declaring it "frozen concentrate," a form not subject to antidumping duties.

Some of this so-called "frozen concentrate" was shipped directly from China to the United States, while other suppliers shipped Chinese concentrate to Canada to be chilled and re-exported to the United States. Either way, this semi-frozen concentrate entered the United States duty-free and was sold or "dumped" in the American market at prices well below production costs.

From 2000 to 2001, US imports of the so-called frozen apple juice concentrate from China increased 717 percent, from 82.2 million single strength equivalent (SSE) gallons in June 2000 to 670.3 million SSE gallons in June 2001. In addition, imports of so-called frozen concentrate imports from Canada, much of which was known to contain product of Chinese origin, increased by 258 percent from 14.3 million SSE in June 2000 to 51.2 SSE in June 2001.

In April 2001 the Coalition for Fair Apple-Juice Concentrate Trade (FACT), a US Apple-administered group comprised of apple associations, processors and concentrators, filed a request that the Commerce Department expand its antidumping ruling to include semi-frozen concentrate. In October 2001 the Commerce Department announced it would apply antidumping duties of up to 52 percent on all nonfrozen Chinese apple juice concentrate (US Apple Association).

The Customs Service is investigating leads on illegal schemes designed to circumvent antidumping duties by falsely labeling the country of origin of apple juice concentrate imports. Industry sources say a significant volume of Chinese apple juice concentrate is being shipped to third-party countries where it is blended with domestic product or falsely relabeled as a product of the third-party country and re-exported duty-free to the United States. The actions on behalf of the domestic industry and counter-actions by suppliers and importers underscore the complex nature of trade for a country with relatively open borders, such as the US has with Canada and Mexico. Much industry effort and dollars are expended on trying to protect the domestic industry.

Outlook for the Chinese apple industry: The world leader in apple production is China. Production in the early '90s was about a quarter of a million bushels, but grew rapidly, reaching 1 billion bushels in the '98 season. Since then, production stabilized at around a billion bushels. This compares with US production which averaged about 250 million bushels annually from '98 through '01. Thus, the "China apple dynamics" may ultimately dictate the health of the worldwide industry. According to the USDA's Foreign Agricultural Service (USDA, 2002c), China has been the third largest source in the dollar value of apple juice concentrate in the last two years, behind Argentina and Chile.

Shakeout of the concentrate industry in China: The number of apple juice concentrate factories hit a peak at 55 in 1998, with 22 located in Shandong province. It is expected that fewer than 10 companies will remain in operation when the

current string of mergers end, with significantly less than 55 factories operating. These mergers are occurring due to the low price of concentrate around the world. Still, China is expected to remain strong in the apple juice concentrate business as the low cost producers will remain viable and export oriented.

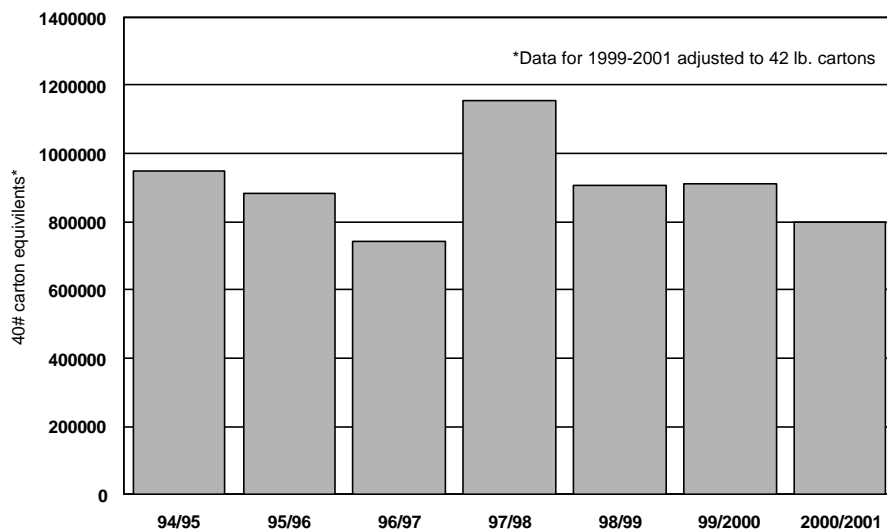
US fresh apple exports may rise with China's entry into the WTO. Current US exports of apples to China are a relatively low \$2.2 million. This figure will most certainly rise in the future as WTO tariffs on apple exports to China decline from 30 percent currently to 10 percent by 2004. Major competition will be domestic production in China, as well as exports of apples into China from New Zealand. Other competition is minor.

Apples: New York Fresh Exports

New York fresh apple exports have been a relative bright spot in the trade situation for NY State agriculture. Over the past five seasons ('97-'01), utilized fresh apples have averaged 482 million pounds, or 12.05 million 40-pound boxes. Exports have accounted for 887 thousand 40-

pound boxes, or about 7.4 percent of total fresh utilization. Separate prices are not surveyed for exports and domestic sales, but it is estimated that fresh export sales have averaged about \$14 per box, or about \$12.4 million annually for the New York industry (at FOB packing house prices, not farm level prices). Exports peaked at 1.15 million boxes for the '97 crop. A dearth of southern hemisphere good quality red apples, Market Access Program (MAP) promotion efforts, and an extremely short crop in the United Kingdom led to a surge of exports to that country (743 thousand boxes) in '97-'98. The UK is easily the largest market for New York exports, accounting for about two-thirds of the total volume over the past five years. The UK market has been favorable for an apple size (120 per carton) that is less than optimal for the domestic market; that is, prices are nearly always greater for the export of that size of apple compared with prices in the domestic market. The UK market is also an important market for the Empire variety, the state's second most important variety, accounting for about 13 percent of the state's production (New York Agricultural Statistics Service (2002b)). The United Kingdom deal is not, however, a totally

Figure 11. New York fresh apple exports to all countries, 1994-2001



Source: NY State Apple Association.

liberalized market for US apples; there is an early season tariff that effectively prevents NY shipments until after January 1 of any given year.

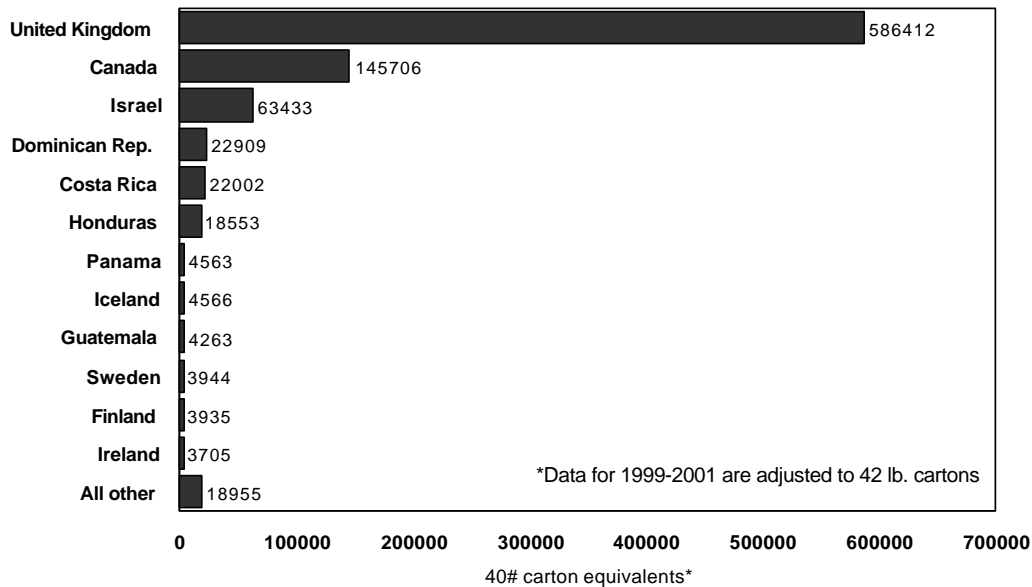
The second largest market is Canada, which accounted for an average of 144 thousand boxes (16 percent) of NY fresh exports in the past five years. Exports provide market diversity that helps increase the overall value of the NY apple crop. Notwithstanding the fact that Canada is an important market for NY fresh apple exports, there are still pressing nontariff issues on cross-border trade, the chief one being the Canadian Bulk Exemption. The problem from the view of the New York apple industry is that New York apples are partially excluded from supplying the Canadian market and, of particular importance, the Toronto Metropolitan area by a Canadian regulation that says the Canadian buyer must obtain a “Ministerial Exemption” (Bulk Waiver) from the Canadian Ministry of Agriculture for every load of “bulk apples” that they buy from the US. These exemptions are given only when there are no

Canadian apples available of the specified variety and pack. New York marketers assert that when a Canadian importer seeks the Ministerial Exemption, there is often not a negative exemption, but rather no decision at all, leading to the allegation of the “black hole” for bulk exemptions for apples.

The Canadian government makes it very difficult for New York packed apples to be sold as well. The New York industry’s point of view is that much more than the 100 to 200 thousand boxes that sold in recent years would be exported to Canada with truly open borders.

One more example that trade, even within NAFTA, is not fully liberalized was brought to the attention of the NY industry recently. In August, Mexico announced that it would revoke an anti-dumping agreement with the Washington apple industry and institute a 46 percent tariff on imports of Red and Golden Delicious apples. That agreement, and tariff reductions under NAFTA, had “leveled the playing field” between the US and

Figure 12. New York fresh apple exports by destination, five-year average, 1996-2001



Source: NY State Apple Association.

Mexico, leading to exports of 6 to 10 million bushels to Mexico annually. Washington State is currently the only US importer to Mexico, although Michigan and Pennsylvania had been contemplating exports to that country. Mexico had been the largest destination for US fresh apple exports in recent years accounting for about 30 percent by volume (New York Agricultural Statistics Service (2002b)). The likely diversion of most of this fruit will affect domestic prices and/or cut into markets for NY apples in other markets (New York State Horticultural Society, 2002).

Greenhouse: Canadian Tomatoes and Floriculture

The main greenhouse vegetable crops in Canada are tomatoes (901 acres), cucumbers (400 acres), peppers (223 acres), and lettuce.⁵ Ontario, claiming more than half the greenhouse vegetables produced in Canada (893 acres) compared with a national total of 1,576 acres, is a net exporter of greenhouse tomatoes and cucumbers to the United States. The Ontario Greenhouse Vegetable Producers Marketing Board estimated that 70 percent of the spring 1998 tomato crop was exported to the United States. Although greenhouse vegetables are grown in all regions of Ontario, the major producing area is in the southern part of Essex County, in and around the Town of Leamington. With a 707-acre (1999) greenhouse vegetable industry, Leamington boasts the largest concentration of greenhouse vegetables in North America. In fact, the Leamington greenhouse vegetable industry is about as big as the entire corresponding US industry (886 acres).⁶

Greenhouse vegetable production started in Ontario shortly after World War II. The Leamington industry was started by a number of immigrant families mostly from Italy and Holland, many who are still operating greenhouses today. The Ontario Greenhouse Vegetable Producers

Marketing Board (OGVG), enabled through the Ontario Farm Products Marketing Act, has been conducting marketing activities on behalf of over 200 growers for over 30 years.

The greenhouse vegetable industry in Ontario exhibited strong growth in farm value during most of the 1980s. The growth was attributed to the corresponding increase in production. Farm value grew steadily; however, the Ontario industry became embroiled in destructive competition around 1990 and farm value tumbled. Since 1991 the OGVG has reestablished its role and is once again setting the price of greenhouse vegetables in Ontario. Significant new greenhouse vegetable production technology that was transferred to commercial producers has been primarily responsible for dramatic yield increases, estimated at 100 to 120 percent for tomatoes and 70 to 80 percent for cucumbers.

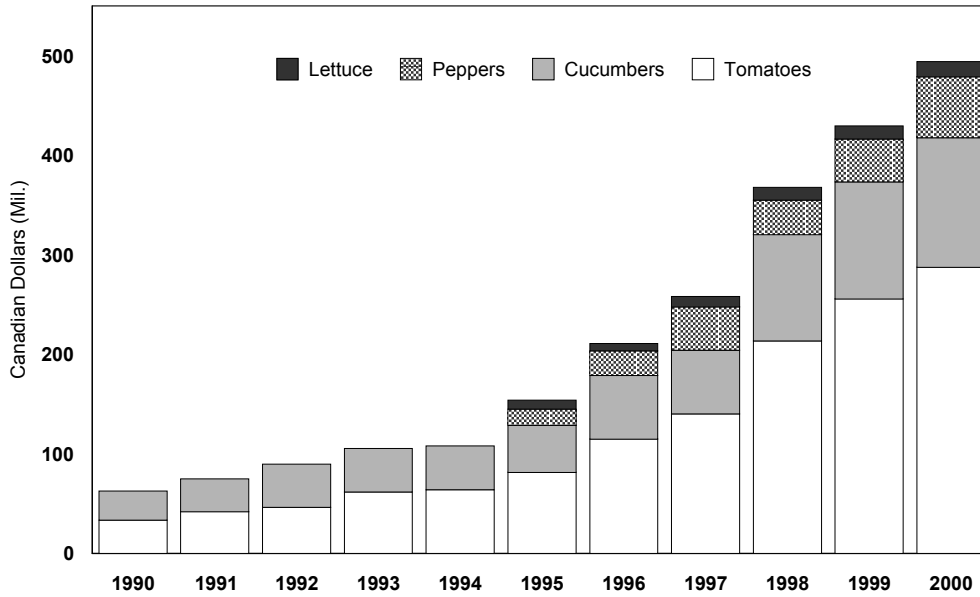
The Greenhouse & Processing Crops Research Centre (GPCRC) in Harrow, Ontario, is the largest of its kind in North America. One of the major achievements in past years has been the development of double polyethylene houses. Substantial savings in heating costs (up to 30 percent) and in capital investment (up to 70 percent) were demonstrated by growing tomatoes or cucumbers in double polyethylene houses rather than glass-houses. Savings of more than \$100 million CAD were estimated with the exclusive use of double polyethylene greenhouses for the (1993-1997) expansion of the Leamington industry.

Greenhouse cucumbers and tomatoes are grown in computer-controlled environments, ensuring a protected growing environment. At present, 100 percent of sweet peppers, 90 percent of cucumbers and 92 percent of tomatoes in the Leamington area are cropped using soilless methods. Because integrated pest management is used, Ontario's hydroponic crops are virtually pesticide free.

⁵ Estimates by industry analysts for 1999 found in Agriculture and Agri-Food Canada Research Branch, Greenhouse & Processing Crops Research Centre, Dr. Papadopoulos.

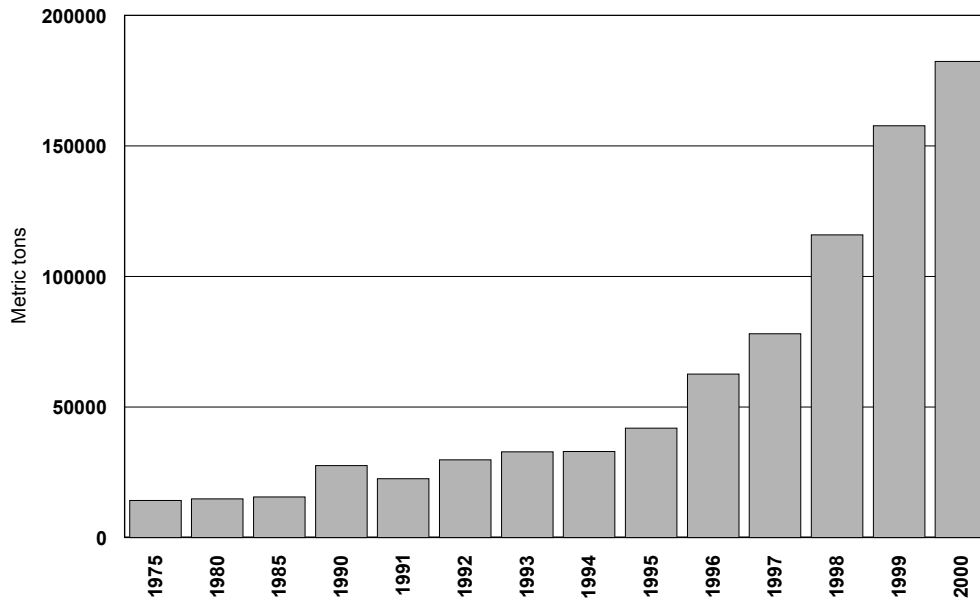
⁶ The 1997 Census of Agriculture (USDA-NASS, 2002d) reported 38,605,409 square feet of greenhouse vegetables (equivalent to 886.2 acres). In 1992, the area reported nationwide was 28,486,757 square feet (653.9 acres).

Figure 13. Farm gate value of Canadian greenhouse vegetable production, 1990-2000



Source: Agriculture and Agri-Food Canada.

Figure 14. Canadian greenhouse tomato production, selected years, 1975-2000



Source: Agriculture and Agri-Food Canada.

Most of the new construction is devoted to the production of tomatoes (beefsteak tomatoes with some cluster or tomato-on-the vine (TOV) varieties). The change from the pink skinned tomato cultivar to the red skinned variety has opened the marketplace. The greater demand for the red greenhouse tomato has allowed for the increase in the tomato production (Kosla, 1999).

Canadian Floriculture and Nursery Industry

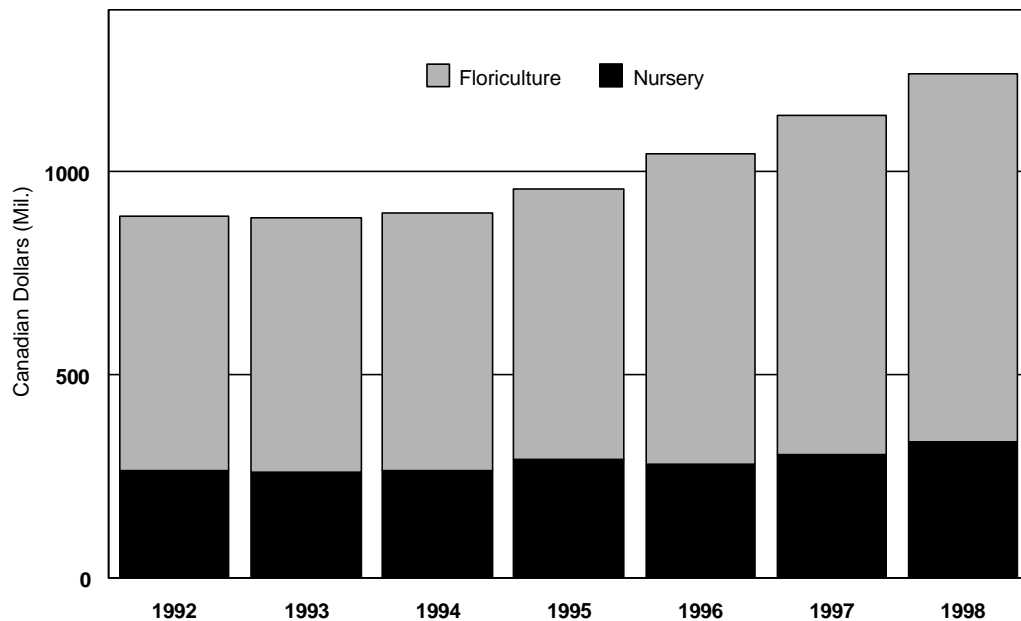
In 2000 the floriculture and nursery sectors recorded the highest production value in the Canadian horticultural industry with \$1.6 billion CAD. This represents nearly 40 percent of the total horticultural sector and 4.7 percent of total farm cash receipts. In fact, this sector has the highest cash receipts for any crop after wheat and canola. Average cash receipts for 1991-95 amounted to \$888 million CAD and increase to an average of \$1,250 million CAD for 1996-2000, which represents a 41 percent increase. Figure 15 shows how

cash receipts have steadily increased in the latter part of the 1990s. The number of nursery operations increased by 26 percent from 1991 to 1996 (Agriculture and Agri-Food Canada). The number of greenhouse flower operations decreased in number, but at the same time the area of production expanded by 52 percent. For the floriculture and nursery sectors, Ontario and British Columbia are the largest regions of production.

In 1997 for the first time Canada went from an importer to a net exporter of floriculture products. Ontario is responsible for close to 70 percent of total exports. Improved facilities and an emphasis on quality have placed the floriculture and nursery industry in a position to expand its export capability, especially to the Northern United States. Limitations for exporting to other countries are primarily related to Sanitary and Phytosanitary import restrictions (Agriculture and Agri-Food Canada (1999)).

The Ontario greenhouse flower industry has

Figure 15. Canadian floriculture and nursery stock sales, 1992-1998



Source: Agriculture and Agri-Food Canada.

had significant growth over the past 20 years. Modest growth has occurred even through times of recession in the rest of the Canadian economy. Ontario production comprised 52 percent (1998) of the total Canadian production, followed by British Columbia (23 percent) and Quebec (12 percent). The majority of the production is situated in southern Ontario in the counties located around the western end of Lake Ontario and the north shore of Lake Erie. Production in six of these counties/regions represents 60 percent of Ontario production.

One of the major reasons for the strong recent growth has been the development of the export market throughout the United States' eastern seaboard, including destinations as far south as Florida and as far west as Chicago. For Ontario, exports have increased from \$63.3 million CAD in 1991 to \$228.7 million CAD in 1998. This is over a 360 percent increase over 7 years. Among North American states and provinces, Ontario is the third largest producer of greenhouse floricultural products behind California and Florida. The industry can be divided into three major sectors: bedding plants, potted plants and cut flowers.

Rapid adoption of new technologies including those from Europe is very typical of the industry. Development of new technologies such as greenhouse structures and/or modification of existing technologies and production facilities is ongoing. Expansion by many of the larger growers is closely linked to the expansion of major chain stores such as Wal Mart or Home Depot. For example, when Home Depot develops a new retail location, their grower suppliers require approximately two additional acres of production area to service that new store with plant material. The chains are demanding that their key growers continue to expand their growing facilities to meet their product needs if they wish to continue a business relationship.

The closeness and size of the support/supply (allied trades) industry to growers has been beneficial. The concentration of growers has allowed suppliers to provide very competitive prices and service to the grower community. Also,

being located along Lakes Ontario and Erie has ensured a plentiful supply of fresh water of excellent quality. This is becoming increasingly important as the industry shifts to subirrigation and the recirculation of nutrient solutions. Access to natural gas for a heating fuel has been important because of its lower cost. When the natural gas industry was deregulated, the industry established its own gas purchasing cooperative to achieve better volume discount pricing for its membership. Electricity costs have been considered relatively inexpensive compared with those of many of the adjacent US states. The use of high pressure sodium lighting has been used extensively to improve winter production of many cut and potted crops. A number of larger growing operations have installed their own co-generation units to produce their own electricity and utilize the waste heat as a secondary heat source for the greenhouse facility. Another strength is marketing cooperation that has allowed greater efficiency and ability to penetrate target markets.

We conclude that success for the Canadians in this sector (greenhouse for both floriculture and vegetables) is dependent not only on the weakness of the Canadian dollar, but on economies of scale in both production and marketing, adoption of advanced technology, the knowledge and experience of Canadian greenhouse growers, cooperative action in both marketing and purchasing important inputs, and the government support the industry receives in research and development. The dynamic nature of the Ontario greenhouse industry, in conjunction with its favorable location for transporting product into the large Midwest and Northeastern US markets, has made it a formidable competitor for New York growers. We conclude that Ontario would have significant penetration into these markets even if the US dollar *vis a vis* the Canadian dollar weakened considerably.

Grape Juice and Related Products

Exports are important to the juice grape industry in New York. National Grape Cooperative Association, Inc. (sole owner of Welch Foods, Inc.) is the state's major grape processor (National

Grape Cooperative Association, Inc., 2002). The Cooperative, with national membership of 1,442 members, has 477 members in New York with contracted acreage of 11,549, including Concord and Niagara. New York production marketed through the Cooperative has averaged 66,333 tons over the past three years ('99-'01), or 39 percent of New York grape production for those years.

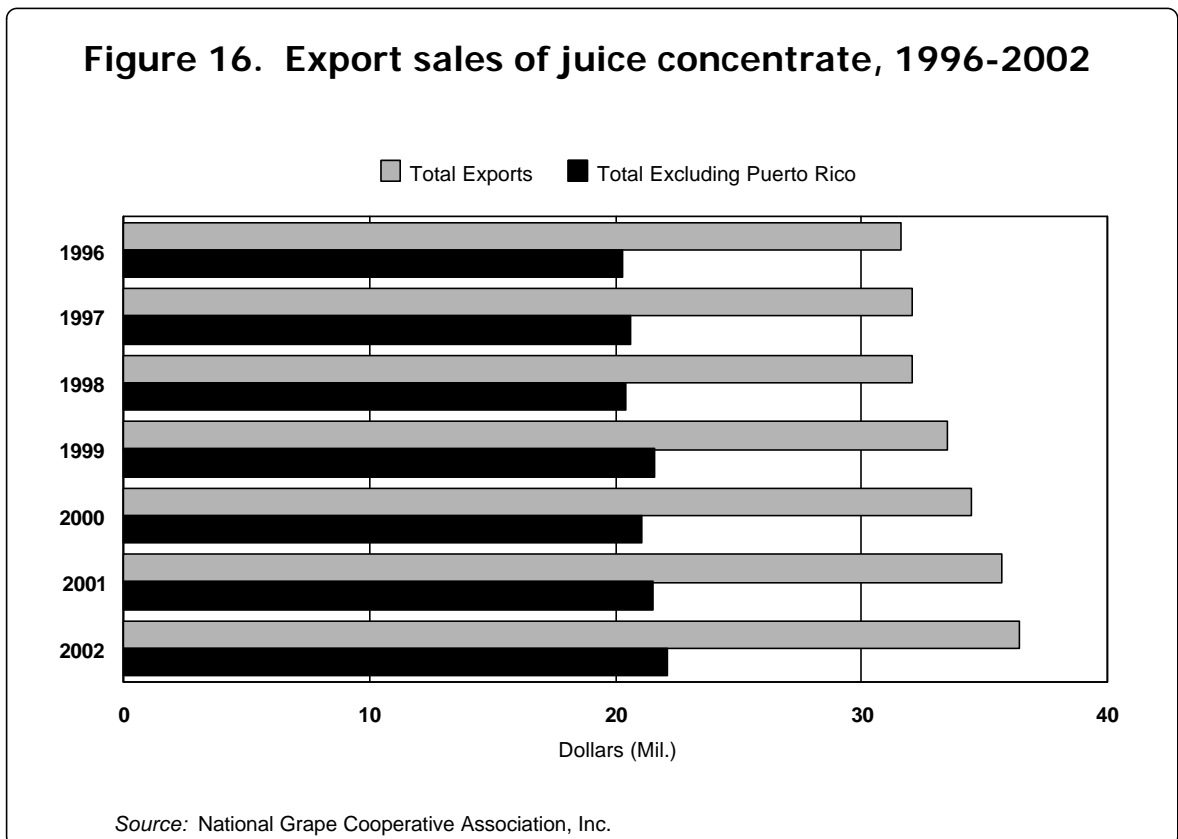
International trade expanded greatly in the late 1980s, with growth in concentrate sales to Japan especially. Total international sales of finished sales are shown in Figure 16. International trade of finished case goods has grown by an average of just over 2 percent over these years (including Puerto Rico, a territory of the US) and by just over 1 percent excluding Puerto Rico. Foreign trade now amounts to over \$22 million for all members. (In addition to Puerto Rico, major receiving countries in order of importance are Japan, Canada, Korea, Mexico, Hong Kong, Honduras, Dominican Republic, Costa Rica, and Chile). Per patron acre, that amounts to \$450, and per ton of

grapes sold, it amounts to about \$80. In total sales, this represents about \$5 million annually to the New York Industry.

Major receiving countries for concentrate are Japan, Canada, Korea, and the United Kingdom in order of importance. All cooperative members benefit from every ton of export sales, whether it is finished goods or bulk concentrate and whether it is shipped from eastern or western US ports.

Discussion

We have examined trends and explored four case studies of the impacts of international trade on New York agriculture. First we examined the Chinese apple juice concentrate situation, finding harm to the New York and US industry from dumping of concentrate. Next we reviewed New York fresh apple exports, which contribute about \$12 million to the New York apple industry in both returns to growers and packing houses and marketers, and representing an important outlet for



an important variety (Empire) and a suboptimal size of apple for the domestic market. We noted the importance of international trade to the National Grape Cooperative which processes and markets about 39 percent of the state's grape crop. International trade represents sales of about \$450 per contracted grape acre, or approximately \$80 per ton of grapes sold, and generates over \$5 million annually in sales. Finally, we looked at the imported greenhouse (vegetable and floriculture) and nursery sectors of Ontario, Canada, whose products compete head-to-head with New York growers, and found considerable success in New York growers' market area.

These cases, we believe, are highly illustrative and add some additional precision to the ongoing debate about the export trade and the economic vibrancy of New York farm and food producers. At the same time, however, these are simply cases, and other examples could be drawn from New York's highly segmented horticultural industries. Some of these examples would probably suggest a materially different picture of trade relationships. This commodity-to-commodity variability helps point out the critical importance of one's general perspective and context when discussing the New York presence in the global food and fiber marketplace. Early in this report we attempted to provide such context by summarizing national trends for agricultural exports. We also registered our disappointment with the data; while close attention is being paid to the trade debate, marketing channels for major and minor New York agricultural commodities are understood in only a rudimentary way.

Yet, our analysis does deal with some of the extenuating circumstances that appear to principally govern trade relationships between New York and neighboring countries. A particular concern is the circa 1994 NAFTA trade agreement which has reordered trade relationships between the US, Canada and Mexico. We pointed out that persistent increases in the value of the US dollar against both the Canadian dollar and the Mexican peso have been a hallmark of the NAFTA years. A similar pattern has prevailed in currency relations between the US and Mexico during the post-

NAFTA period. The strength of the US dollar has further exacerbated farm and food trade issues between the US and its NAFTA partners.

We did not, however, stress the obvious, namely that New York is geographically positioned in close proximity to the Canadian border. Key agricultural industries in Canada are situated in the provinces of Québec and Ontario, located just north of Northern NY and Western and Central NY, respectively. Major markets in the Northeastern quadrant of the US are nearer to their production areas than Western Canadian market centers like Vancouver, Edmonton, Calgary, or Winnipeg. All agree on both sides of the border that large urban markets in the Northeastern US and beyond are major targets for Canadian horticultural producers. New York growers must live with this locational reality and the overlapping of market interests and tensions that it entails.

Location and its impact on New York growers is probably exacerbated by the economic positions of neighboring countries. Namely, both Canada and Mexico are materially smaller societies than the US. Economies in both nations, a developing economy in Mexico's case and a modern economy in the Canadian case, are relatively dependent upon trade as a source of gross national product compared with the US. Economic vibrancy for both of these countries, to a much larger extent than in the US, pivots on success or failure in external markets.

In the interest of time, also absent from our discussion are some of the wider issues associated with trade relationships between countries. Because of differing concentrations of technology, experience or resources, many New York growers, while challenged in global or intercountry commodity markets, are often benefited by ready access to imported capital equipment and other production perquisites (e.g., French oak barrels and Italian winery equipment) that are either cheaper or of better quality than domestic equipment. Such access is an economic plus and essential to the longer-term viability of many US producers.

Finally, whole nations aggressively pursue freer international trade with a full understanding that, from a production perspective, there will clearly be gainers or losers. The organizing principle for reordering trade relationships is the opportunity to capitalize on improved welfare for the larger society through ready access to the least expensive goods and services. New York growers

are also consumers and realize some of these benefits as well. Despite these benefits, always the abiding question remains: Is international trade good for the New York agricultural industry? Our case studies show that “it depends” and closure on these questions, perhaps unfortunately, depends upon time, place, and commodity.

References

- Agriculture and Agri-Food Canada. *1999/2000 Canadian Floriculture, Nursery and Christmas Tree Situation and Trends*. Market & Industry Services Branch, Ottawa, Canada, 1999.
- Bills, Nelson. *Agriculture-Based Economic Development: Trends and Prospects for New York*. EB 2001-18, Department of Applied Economics and Management, Cornell University, December 2001.
- Butler, Thomas C. and Dawn Drake. *Apple Crop Statistics and Market Analysis*. Processing Apple Growers Marketing Committee, Michigan Agricultural Cooperative Marketing Association, Inc., July 2002.
- Cuellar, Sandra. *Marketing Fresh Fruit and Vegetable Imports in the United States: Status, Challenges, and Opportunities*. RB 03-02, Department of Applied Economics and Management, Cornell University, Ithaca, NY, April 2002.
- Donovan, J. and Barry Krissoff. *Trade Issues Facing US Horticulture in the WTO Negotiations*. United States Department of Agriculture, VGS-285-01. Washington, DC, 2001.
- Federal Reserve Bank of St. Louis. (<http://research.stlouisfed.org/fred2/categories/13>).
- Kosla, S. "Status of the Greenhouse Vegetable Industry and Hydroponics in Ontario, Canada." *ISHS Acta Horticulturae*, 481, International Symposium on Growing Media and Hydroponics, Windsor, Ontario, Canada, 1999.
- National Grape Cooperative Association, Inc. Personal Communications. Westfield, NY, August 2002
- New York Agricultural Statistics Service (NYASS). *Agricultural Statistics, 2002a*. (<http://www.usda.gov/nass/pubs/agstats.htm>).
- New York Agricultural Statistics Service (NYASS). *Fruit: 2001 Annual Summary*. No. 975-1-02, Albany, NY, January 2002b.
- NY State Apple Association. *NY State Apple Association Biennial Report*, Fishers, New York, 1999-2001, No date.
- NY State Apple Association. Unpublished data on New York Fresh Apple Exports to All Countries, Fishers, New York, 2002.
- New York State Horticultural Society, "Mexico Clobbers Washington and the US Apple Industry." *HORT FLASH*, Geneva, NY, August 20, 2002.
- US Apple Association. "Commerce Department Closes Chinese Apple Juice Concentrate Import Loophole", *US Apple News*, Volume 32, Number 4, Vienna, Virginia, October 2001.
- US Department of Agriculture, Economic Research Service. *Data: Foreign Agricultural Trade of the United States (FATUS)*, Washington, DC, 2002a (On-line at <http://www.ers.usda.gov/data/FATUS/>).
- US Department of Agriculture, Economic Research Service. *US Agricultural Exports: Estimated Value, by Commodity Group and State, FY 1997-2001*. Washington, DC, 2002b (Online at <http://www.ers.usda.gov/Briefing/AgTrade/articles.htm#state>).
- US Department of Agriculture, Economic Research Service. *World Agriculture: Trends and Indicators, 1970-1991*. Statistical Bulletin No. 861, Washington, DC, November 1993.
- US Department of Agriculture, Foreign Agricultural Service. *World Horticultural Trade and US Export Opportunities*. Circular Series FHORT 03-02, Washington, DC, March 2002c.

US Department of Agriculture, National Agricultural Statistics Service. *Agricultural Statistics*, Washington, DC, 2002d. (On-line at <http://www.usda.gov/nass/pubs/agstats.htm>).

US Department of Agriculture, National Agricultural Statistics Service. *1997 Census of Agriculture. Volume 1: National, State, and County Tables*, Washington, DC, 2002e. (On-line at <http://www.nass.usda.gov/census/census97/volume1/vol1pubs.htm>)

US Department of Commerce, Bureau of Economic Analysis. *Regional Accounts Data-Gross State Product Data, 2002*, Washington, DC. (On-line at <http://www.bea.doc.gov/bea/regional/gsp/>)

Zahniser, Steven and John Link (Eds.). *Effects of North American Free Trade Agreement on Agriculture and the Rural Economy*. Agriculture and Trade Reports, US Department of Agriculture, Economic Research Service, WRS-01-1, July 2002.

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