Chapter 3

Basic Determinants of Global Trade in Fruits and Vegetables*

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The volume, price, and direction of trade flows change over time, reflecting the dynamic nature of demand and supply in fruit and vegetable markets. This chapter explores the basic determinants of trade and the factors that have combined to shape trade patterns in fruits and vegetables. Basics such as climate, proximity, and seasonality have not changed much over time, but technology has advanced substantially. In combination with trade agreements and changing consumer preferences as incomes rise, a more global market has been created, providing consumers with an expanding array of fruits and vegetables.

Supply-Side Factors: Climate, Location, and Growing Season

The most basic factors determining the international supply of horticultural products are climate, proximity to the major importers, and growing season. Other important factors include a country's supply of suitable land and human capital and its infrastructure for exploiting its resources and marketing potential.

Production Tied to Climate

Horticultural crops have quite diverse production and storage attributes. Some can be grown in a variety of climates and locations, while others can be grown in only a few places. Some, such as apples or potatoes, can be stored but many must be consumed or processed soon after harvesting. This makes geographical distance important in determining trade patterns of fruits and vegetables, compared with patterns for the major field crops.

The EU, North America, and Japan account for over 80 percent of the world's demand for imported fresh fruits and vegetables. Although some high-income countries, such as the United States and the EU nations, have suitable climates for producing many kinds of fruits and vegetables, none has the ability to meet all its domestic needs. International trade has expanded consumer access to a variety of fruits and vegetables during seasons when they are not domestically produced.

Trade Tied to Proximity of Markets

Distance is another factor that determines trading partners. Although transportation costs have declined significantly over the last 20 years, they are still an important barrier for exporters. Most of U.S. fresh produce imports come from its neighbors—Canada and Mexico.

Regional trade agreements also significantly affect patterns of trade because of lower tariffs. For example, NAFTA and the formation of the EU reinforce the tendency of the large tomato producers in North America and Europe to export mainly to neighboring countries. Where transportation costs claim a smaller share of a product's final value, there tends to be a larger geographical spread for importers. Processed tomato products, for example, are storable with little spoilage. Lower spoilage and less handling reduces transportation costs as a proportion of total costs and provides processed tomatoes with a wider geographical market than fresh tomatoes.

These observations for tomatoes apply to fruits and vegetables overall: for fresh fruits and vegetables, where transportation costs are large, countries tend to import from the closest producers. Imports of processed goods are more geographically dispersed because transportation costs are lower as a portion of total costs.

Seasonality and Price

Seasonality is an important feature of the global trade in fruits and vegetables. Countries in the Southern Hemisphere can produce during the Northern Hemisphere's winter season. In addition, in the Northern Hemisphere, the southernmost countries can produce some fruits and vegetables earlier in the spring or later in the fall than countries farther north. The seasonal pattern has changed over the last 20 years. Improvements in production methods, as well as the development of more varieties of fruits and vegetables, have allowed growers in the Northern Hemisphere to expand their production seasons.

U.S. grape trade provides a good example of seasonality. The United States receives nearly 90 percent of its fresh grape imports, mainly from Chile—and to a much smaller degree from Mexico—January through April. Meanwhile, the United States ships 85 percent of its grape exports, mainly to its NAFTA neighbors and East Asian countries, during August through November (fig. 3.1).

The growing volume of seasonal trade to the United States has had a price-smoothing effect on fruits and vegetables throughout the year, in part because of marketing agreements with wholesalers that supply retailers with products year-round. The importance of exchange rates can also be an important factor in the movement of prices (see box, "Exchange Rates and Horticultural Trade"). Advances in transportation and the handling of fruits and vegetables have extended the distance and shortened the time that previously defined the market reach of many commodities.

Technology Aids Trade in Fresh Produce

Technology has been at the forefront of changes making fresh fruits and vegetables available to consumers globally, at an affordable price. Advances in transportation, in combination with other technological developments that have complemented the progress in transportation, have helped reduce delivery time, maintain product quality, and cut shipping costs. In recent decades, it has become easier for shippers to deliver horticultural products to purchasers thousands of miles away, with no substantial loss in freshness.

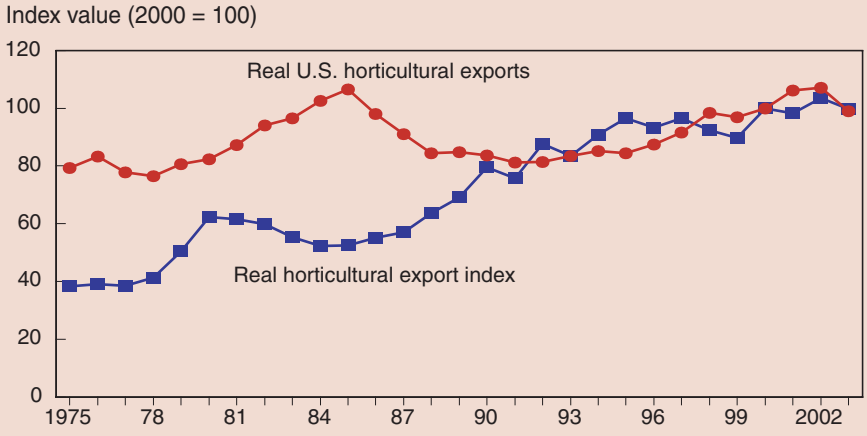
Exchange Rates and Horticultural Trade

Since the seminal article by Ed Schuh in 1974,[1] economists have generally agreed that exchange rates play an important role in creating the competitive environment for U.S. agriculture. Since that time many studies have attempted to determine the impact of exchange rates and the variables that affect exchange rates (e.g., monetary and fiscal policy) on agricultural trade, as well as on domestic prices and input markets. A recent publication[2] reviewed the literature on this topic and provides a useful array of approaches and results for various commodities. Of the 29 studies reviewed, 19 concluded that exchange rates played an important role in agricultural trade.

Most of the studies concentrated on grains, oilseeds, or total agricultural exports. However, two of the studies did look at the effect of exchange rates on U.S. horticultural exporters. A 1991 study[3] of the U.S. onion trade for the 1976-85 period found that devaluation of the Mexican peso, particularly when it was allowed to move freely against the U.S. dollar, did result in higher U.S. imports of onions from Mexico. A 1998 study[4] of the export of Mexican melons (watermelon, honeydew, and cantaloupe) to the United States increased significantly as a result of the 1994-95 devaluation of the Mexican peso against the U.S. dollar.

Although many factors affect agricultural trade, exchange rates frequently play a major role in the competitiveness of U.S. agriculture exports. This is particularly true for agricultural commodities that are highly traded. While the magnitude of the impact of exchange rates on trade will vary by commodity, it is likely that the responsiveness of agricultural exports will be inelastic. That is, for a 1-percent change in the exchange rate, U.S. exports of agricultural commodities are likely to change by less than 1 percent. It is also likely that an exchange rate change will have an impact on domestic prices. If the U.S. exchange rate appreciates, then downward pressure is exerted on U.S. commodity exports and domestic commodity prices.

Real U.S. horticultural exports and trade-weighted U.S. exchange rate



Source: USDA, ERS.

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Most exchange rate studies focusing on agricultural commodity exports use a trade-weighted measure of exchange rates (see figure on page 18). ERS maintains a unique dataset of agricultural commodity exchange rates, often used to evaluate any exchange rate impact.[5] Trade-weighted exchange rates could be derived for any of a variety of commodities such as apples or tomatoes, or for any agricultural product. Since U.S. horticultural trade is highly concentrated, the trade of only a few countries will enter into determining the combined trade-weighted exchange rate index for horticultural products. The horticultural markets of Canada, Mexico, Japan, China, Hong Kong, and Taiwan account for approximately two-thirds of U.S. horticultural exports. For U.S. imports, 70 percent come from Canada and seven countries in Central and South America. Nevertheless, the problem remains that there are large numbers and varieties of traded horticultural commodities grown in various countries. Because of the number of commodities involved and the difficulty obtaining comparable price and quantity data, there has been very little research on the impact of exchange rate changes on individual horticultural commodity exports. Thus, there is a clear need for further work in this area.

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[1] Schuh, G.E. "The Exchange Rate and U.S. Agriculture." *American Journal of Agricultural Economics*, Vol. 57, February 1974, pp. 1-13.

[2] Kristinek, Jennifer J., and David P. Anderson. *Exchange Rates and Agriculture: A Literature Review*. Agricultural and Food Policy Center, Texas A&M University. February, 2002.

[3] Espinoza-Arellano, J.J., S. Fuller, and J. Malaga. "Analysis of Forces Affecting Competitiveness of Mexico in Supplying U.S. Winter Melon Market," *International Food and Agribusiness Management Review* 1, no. 4, 1998, pp. 495-507.

[4] Fuller, S.F., O. Capps, Jr., H. Bello, and C. Shafer. "Structure of the Fresh Onion Market in the Spring Season: A Focus on Texas and Its Competition," *Western Journal of Agricultural Economics*, no. 16, Dec. 1991, pp. 405-16.

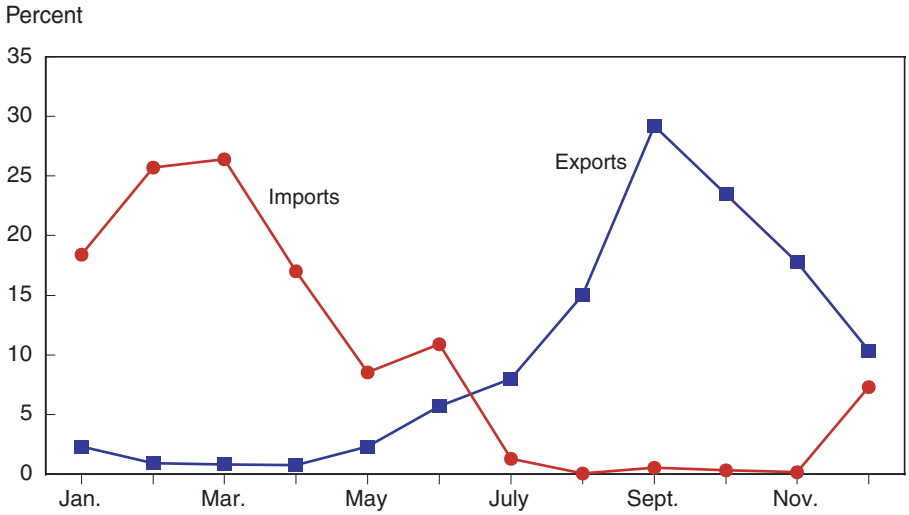
[5] This exchange rate dataset is now available on the Internet at *www.ers.usda.gov/data/exchangerates/*.

The feasibility of long-distance trade in perishable products will likely increase further as shipping technologies continue to improve.

In particular, advances in controlled atmosphere (CA) technologies have extended the shelf life of perishable products and continue to improve product quality and variety on a worldwide basis. With CA, products hold up better during transportation. CA technologies allow operators to lower the respiration rate of produce by monitoring and adjusting oxygen, carbon dioxide, and nitrogen levels within a refrigerated container. In this way, CA can slow ripening, retard discoloration, and maintain freshness of perishables like lettuce, asparagus, peaches, mangoes, and avocados that would not remain fresh during ordinary refrigerated ocean transport. Some sophisticated CA systems are combined with systems that maintain relative humidity—a crucial factor for some produce such as grapes, fruit with pits, and broccoli—and that control levels of ethylene, a naturally occurring gas that accelerates the ripening of fresh fruits and vegetables.

Figure 3.1

Monthly distribution of U.S. grape trade, average 1989-2001



Source: USDA, ERS.

In addition, satellite technologies—particularly global positioning systems, which are becoming increasingly available and less expensive—enable shippers to track their cargo around the world electronically. Other electronic technologies enable shippers and carriers to monitor quality, reduce risk (and costs) of liability claims, and shorten cargo delivery time. Information technology has also resulted in the development of remote monitoring systems for refrigerated containers, which transmit and collect performance information electronically so that physical checks are not required while the container is stacked in the hold or on the dock. The remote system may also activate an alarm, helping minimize losses when problems arise.

Changing Demand Stimulates Fruit and Vegetable Trade

Consumer demand is allied to rising incomes, urbanization, and the associated increases in levels of information and education. Largely through education, for instance, health issues have increasingly influenced consumer preferences for fruits and vegetables. A familiar example of health information is the Food Guide Pyramid—the diagram of nutritional recommendations developed by the U.S. Departments of Agriculture and Health and Human Services—which advises Americans to eat five to nine servings of fruit and vegetables per day. Various other campaigns seek to inform consumers of health benefits associated with fruit and vegetable consumption (Handy et al., 2000). These campaigns, and publicity about scientific studies that affirm the benefits of eating fruits and vegetables, have spurred greater consumption and trade; Americans are eating more fresh produce.

It is expected that per capita expenditure on fruits and vegetables will increase more than for any other product group from 2000 to 2020 (Blisard, et al., 2002). In 2001, per capita consumption of fresh vegetables and melons totaled 217.9 pounds, up 33 percent from 1980. Similarly, in 2001 per capita consumption of fresh fruit totaled 98.0 pounds, up 11 percent over the same period.

Demand for variety and convenience has increased along with consumption. The typical grocery store carried 345 produce items in 1998, compared with 173 in 1987 (Calvin and Cook et al., 2001). The new items are both exotic imports, such as clementines and passion fruit, and variations on standard products such as an increasing number of tomato varieties, many of which are also imported. By 2000, however, the introduction of new produce items was down to 192, compared with a high of 545 in 1996 (Harris, 2002).

Changing consumer preferences are also evident in the year-round availability of items once thought seasonal, with U.S. consumers willing to pay the higher price for imported out-of-season fresh products. For example, table grapes are now available all year. California supplies of summer and fall grapes are augmented with grapes from Chile and Mexico during the winter and spring, with minor amounts from several other countries. Table grapes are now considered a staple, and consumption has increased for the California product as well as imports. Per capita consumption of grapes grew from 4 pounds in the 1980 season to 7.6 pounds in 2001, an increase of 90 percent. Over the same period, total fresh fruit consumption increased 11 percent. Year-round availability undoubtedly accounts for some of the increase in consumer demand. In other cases, imports have substituted for domestic production. One sector of the California grape industry is facing this concern, since Mexican producers across the border compete in the same season.

The demand for year-round supplies has created market niches for nontraditional sources. If a country can supply a critical market niche when supply is low and prices are high, then it may have a viable industry even if it is exporting for a relatively short period. For example, beginning in the mid-1990s the Guatemalan raspberry industry capitalized on two short market windows in the spring and fall between the Chilean and California raspberry seasons (Calvin et al, 2002).

Growing consumer demand in other countries is also fueling trade. Real per capita income grew on average by almost 100 percent among all countries in the last four decades (The World Bank, 2001). The large gains in per capita income levels have resulted in significant changes in global food consumption patterns, especially in middle-income developing countries. Studies show that fruit and vegetable consumption is positively correlated with income growth. Wealthier middle-income countries are most likely to upgrade their diets to include more fruits and vegetables as income levels increase (Regmi et al., 2001; Regmi and Dyck, 2001). In addition, research suggests that besides income and price, other demographic variables also determine the rate and composition of changes in food consumption (Regmi and Dyck, 2001). For example, unpublished 1998 ERS data indicate that urban consumers in China consume 38 kg more fruit and vegetables per capita per year than rural consumers. Similarly, FAO data from the 1980s indicate fruit and vegetable consumption to be generally greater in urban areas across all developing countries (FAO, 1993 and 1994). Given their rapid rate of urbanization and income growth, middle-income countries appear to be promising future markets for fruits and vegetables.

The Drive To Globalize Markets in Fruits and Vegetables

Year-round consumer demand for high-quality fresh fruits and vegetables is a critical influence in global changes in the fruit and vegetable trade. Without trade in fresh fruits and vegetables, consumers in temperate climates would face long winters with very limited supplies of fresh produce. While some fresh crops can be stored for a few months, such as apples and potatoes, more perishable products like strawberries and tomatoes would be available in much smaller quantities, if at all. Variety is also important. Without trade, temperate countries would not have tropical fruit such as bananas and tropical countries would not have deciduous fruit like apples.

Even when weather or biology is not a barrier to production in a particular country, there are many other economic reasons for trade in produce. In some cases it is cheaper and more efficient to produce a commodity in a foreign country, so production shifts geographically. For example, much of the U.S. fresh green onion and frozen broccoli supply is now imported from Mexico because the cost of labor is lower in Mexico and preparing these products for market is labor intensive; green onions are formed into bunches by hand and some types of broccoli, such as spears for freezing, are cut by hand. Some U.S. firms have shifted operations to Mexico because of the lower labor costs, and local Mexican firms have also developed their own industries.

In other cases, restrictions on production in one country may lead to increased production in other countries without the same constraints. For example, new cranberry production in the United States is severely constrained by the 1972 Clean Water Act's wetland usage rules. Canada's wetland use regulations for agriculture were less restrictive than those of the United States, allowing the industry there to grow rapidly in the mid-1990s in response to high demand across the border (Calvin, 1997). Some U.S. strawberry growers have transferred production to Baja California, Mexico, partly because of the difficulty in overcoming restrictions to expanding winter production in the Los Angeles area.

Transportation costs have also forced countries to import products rather than buying from domestic sources that might be more distant. For example, Seattle is closer to the large greenhouse tomato industry in British Columbia than to the closest major U.S. greenhouse in Colorado. Trade also occurs when there are unexpected declines in domestic production; tomato exports from the United States to Mexico are generally in response to shortfalls of what is a staple commodity in that country. U.S. tomato exports to Mexico are small and highly variable.

Technological developments have changed the profitability of exporting certain produce items and contributed to the growth of trade. For example, transportation advances, as discussed above, have made it cost-effective to ship more perishable products to U.S. markets from abroad. High-value but fragile products, such as asparagus from Peru and raspberries and cherries from Chile, are shipped by airfreight to U.S. markets. Improvements in communications have made these international transactions easier. The streamlining of phytosanitary barriers through technology has opened new

markets for many products. Mexican avocados are now shipped to 31 States during a 6-month period under a strict phytosanitary plan, after years of being barred from the United States.

Declining trade barriers, including bilateral and multilateral trade agreements, harmonization of sanitary and phytosanitary regulations, and dispute settlements under the auspices of the World Trade Organization (WTO), have also fostered more trade. The fast export growth of U.S. produce to Asia between the mid-1980s and mid-1990s is a good example. During that period, the high trade barriers for horticultural imports in Asia were lowered substantially through bilateral and multilateral negotiations. For example, after completing liberalization of lemons and grapefruit and the partial liberalization of oranges in 1977, Japan eventually dismantled its quota system for fresh oranges on April 1, 1991. Another example is that U.S. trade agreements, such as the Caribbean Basin Initiative and the Andean Trade Preference Act, have eliminated most agricultural tariffs on imports from those countries. Peru is now one of the largest producers and exporters of asparagus in the world. Thanks to its open access to the U.S. market, Peru supplied 47 percent of U.S. asparagus imports in 2001, compared with 10 percent in 1990.

Despite the improvement in the overall trade environment for fruits and vegetables, there are still high tariffs and other nontariff barriers to trade. One of the most common nontariff barriers is comprised of the various anti-dumping rules (see box, "Anti-dumping Cases Involving Produce") that countries can and do invoke to avoid the influx of imports. Anti-dumping practices affect the patterns of trade in fruits and vegetables and remain a threat to the trade of some commodities in some countries.

Implications of Globalization for the Produce Industry

With fewer constraints and lower transaction costs, firms can design strategies for optimization of sourcing on a global level, not just on a national level. Being a player in an international arena requires more resources than being a player in a national market, but may be necessary to stay competitive in domestic markets. Some types of firms will be better able than others to adapt to the challenges.

Several types of firms handle fresh produce imports. Traditional importers have no domestic production ties and may or may not have production ties in the country of origin. They are mainly marketers. Some U.S. importers are the marketing arms of large producers in other countries. Others are large multinational firms with brand name recognition such as Del Monte, Chiquita, and Dole. Some large U.S. grower/shippers have also developed import ties to augment their domestic production. Many of these firms have expanded the number of countries from which they import to ensure year-round supplies and the wide range of products that retail buyers desire.

U.S. firms have several options in using foreign production to help expand their season. For one, a U.S. firm may grow a product on its own farms in a foreign country for sale in the U.S. market. This kind of investment provides

Anti-dumping Cases Involving Produce

Dumping is defined as selling a good in another country at less than its "normal value." Anti-dumping laws provide a means to impose additional duties to compensate for this unfair trade. However, economists have long argued that anti-dumping rules are generally used to protect an industry (Kerr, 2001; *Michigan Law Review*, 1982; Barichello, 2002; Regmi, 2000). This discrepancy derives from the difference between what lawyers and economists consider dumping and how dumping laws compare prices between two countries. An industry could win a dumping ruling against a foreign country, but economists might not consider that dumping had occurred. Many economists think that the problems with anti-dumping laws are particularly serious for perishable agricultural products (*Michigan Law Review*, 1982).

Defining normal value is the key to anti-dumping law. The U.S. Department of Commerce allows three different methods to calculate normal value. Findings of whether dumping occurs can vary with the methodology used (Bredahl et al, 1987). First, the Department of Commerce can compare the price in the U.S. market with the price in the foreign market. Second, in those cases where there is no domestic market in the foreign country, the department can compare the price in the United States with the price in a third-country market. The third option is to compare the U.S. price with a constructed cost of production in the foreign market. The department also uses the constructed cost-of-production method when home-market or third-market sales have been made at prices below total cost of production over an extended period that will not allow recovery of all costs within a reasonable period. These conditions would hold if more than 20 percent of sales over a 1-year period were below the cost of production. With perishable agricultural commodities, many firms sell below total cost of production, perhaps for extended periods. At harvest time, if the price exceeds the variable harvesting and marketing costs, it makes sense to sell since the grower can recoup some of the production costs even if the price does not cover total production costs.

Economists expect to see different prices for U.S. commodities and imported commodities under various conditions. Price differentials could occur if foreign firms could price-discriminate. If a firm has some degree of market power and faces different price elasticities in different markets that can be separated, it can maximize profits by selling at a lower price in a market with a higher price elasticity of demand. In such a case, the consumers in the lower price market are more price-sensitive than those in the higher price market. Price discrimination is legal and common in the United States. A foreign firm employing this same profit-maximizing strategy in its sales to the United States could be found guilty of dumping.

Different prices in different countries would also occur if firms could potentially use a predatory pricing strategy. This is a short-run strategy where a firm would sell below marginal cost in a foreign country to undercut its competitors. If the targeted firms exit the industry, the predatory firm, now with some degree of market power, could raise prices. Domestic antitrust laws regulate this problem within the U.S. and anti-dumping laws regulate the problem across national borders. However, predatory pricing is rare because it is less costly to develop a degree of market power through mergers and acquisitions (Kerr, 2001).

a high level of control over the quality of the product. A U.S. firm might also have a joint venture with a firm in a foreign country to produce a crop to be sold in the United States. In some cases, U.S. firms may merge with a foreign supplier. Many U.S. shippers and grower/shippers also market for foreign growers and charge a sales commission. Some U.S. grower cooperatives have foreign members who must also meet the organizations' domestic production standards.

Suppliers must develop relationships with reliable foreign growers to provide produce. A high level of integration is essential for success in a multicountry operation because of problems of coordination and quality control. Suppliers may travel frequently to foreign production regions to cement the relationship with their growers. The suppliers may send agronomists to check on production and crop conditions. Some firms have staff living in foreign countries.

The stakes are high for procuring products from another country. If the product does not arrive on time or has quality problems and cannot be sold, the U.S. supplier may not have adequate supplies for its customers, a serious problem in the competitive produce industry. On the other hand, selling a substandard product may damage the firm's reputation. The stakes are also often high for the foreign producer. Many foreign countries have very specialized produce industries, geared almost exclusively towards exports. If products are not acceptable in the U.S. market, the producers often have few alternative markets and must sell at lower prices. For example, some of the products grown in Mexico for export to the United States, such as bell peppers, cherry tomatoes, and eggplant, have virtually no domestic market.

The example of U.S. grape grower/shippers illustrates some of the issues to be considered in importing grapes from other countries. (These same issues are relevant for other types of produce importers.) Grower/shippers have several options when confronted by the increasing importance of imports. They can maintain the traditional model of growing for their season and marketing their own output and perhaps that of some of their neighbors. Alternatively, some California grape firms have become year-round suppliers by expanding beyond their traditional California base to import grapes from Chile and Mexico. Many retailers prefer to do business with a firm that can supply all their grape needs on an annual basis instead of shifting from firm to firm as different production areas come into season. Operating on a year-round basis allows firms to gain economies of scale and spread fixed costs over a large volume of the product. Most California grapes are shipped from June to December, leaving facilities idle for half the year if a firm sells only domestic grapes. Year-round supply strategies also benefit shippers by maintaining their marketing presence with buyers all year. However, coordinating supplies from Chile or Mexico demands more capital and risk-bearing capabilities than are usual in domestic marketing alone. Not all firms have the wherewithal, or the desire, to become international grape suppliers.

Large foreign suppliers are following the same trend in integration and coordination in reverse. For example, some large Mexican and Chilean winter suppliers are expanding into production or joint ventures in the United States and other countries to provide a year-round supply for their U.S.

buyers. Some foreign growers have vertically integrated by acquiring marketing operations in the United States. These growers already have direct control over the quality of their produce; vertically integrated operations give them better ability to market their fruits and vegetables. For example, many of the shippers located in Nogales, Arizona, where winter vegetables from Mexico enter the United States, are really just the marketing arms of large Mexican growers. In the 1996/97 season, 63 percent of the tomatoes in Nogales were sold by these vertically integrated, Mexican-owned firms (Calvin and Barrios, 1998).

Impact of Retail Consolidation on the Produce Industry

Consolidation in the retail sector, both in the United States and in many countries around the world, also has an impact on the supplier/buyer relationship. Large retailers desire large volumes of consistent products to provide uniformity across all their stores, which may be more easily supplied by larger shippers. Recent research has shown that retailers buying a select group of produce items acquired 91 percent of the volume from their top four suppliers (Calvin and Cook et al., 2001).

Retailers are also increasing their demand for differentiated products. For example, an apple can be marketed in many different ways to appeal to a wide customer base. A retailer may want an apple for which a specific firm provides third-party certification for compliance with good agricultural practices or a particular type of packaging, an unusual variety, a special kind of storage, or a particular production system, such as organic. Product differentiation has an important impact on international trade because it requires increased coordination between shipper and buyer as shippers provide more specialized products for particular buyers.

Globalization of markets is likely to continue as the basic factors of supply combine with technological developments and lower trade barriers to meet consumer preferences to shape and create trade flows. Innovative financial arrangements across borders and flexible global sourcing have combined to provide markets with high quality and a wide variety of fresh produce year-round to consumers around the world.