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China's Rising Fruit and Vegetable Exports Challenge U.S. Industries

Sophia Huang and Fred Gale

Abstract

China has raised its profile in global fruit and vegetable markets. The value of its exports during 2002-04 were more than double the value from a decade earlier. Most of China's exports are processed fruits and vegetables that do not yet pose a serious challenge to U.S. exports. China's fresh vegetable sales to Japan and several other Asian markets and its apple exports to Southeast Asia compete directly with U.S. products. The United States has been the largest market for China's exports of apple juice. China's export competitiveness arises from low costs, a growing processing industry, and policies that encourage fruit and vegetable production. However, China's growing domestic market may absorb more of its production. China also faces stiff challenges in improving the quality and safety of products, upgrading marketing and distribution infrastructure, and reducing marketing costs.

Keywords: Fruit, vegetables, China, Asia, apples, exports, competition, marketing, costs of production, food safety

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Table of Contents

Introduction	2
China's Rapid Rise in Exports	3
Points of Rivalry With the United States	5
Factors Behind China's Competitiveness	11
Factors That May Slow China's Exports	14
Conclusions and Trade Prospects	19
References	20

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Introduction

Since the 1990s, China has substantially raised its profile in the global market for fruits and vegetables. Total export value of China's fruits and vegetables (here including fresh fruit, fresh vegetables, processed fruit and vegetables, fruit and vegetable juices, pulses, and tree nuts) more than doubled between 1992-94 and 2002-04, from \$2.3 billion to \$5.1 billion (see box, "Fruit and Vegetable Foreign Trade Data"). China has become a leading exporter in some markets where its presence was negligible 10 years earlier. China's exports go mainly to Asian countries, which also are important markets for U.S. exporters. A sharp decline in U.S. market share has coincided with the surge in Chinese exports in a number of markets.

Fruit and Vegetable Foreign Trade Data

The foreign trade data used in this study were accessed from the USDA Foreign Agricultural Service's Global Agricultural Trade System, a database containing foreign trade data for 1992-2004 (for most countries) from the U.N. Trade Statistical Office. This report's definition of fruits and vegetables includes fresh and processed fruits and vegetables, juices, tree nuts, beans, and pulses as shown below. It does not include sugar cane, sugar beets, or alcoholic beverages.

Fruit and vegetable subcategories

Category	Harmonized codes	Description
Fresh fruit	0803-0810	Bananas, dates, figs, pineapples, avocados, citrus fruit, grapes, melons, papayas, apples and other deciduous fruit, and berries
Fresh vegetables	0701-0709	Potatoes, tomatoes, onions, garlic, brassicas, leaf and root vegetables, beans, peas, cucumbers, asparagus, celery, mushrooms, peppers
Processed fruit and vegetables	0710-0712, 0714 080620 081110-081140 110510-110630 200110-200899	Frozen, dried, preserved, boiled, or steamed vegetables and fruits; flour or meal of potatoes, legumes, fruits, or nuts; prepared or preserved vegetables or fruits; jams, jellies, purees, or fruit pastes
Fruit and vegetable juice	200911-200990	Fruit and vegetable juices
Pulses	0713	Dried and shelled peas, beans, chickpeas, and lentils, including seed
Nuts	0801-0802	Coconuts, brazil nuts, cashews, almonds, hazelnuts, walnuts, chestnuts, and pistachios, fresh or dried, shelled or unshelled

Source: USDA, Foreign Agricultural Service, Global Agricultural Trade System, accessed January 2006.

China's Rapid Rise in Exports

Chinese fruit and vegetable exports are mainly processed products, accounting for 60 percent of the total value of fruit and vegetable exports in 2002-04 and about 12 percent of global trade. Exports of processed products more than doubled between 1992-94 and 2002-04 (fig. 1). Leading exports include vegetable mixes (prepared and preserved but not frozen), frozen vegetables, and mushrooms. China's exports of processed fruit are relatively small, but a number of frozen and processed fruit items (jams, jellies, citrus, dried grapes, frozen strawberries, and apricots) registered rapid percentage growth during the most recent period (2002-04).

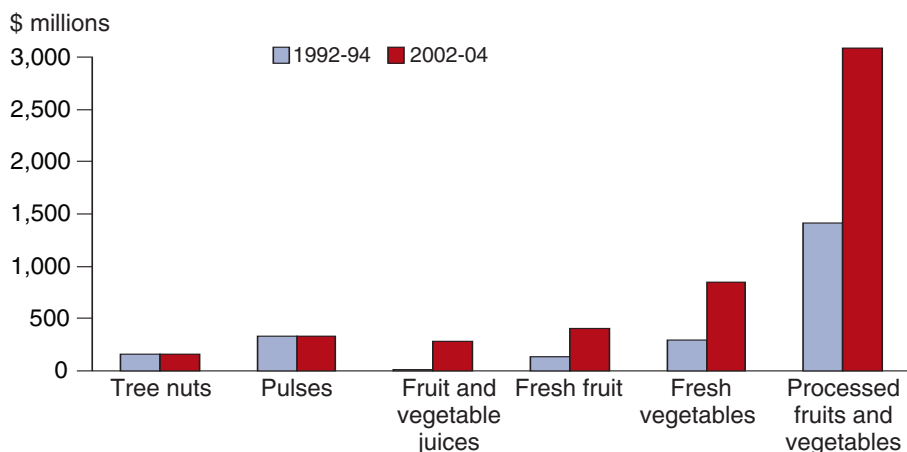
While most of China's vegetable exports are processed, fresh vegetable exports nearly tripled between 1992-94 and 2002-04. Fresh vegetables are now the second-largest fruit and vegetable export category, accounting for 16 percent of export value and about 5 percent of global trade. Two products, garlic and mushrooms, account for more than half of fresh vegetable exports, with a combined average value of \$481 million per year during 2002-04. Other leading fresh vegetable exports include onions, carrots, and radishes (table 1).

Fresh fruit, more than tripling its export value between 1992-94 and 2002-04, accounts for 8 percent of China's fruit and vegetable exports. Apples are the primary fruit export, accounting for more than half of the annual export value. Other major fresh fruit exports include pears and tangerines.

Fruit and vegetable juices account for nearly 6 percent of fruit and vegetable exports, but growth in apple juice exports has presented a direct challenge to U.S. producers. Concentrated apple juice accounted for nearly 90 percent of China's total value of juice exports in 2004. China's apple juice exports grew from \$5 million annually in 1992-94 to \$251 million in 2002-04, and its share of global export value of apple juice grew from less than 1 percent

Figure 1

China's fruit and vegetable exports grew substantially in most categories



Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

to more than 18 percent. Since 2001, China has been the world's leading apple juice exporter.

The remainder of China's fruit and vegetable exports includes pulses (7 percent) and tree nuts (3 percent). In contrast to the remarkable growth in other fruit and vegetable categories, pulse and nut exports have been relatively stable over the past decade. China's exports of nuts are primarily chestnuts, walnuts, pine nuts, and ginkgo nuts.

China's export markets for fruits and vegetables are mainly in Asia. More than 40 percent of processed fruit and vegetable exports by value go to Japan. Nearly three-fourths of China's fresh vegetable exports went to its Asian neighbors in 2002-04. Major markets included Japan (31 percent), Association of Southeast Asian Nations (ASEAN) (25 percent), South Korea (7 percent), and Hong Kong (6 percent). Garlic, mushrooms, onions, carrots, and radishes accounted for over three-fourths of the 2002-04 total. More than half of Chinese fresh fruit exports go to the ASEAN region, which includes 10 member countries—Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. Other important markets include Russia, Hong Kong, and to a much lesser degree, Canada. China's apple juice exports, in contrast, have a worldwide market with most juice exports shipped to countries outside Asia.

Table 1
China's major fresh produce exports

Item	Average value, 2002-04 \$ million	Major markets
Fresh fruit	405	
Apples	211	ASEAN ¹ (56%), Russia (13%), European Union (12%)
Pears	77	ASEAN (56%), Russia (12%), Canada (7%)
Tangerines	65	ASEAN (70%), Russia (12%), Canada (10%)
Oranges	8	Hong Kong (65%), ASEAN (26%)
Fresh vegetables	843	
Garlic	373	ASEAN (39%), European Union (7%), U.S. (7%), South Korea (4%)
Mushrooms	108	Japan (84%), European Union (8%), U.S. (4%)
Onions	73	Japan (51%), Russia (26%), ASEAN (15%), South Korea (5%)
Carrots	46	Japan (27%), South Korea (23%), Hong Kong (21%)
Radishes	43	Japan (63%), South Korea (32%)

¹Because of data unavailability, the Association of Southeast Asian Nations (ASEAN) here includes only Myanmar, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

Source: USDA, Foreign Agricultural Service, Global Agricultural Trade System.

Points of Rivalry With the United States

China's emergence as a fruit and vegetable exporter presents a new source of competition for U.S. producers, mainly in three categories: apple juice, fresh apples, and fresh vegetables (figs. 2 and 3). China exports apple juice (mainly concentrated) directly to the United States, Japan, and Canada, and its exports of fresh apples and several types of vegetables compete with U.S. exports in Asian markets. China's largest export category, processed fruits and vegetables, does not yet pose a serious challenge to the United States because the United States and China have been exporting mostly different types of processed fruits and vegetables (Huang, 2002). However, China's rising exports of fresh vegetables and apples have coincided with falling market share of U.S. exports in Asian markets.

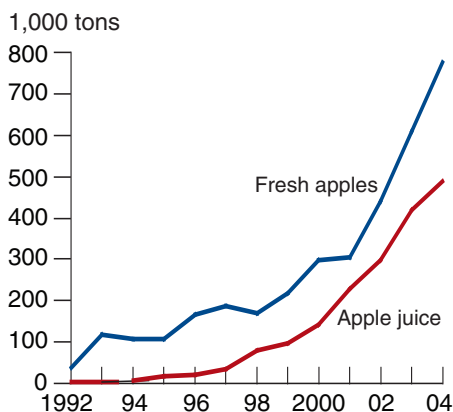
Fresh Fruit Exports

U.S. fresh fruit exports face competition from China's exports in a handful of Asian countries that are the largest markets for U.S. fresh fruit outside of Canada and Mexico, which receive nearly half of U.S. fresh fruit exports. Four East Asian markets—led by Japan and followed by increasingly affluent Taiwan, South Korea, and Hong Kong—account for more than three-fourths of the U.S. fresh fruit shipments to Asia. Southeast Asia, in comparison, is a distant second for aggregate U.S. fresh fruit exports to Asia. Southeast Asia, however, is almost as important as East Asia for two major U.S. fresh produce sales to Asia—apples and grapes.

China and the United States compete directly in fresh apple exports. The average value of China's apple exports, with about two-thirds of the shipments to its neighboring Asian countries, was \$211 million during 2002-04 (table 1). China's other major fresh fruit exports—Asian pears and tangerines—are not exported in large quantities by the United States, and China is not currently a major exporter of the two leading U.S. fresh fruit exports to Asia—oranges

Figure 2

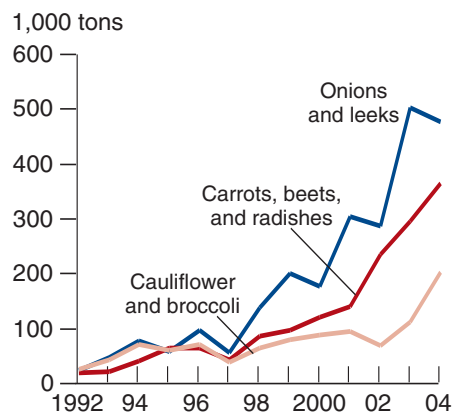
China increased its exports of fresh apples and apple juice



Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

Figure 3

China's exports of selected fresh and chilled vegetables



Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

and grapes. However, with a value of \$115 million, apples comprise 12 percent of U.S. fresh fruit exports to Asia (table 2), and they are facing a growing challenge from China. Since 2003, the volume of China's global apple exports, reaching 609,000 metric tons for that year, has surpassed that of the United States (USDA, 2006).

U.S. apples compete directly with Chinese exports in Southeast Asia. More than half of China's apple exports go to ASEAN and 13 percent to Russia. U.S. apple exports to Asia are shipped mainly to ASEAN (46 percent) and Taiwan (31 percent). Taiwan does not allow entry of Chinese apples for phytosanitary reasons. Therefore, competition from China for U.S. fresh fruit exports is primarily within the ASEAN region for apples, which took a nearly 15-percent share of U.S. apple exports by value in 2002-04.

The rapidly growing countries of ASEAN with tropical climates—particularly Indonesia, Malaysia, the Philippines, Singapore, and Thailand—are important markets for temperate fruits like apples. U.S. apple exports to ASEAN surged in response to growing demand in the early 1990s, but Chinese exports have grown fast particularly in recent years as China's production increased, quality standards improved, and some Asian companies began growing apples in China for export. China-ASEAN trade in fruits further accelerated with implementation of the "Early Harvest" program of the China-ASEAN Free Trade Agreement, signed in late 2002, which slashed or eliminated tariffs on a variety of goods, including fruits (USDA, September 2004).

China's exports to ASEAN, China's largest traditional export market for apples, increased almost without interruption since the 1990s. U.S. apple exports to ASEAN also increased steadily until late 1997, when the region suffered a severe economic downturn during the Asian financial crisis.

Table 2

Major U.S. fresh produce exports to Asia

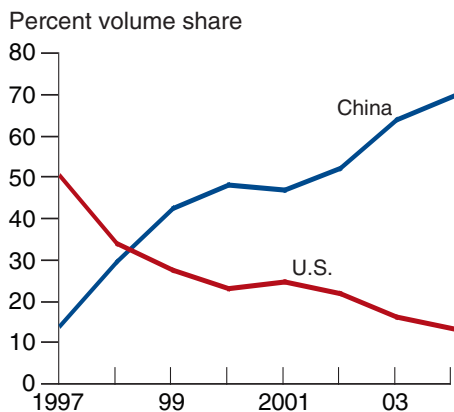
Item	Average value, 2002-04	Major Asian markets
	<i>\$ million</i>	
Fresh fruit	961	
Oranges	230	South Korea (37%), Japan (25%), Hong Kong (24%)
Grapes	179	ASEAN ¹ (49%), Hong Kong (34%), Taiwan (6%)
Grapefruit	130	Japan (89%), Taiwan (4%), South Korea (4%)
Apples	115	ASEAN (45%), Taiwan (27%), Hong Kong (20%)
Fresh vegetables	169	
Broccoli	54	Japan (82%), Taiwan (16%)
Onions	24	Japan (66%), Taiwan (19%), South Korea (10%)
Cauliflower	19	Japan (90%), Taiwan (9%)
Asparagus	13	Japan (96%), Taiwan (3%)
Head lettuce	10	Taiwan (31%), Japan (25%), Hong Kong (12%)

¹Because of data unavailability, the Association of Southeast Asian Nations (ASEAN) here includes only Myanmar, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

Figure 4

China surpassed the U.S. in ASEAN's import market for apples¹



¹Because of data unavailability, the Association of Southeast Asian Nations (ASEAN) here includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

Although the United States has since recovered some of its apple export business, U.S. share in these apple import markets as a whole has declined. Since 1999, China has surpassed the United States as the leading apple supplier to ASEAN by volume (fig. 4).

Fresh Vegetable Exports

As with fresh fruit exports, U.S. fresh vegetable exports go primarily to Canada and Mexico, but Asia is an important market where U.S. products face competition from China. Although trade disputes with the United States and other countries over Chinese garlic¹ since the early 1990s have been indicators of China's

growing presence in world markets for fresh vegetables, the main competition between the United States and China lies in Asia.

Four East Asian markets—Japan and, to a much lesser degree, Taiwan, South Korea, and Hong Kong—are the primary markets outside North America for U.S. fresh vegetable exports. Broccoli, onions, cauliflower, asparagus, and head lettuce account for about 70 percent of U.S. fresh vegetable exports to Asia (table 2). Although most products exported by the United States are different from those of China, China's rising fresh vegetable exports to Asia have shown greater variety and have begun to include many of the major items that the U.S. exports, particularly since the mid-1990s.

Two of the four East Asian markets—Japan (with 69 percent of U.S. exports to Asia) and South Korea (with 6 percent)—are points of competition between the United States and China. The other two markets—Taiwan and Hong Kong—have unique trade relationships with China. Taiwan, with a 14-percent share of U.S. fresh vegetable exports to Asia, does not permit entry of most Chinese fresh produce for political, economic, and food safety reasons. Hong Kong received 5 percent of U.S. fresh vegetable shipments to Asia in 2002-04, but its imports of fresh vegetables from China rose steadily following its return to Chinese sovereignty in 1997. Some Hong Kong growers have moved their production to China to reduce production costs (USDA, March 2005). China's share of Hong Kong's import market for fresh vegetables reached 73 percent in 2004.

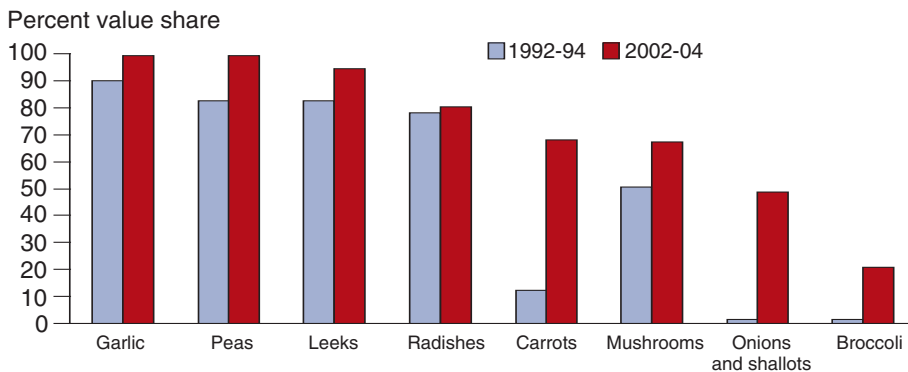
Japan receives most U.S. exports to Asia of broccoli, onions, cauliflower, and asparagus. China's share of Japan's import market for fresh vegetables grew from less than 10 percent in 1989-91 to 37 percent in 2002-04. It surpassed the United States as the leading supplier to Japan in 1996. The U.S. share, after reaching a peak of 29 percent in 1994, dropped to 19 percent in 2002-04.

¹For example, U.S. garlic growers raised concerns about Chinese garlic imports beginning in the early 1990s. See U.S. Department of Commerce (2004, 2005) for recent developments.

Onions and, to a lesser degree, broccoli are the major fresh vegetables exported to Japan by both countries at present, but the variety of Chinese exports is broadening. China has substantially increased its market share for nearly all of Japan's top 10 fresh vegetable imports, including many of the major crops the United States exports, from a decade ago (fig. 5).

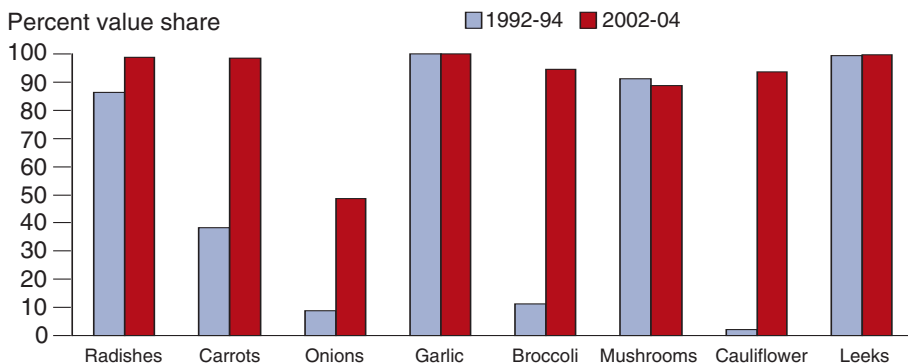
Similarly, South Korea's imports of China's fresh vegetables increased from less than \$1 million before 1994 to \$66 million in 2004, and China's market share surged from under 36 percent before 1994 to 75 percent in 2002-04. In fact, China has been the leading supplier of fresh vegetable exports to South Korea for most years since the 1990s. In comparison, the U.S. market share, after peaking in 1996 at 43 percent, generally declined. In addition, as in Japan, the growth of China's market share in South Korea is broad based, including onions, broccoli, and carrots, although quantities remain small for some of these imports (fig. 6).

Figure 5
China's growing market share in Japan's top imported fresh vegetables



Note: This chart includes 8 of the 10 top fresh vegetables imported by Japan during 2002-04. China's shares of Japanese asparagus and pepper imports were negligible. These eight vegetables accounted for 60 percent of Japan's global import value for fresh vegetables in that period. Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

Figure 6
China increased market share in most of South Korea's top fresh vegetable imports



Note: These eight vegetables accounted for 71 percent of South Korea's global import value for fresh vegetables in 2002-04. Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

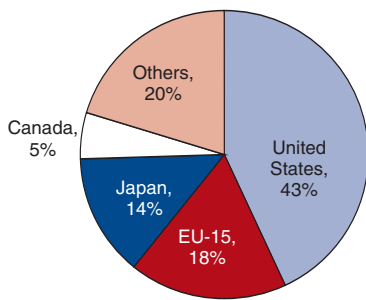
Juice Exports

China's apple juice exports present the most direct challenge to U.S. producers. The United States has been China's biggest market for its escalating apple juice shipments since 1997. On average, 43 percent of China's apple juice exports went to the United States during 2002-04 (fig. 7). China has substantially boosted its apple juice shipments to the United States, from less than \$1 million in the early 1990s to \$108 million during 2002-04.

The rapid rise of apple juice imports from China led the U.S. Apple Association to file an antidumping complaint in 1999. Since May 2000, the United States has imposed antidumping duties on nonfrozen apple juice concentrate from China. These duties, however, are imposed only against particular Chinese companies and not against the industry as a whole (USDA, 2002). In November 2002, the U.S. International Trade Commission (USITC)

Figure 7

Chinese apple juice had a worldwide export market average of \$251 million, 2002-04



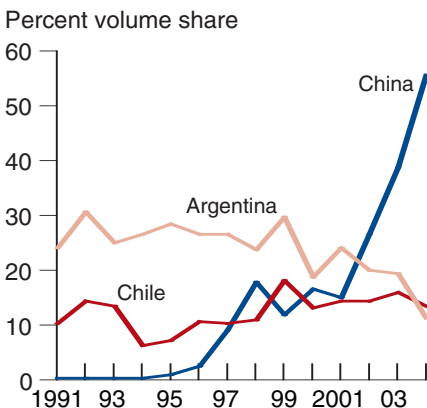
Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

waived the duties on five Chinese apple juice processors, and in February 2004, USITC waived duties on an additional 10 Chinese processors (USDA, 2003; USDA, September 2004). The volume of apple juice entering the United States from China has continued to increase in spite of the duties. China has surpassed Argentina and Chile as the leading imported apple juice supplier to the United States since 2002. Chinese apple juice accounted for a 56-percent share by volume in the U.S. import market in 2004 (fig. 8, panel A).

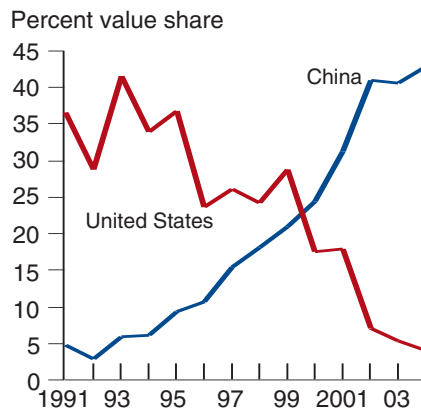
Figure 8

The share of Chinese apple juice rose in the U.S., Japanese, and Canadian import markets

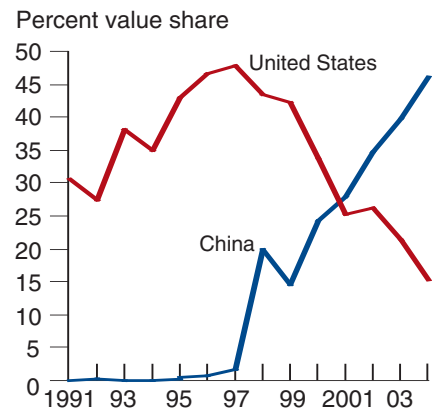
Panel A: China became the leading supplier to the United States, over Chile and Argentina



Panel B: China's share in the Japanese import market rose almost without interruption as the U.S. share fell



Panel C: China's share in the Canadian import market surged, while the U.S. share declined



Source: ERS calculations based on data from USDA, Foreign Agricultural Service, Global Agricultural Trade System.

During China's export expansion, U.S. apple juice exports fell from a peak of \$75 million in 1995 to \$17 million in 2002-04. Other major markets for China's apple juice exports include the two leading destinations for U.S. apple juice exports: Japan (14 percent of Chinese exports) and Canada (5 percent). The United States, once the leading supplier for both of these countries' apple juice imports, saw its share drop significantly over the past several years, while China's market share increased almost without interruption. In Japan, China's share rose from 5 percent in 1992-94 to nearly 41 percent in 2002-04, while the U.S. share declined from 35 percent to 5 percent. Similarly, China's share in Canada surged from almost zero to 40 percent, while the U.S. share declined from 34 percent to 21 percent during the same period (fig. 8, panels b and c).

Factors Behind China's Competitiveness

Farmers Respond to Profits

China's substantial increase in fruit and vegetable production is a major factor behind its fast export growth. Market reforms introduced in the late 1970s gave farmers more freedom in planting decisions, allowing them to divert land from grains to more lucrative cash crops. Fruits and vegetables yield high returns per acre of land—a scarce resource in China—and use more labor, an abundant resource in China. China's National Development and Reform Commission (NDRC) estimated that vegetable production in China yielded an average profit of 1,563 yuan per mu (equivalent to \$1,172 per acre). Apple production brought an average net profit of 943 yuan per mu (\$690 per acre) versus an average of 197 yuan per mu (\$148 per acre) from grain production in 2004.

China's horticultural crop production has increased dramatically. Fruit orchard area rose from 1.73 million hectares in 1978-80 to 9.44 million hectares in 2002-04. Vegetable area swelled from 3.68 million hectares to 17.62 million hectares (China National Bureau of Statistics). In 2004, China grew 550 million metric tons of vegetables on 17.6 million hectares of land (table 3). Apples are China's most important fruit, with production of 23.7 million tons in 2004, up 3.2 million tons from 2000.

According to data from the Food and Agriculture Organization of the United Nations, China produced nearly half of the world's vegetables—five times the U.S. share. China also produced 16 percent of the world's fruit, more than double the U.S. share, including 36 percent of the world's apples. China's *increase* in vegetable acreage between 2000 and 2004 (2.3 million hectares, or 5.7 million acres) exceeded the entire vegetable acreage in the United States (3.7 million acres in 2002). China's production has grown mainly to meet domestic demand (over 90 percent of fruit and vegetable production is for the domestic market), but the production increase has facilitated China's increased presence in global fruit and vegetable trade.

China's rapid expansion of apple production since the 1980s typifies Chinese farmers' response to the country's market-oriented reform policy.

Table 3

Harvested area and production of vegetables and selected fruits, 2000-04

Crop	Area		Production	
	2004	Change, 2000-04	2004	Change, 2000-04
	-----1,000 hectares-----		---1,000 metric tons---	
Vegetables	17,560	2,320	550,647	NA
Melons	2,147	103	69,467	NA
Apples	1,877	-377	23,675	3,244
Citrus	1,627	355	14,958	6,175
Pear	1,079	64	10,642	2,230
Bananas	264	15	6,056	1,115
Grapes	414	131	5,675	2,393

NA = No data available.

Source: Calculations by ERS using data from China National Bureau of Statistics.

China's apple production rose from 2.5 million tons in 1978-80 to 201.2 million tons in 2001-03 (China National Bureau of Statistics). Since the early 1990s, China has overtaken the United States as the world's largest apple producer and now accounts for more than one-third of world apple production (Food and Agriculture Organization of the United Nations, 2005). While apple orchard acreage in China has fallen after peaking in 1996, production has continued to increase because of better management techniques and commercialization of orchards (USDA, 2003).

Low Production Costs

China's competitive advantage lies in its low production costs. Survey data reported by NDRC indicate that prices received for vegetables at the farm level were about 5 cents per lb in 2004, and production costs were less than 3 cents per lb (fig. 9). Material inputs accounted for slightly more than half of production costs, and labor costs accounted for less than half.

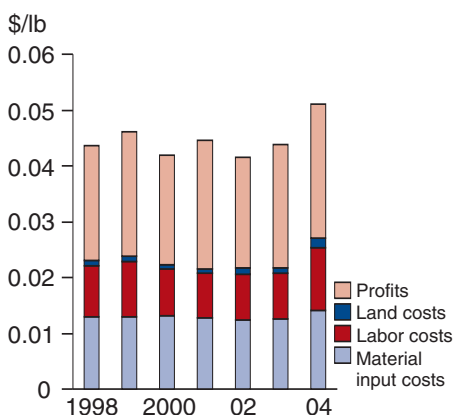
China's abundant rural labor supply means that wages and labor costs are low. Case studies by Crook (2003) and Hu (2005a) reported monthly wages of 500-600 yuan (\$60-\$75). Lohmar and others (2003) reported daily wages of 15 yuan (less than \$2) for contract workers in fruit orchards and vegetable-processing facilities. Most work is done by hand, so machinery costs on Chinese fruit and vegetable farms are also low.

Small producers serving the domestic market have low land costs, but companies leasing large tracts of land in prime growing regions pay rents similar to those in the United States. NDRC's estimates of land costs for domestic vegetable production for 2004 were about \$84 per acre, and Hu (2005b) reported land rents paid by small households in the range of \$25-\$30 per acre.² However, commercial producers in China's prime fruit and

vegetable production areas of eastern Shandong Province pay land costs close to those in the United States. Hu (2005a) reported annual land rent equivalent to \$350-\$600 per acre paid by a foreign-invested company for cropland leased for commercial fruit production and \$220 per acre paid by a Chinese trading company renting land for vegetable production. Lohmar and others reported farm rental of \$300 per acre in 2003. These rents are comparable to average rents of \$120 per acre in Oregon and \$300 per acre in California for irrigated cropland during 2003 (USDA, March 2004).

²Rents reported in this paragraph were converted to dollars per acre from Chinese yuan per mu at the official exchange rate.

Figure 9
Costs and profits of vegetable production in China, 1998-2004



Notes: Original data converted to dollars per lb by dividing costs per unit of land by output per unit of land. Costs were converted to dollars at official exchange rates.

Source: Calculations by ERS using data from China National Development and Reform Commission.

Low production costs are reflected in low retail prices for fruits and vegetables in China. For example,

Table 4

Average retail prices of selected vegetables and fruits, China, August 2005

Item	Average price
	\$/lb
Carrots	0.10
Cabbage	.10
Potatos	.11
Chinese cabbage	.11
Carrots	.13
Eggplant	.14
Green peppers	.16
Tomatoes	.16
Celery	.16
Garlic	.29
Bananas	.20
Fuji apples	.28
Watermelon	.09

Note: Values converted to U.S. dollars at the official exchange rate of \$1 = 8.1 Chinese yuan.

Source: ERS calculations based on data from China Price Information Network.

in August 2005, average retail prices for vegetables ranged from the equivalent of 10 cents per lb for carrots to 16 cents per lb for celery, green peppers, and tomatoes (table 4). Apples sold for 28 cents per lb, and watermelons for 9 cents per lb.

Processing Industry Developing Rapidly

Most of China's fruit and vegetable exports are processed. Lack of cold storage and other infrastructure makes transporting perishable items difficult, and fresh products often do not meet exporters' standards for uniformity and color. Processing industries have grown rapidly due to the combination of China's low costs, growing market, and government

policy that encourages agricultural processing as a means of helping farmers. Low labor costs are a key cost-saving factor for processors as they are for growers. Many local authorities, eager to create jobs and develop their economies, welcome investment by vegetable- and fruit-processing companies, often providing tax breaks, inexpensive land, or other concessions. Environmental and other regulatory compliance costs for food processors in China are also much lower than in the United States and other developed countries.

China's agricultural industrialization policy has aided agricultural processing and trading enterprises, viewing them as key links between small farmers and markets that create badly needed jobs for rural workers. Companies that meet government standards for capital investment, technical prowess, and potential to provide markets and technical knowledge to farmers can be recognized as "dragon head" enterprises. This designation gives the company prestige, access to markets, authority to contract with villages, and favorable terms for loans from state-owned banks.³ Fruit and vegetable processors and trading companies are among the most prominent "dragon head" enterprises.

Exports Targeted by Policy

Exporting agricultural products, especially fruits and vegetables, was emphasized as an important way to aid the farm sector in China's "Number 1 document." The document is a 2004 policy statement that gave primary importance to addressing the "three rural problems" of low rural incomes, slow rural economic growth, and a weak agricultural sector. The "Number 1 document" set a goal of boosting agricultural exports to \$30 billion within 4-5 years by improving quality and safety of products, increasing the scale and competitiveness of processing enterprises, diversifying export markets, and aiding exporters through access to credit and insurance, value-added tax rebates, and other policies facilitating exports (China Ministry of Commerce, 2005).

³Private enterprises that do not have "dragon head" status can have difficulty obtaining bank loans (Gale and Collender, 2006).

Factors That May Slow China's Exports

While the Chinese fruit and vegetable sector appears to have the potential to become an export juggernaut, several factors may impede China's export growth.

High Marketing Costs

China's advantage in production costs does not necessarily translate into competitiveness in final markets. As produce moves through the marketing chain, high markups, losses, waste, and other inefficiencies dramatically raise the cost. One Chinese official estimated that about 30 percent of vegetables in China are lost post-harvest due to poor storage and that 90 percent of vegetables arrive at market with inadequate grading, washing, or packaging (Lohmar and others, 2003).

We illustrate the marketing costs by comparing Chinese Fuji apple prices per kilogram (1 kg = 2.2 lb) at various points in the marketing chain in October 2005 (table 5). The cost of production is estimated at just 11-12 cents per

Table 5

Comparison of apple prices, October 2005

Item	Price \$/kg
China prices:	
Cost of production ¹	0.11-0.12
Wholesale market prices: ²	
In production areas	
(Shandong, Hebei)	.17-.20
In urban areas (Beijing)	.37-.49
In Southern China	
(Guangdong)	.69-.80
Export price f.o.b	
(Qingdao port) ³	.47
U.S. apple prices:	
Producer price ⁴	.64
U.S. export price f.o.b. ³	.70
China retail prices: ⁵	
Shandong	.47
Beijing	.50
Shanghai	.67
Guangdong	.74
China import price ³	.77-.80

f.o.b. = Free on board.

¹Source: China National Development and Reform Commission.

²Source: China Ministry of Agriculture.

³Source: Customs statistics, U.S. and China.

⁴Source: USDA, National Agricultural Statistics Service.

⁵Source: China Price Information Network.

kg, but wholesale prices at markets in Shandong, one of the largest apple-producing areas, are over 50 percent higher, at 17-20 cents per kg. Wholesale prices in Beijing, about 200 miles north of Shandong, are higher still, at 37-49 cents per kg. The export price at Qingdao, Shandong (in August 2005) was 47 cents per kg, over four times the production cost. By comparison, average producer prices for Washington State apples in the United States were 64 cents per kg, and the average export price was 70 cents per kg, a differential of less than 10 percent between producer and port.

The high cost of marketing in China means that retail prices of Chinese apples are only slightly below those of imported apples in cities of South China.

Chinese apple prices rise further as they move further from production areas. In Shandong (a major producing area), apples sell at about 47 cents per kg, close to the export price. In Shanghai, further to the south, the price averaged 67 cents per

kg. In Guangdong Province (adjacent to Hong Kong), the average was 74 cents per kg, very close to the average price of imports of 77-80 cents per kg. About 40 percent of China's apple imports came from the United States in 2005, and about one-third came from Chile.

While Chinese apples appear to have a tremendous cost advantage at the farm level, high marketing costs mean that they have only a slight advantage over apples from the United States, Chile, and other countries by the time they reach markets in southern China. High marketing costs stem from a variety of sources, including poor rural roads, lack of refrigerated storage and transportation, spoilage and waste, inefficiency in the transportation sector, and long marketing chains with numerous middlemen, each of whom takes a markup.

While marketing remains a problem, China is improving its market infrastructure rapidly. A vast system of toll roads now connects nearly all major cities and most towns, and the Government is in the midst of a campaign to build roads in rural areas. Since 1995, China's Government has promoted construction of a "green corridor" network of roads designed to connect areas that produce fresh agricultural produce with urban markets. Many cold storage facilities have been built in recent years (Crook, 2003; Lohmar and others, 2003).

The emergence of modern supermarket chains with advanced procurement systems is advancing marketing efficiency greatly. The opening of the wholesale and distribution sectors to foreign competitors in 2005 as a result of China's commitments as a World Trade Organization member is likely to bring even greater competition and efficiency in marketing as well as increased investment in cold chain facilities (USDA, December 2005).

Growing Domestic Market

Growing domestic demand for fruits and vegetables is providing an increasingly attractive alternative to exports, a factor that may constrain growth in Chinese exports in coming years. Vegetables are a major part of Chinese meals, whether at home or in banquet halls. Chinese consumers are cutting back on consumption of traditional cabbage and other low-end vegetables and diversifying their consumption to include a wider variety of vegetables. Fruits are popular as desserts and snacks, and imported fruits are a luxury item often given as gifts. Between 1990 and 2004, urban per capita consumption of fruits and melons rose 37 percent, and rural consumption nearly tripled.

As Chinese household incomes rise, fruit and vegetable consumption will rise. The relationship between income and fruit and vegetable consumption is evident from a comparison of per capita purchases by high-income households in China with the overall average. For example, household survey data for 2000 show that the top 10 percent of households (ranked by disposable income per capita) purchased 19 percent more vegetables and 40 percent more fruit than did the urban per capita average (table 6). Purchases of several important export crops—carrots, onions, garlic, eggplant, celery, and spinach—are especially popular among high-income Chinese households, with purchases by the top 10 percent exceeding the urban average by 20-40 percent. The top 10 percent of Chinese urban households purchased 24 percent more apples than did the average urban household, and their purchases of other fruits were even higher.

As the Chinese economy grows, income gains will be spread more widely over the Chinese population. Development of modern food markets is expanding the array of fruits and vegetables available to middle and lower income households, including those in remote inland provinces and rural areas. More households likely will emulate the consumption patterns of the top-earning households in coming years, and domestic consumption of fruits and vegetables will rise sharply. As domestic consumption rises, producers will find lucrative markets closer to home, possibly diverting production away from exports into the domestic market.

Table 6

China's urban household purchases of vegetables and fruits, by income percentile, 2000

Item	Average purchases	Top 10 percent of households ¹	Ratio
	-----\$/person-----		<i>Percent</i>
Disposable income	758	1,608	212.0
	-----Kg/person-----		<i>Percent</i>
Vegetables	114.7	136.7	119.2
Chinese cabbage	18.1	20.6	113.3
Tomatoes	7.6	9.0	118.7
Cucumbers	6.7	8.5	126.3
Green onions	5.0	6.3	126.0
Rape	4.9	5.7	115.4
Radishes	4.6	5.7	122.2
Egg plant	4.6	5.6	122.5
Peppers	3.8	4.6	119.4
Celery	3.0	3.6	122.1
Cabbage	2.6	2.8	106.2
Winter melon	2.5	2.9	120.0
Garlic	2.3	2.8	125.7
Chives	1.9	2.2	115.5
Spinach	1.9	2.3	121.6
Carrots	1.7	2.4	138.4
Cauliflower	1.4	1.6	112.0
Asparagus	1.2	1.4	118.1
Onions	0.9	1.1	128.7
Gourds	0.9	1.0	118.8
Ginger	0.7	1.0	129.7
Other vegetables	38.5	45.8	118.8
Fruit	58.1	81.1	139.7
Watermelons	20.6	28.0	136.2
Apples	10.5	13.0	124.4
Pears	4.4	6.1	138.5
Tangerines	3.8	5.3	138.3
Peaches	3.6	5.2	142.9
Bananas	2.8	4.3	156.0
Grapes	1.9	2.9	156.8
Oranges	1.7	2.5	145.8
Other fruits	8.9	13.9	155.8

Note: Table shows average per capita purchases by urban households.

¹Average for top 10 percent of urban households ranked by disposable income.

Source: ERS analysis of data from China National Bureau of Statistics, Urban Survey Organization.

Food Safety and Phytosanitary Concerns

High-quality requirements and strict phytosanitary regulations in Japan and other Asian countries deter the entry of Chinese fresh fruits. In 2002, Chinese vegetables suffered a series of widely publicized setbacks in Japan due to pesticide residues on produce imported by Japan. In 2004, pest problems also interrupted Chinese apple exports to Canada. Food safety has become a much bigger concern in the domestic Chinese market as well.

Chinese fruits and vegetables often have high levels of pesticide residues, heavy metals, and other contaminants. Water, soil, and air are dangerously polluted in many rural areas as a result of heavy industrialization and lax environmental regulation. Heavy chemical use results from the intensive cultivation of China's relatively scarce cropland. Chinese farmers rely on chemical fertilizer to coax high yields out of soil that has little organic matter, and pesticides are applied in high doses to control pest infestations that result from monocropping (when one type of crop is grown). Farmers generally know little about the proper use of fertilizers and pesticides, and the agricultural extension service is weak. Pesticides, fertilizers, and seeds purchased by farmers are often fake or mislabeled.

China is trying to raise quality standards through "green food" and "pollution free" production standards promoted by China's Ministry of Agriculture.⁴ These standards prohibit or limit the use of potentially harmful chemicals by growers and set limits on the presence of contaminants in soil, water, and air in production areas. These standards are primarily for the domestic market but also are part of a general escalation of quality and safety standards.

Many enterprises are contracting with farmers to produce vegetables for export and increasingly for the domestic market. One of the motivations for contracting is to gain direct control over the use of chemical substances. Contracts often specify the chemicals to be used, and farmers often obtain chemicals on credit from the contracting enterprise (Crook, 2003; Hu, 2005a; *The Nikkei Weekly*, 2002). One of the purposes of China's "dragon head" enterprises is to disseminate information on chemical use and other production techniques to farmers, playing the role, in effect, of an agricultural extension service.

In addition, China also has a small organic food industry that has been mainly targeted at export markets but is starting to catch on domestically. The high labor requirements of organic farming make it well-suited to China, with its low-cost labor force. But widespread pollution, high pest infestations, and a long history of heavy chemical fertilizer and pesticide use make growing crops organically difficult in most areas of China.

Currency Appreciation

China's domestic fruit and vegetable prices and production costs are low when converted to U.S. dollars at the official exchange rate, but an appreciation of the Chinese currency would narrow China's price advantage on international markets. For example, in early February 2006, the average wholesale market price of Fuji Apples at Qingdao (the port at Qingdao accounts for

⁴The Chinese term *wu gong hai*, translated here as "pollution free," is variously translated as "no harm," "hazard free," or "safe."

about half of Chinese apple exports) was 3.8 yuan per kg. That price was equivalent to 47 cents per kg (in U.S. dollars) at the prevailing exchange rate of 8.1 Chinese yuan per dollar, and 40 percent less than the U.S. free-on-board export price for apples of about 80 cents per kg.

If the Chinese currency appreciated, Chinese exporters would receive fewer yuan for each dollar earned by exports. If the currency appreciated to 6 yuan per dollar, an exporter buying apples at the Qingdao price of 3.8 yuan per kg would have to sell them at 63 cents per kg to cover the cost of the apples. If Chinese exporters raised their price to 63 cents per kg, the differential between Chinese and U.S. apples would be narrowed to 20 percent.

Economists generally agree that the Chinese yuan is undervalued at the current exchange rate, but estimates of the magnitude vary widely, from 5 percent to 40 percent. China appreciated its currency by a modest 2 percent in July 2005 in response to strong pressure from trading partners, but China's trade surplus was virtually unaffected. Chinese authorities appear reluctant to allow further appreciation of the currency.⁵

While labor costs and fruit and vegetable prices are astoundingly low at the current exchange rate, other prices—for example, for land, grain, soybeans, and automobiles—are close to international prices. Consequently, the “true” value of the Chinese yuan is unknown and appreciation is highly controversial. The new currency regime allows the Chinese yuan to appreciate or depreciate within a narrow band each day, but the currency's value did not appreciate further in the second half of 2005.

If China's currency does eventually appreciate against the U.S. dollar, the growth in its exports of industrial goods as well as fruits and vegetables would slow. Currency appreciation would also reduce the price of imported commodities, making them more competitive in the Chinese market.

⁵The currency value is now determined by daily trading of an unspecified market basket of currencies traded by Chinese banks, but the value did not change significantly during the 6 months after the initial appreciation. China's central bank likely intervenes to prevent the value of the yuan from falling.

Conclusions and Trade Prospects

China, the world's largest producer and one of the world's top exporters of fruits and vegetables, has raised its profile in the global market since the 1990s, resulting in increasing challenges for U.S. fruit and vegetable industries. In addition to surpassing the United States in the import markets for apple juice in Japan and Canada, China has been the leading supplier of U.S. apple juice imports. China also has edged out the United States to become the leading supplier for fresh apple imports in the ASEAN region and for fresh vegetable imports in Japan and South Korea. Indeed, China has emerged as a serious competitor in many kinds of U.S. fruit and vegetable industries.

The challenge to the U. S. apple juice industry both at home and abroad from Chinese apple juice is expected to continue. State-of-the-art facilities and low-cost labor and raw materials enable Chinese processors to improve quality and keep prices competitive (USDA, September 2004). Challenges facing China's apple juice industry are that too-rapid export growth may result in safeguard measures by importing countries or that too few apples will be available for processing. Chinese processors are contracting more high-acid or "high-sour" apple varieties, which are more suitable for juice processing (USDA, May 2005). After the recent "sunset" review process, the USITC and the U.S. Department of Commerce announced in September an extension of the current antidumping duties on Chinese apple juice for another 5 years.

The strong pace of fresh apple exports from China is also expected to continue because quality is improving and prices are competitive (USDA, September 2004), particularly in the ASEAN market. The agreement between China and ASEAN to establish a comprehensive free trade area by 2010 bodes well for Chinese apple exports to the region. The United States has lost market share in fresh-market vegetables, notably in Japan and South Korea. Exports of fresh vegetables from China to these two markets have been bolstered by many factors, especially foreign investment by trading companies from these two countries. Attracted by China's low production costs and its geographic proximity, these companies have rushed to invest in China to provide seeds, spores, and techniques of production and packing and then to import the harvest back for retailers. Improved ocean freight service from major Chinese ports to these two countries has been another important factor.

However, China's looming threat to the U.S. industry is somewhat offset by high marketing costs, uneven quality, and chemical residues on Chinese fruits and vegetables. China still faces stiff challenges in improving the quality and safety of products, upgrading marketing and distribution infrastructure, and reducing marketing costs. China is making great strides to address all of these issues, but improving these weaknesses is a time-consuming process. In addition, the growth of the domestic market will absorb more of China's fruit and vegetable production, a factor that may slow the growth of Chinese exports. In the final analysis, China's rising global presence remains a longrun factor, and China's recent investments in the quality and marketing of its fruit and vegetable exports and in upgrading its port facilities point to increasing competition for U.S. fruit and vegetable industries.

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