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Investment in Processing Industry Turns Chinese Apples Into Juice Exports

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Abstract

In this report, ERS profiles the remarkable growth in China's apple juice concentrate exports since the 1990s and analyzes the factors behind the boom. Investment in the juice processing industry brought apples from China to the world market in the form of apple juice concentrate. The United States is the largest buyer, and concentrate from China now accounts for two-thirds of the U.S. apple juice supply. China's juice industry sustained its dramatic growth by expanding into the country's hinterland with support from officials eager to develop the poor northwestern region. In recent years, rising apple prices have begun to act as a brake on the industry's expansion, and the industry faces challenges in improving the quality of apples used for juice processing.

Keywords: China, apples, fruit, juice, agricultural exports, prices, investment

About the Authors

Fred Gale and Sophia Huang are agricultural economists, and Yingying Gu was an ERS intern when this report was written.

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Introduction

China has emerged as a major exporter of a wide range of food products (Huang and Gale; Lohmar et al.; Carter and Gunning-Trant). While China's competitive advantage in agricultural exports is often ascribed to its labor abundance, exports of its labor-intensive agricultural commodities are limited by the cost of shipping perishable products long distances and sanitary or phytosanitary concerns in overseas markets. Consequently, China's most internationally competitive commodities reach the world market as processed food products. Thus, capital investment in processing facilities is instrumental in bringing many of China's labor-intensive agricultural products to the world market.

In this report, ERS analyzes the emergence of China's apple juice concentrate (AJC) industry, a prime example of the nexus between capital investment and labor-intensive agricultural exports. A large expansion of orchard area made China the world's leading apple producer but also led to depressed prices in the 1990s. A combination of government, private, and foreign investment built a network of apple juice processing plants that turned apples into juice concentrate that could be exported, creating a new market opportunity for China's vast supply of apples. China is now the world's leading exporter of apple juice concentrate, and the United States is the largest buyer. Two-thirds of the U.S. apple juice supply now comes from China.

Since the 1990s, China's AJC exports have boomed, fueled by the country's vast supply of apples and investments in the industry. During the 2000s, the AJC industry sustained its dramatic growth by expanding into China's poor northwestern region in search of additional apples to use as raw materials. Chinese officials encouraged the expansion by "guiding" investment and recruiting apple growers.

China is likely to remain the world's leading supplier of AJC because no other country can match its raw material supply. Juice companies, however, still must compete with the fresh apple market for a limited supply of fruit. The industry's potential for further expansion may be constrained by its ability to acquire apples for processing. Rising apple prices may also act as a brake on the industry's expansion. Other challenges include the need to continuously improve the quality of apples used for juice processing.

China's Juice Gains Market Share

China first emerged as a significant exporter of apple juice concentrate in the late 1990s when it accounted for about 20 percent of world trade in AJC. Major exporters at that time included Poland, Germany, and other European Union countries, and Southern Hemisphere countries that supplied products during the Northern Hemisphere's off-season.

China's AJC exports grew at an astonishing rate, from under \$50 million in 1998/99 to a peak of \$1.4 billion in 2007/08. In 1999/2000, the value of exports more than doubled from the previous year and grew 20-40 percent annually until 2005/06. China's AJC export value then surged by \$400 million in 2006/07 and by over \$500 million in 2007/08. Exports fell by over 40 percent in 2008/09 due to declining orders and falling prices as a result of the global economic slowdown. China's AJC exports totaled \$770 million in 2008/09, down 40 percent from the previous year but still 60 percent higher than in 2005/06.

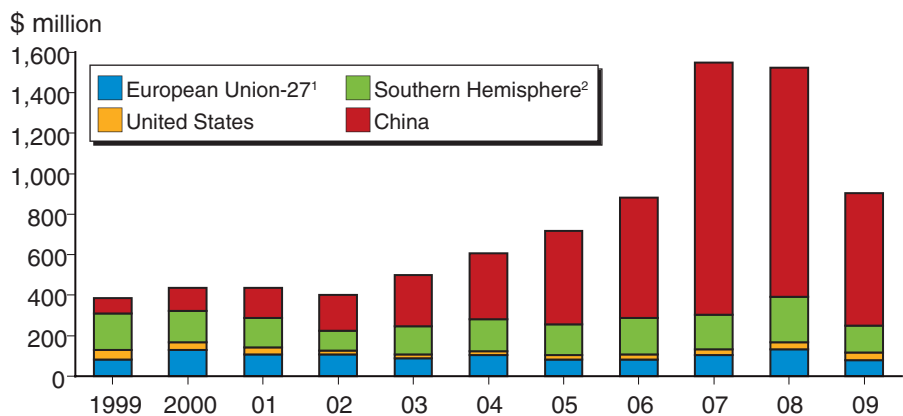
China's emergence on the market represented a fourfold increase in world AJC trade. Sales by traditional exporters in the Southern Hemisphere and Europe remained relatively stable as China's sales exploded (fig. 1).

The United States is the largest market for China's AJC exports. U.S. apple juice imports peaked at over \$600 million in calendar year 2008 and exceeded \$300 million in 2009. While China exported apple juice to about 60 countries during 2007-09, over 40 percent went to the United States, about 20 percent went to the European Union, and 10 percent went to Japan (fig. 2). Japan was China's main market for AJC exports in the 1990s, but the United States and Europe accounted for most of the growth after 1999.

An initial surge of Chinese AJC exports in the 1990s prompted the United States to levy antidumping duties against some Chinese apple juice suppliers

Figure 1

China is now the leading exporter of apple juice



¹External trade only; does not include trade between countries within the EU-27.

²Southern Hemisphere includes Argentina, Australia, Brazil, Chile, New Zealand, and South Africa. Data include Harmonized System codes 200970, 200971, and 200979.

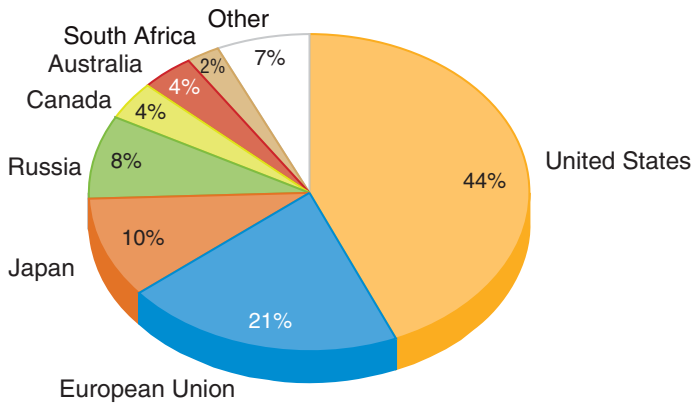
Source: USDA, Economic Research Service analysis of customs data from Global Trade Information Services, Inc.

in 1999, but the action did not prevent U.S. imports of Chinese juice products from growing dramatically (Carter and Gunning-Trant; Warner).¹ ERS estimates that imports from China accounted for about two-thirds of the U.S. apple juice supply by 2007/08 (fig. 3).

U.S. apple growers view China's AJC exports as a threat. U.S. apple industry leaders cite the rapidly rising volume and low cost of Chinese apple juice concentrate as the main force putting downward pressure on prices of juice and apples (Warner; U.S. Apple Association). At least one U.S. Senator has blamed "cheap Chinese apple juice concentrate imports" for harmful effects on U.S. apple farmers (Schumer).

¹Apple juice antidumping duties, effective in 2000, were waived for some Chinese companies in November 2002; other companies were assessed duties until February 2004. However, the antidumping duties order remained in place after the "sunset" review process in 2005 by the U.S. International Trade Commission and the U.S. Department of Commerce. The law requires that antidumping orders be reassessed every 5 years to ensure that they are still appropriate.

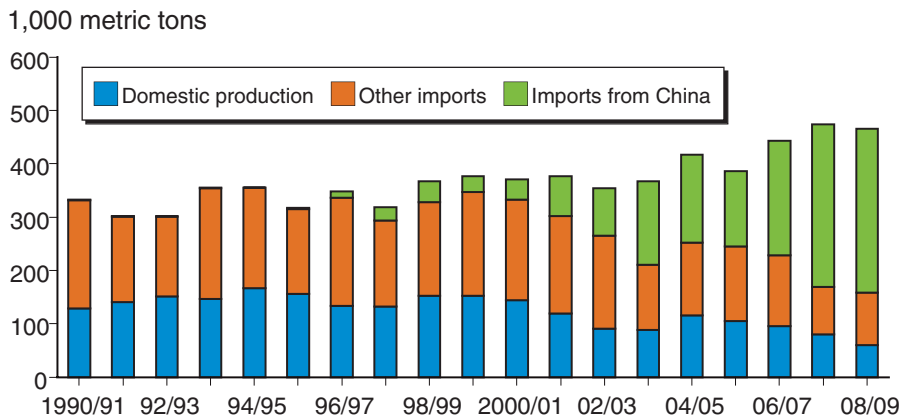
Figure 2
The United States is the largest market for China's apple juice exports



Note: Based on value of exports by destination during calendar years 2007-09 for Harmonized System codes 200971 and 200979.

Source: USDA, Economic Research Service analysis of customs data from Global Trade Information Services, Inc.

Figure 3
Imports from China now account for two-thirds of the U.S. apple juice supply



Note: Total imports and U.S. production from USDA supply and utilization estimates. Imports from China estimated based on China's share of import volume calculated from U.S. customs statistics. Market year is July-June.

Source: USDA, Economic Research Service estimates using data from USDA, Foreign Agricultural Service and Global Trade Information Services, Inc.

The effects of increased AJC imports from China are more complex than a simple one-for-one displacement of U.S. juice. Manufacturers use juice and other ingredients with different degrees of acidity, flavor, and seasonal availability from China, the United States, and other countries. Chinese AJC may replace concentrate imported from other countries. It is possible that the availability of low-cost concentrate from China facilitated an expansion of the juice industry that would not have occurred otherwise, possibly expanding demand for U.S. juice apples if Chinese and U.S. juice concentrate are mixed in fixed proportions.² Competition from Chinese AJC also pushed U.S. growers to make innovations to cut costs and satisfy consumer demand (Hefling).

On balance, the rise in imports from China appears to have displaced roughly equal amounts of apple juice from domestic and other imported sources, but it also facilitated a net increase in apple juice consumption in the United States. From 2000/01 to 2008/09, U.S. apple juice imports from China rose by a cumulative 270,000 metric tons (mt) (see fig. 3). During that period, the total U.S. apple juice supply from all sources (domestic production and imports) increased by 100,000 mt. The net expansion of the U.S. apple juice supply implies an increase in U.S. apple juice consumption because nearly all of the supply is consumed domestically.

Imports from China during the 2000s appear to have displaced a large volume of U.S. and other imported juice concentrate. The increase in imports from China (270,000 mt) far exceeded the cumulative increase in total supply (100,000 mt), which reflects a decline in apple juice supply from domestic sources of over 80,000 metric tons and a decline in imports from countries other than China (such as Chile, Argentina, Mexico, and the European Union) of about 90,000 metric tons.

²In a 1998 interview, a consumer beverage products company asserted that the abundant supply of foreign concentrate encouraged his company to buy more U.S. juice apples because the supply of raw materials allowed plants to operate at full capacity (Naegely).

Boom in China's Apple Production Encouraged Juice Exports

Abundant, inexpensive fresh apples are the key to China's competitive advantage in producing apple juice. China began boosting apple production in the early 1990s as farmers sought to grow commodities that would bring higher returns than traditional field crops. In the early 1990s, China and the United States produced a similar volume of apples, each accounting for nearly a fifth of world apple production. After two decades of growth, China produced about seven times as many apples as the United States in 2009/10 and now accounts for roughly half of world apple production (fig. 4).

Also during the 1990s, Chinese consumers diversified their diets to include more fruit, but not fast enough to absorb a fourfold increase in domestic apple production. Supply outpaced demand and pushed down Chinese apple prices. In 1991, the average farm price of apples in China was the equivalent of about \$.25 per kg, roughly one-half of the U.S. price (fig. 5). The price in China reached a low point of \$.10 per kg in 2000, about one-fourth of the U.S. price that year. Chinese apple prices began rising after 2003, coinciding with the juice export boom. The average reached \$.30 per kg in 2008—three times the price in 2000 but still about one-half the average U.S. price at the time.

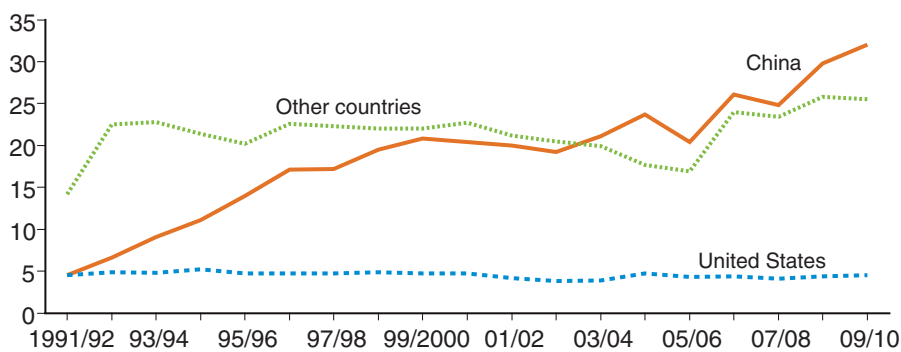
Depressed apple prices in the 1990s encouraged agricultural officials in China to look to juice exports as an outlet for the apple supply. Low apple prices also generated interest among juice processors; according to Chinese industry sources, each kilogram of juice concentrate requires about 7 kg of apples as raw material and apples constitute 60-70 percent of AJC production costs (China Juice Concentrate Net).

In China, few apples are grown specifically for juice processing. The AJC industry offers an outlet for the abundant supply of apples that are too small, misshapen, or off-color to sell on the fresh market and would otherwise be discarded or used as animal feed. Typically, 20-30 percent of an apple crop is below fresh-market standards. USDA estimates indicate that processing

Figure 4

China now produces about one-half of the world's apples

Million metric tons

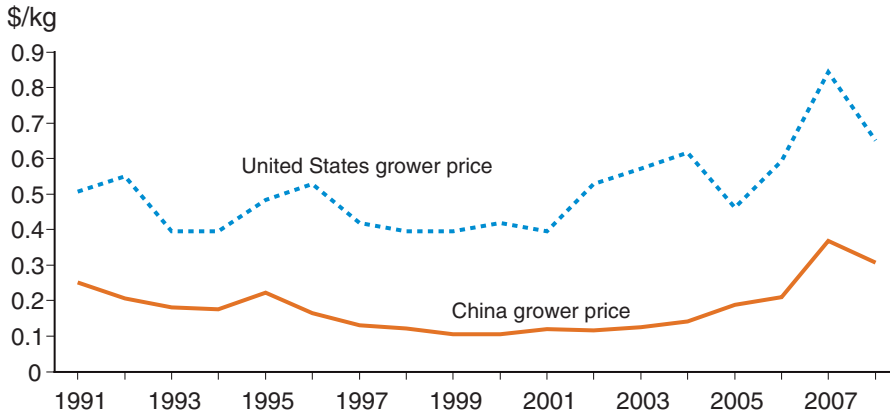


Note: Market year is July-June.

Source: USDA, Economic Research Service analysis of USDA, Foreign Agricultural Service data.

Figure 5

Low apple prices in China are key to juice competitiveness



Note: Prices are season averages for fresh apples. Prices for juice apples are lower than those for fresh apples but follow similar trends. China prices are average prices received by farmers converted to dollars at the official exchange rate.

Source: USDA, Economic Research Service analysis of data from China National Development and Reform Commission and USDA, National Agricultural Statistics Service.

accounted for only 5 percent of China’s apple use in the 1990s, but the share rose to 15-25 percent in recent years.³

Apples used for juice processing command a much lower price than those destined for the fresh market. For example, according to an article from *Economic Reference News*, the highest quality apples for export in Shandong Province in 2009 brought a price of 3.4 yuan/kg (in U.S. dollars, 50 cents/kg). Lower quality fruit for the domestic fresh market was quoted at about half that price, 1.6 to 1.8 yuan/kg (24-26 cents/kg). “Defective” or “fallen” fruit sold for juice processing brought much lower prices of .2 yuan or less (3 cents/kg or less). A farmer quoted in the article claimed that many traders come to the province to buy defective or fallen apples. “Even rotten fruit picked up off the ground can be sold,” he said, “but the price is low” (*Economic Reference News*).

China’s exports of both fresh apples and AJC have grown sharply since the 1990s (fig. 6). The value of exports of fresh apples and AJC combined was roughly \$100 million per year in the 1990s and rose to a peak value of \$2 billion in 2007/08. The combined total was \$1.47 billion in 2008/09. In most years, the export value from fresh apples and AJC were similar as exports of both products grew rapidly.

AJC exports are now consuming a substantial share of China’s apple crop. ERS derived estimates of the volume of apples required to produce AJC for export by multiplying the volume of AJC exports each year by the ratio of 7 kg apples required to produce 1 kg of AJC.⁴ Based on these calculations, China exported the equivalent of 30 percent of its apple crop during the peak export year of 2007/08—26 percent for AJC and 4 percent for fresh apples (fig. 7). The exported share fell to a combined 20 percent of the apple crop in 2008/09 when the global economic slowdown reduced international demand for juice. Still, this amount far exceeded the 2 percent of China’s apple crop exported in 1995/96, which was split equally between exports of fresh fruit and apples used for exported juice.

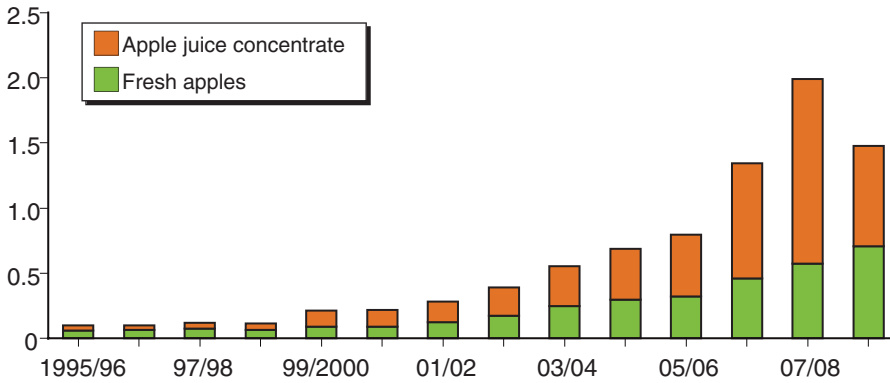
³The processed share of apple use is 35 percent in the United States and exceeds 50 percent in many European countries.

⁴A number of industry sources (for example, China Juice Concentrate Net) report a 7:1 ratio of apples to juice concentrate.

Figure 6

Combined value of fresh apple and juice exports reached \$2 billion in 2007/08

Billion dollars



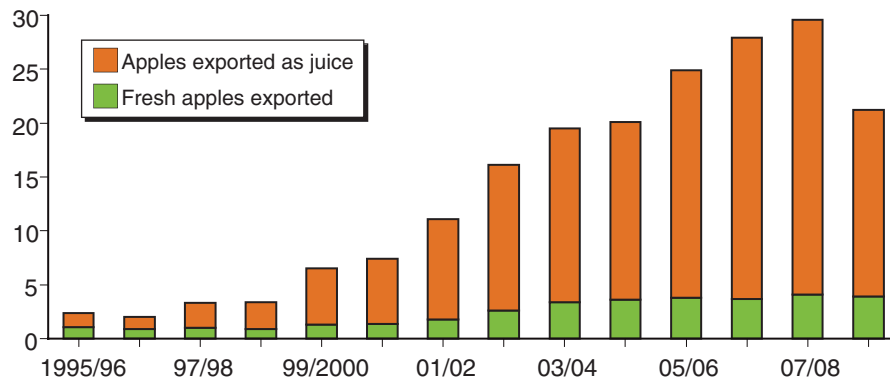
Note: Fresh apples include Harmonized System (HS) code 080810. Apple juice concentrate includes HS codes 200970, 200971, and 200979. Market year is July-June.

Source: USDA, Economic Research Service analysis of China customs statistics accessed through Global Trade Information Systems, Inc.

Figure 7

China's apple juice exports now consume a large share of its apple production

Percent



Note: Figure shows ratio of apples exported to apple production. Apples exported as juice estimated based on a ratio of 7 kg of apples required for 1 kg of apple juice concentrate. Market year is July-June.

Source: USDA, Economic Research Service estimates using data from China customs statistics and USDA Production, Supply, and Distribution database.

Behind the Boom: Expansion of Processing Capacity

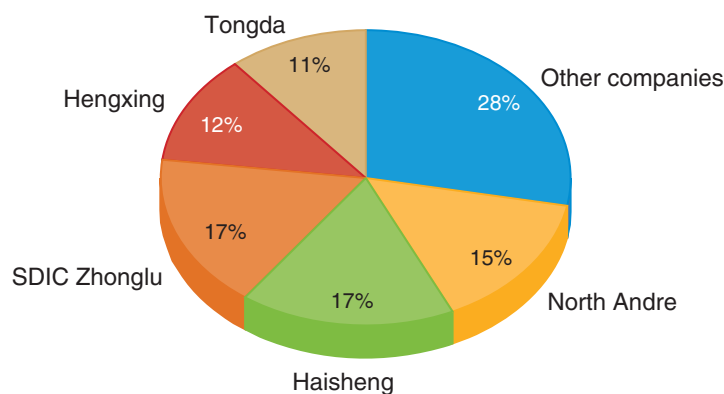
The transformation of apples into juice cannot take place without investments in processing plants and equipment. Thus, capital investment in processing capacity has been instrumental to the boom in China's apple juice exports. Apple growing is a labor-intensive process conducted by an estimated 10 million small farmers who have little education and minimal financial resources (China Ministry of Agriculture). Apple juice processing is a capital-intensive activity carried out by a few dozen companies that buy apples from farmers (through traders, brokers, cooperatives, or other intermediaries), crush them to make juice concentrate, and sell AJC mainly to large multinational companies as raw material for consumer products sold overseas. China's processing companies export over 90 percent of the AJC they manufacture.

Five companies account for over 70 percent of China's AJC exports (fig. 8). The two leading exporters—SDIC Zhonglu Fruit Juice Co., Ltd. and Haisheng Group—each account for about 17 percent of exports. The other three leading companies have slightly smaller shares, and the remaining share is split among dozens of smaller companies.

Since the 1990s, the industry has expanded rapidly through a diverse mix of government, private, and foreign investment, loans from Chinese banks, and infusions of capital from stock market listings in China, Hong Kong, and overseas. The five major juice concentrate producers are conglomerates with diverse holdings that include regional subsidiary juice companies as well as businesses unrelated to apple juice.

China's apple juice industry was small and stagnant until 1992, when Japan's Mitsubishi Company formed a joint venture with a Chinese government investment company to set up a juice company in Shandong Province. The venture, SDIC Zhonglu Co., was China's first modern juice-processing company and began exporting AJC to Japan in the 1990s.

Figure 8
Five companies account for about 70 percent of China's apple juice exports



Source: USDA, Economic Research Service using Liu, Qian, *Review of 2008 Apple Juice Concentrate Industry and 2009 Outlook*, unpublished industry analysis report, March 23, 2009.

After the initial success of SDIC Zhonglu, a second wave of major companies were set up in 1996-97 and expanded rapidly. North Andre Fruit Juice Co., Ltd., founded in 1996, is also based in Shandong's main apple-producing area (Yantai City), but it now owns nine juice processing plants in five provinces. North Andre's initial owners were a diverse group of companies engaged in the fruit business, afforestation projects, and the supply of construction materials. Two other leading juice companies, Hengxin Fruit Juice Co., LTD. and Haisheng, were founded in 1996-97 in Shaanxi Province, another apple-producing region. Like Zhonglu, Hengxin was set up as a joint venture with a 51-percent controlling interest held by a Singapore company (QAF). Haisheng is a holding company registered in the Cayman Islands with shares owned by a diverse group that includes individual Chinese investors, another Chinese holding company, and the U.S. investment bank Goldman Sachs. The Haisheng group consists of local fruit juice subsidiaries, an investment company, and a U.S. sales branch.

Another wave of investment flowed into the industry in the first half of the 2000s. In 2002, Tongda Fruit Juice and Beverage Co. Ltd., the fifth-leading AJC company, was established. North Andre was listed on the Hong Kong Stock exchange in 2003, giving it access to more capital. In 2004, Zhonglu raised funds through an initial public offering in China. Most of the investment at this stage was domestic, but foreign investment also played a role. Goldman Sachs acquired a passive 20-percent ownership stake in Haisheng in 2005, and the International Finance Corporation (the investment arm of the World Bank) made investments in North Andre to help the company expand its operations.

The industry expanded rapidly as each company sought to maximize its share of a growing market. Companies built new production lines and acquired smaller companies. According to industry reports, China's apple juice concentrate production capacity rose from about 3,000 mt per year in the 1980s to 20,000 mt in 1995. As new companies entered and expanded, capacity shot up to 370,000 mt in 2001, and it expanded 44 percent in 2004/05 alone (Chen). Recent industry reports indicate that capacity now far exceeds export demand (China Juice Concentrate Net).

Until the late 2000s, China's juice industry was segmented between the export-oriented "upstream" AJC processors described in this section and a different set of "downstream" companies, including Huiyuan, Coca Cola, and President, that serve the domestic consumer beverage market. More recently, with heated competition and maturation of the domestic market, some AJC companies have sought to forward-integrate into beverage products. Consumer beverage companies have begun backward-integrating by forming joint ventures with processors or developing their own supply networks. The Huiyuan Co. has begun a strategy of contracting with "production bases" of farmers who can supply fruit as raw materials. Also in 2009, COFCO, a large state-owned food company, signed an agreement with authorities in Xinjiang Autonomous Region to invest 2 billion yuan (\$290 million) over 5 years in fruit production and processing and marketing of juice and other fruit products.

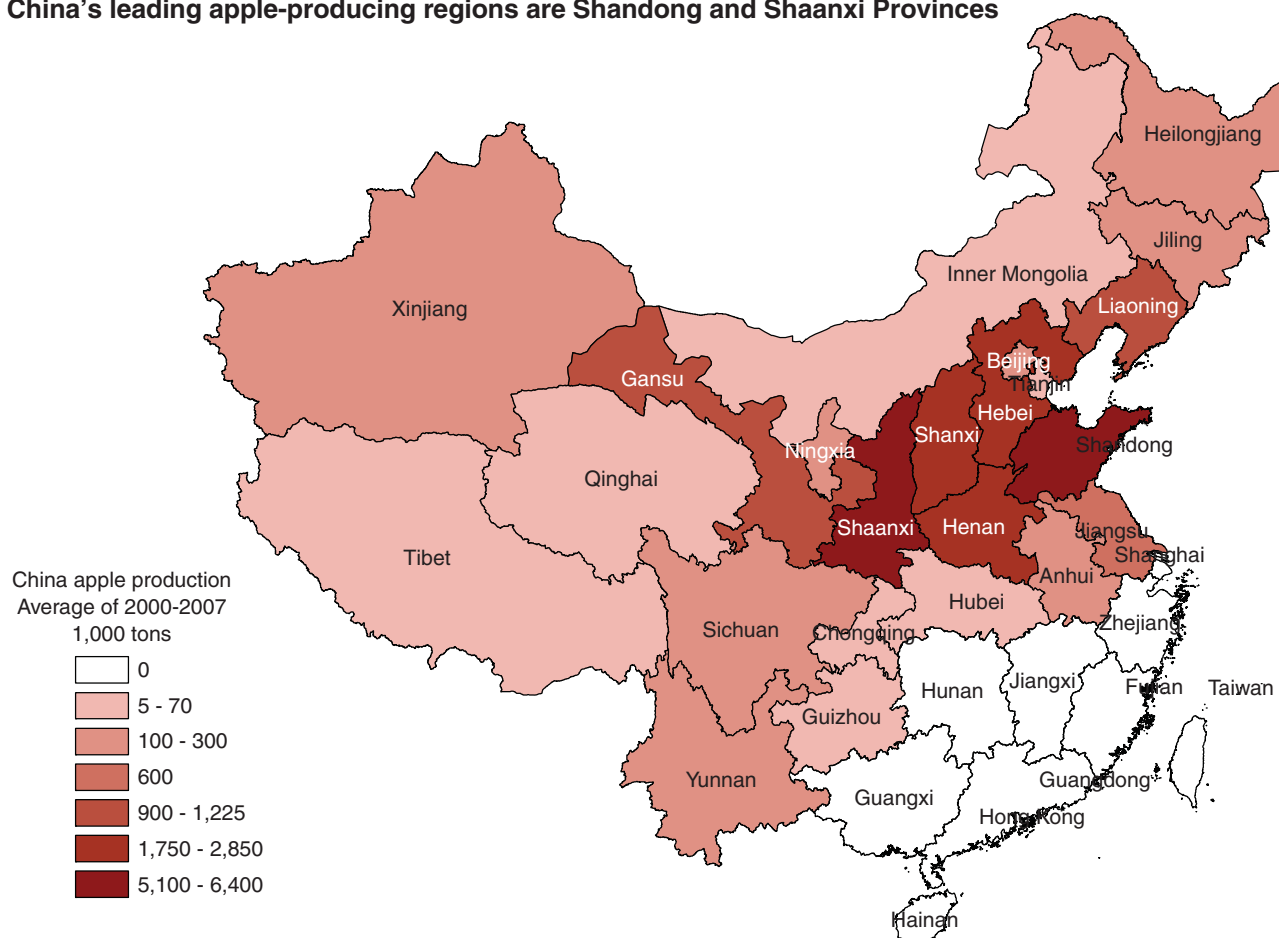
Regional Shift to the Northwest

Geography is an important factor in the development of the juice industry. Apple juice production is located mainly in China's two main apple-producing regions: the Bohai Gulf region (Shandong, Liaoning, and Hebei Provinces) and the Loess Plateau region (Shaanxi, northwestern Henan, southwestern Shanxi, and parts of Gansu and Ningxia Provinces) (fig. 9).⁵ The government's strategic plans for the apple industry call for concentrating production in these two regions based on their temperature, rainfall, and soil type.

The Bohai Gulf region is on China's east coast, where easy access to Japan and South Korea encouraged the initial round of apple juice investment and trade in the 1990s. But further expansion in that region was constrained by scarcity of land and labor due to the rapid development in both agriculture and industry in eastern China. Recent growth in apple production is mostly in the northwestern provinces of the Loess Plateau region. Studies of climate and soils show that this region has excellent conditions for growing apples. Farmers and officials in the Loess Plateau are encouraged by the potential positive effects that apple production may have on the local economy, particularly as industrial development in the region has been slow and few other crops grow well due to the region's arid climate and hilly topography.

⁵Note: "Shaanxi" and "Shanxi" are different provinces with similar names.

Figure 9
China's leading apple-producing regions are Shandong and Shaanxi Provinces



Source: USDA. Economic Research Service analysis of data from China National Bureau of Statistics.

The Loess Plateau region accounted for most of the increase in China’s apple production between 2000 and 2008. Shaanxi’s production nearly doubled during 2000–2008, and its apple output is now comparable to that of Shandong, traditionally the leading apple-growing province.⁶ Over the same period, production also increased substantially in Henan, Gansu, and Shanxi (fig. 10).

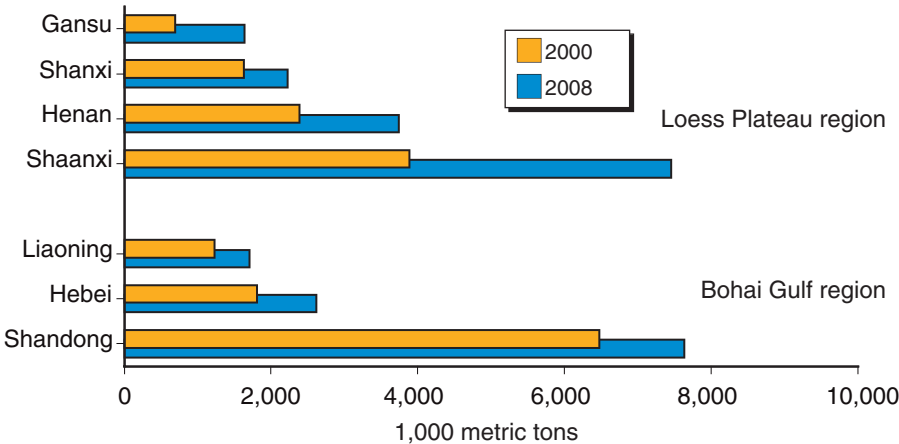
⁶Preliminary reports say that Shaanxi’s output surpassed Shandong’s in 2009.

Analysis of Chinese customs statistics by region shows that most of China’s apple juice exports come from a belt of counties in the Loess Plateau and eastern Shandong and Liaoning Provinces, which reflects the geographic concentration of processing investment (fig. 11). Tabulations of customs data for calendar year 2009 show that two-thirds of China’s apple juice exports came from provinces in the Loess Plateau region. The leading exporter was Shaanxi Province (43 percent of exports). Other Loess Plateau provinces supplying juice to the international market included Henan (10 percent of exports, mostly from the western part of the province), Shanxi (7 percent), Gansu (6 percent), and Ningxia (1 percent). Provinces in the Bohai Gulf region—Shandong (25 percent of exports) and Liaoning (6 percent)—accounted for 31 percent of apple juice exports.

ERS estimates that Shaanxi’s juice exports required over 2.3 million metric tons of apples as raw materials (table 1), equivalent to over one-fourth of the province’s apple harvest in 2009. Shaanxi also was China’s second-leading source of fresh apple exports, but the province’s fresh apple exports were only about one-tenth of the quantity used to produce its juice exports. Henan and Shanxi exported few fresh apples. The volume of apples required for Gansu’s juice exports was equivalent to nearly 10 times the volume of its fresh apple exports.

Most of China’s fresh apple exports come from the Bohai region, but this region also uses more apples for juice exports than for fresh exports. Shandong is the leading source of fresh apple exports—Shandong exports twice as many apples as Shaanxi—but Shandong’s apple use for juice exports is more than double the amount of fresh apples it exports.

Figure 10
The Loess Plateau region accounted for most of the increase in China’s apple production in 2000-2008



Source: USDA, Economic Research Service using data from China National Bureau of Statistics.

Table 1

Estimated apples for juice and fresh exports, 2009

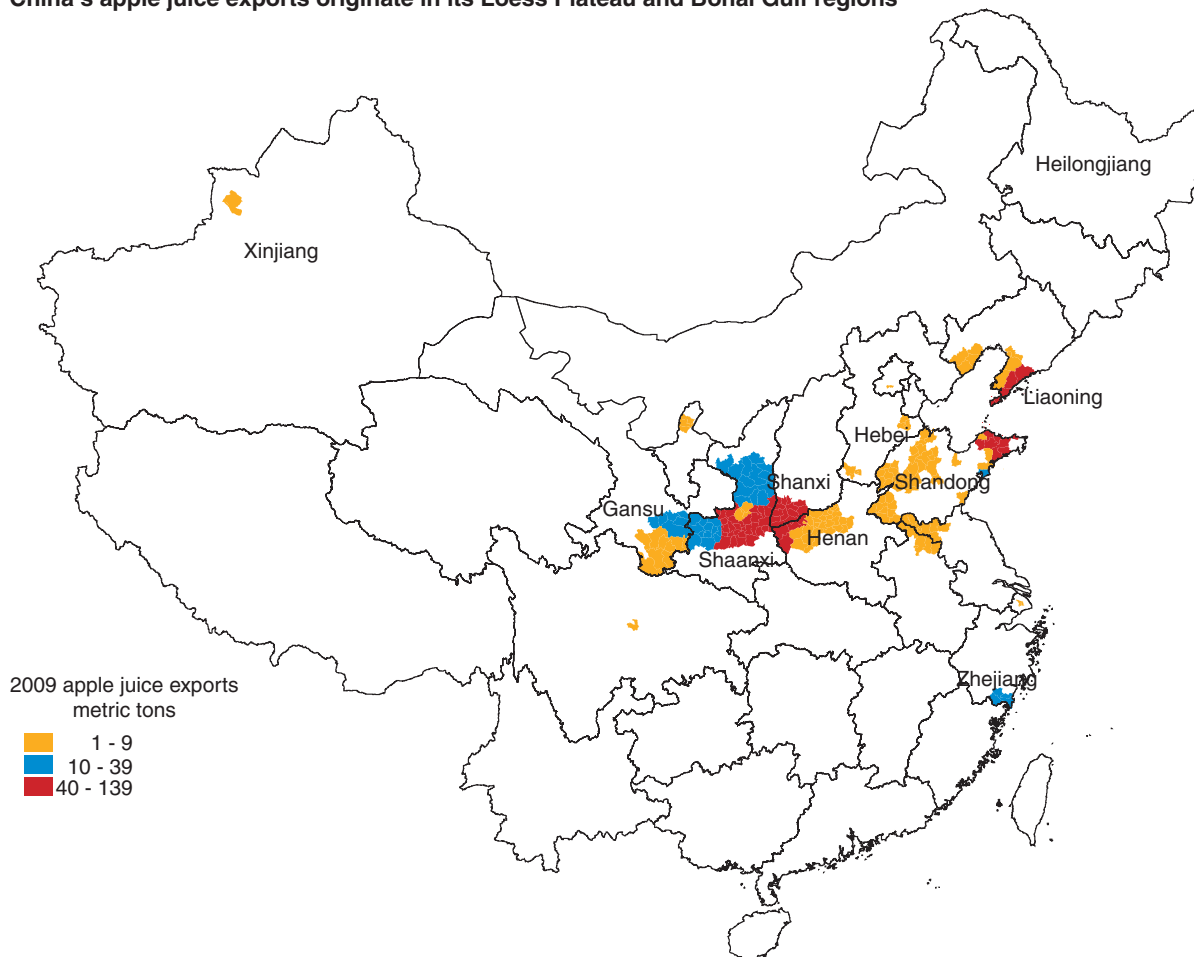
Province	Apples exported as:	
	Apple juice	Fresh apples
<i>1,000 metric tons</i>		
Northwest:		
Shaanxi	2,377	221
Henan	542	<10
Shanxi	399	<10
Gansu	350	36
Bohai Gulf:		
Shandong	1,373	549
Liaoning	344	75
Hebei	<10	16
Other regions:		
Xinjiang	<10	90
Heilongjiang	0	83
Other provinces	186	93

Note: Based on customs statistics by source of exports. Apples for juice exports reflects estimate of fruit required as raw material to produce quantity of apple juice exported. Calculated assuming 7:1 ratio of apples to juice. Data are for calendar year.

Source: USDA, Economic Research Service estimates based on China customs statistics accessed through Global Trade Information Services.

Figure 11

China's apple juice exports originate in its Loess Plateau and Bohai Gulf regions



Note: Based on tabulation of exported quantity of apple juice (Harmonized System codes 200979 and 200971) during 2009 reported by multicounty regions under the administration of cities.

Source: USDA, Economic Research Service using data from China customs statistics accessed through Global Trade Information Services.

Government Support To “Develop the West”

Government support played a role in promoting the northwestern region’s apple juice industry development. In 2000, the Chinese government formally launched a “Develop the West” (*Xibu Da Kaifa*) program to steer investment to the less-developed western provinces, including the Loess Plateau (Ma and Summers). The program includes direct government investment, financial transfers to western provincial governments, and such measures as subsidized loans, tax breaks, and access to infrastructure projects to “guide” private investment to western provinces.

The strategy emphasizes developing industries based on local resources (“industries with special characteristics”). The Ministry of Agriculture issued a set of strategic plans (“advantaged regional layout plans”) that identified apples as one of China’s most internationally competitive crops and called for concentrating production in the most efficient production regions, including the northwestern provinces.⁷ In 2006, the Ministry of Commerce formulated a plan for promoting agricultural exports that encouraged companies to develop “export bases” in inland areas.

According to news articles and documents, investment in the apple and apple juice industries was encouraged as part of the Develop the West initiative. Shaanxi Province cites the quadrupling of apple juice concentrate exports as one of the initiative’s achievements. Other news articles point to North Andre’s expansion into northwestern provinces as an expression of support for Develop the West (Fuquan Zhao). IFC describes its investment in North Andre’s ventures in the northwest as motivated by poverty alleviation.

Shaanxi’s third-largest apple juice company, Tongda Group, was explicitly set up as part of the Develop the West program.⁸ Tongda was established with investment by Shenzhen Eastern Development Group, a real estate conglomerate based in Shenzhen, China’s most wealthy city, which is engaged primarily in businesses unrelated to apple juice (construction of housing projects, hotels, shopping malls, and infrastructure). The Tongda Group website highlights the contributions it has made to improving the welfare of apple farmers in several remote counties of Shaanxi, Gansu, and Ningxia Provinces. The Tongda website also includes a paragraph describing the company’s contract to construct a sewage treatment plant for a county government in Gansu Province, and the parent company’s web site mentions that the company built a shopping mall in Xian, the capital of Shaanxi.

Provincial and local governments have supported the industry’s growth in the northwest by working with local officials to recruit apple growers, disseminating new technologies and apple varieties, building breeding centers and infrastructure, assisting farmers and companies in adopting safety standards, arranging bank loans, giving tax breaks, awarding food safety certifications, and setting up market information networks. In 2000, Shaanxi province officials issued a document promoting the fruit industry—especially apples for processing—as an engine of rural economic development. Shaanxi was the first province to establish a Fruit Industry Bureau, and provincial officials formulated a plan to expand apple production more than 50 percent by 2012 (*Invest in Shaanxi*; Guangfei Zhao). Local branches of China’s inspection and

⁷Plans for selected commodities and provinces were formulated for 2003-07 (China Ministry of Agriculture Development Plan Office). A similar set of plans for apples and other commodities were formulated for 2008-15.

⁸The website of the Tongda subsidiary in Shaanxi’s Liqian County introduces the company as follows: (author’s translation) “Tongda Liqian Fruit Juice LLC...was founded in November 2001 with investment of 78 million yuan from the Shenzhen City Eastern Development Group to implement the central party/government’s western development process.” <http://www.86xc.com/369024.html>

quarantine bureaus assist processing plants and farmers in attaining certifications and registrations needed to make sales in overseas markets (Sanmenxia Municipal Government).

Integrating juice companies with small farmers is part of the government's development strategy. Shaanxi's development plan was to "follow the large company development road" by cultivating "dragon head enterprises" that lead farmers into the market (China Ministry of Agriculture Development Plan Office, pp. 386-87). Dragon head enterprises (the term is sometimes translated as "leading" or "flagship" enterprises) are companies identified by central, provincial, or local governments as having potential to help farmers by providing them with a market for their products and disseminating technical information. In return, companies receive tax breaks, preferential bank loans, access to land, assistance raising capital, and government help meeting export standards. An official of the Shaanxi Fruit Industry Bureau identified dragon head enterprises as the key players in the fruit industry and listed support measures that included low-interest loans, subsidies for storage and cold-chain facilities, and export incentives such as value added tax rebates for exports (*Invest in Shaanxi*).

Government officials sometimes act as intermediaries by introducing overseas customers or arranging trade shows. Shaanxi's industry plan called for local juice companies to unite with farmers to sell in the international market. A similar plan for Henan Province called for government investment of 20 million yuan for building five model refrigerated apple storage facilities and 40 million yuan for building four model juice factories. China's Export-Import Bank earmarked special loans to help Shaanxi juice companies with cash flow because farmers want to be paid in cash (Tie).

Prices on the Rise

After more than a decade of rapid growth in China's juice industry, competition to procure China's apple supply has intensified. The price of apples is rising, and concerns have been raised about the quality of the apples themselves. A trend toward higher prices that began in 2004 was punctuated by an unusual spike in juice and apple prices in late 2007. Recent industry reports indicate that the limited supply of juice apples prevents processors from fully utilizing capacity.

The average unit value of Chinese apple juice exports—a proxy for the price of juice exports—rose from a low point of about 60 cents per kilogram in 2003 to about \$1 per kg in 2007 (fig. 12). In late 2007, the unit value shot up as high as \$2 per kg as a poor apple harvest in Europe tightened world juice supplies at a time when most commodity prices were rising. With a surge of orders for Chinese AJC, panic buying of apples pushed the price of 7 kg of juice apples (the amount needed for 1 kg of juice) to as high as \$1.70 in late 2007.⁹ By comparison, the wholesale market price of apples (which reflects domestic fresh market prices) did not display any unusual increase during this period, suggesting that the panic-buying phenomenon was confined to the juice-apple market.

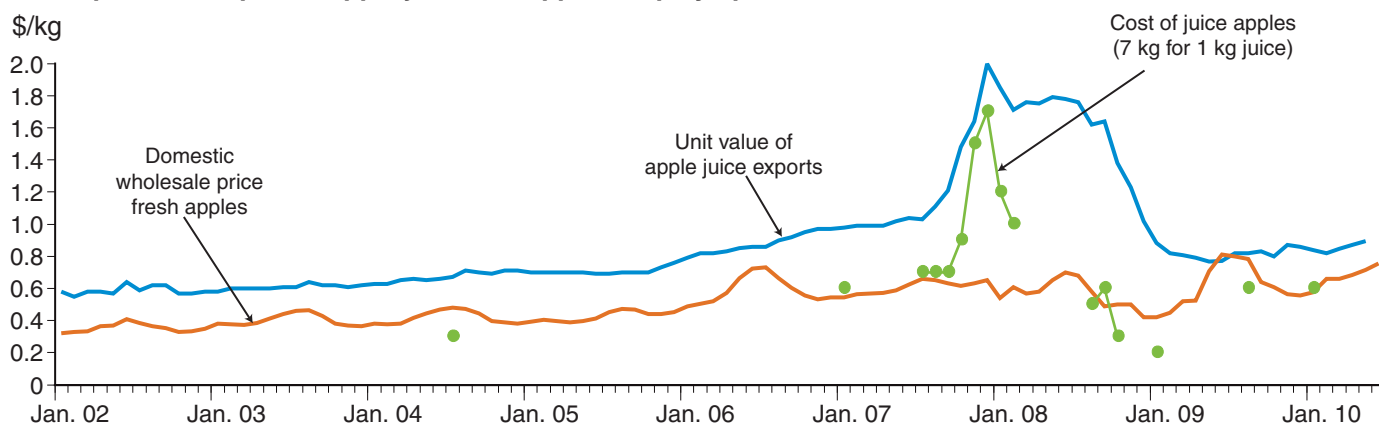
The surge in juice prices ended abruptly in 2008 when China's apple harvest surpassed expectations, the world economy began to slow, export orders plummeted, and many juice processors idled their plants. Prices for exported juice and juice apples dropped in late 2008. Industry news reports recounted piles of unsold apples in villages and warehouses in 2008 (Li et al.; Nongbo Net, 2009; Wang). The wholesale apple price also dipped in late 2008, another reflection of the slowdown in the general economy.

After the boom and bust had run its course, prices settled at a level similar to their pre-boom values. In the latter half of 2009, the unit value of juice

⁹Chinese pork, vegetable oil, and dairy prices also increased sharply during this period.

Figure 12

China prices of exported apple juice and apples display upward trend



Note: Unit value of apple juice exports is ratio of value of exports to volume. Cost of juice apples is based on requirement of 7 kg of apples for 1 kg of juice; prices gathered from news reports. Domestic wholesale price of fresh apples is average price in farm production areas; reflects averages mainly for apples sold for fresh consumption. China data converted to U.S. dollars using official exchange rate.

Source: USDA, Economic Research Service analysis of data from China customs statistics, China National Bureau of Statistics, and industry news reports.

exports was roughly \$.80 per kg, lower than the \$1-per-kg value preceding the boom in 2007 but about one-third higher than the average in 2002-03. The cost of juice apples dropped as low as \$.20 per kg in 2009 but recovered to \$.60 in early 2010, similar to the pre-boom level and well above the 2004 value. The wholesale price of apples also rose to about \$.70 per kg in 2010, about double the average price in 2002-03.

Addressing Quality and Safety Issues

The supply of raw materials is also a major determinant of the quality and safety of juice concentrate. A weakness of Chinese juice in the international market is its low acidity, which reflects the predominance of sweet apple varieties like Fuji and Guoguang used as raw material. Sweet juice from China must be mixed with other juices and ingredients to make final products with high acidity demanded by consumer markets in North America and Europe.

A number of industry representatives in China have voiced concerns over the lack of high-acid apples. In Shaanxi Province, high-acid varieties account for less than 10 percent of apple area, and juice processors there procured less than half the volume of high-acid apples needed to fulfill their contracted juice sales in 2005 (*Economic Reference News*; Xuetao Liu). Lacking options, processors use sweet apple varieties intended for the fresh market that yield juice with low acidity; the resulting juice concentrate may sell at a 40-percent discount or be rejected by customers (*Economic Reference News*). An industry expert quoted in another article described the lack of high-acid apples as a bottleneck for the industry's growth (Nongbo Net, 2009).

While the price for apples purchased by juice companies has been rising, apples sold for the fresh market still sell for higher prices. Consequently, the expansion of high-acid apple plantings has been slow because farmers prefer to grow sweet varieties that can be sold on the fresh market. Some companies and officials are promoting planting of orchards of high-acid apple varieties specifically for use in juice processing (Nongbo Net, undated) and the government's strategic plan for the apple industry encouraged production of these varieties (China Ministry of Agriculture). However, farmers are reluctant to plant apples primarily for juice processing. Juice processors use predominantly defective or fallen fruit intended for the fresh market. While pasteurization kills bacteria, Chinese industry experts warn that use of poor quality fruit can yield juice with a brown color or poor taste, or juice with high levels of patulin (a mycotoxin produced by molds) that is rejected by buyers (*Economic Reference News*; Yue Cui).

Some U.S. consumers voice concerns over potential food safety risks of juice from China (Robinson-Jacobs), but to date there have been no food safety incidents involving Chinese juice (CCCFNA; Gale and Buzby) despite the low quality of fruit used as raw materials. Manufacturers and officials in China closely monitor overseas safety standards because over 90 percent of their products are exported. Processing plants use high-quality imported processing equipment and quality management systems required by overseas customers. Chinese universities have also been active in developing methods to detect and eliminate potentially harmful pesticide residues and toxins from apple juice and implementing traceability and recall systems (Pu et al.) Overseas industrial customers carry out third-party audits and conduct their own testing of juice products as well.

Aware of the risks and potential negative consequences of food safety incidents, Chinese officials have been on guard against food safety problems. In 2007, China's National Native Produce and Animal By-products Import and Export Association (an arm of the Foreign Trade Ministry) convened

a meeting where representatives of major companies signed a pledge that they would adhere to good food safety practices throughout the supply chain (CCCCFNA). The meeting followed the appearance of an article in the Chinese press alleging that one company processed rotten apples to manufacture juice. The document included a pledge to "...resist diseased and rotten fruit" (Yue Cui).

Concerns about chemical residues and adulteration of juice apples are reflected in an article reporting an inspection of apple-growing and juice-processing areas in Shaanxi Province (Zhou and Guan). The authors recommended that local officials train farmers with emphasis on the slogan "don't sell inferior [fruit]; don't adulterate." The authors also urged police to crack down on rogue apple merchants, and local governments were urged to send technical advisors to help farmers apply pesticide and fertilizer and carry out strict inspections of farm input dealers to "prevent fake pesticides and fertilizer from entering orchards."

China's inspection and quarantine authority (AQSIQ) and its provincial and local branches (known as CIQs) test and monitor exported products but are also engaged in helping companies and orchards meet overseas standards. Companies are expected to adopt measures to ensure their products meet overseas standards, but CIQs inspect facilities and test products prior to export. CIQs advise exporting companies about standards on foreign markets, inspect the layout of new or refurbished facilities, inspect orchards that supply fruit, and help companies implement quality management systems required by overseas customers (Henan MOFCOM; Sanmenxia Municipal Government; Shaanxi CIQ).

The articles about CIQ activities report that pesticide residues on China's apples are a longstanding concern for exporters of fresh-market apples and juice. In 2007, the CIQs in Henan and Shaanxi conducted pesticide surveys, required companies to implement remediation measures, and set testing procedures and thresholds for exports to various countries. The Henan articles report that no juice export shipments had been rejected since the program was implemented, but they also report that CIQ testing rejected 2 of 58 apple juice concentrate shipments bound for the United States in 2008 for pesticide residues that exceeded tolerances.¹⁰

Quality and safety strategies call for closer links in the supply chain and adoption of production standards in orchards. Shaanxi's CIQ encouraged juice processors to adopt a "company + production base + standard" supply chain that implies fixed supply relationships with groups of apple farmers that follow the company's standards. The CIQ in western Henan executed an agreement with the municipal government to establish 121 new orchards that employ recordkeeping to facilitate traceability systems for apples used in exported juice. Shaanxi CIQ carried out pilot programs to implement Good Agricultural Practices (GAP) and organic production in apple orchards.

The Henan MOFCOM article emphasizes investments in testing and detection capabilities. A local laboratory was accredited by the national accreditation agency and the CIQ in 2008, and newly imported U.S. testing equipment expanded the number of detectible pesticides to 100. The local laboratory

¹⁰Presumably, the rejected shipments were not exported.

began testing juice shipments for melamine adulteration in 2008 and found no traces in 19 samples of fruit juice.

The article also illustrates how CIQs serve as an intermediary to apprise exporters of international standards. After the CIQ in western Henan learned of a new U.S. FDA import alert about heavy metals (arsenic and lead) in grape and pear juice in March 2009, it gathered information about maximum tolerances, informed exporting companies, and required them to implement internal controls and test products. The CIQ also carried out its own testing of export shipments. It reported that none of the samples tested exceeded tolerances.

Conclusion

China will likely continue as the world's leading apple juice concentrate exporter. With China accounting for about half of the world's apple production, it is unlikely that any other country could match China's supply of raw materials. Chinese officials plan further expansion. Shaanxi Province set a target to expand apple production to 10 mmt by 2012 (*Invest in Shaanxi*), up from 8 mmt in 2009. As earlier, officials in western Henan Province launched a project to set up 121 new orchards totaling over 40,000 acres in 2009 (Henan MOFCOM). However, further expansion will require pushing apple production into marginal production areas.

While China's industry supplies a large share of the world's apple juice concentrate, the industry's reliance on price for its competitive position leaves it in a tenuous long-term standing (Li et al.). Chinese juice suppliers have not developed strong brands or consumer product lines, and the industry is predominantly a supplier of low-cost generic ingredients to multinational consumer product companies. This leaves the Chinese industry vulnerable to wide swings in demand resulting from the purchase decisions of price-sensitive downstream users (Chen). The sudden boom in demand for Chinese juice followed by a sharp reversal during 2007-08 illustrates the vulnerability of the industry to shifts in demand for its product. Juice from China competes with apple juice from other countries and other types of juice and ingredients, and it may be affected by swings in consumer preferences toward nonjuice beverages.

Appreciation of China's currency may also affect the cost of China's apple juice exports. For example, if the exchange rate of 6.83 Chinese yuan per dollar that prevailed during 2008-10 appreciated 10 percent to 6.15, the cost of 7 metric tons of juice apples costing 4,200 yuan would rise from the equivalent of \$615 to \$683.¹¹ Industry reports from China cited currency appreciation as a factor affecting industry competitiveness when the Chinese yuan appreciated roughly 21 percent during 2005-08, yet China's juice exports soared during that period. China's retail prices of fresh-market apples and other foods are far below U.S. prices when converted to U.S. dollars (Gale and Tuan).

This analysis of the apple juice industry reveals the nexus between small-scale farmers, food industry investors, and government officials behind China's emergence as an exporter of agricultural products. The rise of the apple juice industry illustrates the mobilization of investment from a combination of private companies, central and local government, and foreign investors to utilize agricultural raw materials to build an industry and acquire a large share of the world market in a remarkably short time. Procuring raw materials from small farmers in China's hinterland to supply ingredients to multinational food and beverage companies presents many challenges in coordinating the volume and quality of raw material supplies with demand from the global market.

Other industries, like corn-based industrial products (Gale et al.) and dairy products (Fuller et al.; Gale and Hu), carried out similar rapid expansions driven by investment in industrial processing of agricultural commodities. Most of these industries meet emerging demand by Chinese consumers (for

¹¹Chinese authorities have indicated a preference for a gradual appreciation of the currency. A 10-percent appreciation might occur over the course of a year or more.

example, dairy products), but many produce goods for export (for example, citric acid produced using corn as a raw material).¹² As China's infrastructure construction and western development campaign push agricultural industrialization deeper into its hinterland, some of the country's other food exports, such as tomato paste, canned mandarins, canned pears and pear juice, and dates, are emerging on the world market following a path similar to that of China's apple juice industry.

¹²Apple juice concentrate is an unusually export-oriented sector—Chinese consumers traditionally do not consume fruit juices, and over 90 percent of the industry's products are exported. While fruit juice consumption is rising in China, orange juice accounts for most of the increase.

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