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## IDE DISCUSSION PAPER No. 201

### Structural Changes in Asparagus Production and Exports from Peru\*

Tatsuya SHIMIZU\*\*

May 2009

#### **Abstract**

Asparagus is the star product among non-traditional agricultural exports (NTAXs) in Peru. The export of preserved asparagus has expanded since the end of the 1980s. Although there was some stagnation in the mid-1990s, exports of fresh asparagus have expanded rapidly since the end of the 1990s. Now, the export of both preserved and fresh asparagus constitute the second most important agricultural export in Peru after coffee.

Besides the change in demand on the international market, the important factor behind the shift from preserved to fresh asparagus is the change in the supply structure of asparagus. In the case of preserved asparagus, Peruvian exports expanded because of Peru's competitiveness, which originated from favorable production factors, such as climate, soil and labor. However, because of the growing presence of Chinese products on the international market, Peru's products lost their competitiveness. In the case of fresh asparagus, the investment of agricultural corporations in production and their innovation in integrating different economic processes from the point of production to the time of export built a successful supply structure that is suited for the export of fresh agricultural produce.

**Keywords:** agriculture, exports, asparagus, Peru

**JEL classification:** N56, O13, Q13, Q17

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\* Prepared for delivery at the 2009 Congress of the Latin American Studies Association at Rio de Janeiro, Brazil, June 11-14, 2009.

\*\* Research Fellow, Latin American Studies Group, Area Studies Center, IDE-JETRO (tatsuya\_shimizu@ide.go.jp).

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**INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO**

**3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI**

**CHIBA 261-8545, JAPAN**

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## Introduction

The expansion of non-traditional agricultural exports (NTAXs) from Latin American countries has attracted the attention of researchers since the 1980s. Starting with Chilean fruits, there have been many attempts to increase NTAXs from Latin America, for example, tomatoes from Mexico, snow peas from Guatemala, melons from Honduras, and cut flowers from Colombia and Ecuador. Researchers have been trying to appraise the impact of NTAXs on economic development. Barham and others reviewed existing studies on NTAXs from Latin America (Barham, et al. 1992). They argued that in order to appraise the impact of NTAXs on economic development, it is important to emphasize long-term growth and distributional concerns. They concluded that it is crucial to analyze the basic characteristics of NTAXs as well as the link between export expansion and economic growth. Many studies during the 1990s criticized the long-term viability of NTAXs (Hojiman 1990, Murray 1994, Thrupp 1996). They argued that the expansion of NTAXs did not lead to any improvement in the welfare of those engaged in their production.

Asparagus is a star product among NTAXs from Peru. Exports of preserved asparagus first grew at the end of the 1980s. When stagnation set in during the mid-1990s due to the increase in cheap Chinese exports, exports of fresh asparagus started to grow. During the early 2000s, fresh asparagus exports surpassed those of preserved asparagus.

There are some studies on the production and export of asparagus from Peru. Glover and Kusterer (1990) analyzed asparagus production by looking at the out-grower system on Peru's northern coast. Elías Minaya (1995) studied the development of the asparagus industry in the same area and its effect on local small-scale farmers. Marañón (1993) analyzed the development of the asparagus industry and its impact on the labor force. Huamán (1999) studied the competitiveness of small-scale asparagus producers. The Inter-American Institute for Agriculture Cooperation (Instituto Interamericano de Cooperación para la Agricultura: IICA (n.d.)) studied the asparagus industry on the basis of the Ministry of Agriculture's census of asparagus producers (MINAG 1999). Valcárcel (2002) studied production by small-scale farmers who received help from non-governmental organizations. These studies found that the competitiveness of Peru's asparagus lay in favorable production factors, such as climate, soil and labor.

More recent studies have analyzed the growth in the exports of fresh asparagus. Studies such as Gómez (2001) and IICA (2004) analyzed the competitiveness of the

exports by focusing on efforts by the asparagus industry, but these studies did not mention the importance of the changes in the production and export structure for Peru's asparagus.

The purpose of this study is to analyze the expansion of the Peruvian asparagus industry. Instead of making a direct appraisal of its impact on economic development, this study analyzes the changes in the production and export structure that occurred when the main export shifted from preserved to fresh asparagus. The hypothesis is that because of changes in the supply structure, Peru was able to increase its exports of fresh asparagus. With the traditional supply structure, the competitiveness of preserved asparagus was based on favorable production factors. With the new supply structure, the competitiveness of fresh asparagus is based not only on these factors but also on technologies and innovations that have been introduced by agricultural corporations.

This paper is in four parts.

First, changes in the international asparagus trade are reviewed. This provides some background to the increase in fresh asparagus exports from Peru.

Second, the expansion of asparagus production and its exports from Peru is explained. This part describes how fresh green asparagus replaced preserved white asparagus as a growing export.

Third, the changes in the supply structure for asparagus in Peru are analyzed. The emergence of agricultural corporations in production is discussed.

Fourth, the change in the role of small-scale farmers is analyzed. Continually entering and exiting asparagus production, the role of small-scale farmers has changed from being principal to supplementary suppliers in the industry.

Finally, the conclusion summarizes the findings of the study.

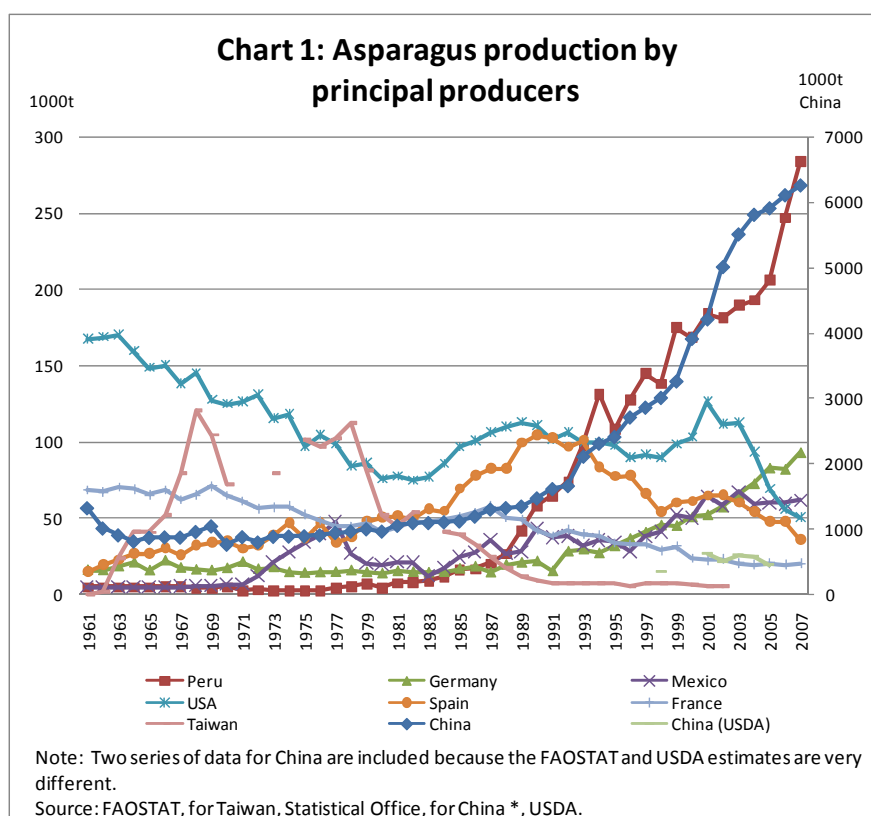
## 1 Expansion of the global asparagus trade

The production and international trade of asparagus in recent years have several characteristics: changes in the main producers, the expansion of trade, different tendencies in terms of growth for two types of products, and the concentration of asparagus production and its export among a few principal producers.

As Chart 1 shows, the production of asparagus spread geographically during the second half of the last century. First, the principal consumers, such as the United States and France, were also the main producers until the 1970s. After that, Taiwan became an important producer and exporter during the 1970s and 1980s. However, its

production declined rapidly due to the industrial development there. Meanwhile, the principal producers shifted from the consuming countries to their southern neighbors, such as Mexico and Spain. Since the 1990s, countries far from the consuming countries, such as China<sup>1</sup> and Peru, have expanded their production and have become the main producers.

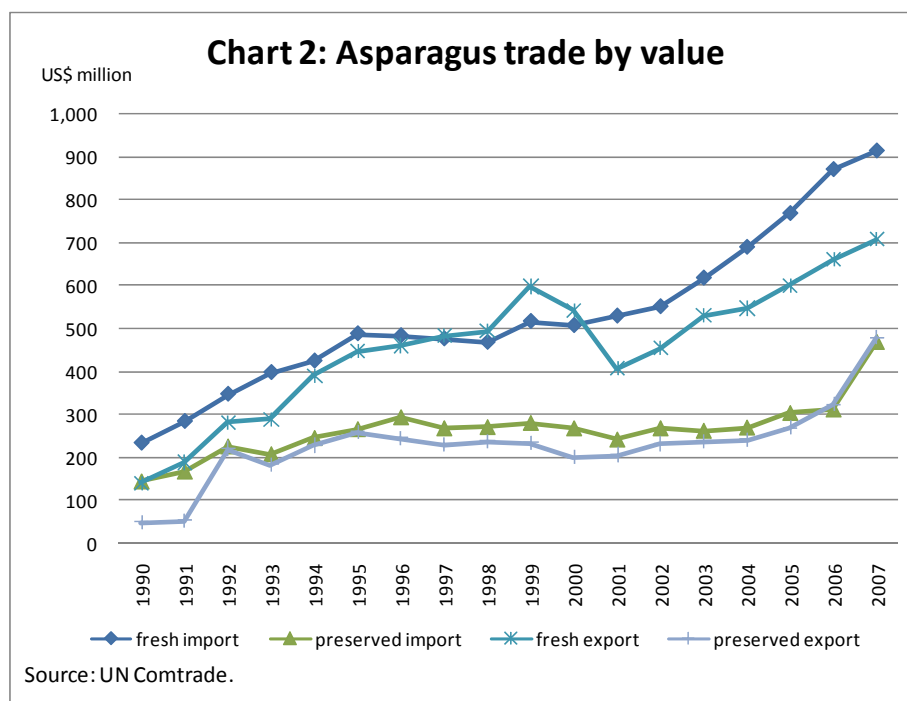
The geographical spread of asparagus production and the change in the main producers have been accompanied by an increase in the asparagus trade in the international market. Asparagus is mainly traded in three forms: preserved, fresh and frozen. Because the volume of the frozen asparagus trade is relatively small, compared to the other two products, and it is difficult to obtain exact trade data because the frozen product does not have an individual commodity code, this paper will only analyze the preserved and fresh asparagus trade. Chart 2 shows the export and import values of asparagus in the world.<sup>2</sup> We note that these traded values have been rising rapidly since the beginning of the 1990s.



<sup>1</sup> The FAOSTAT and USDA estimates for asparagus production in China are very different. Judging from China's export volumes, FAOSTAT seems to overestimate its production, and this study uses estimate by USDA.

<sup>2</sup> Because export and import values sometimes differ, Chart 2 includes both figures to show trends in the global asparagus trade.

However, when we carefully observe the trade in these two products, we can find differences in their trends of growth. While the trade in fresh asparagus has shown a continual increase throughout the 1990s and the 2000s, the trade in the preserved product only increased until the middle of the 1990s; it stagnated thereafter.



The other characteristic of the international trade in asparagus is the concentration among exporters and importers. Table 1 shows the principal asparagus exporters and importers by volume in 1992<sup>3</sup> and 2007. Comparing export countries and their share in the world market in two periods, the concentration of exports in the principal countries is notable. In the case of preserved asparagus, the combined share of China and Peru, the two leading exporters, increased from 65.2% in 1992 to 89.7% in 2007. With fresh asparagus, there were four countries that had more than a 10% share in 1992. However in 2007, Peru and Mexico dominated the market, leaving other countries far behind. Regarding asparagus imports, we can find a concentration of fresh imports in the United States.

These characteristics of asparagus production and trade indicate that more and more asparagus is produced for export, rather than for domestic consumption, in countries that are located far from consumers.

<sup>3</sup> The year 1992 was chosen because this was the first year that the trade volume of China was included in the UN Comtrade database.

Table 1: Principal asparagus exporters and importers by volume

Exporters	1992			2007		
	Country	Volume (t)	Share	Country	Volume (t)	Share
Preserved	China	40,269	38.3%	China	97,169	55.9%
	Peru	28,235	26.9%	Peru	58,706	33.8%
	Netherlands	17,049	16.2%	Germany	5,679	3.3%
	Spain	5,370	5.1%	Spain	4,907	2.8%
	Germany	3,633	3.5%	Netherlands	1,954	1.1%
	Total	105,008	100.0%	Total	173,694	100.0%
Fresh	Mexico	22,681	22.2%	Peru	96,329	38.1%
	USA	21,612	21.1%	Mexico	55,776	22.1%
	Spain	21,533	21.0%	USA	20,786	8.2%
	Greece	13,744	13.4%	Spain	14,164	5.6%
	Netherlands	8,603	8.4%	Thailand	13,759	5.4%
	Total	102,336	100.0%	Total	252,579	100.0%

Importers	1992			2007		
	Country	Volume (t)	Share	Country	Volume (t)	Share
Preserved	Germany	57,891	57.0%	Spain	55,678	33.7%
	Netherlands	17,658	17.4%	Germany	38,069	23.0%
	Denmark	5,936	5.8%	France	23,293	14.1%
	Japan	5,272	5.2%	USA	11,578	7.0%
	Australia	4,412	4.3%	Denmark	6,864	4.2%
	Total	101,630	100.0%	Total	165,390	100.0%
Fresh	Germany	38,026	37.7%	USA	124,045	48.4%
	USA	26,176	26.0%	Germany	23,607	9.2%
	Japan	15,045	14.9%	Canada	17,853	7.0%
	Canada	9,912	9.8%	France	17,118	6.7%
	Switzerland	8,045	8.0%	Japan	12,542	4.9%
	Total	100,864	100.0%	Total	256,466	100.0%

Source: Prepared by the author with data from UN Comtrade.

## 2 Expansion of asparagus production and exports from Peru

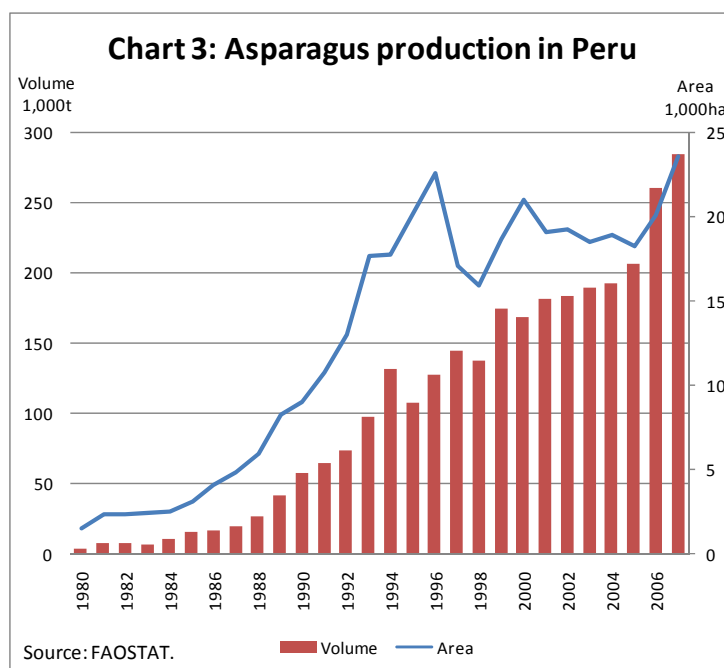
As reviewed in the previous section, Peru is presently the second largest producer of asparagus, the second largest exporter of preserved asparagus, and the largest exporter of fresh asparagus in the world. This section briefly explains asparagus production in Peru, and how and why production and exports have increased in the country.

### 2-1 The expansion of white asparagus production for exports of preserved asparagus

The history of asparagus production in Peru is described in Mara  n (1993) and El  as Minaya (1995), and briefly summarized in Shimizu (2006). The production of white asparagus for exports of preserved asparagus started in the 1950s in the La Libertad region in the northern coastal area of Peru. At that time, mainly small-scale farmers cultivated white asparagus and sold the crop to processing plants in the area through intermediaries. The processing plants produced the preserved asparagus and exported it overseas, mainly to European countries. Because of the agrarian reform of

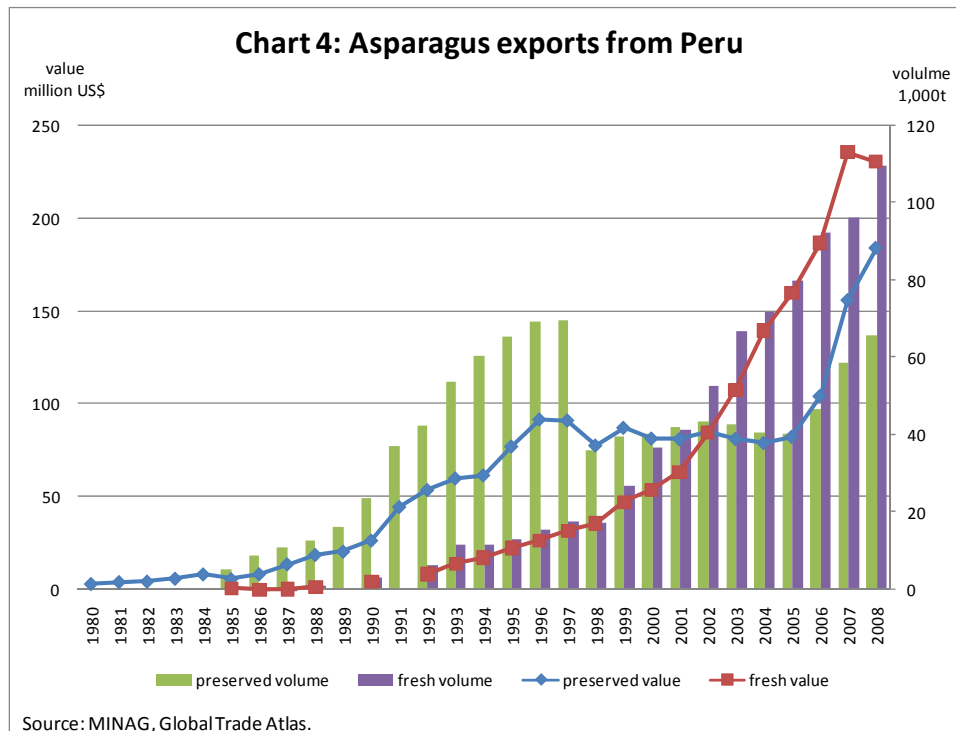
the 1970s, it was difficult for processing plants to own large-scale agricultural property and cultivate asparagus by themselves. Instead, they promoted its cultivation among small-scale farmers by providing seeds and credit, and by transferring cultivation techniques. It is called out-grower system analyzed by Glover and Kusterer (1990).

During the 1980s, the fall in the export of preserved asparagus by Taiwan triggered the expansion of asparagus production and exports in Peru. In order to fill the gap between demand and supply on the international market, a few new asparagus processing plants were established in the region, and production and exports increased rapidly during and after the second half of the 1980s. Production first exceeded 10,000 tons in 1984, and reached 100,000 tons within ten years (Chart 3). At the same time, the volume of exports of preserved asparagus first exceeded 10,000 tons in 1987 and reached close to 70,000 tons in 1996 (Chart 4).



Several factors lie behind the development of the preserved asparagus industry in the northern coastal region of Peru. First, the climate and soil of the region are suitable for white asparagus production. The temperature of the northern coastal region of Peru is very stable throughout the year, with monthly maximum temperatures between 20 and 25 degrees centigrade, and minimum temperatures between 14 and 18 degrees. With this temperature, it is possible to harvest asparagus twice a year. In addition to the climate, the sandy loam of the region is suited for the production of white asparagus. With this type of soil, it is easy to mound up soil over the plant, and asparagus grows straight in the mound.





The second factor is the agricultural base in the region. In the La Libertad region, there are four main rivers, the Chao, the Virú, the Moche and the Chicama. Commercial agriculture, especially the production of sugar cane and maize for animal feed, has developed for many years along these rivers. Therefore, farmers can easily obtain capital and input goods, as well as technical services from local suppliers.

In addition to this agricultural base, the industrial base in Trujillo city, the capital of the La Libertad region, contributed to the development of the asparagus industry. Trujillo is the third largest city in the nation, after Lima, Peru's capital, and the southern city of Arequipa. Because of its proximity to some fishing ports, the production of canned tuna was an important local industry. This industrial base helped to develop processing plant for asparagus.

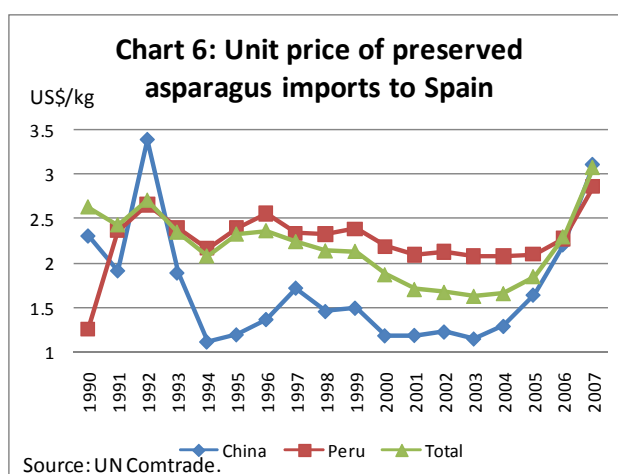
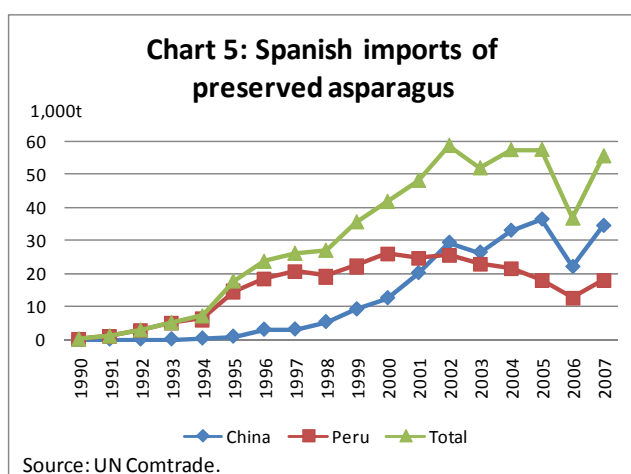
Finally, the availability of an inexpensive labor force was an important factor in the development of the preserved asparagus industry. Since the 1960s, there has been large-scale immigration from the Andean mountain region to the coastal region. The immigrants became a source of inexpensive labor. Therefore, farmers and processing plants in the region could find enough labor at a reduced cost.

## 2-2 The stagnation in exports of preserved asparagus

As can be observed in Chart 4, the exports of preserved asparagus suddenly dropped in 1998, then stagnated for almost a decade. While the sharp drop in

production and exports of preserved asparagus was due to the abnormal climatic conditions caused by El Niño, its stagnation thereafter was due to competition from Chinese product on the international market. When we closely examine Spain's imports of preserved asparagus, we can see this.

Chart 5 and Chart 6 show the volumes and unit prices for Spain's imports of preserved asparagus. The volumes from China and Peru occupy around 95% of Spain's total imports of preserved asparagus in 2007. In addition, one third of total preserved asparagus exports from Peru goes to Spain, making the country the most important market for Peruvian product. Until 1994, most of Spain's imports of asparagus were from Peru. However, because of its low price, the volume of Chinese asparagus increased in the Spanish market toward the end of the 1990s. By 2002, the volume of imports from China overtook that from Peru. In 2007, the import shares of Chinese and Peruvian asparagus were 61.9% and 32.5% respectively. Not only in the Spanish market, but also in other important markets in Europe, such as Germany and France, Peru's preserved asparagus has lost its market share due to the advance of cheap Chinese asparagus. This is an important reason behind the stagnation in the level of exports of Peru's preserved asparagus.



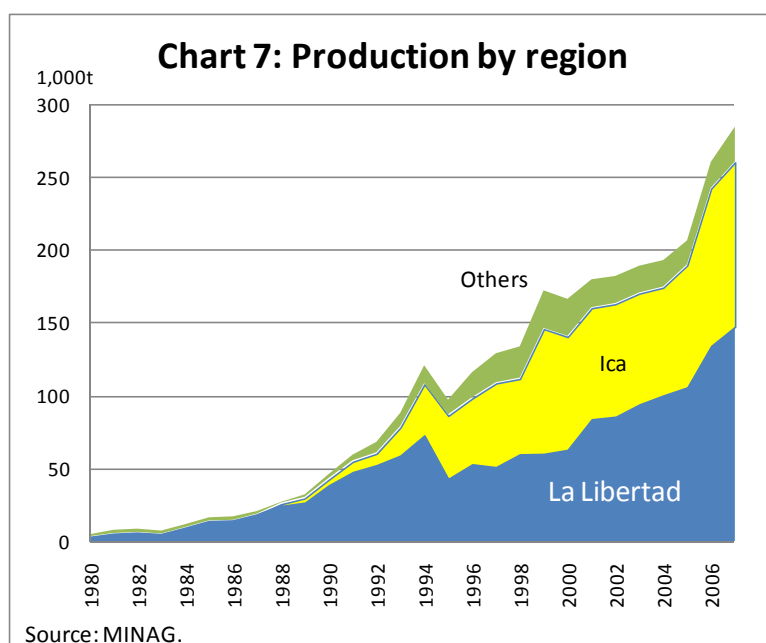
### 2-3 Expansion of green asparagus production for exports of fresh asparagus

While the export of preserved asparagus stagnated in the second half of the 1990s, that of fresh asparagus expanded rapidly. The volume and value of fresh exports overtook those of preserved asparagus in 2002 and 2003 respectively (Chart 4).

The production of green asparagus for the export of fresh asparagus started at the end of the 1980s with a group of farmers in the Ica region. With help from the United States Agency for International Development (USAID), they examined new crops such as melon, paprika, green beans and asparagus with hopes of exporting their

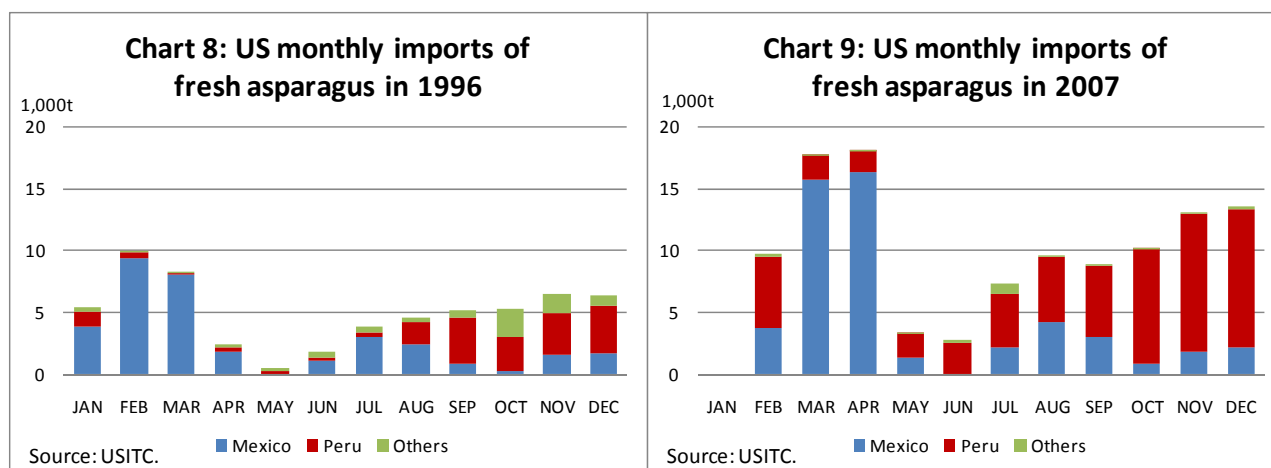
crop to the U.S. market. They chose asparagus and formed an asparagus producers association called APEI (Asociación de Productores de Espárragos de Ica) to promote its production (IICA 2004). In this way, the southern coast of Peru, from the Cañete valley in the Lima region to Ica city in the Ica region became the center of green asparagus production in Peru.

Production statistics for Peru do not differentiate between white and green asparagus. However until the middle of the 2000s, most white asparagus was produced in the northern region, while most green asparagus was produced in the southern region. Therefore, the production of the southern region can give a rough estimate for national green asparagus production. Chart 7 shows the volume of asparagus production in each region. It shows that production in Ica, the southern region, increased rapidly toward the end of the 1990s.



A few factors helped in this expansion of the production of fresh asparagus and its export. One important factor is the climate, which is suited for the cultivation of green asparagus for the U.S. market. Compared to the northern coastal region, the seasonal difference in the climate in the southern coastal region is wider. The monthly maximum temperature of Pisco city in the southern coastal region is between 19 and 27 degrees, and the minimum is between 12 and 19 degrees. This difference makes the cultivation of asparagus more seasonal than in the north. The main harvesting season in the south is from September to December, which coincides with the period when the U.S. market does not have much supply of fresh asparagus from either local or Mexican producers. Chart 8 and Chart 9 shows the volumes of U.S. monthly imports of fresh

asparagus in 1996 and 2007. From these charts, it is clear that Peru has succeeded in exporting fresh asparagus to the U.S. market by taking advantage of the off-season in the United States and Mexico.



The other factor behind this expansion can be found in the U.S. preferential trade measures for Andean countries. In 1991, the U.S. government introduced the Andean Trade Preference Act (ATPA).<sup>4</sup> In order to encourage the Andean countries to reinforce counter-measures against coca cultivation, the U.S. government eliminated import tariffs on many agricultural products. Peru's fresh asparagus is exempt from import tariffs, which are 5% from September 15 to November 15 and 21.3% for the rest of the year.

### 3 Changes in the supply structure

The demand for off-season fresh asparagus in the U.S. market is an important factor in the expansion of Peru's exports. However, it only tells half the story: the demand side. In order to explain the rapid growth in the exports of fresh asparagus, it is important to analyze changes on the supply side. This section argues that the structural change in asparagus supply made the rapid expansion possible. There are three aspects to this change: the entry of agricultural corporations into production, the introduction of new technology in the field, and the integration of different economic processes from the point of production to the time of export.

<sup>4</sup> After its expiration in 2001, the ATPA was extended and became the Andean Trade Promotion and Drug Eradication Act (ATPDEA), and Peru's asparagus remained exempt from import tariffs. The free trade agreement between the United States and Peru, which went into effect in February 2009, made this preferential treatment permanent.

### 3-1 The entry of agricultural corporations

The production of green asparagus for the export of fresh asparagus was first introduced by a group of medium-scale farmers and the association they formed at the end of the 1980s. However, the rapid expansion of fresh asparagus exports since the second half of the 1990s has been supported by large corporate farms that were created during the 1990s. After Peru's agrarian reform of the 1960s, corporate ownership of land was restricted, so the processing plants for preserved asparagus purchased raw material from small to medium-scale framers.

This situation changed with the liberalization of the economy that started at the beginning of the 1990s. The restriction on land holdings by corporations was first loosened in order to promote investment in the agricultural sector, then, later, it was eliminated. Gradually, transfers in land holdings became more frequent, especially in the coastal regions of the country. Many cooperatives that had borrowed money on their communal land could not repay their debts to the banks. So the banks took that land and sold it to private corporations. In addition, private corporations had the chance to buy agricultural land in a large-scale irrigation project in the northern coastal region that was completed in 1997.<sup>5</sup> The land was sold in international bids, and 39,000 hectares of land had been sold by 2004 (Landeras Rodríguez 2004: 243). With these opportunities, national and foreign private corporations obtained large-scale farms for asparagus production.

As a result, the production of asparagus by corporate farms has grown rapidly since the end of the 1990s. In the case of green asparagus for the export of fresh asparagus, most of the raw material has come from large corporate farms. Table 2 provides a list of the main producers of asparagus in Peru. They can be classified into three groups according to their type of business.

The first is a group of fresh asparagus exporting corporations. They are mainly located in the southern coastal region. All of them have large corporate farms ranging from several hundred to over one thousand hectares, and most of the asparagus they process and export is procured from their own farms.

The second is a group of preserved asparagus exporting corporations. All three are located in the northern coastal region. They started as processing plants for preserved asparagus, and used to buy most of their raw material from small and

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<sup>5</sup> The Chavimochic irrigation project in La Libertad. The irrigated land is located in the four-river basin of the Chao, the Virú, the Moche and the Chicama rivers in the La Libertad region.

medium-scale farmers in the region. During the 1990s, they acquired large amounts of agricultural land from the irrigation project and established their own corporate farms. However, at the time of this research, they needed to procure an important portion of their raw materials for their preserved products from other farms. This was because cultivation had just started on many corporate farms, and it would take a few years before they could start to produce at their full capacity.

Table 2: Principal asparagus producers in Peru (as of October 2005)

		Region	Start of operation	Origin of capital	Area of asparagus production	Type of asparagus	Procurement of asparagus	Sales channels	Destination of exports
Fresh exports	A	South	1995	Manufacturing (pharmaceutical)	1200 ha <sup>(1)</sup>	Green	99% from own farm, 1% from out-growers	Principally direct sales	Four years ago, 98% to USA, now 80% Europe and 20% USA
	B	South	1987	Agriculture	480 ha	Green	From own farm and from medium-sized out-growers who are foreign partners	Direct sales to USA and fixed price to England	Europe 70%, USA 30%
	C	South	1998	Mining	560 ha			Sales on consignment to USA and sales with fixed price to Europe (50% each)	USA 70%, Europe 30%
	D	North	1989	Agriculture (broiler)	700 ha	From white to green	100% from own farm	Sales on consignment for fresh, and direct sales for preserved	Fresh to USA, preserved to Europe
Preserved exports	E	North	1997	Fisheries, foreign capital 45% (from 2003)	1500 ha <sup>(2)</sup>	Green 2/3, white 1/3 <sup>(2)</sup>	75-80% from own farm, the rest from large-size (250-300 ha) and medium-size (30-50 ha) out-growers	Sales on consignment for fresh, and sales on fixed price for preserved	Preserved to Spain, France and USA, fresh to USA
	F	North	1994	Agriculture	1100 ha	From white to green	65-70% from own farm and the rest from out-growers	Direct sales 1/3 sales on consignment 1/3 sales through distributors 1/3	Europe and USA
	G	North	1994	Foreign capital 60%	885 ha	White, little green	100% from out-growers, recently started to produce on their own		Preserved to Europe (Denmark) and fresh to North America
Production only	H	North	1997		85 ha	From white to green		Sales on consignment	USA
	I	North	1999		50 ha	From white to green			No exports
	J	North	1998	Local asparagus broker	105 ha	White			No exports

Note: (1) The total area is 1772 hectares as of November 2006. (2) The total area is 2993 hectares as of the end of 2008.

Source: Prepared by the author based on interviews with companies

The third is a group of medium-scale asparagus producers. We call them producers, rather than agricultural corporations, because their scale of production is not as large as the first two groups, and their main business, with one exception, is limited to production. They sell their produce to exporting companies that belong to the first and second groups. Because of the growing demand in recent years for green asparagus for the export of fresh produce, they have switched their production from white to green asparagus.

The expansion of fresh exports and the entry of agricultural corporations can be summarized as follows. The growing demand for fresh asparagus during the off-season in the United States encouraged the expansion in production and exports of asparagus in Peru. Thanks to the liberalization of the economy in the 1990s,

agricultural corporations with large farms were founded in the southern coastal region. These corporations started to produce, process and export fresh green asparagus, and to meet the demand of U.S. consumers. This entry of agricultural corporations into the fresh asparagus sector made rapid growth in Peru's exports of fresh asparagus possible.

The entry of agricultural corporations was not limited to fresh asparagus exports. In the northern coastal region, where white asparagus for export of preserved asparagus has been grown for many years, processing plants started to acquire their own farms and started to grow asparagus on these farms. Although they still procure an important portion of their raw material from other farmers, they are increasing asparagus production on their farms.

These agricultural corporations have two important characteristics: they are introducing new technology into the field, and they are integrating different economic processes from the point of production to the time of export. These two characteristics are key factors that enable the corporations to meet the rapidly growing demand for fresh asparagus from U.S. consumers. The following two sections analyze these characteristics by focusing on agricultural corporations who export fresh asparagus.

### 3-2 The introduction of technology into the field

The production of asparagus on large corporate farms is very different from traditional production by small-scale farmers. Because of the large scale and the financial resources of the agricultural corporations, the farms were able to introduce three important technologies: drip irrigation, hybrid seeds and professional agronomists.

#### 3-2-1 Drip irrigation

The first technology is drip irrigation. Because there is almost no rainfall in the coastal region of Peru, water is a scarce resource. It has to be pumped out using electricity or diesel fuel, or transported through irrigation canals for which farmers have to pay for hours of use. With surface irrigation, which is commonly used by small-scale farmers, the use of water is very inefficient. A large amount of water is absorbed by the soil, not by the crops. Drip irrigation is a technology that was first developed in Israel where water is very scarce. Water reaches crops through tubes that are installed in ridges in the fields where the crops are planted, and tubes are connected to pumps and a water source, such as a well or a reservoir. Compared to surface irrigation, a very small amount of water is required to grow crops because water directly reaches the foot of the crops without being absorbed by the soil.

Another advantage of the drip irrigation system is the precise control of irrigation. With computerized control, which is used on many large corporate farms, irrigation is programmed to maximize yields, or to adjust growing patterns for the harvesting program.

In addition, the use of drip irrigation can save labor costs. Because this system delivers water only to crops, there are fewer weeds in the field, and there is less need for labor for weeding. Furthermore, chemical fertilizers can be mixed with the water and introduced through the irrigation system. This saves on the need for labor to apply fertilizers.

The disadvantage of the drip irrigation system is the cost of installation. Because its installation costs are well over one thousand dollars per hectare for smaller plots, only corporate farms, or farmers with access to credit, can afford it.

### 3-2-2 Hybrid seeds

The second technology is hybrid seeds. In the northern coastal region, most small-scale farmers use asparagus seeds that they have obtained from their neighbors, or the second generation (F2) hybrid seeds that they can purchase from local stores for less than 100 dollars a hectare.

In contrast, large corporate farms use hybrid seeds that are imported from the United States. With the use of genuine hybrid seeds, producers can obtain not only higher yields per hectare, but also a better quality of crop. After the harvest, fresh asparagus for export is usually categorized, and high-grade asparagus receives a premium price. Therefore, both higher quality and better yields are important. The additional investment in hybrid seeds pays, because asparagus is a permanent crop, and farmers can obtain better yields and quality for every harvest for more than ten years.

### 3-2-3 Professional agronomists

The third technology is the introduction of professional agronomists into the field. In general, many small-scale farmers have a primary level of education; only a few have received a secondary schooling. In Peru, the public extension service was discontinued as part of a rationalization of the public sector during the neo-liberal economic reforms of the 1990s. Therefore, small-scale farmers have little opportunity to improve their cultivation practices.

By employing professional agronomists with a tertiary education as production managers, large corporate farms can try to improve the quantity and quality of their



crop. These managers are expected to organize production according to programs established by the administration, which includes the preparation of seedlings, implants in new fields, the control of drip irrigation, the use of fertilizers and chemicals, and the adjustment of harvest periods. One of their most important tasks is to combat pests and diseases. Because of the concentration of asparagus production in the northern and southern coastal regions and the growing scale of the fields, pests and diseases proliferate. They lower the quantity and quality of the harvest, and increase production costs because agro-chemicals need to be used frequently. In order to minimize the damage to the harvest and reduce production costs, production managers always monitor the crop and apply measures to prevent the spread of these pests and diseases. In some cases, the managers introduce Integrated Pest Management and try to reduce the use of agro-chemicals and apply alternative measures. These managers often participate in technical seminars in order to keep up-to-date on the latest production and management techniques.

### 3-3 The integration of different processes

It is important to compare the difference between the supply structure for the export of preserved asparagus until the mid 1990s, on the one hand, and that for the export of fresh asparagus since the end of the 1990s, on the other. This is shown in Chart 10.

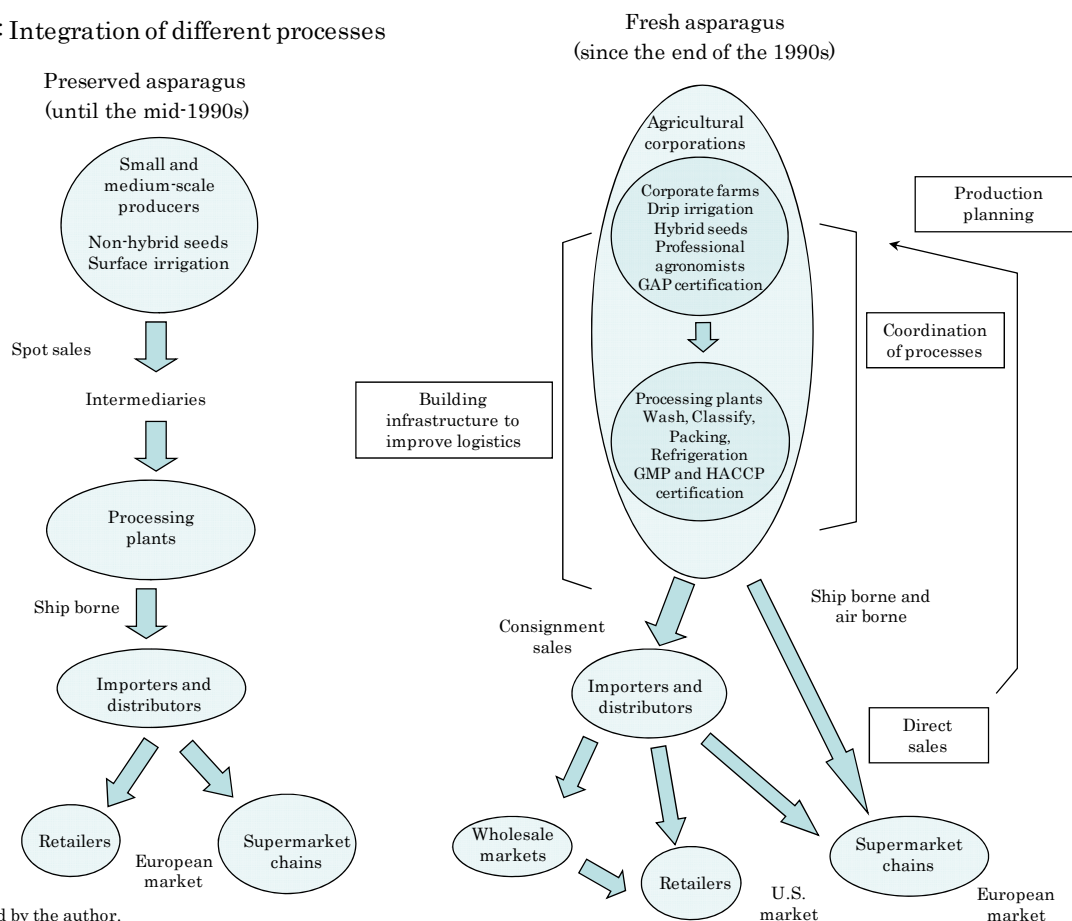
In the case of preserved asparagus, production and processing were carried out by different entities. Small and medium-scale farmers grow white asparagus. The intermediaries buy and collect the crop from the farmers and pay them a spot price. They wash, classify and sell the asparagus to processing plants. The processing plants prepare the preserved product and export it to importers and distributors in the European market.

In the case of fresh green asparagus, agricultural corporations integrate all the different processes between the point of production and the time of export. They grow the green asparagus, deliver it to the plant, process it for export – this includes washing, classifying, packaging and refrigerating – and transport it to the airport. Agricultural corporations sell their products not only to distributors on consignment and to importers at fixed prices, but also directly to supermarket chains in consumer countries in the United States and Europe.

The integration has three characteristics that have made the rapid growth in the exports of fresh asparagus possible. The corporations are monitoring the production process and obtaining certificates, they are building an infrastructure for

their logistics needs, and they are making sales directly, which enables them to plan their production better.

Chart 10: Integration of different processes



Source: Prepared by the author.

### 3-3-1 Monitoring and certification

For the export of fresh agricultural products, monitoring the production process and obtaining certificates related to production and processing are very important for ensuring food safety and informing consumers. By integrating the different processes between the point of production and the time of export, agricultural corporations have been able to introduce these measures.

It is very important that exporters understand and observe food safety regulations in consumer countries. If pesticide residues in the fresh produce imported into consumer countries are higher than the limit established by the regulations of those countries, or if a particular type of pesticide, which is not allowed for fresh produce, is detected in an inspection, all the produce in the same lot will be returned to its country of origin, or will be discarded. Furthermore, the importer who imported the produce can be sanctioned by being prohibited from importing for a certain period of

time. Sometimes, the entire lot of the same product originating from the same country will be inspected, which will raise costs and lower the quality of the produce.

In order to observe the food safety regulations of consumer countries, producers need to ensure the production processes in the field. If their customers ask, they need to show information about their production and processing processes, such as where the food is produced, what agro-chemicals are applied and how often, where the produce is processed, how it is stored, etc. For exporters, it is very difficult to keep track of this information on produce originating from small and medium-scale farmers because many of them do not keep records, or it is very costly to manage information from a large number of small and medium-scale farmers.

In the case of agricultural corporations with large corporate farms, from the moment they program the production, they can keep track of all the records about their produce. By reading the barcodes of the box of produce dispatched from the plant, they can tell when and where it was harvested, what kinds of agro-chemicals were applied, etc.

Keeping a record of the produce and observing safety regulations are not sufficient by themselves, if exporters wish to sell their produce. Agricultural corporations have to give this information to their clients and to the final consumer. Many of their clients, like supermarket chain stores, require their supplier to obtain a certificate on the safety of their produce. Good Agricultural Practice (GAP) for production, and Good Manufacturing Practice (GMP) or Hazard Analysis and Critical Control Point (HACCP) for processing are some examples of these certificates. These certificates specify how production and processing should be managed to ensure safety. These certificates have different versions, and agricultural corporations have to obtain the one designated by their clients. In addition, the certificates should be kept updated through periodical auditing.

### 3-3-2 Logistics infrastructure

Compared with preserved agricultural products, the value of fresh produce declines as it loses its freshness. With integration from the point of production to the time of export, agricultural corporations have built an infrastructure in order to maintain the freshness of their produce.

When asparagus is produced by small-scale farmers, it is collected once or twice a day by intermediaries. They wash and classify it at their collection point, and deliver it to processing plants. It can take several hours for the asparagus to reach a plant, and the asparagus can lose its freshness. When asparagus is produced on a

corporate farm, it is collected about every hour, so the produce does not lose its freshness. Harvested asparagus is pre-cooled, washed, classified, cut, packed and stored in refrigerated storage. Asparagus processed during the day leaves the plant at night in refrigerated freighter trucks for an international airport. It is shipped by air and arrives at the U.S. market the day after it has been harvested with a minimum loss of freshness.

Building a complete cold chain is crucial for the fresh asparagus industry. Because asparagus was the first fresh agricultural product to be exported in quantity, the lack of refrigerated storage and shipping facilities for fresh produce at Lima International Airport was a serious problem for exports until the middle of the 1990s. With some help from the public sector, an association of fresh produce exporters built storage and shipping facilities at the airport to complete the cold chain (IICA 2004).

### 3-3-3 Direct sales and production planning

When agricultural corporations sell their produce, there are various forms of transaction. The most traditional is sales on consignment. Exporters send their produce to brokers, and brokers sell the produce to their clients. Often exporters do not have direct control over the price, nor do they have direct contact with the clients. Exporters export what they have, and supply and demand on the market decides the price. Therefore, the price may fluctuate widely, and there might be some loss when brokers cannot find clients.

Instead of selling their produce on consignment, many agricultural corporations are trying to increase direct sales to large-scale retailers, like supermarket chains. The price, volume and period of the transaction are determined in advance. Sometimes the clients require exporters to use packaging and wrapping materials with their store or brand names. Agricultural corporations in Peru first expanded their exports with sales on consignment to the U.S. market. However, as Table 2 shows, they are trying to increase direct sales to clients in the European market.

The advantage for agricultural corporations of direct sales is that they can determine the client, the specifications, the volumes and the prices for the produce in advance. With this information, they can plan their investment in production and processing capacity, program their production and harvesting, and procure the inputs they need for their production and processing.

To sum up, as a consequence of the liberalization of the economy in Peru, agricultural corporations entered the business of production and export of fresh green asparagus, when demand was growing in the international market. By introducing

technology into the field and by integrating different processes between the point of production and the time of export, these corporations increased their production and exports.

#### 4 Supplementary production by small-scale farmers

As a consequence of the entry of corporate farms into asparagus production, an important part of the supply of raw material for preserved white asparagus by small and medium-scale farmers was replaced by corporate farms. It is true that asparagus production has been concentrated into larger corporate farms. However, small-scale farmers have not been completely forced out of production. Many of them still repeatedly enter or exit asparagus production in accordance with the price at the farm gate. What is certain is that small-scale farmers have become supplementary suppliers of the asparagus rather than the main suppliers that they were in years past.

##### 4-1 The entry and exit of small-scale farmers

In the La Libertad region, the principal production area on the north coast, small-scale farmers were the main suppliers of white asparagus for exports of preserved asparagus until the growth of corporate farms at the end of the 1990s. Table 3 shows the number of producers and their production area by scale of production in 1998 and 2006 in the region. Even though the time period between the two years is not so long, the increased concentration of production into large corporate farms can be observed. The numbers for small-scale farmers with less than 10 hectares and for medium-scale farmers have decreased while the numbers for large-scale producers with more than 50 hectares did not change very much. In terms of the area of production, farms larger than 50 hectares increased from 1,800 hectares to 5,100 hectares while that of farms smaller than 10 hectares decreased. Most of the growth in terms of area of production is by large corporate farms.

In general, it is true that small-scale farmers have exited asparagus production after the entry of the corporate farms. However, when we observe the behavior of small-scale farmers, they repeatedly enter and exit production.

Table 3: Asparagus producers in the La Libertad region

Number of producers						
	<1ha	1-5ha	5-10ha	10-50ha	>50ha	total
1998	19	471	422	206	25	1,143
2006	93	468	271	57	22	911

Area of production (ha)						
	<1ha	1-5ha	5-10ha	10-50ha	>50ha	total
1998	9.17	826.63	1,338.60	1,279.05	1,846.22	5,299.67
2006	70.45	1,004.33	1,035.85	1,385.90	5,133.64	8,630.17

Change between 1998 and 2006						
	<1ha	1-5ha	5-10ha	10-50ha	>50ha	total
Number	74	-3	-151	-149	-3	-232
Area	61.28	177.70	-302.75	106.85	3,287.42	3,330.50

Note: The scale of production includes areas of other crops.

Source: Prepared by the author with data from MINAG (1999) and IPEH (2006).

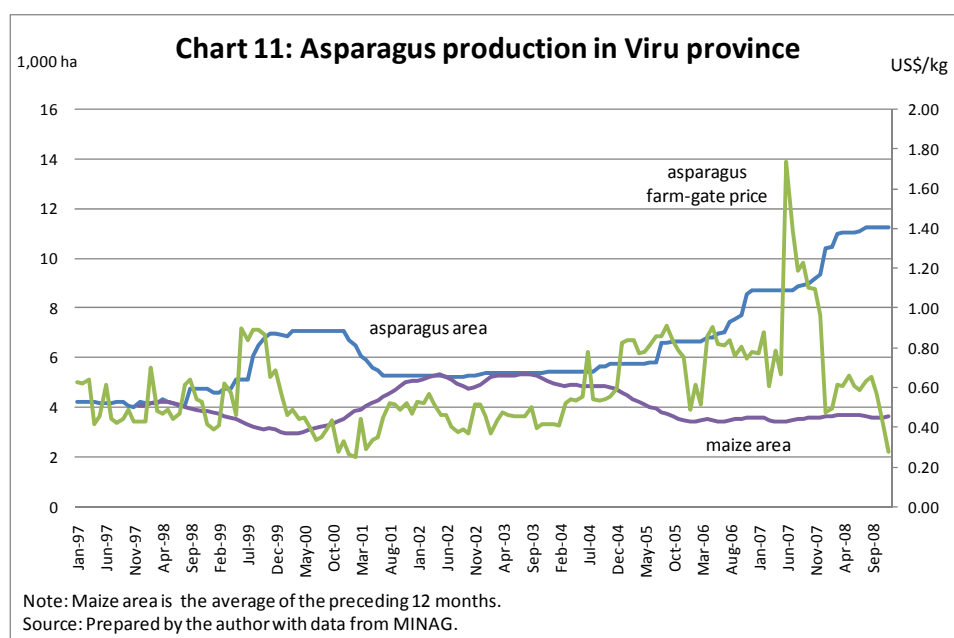


Chart 11 shows the areas given over to asparagus and maize production, and the farm-gate prices for asparagus in the Viru province, which is the most important asparagus producing province in the La Libertad region. Its asparagus production accounted for around 80% of regional production, and 41% of national production in 2007. When the farm-gate price of asparagus went up between 1998 and 1999, and from 2004, the area of asparagus production also increased. At the same time, the area of maize production decreased. On the other hand, when the farm-gate price dropped around 2000 and 2001, the area of asparagus production decreased. Because it takes at least 18 months before the first harvest of asparagus, and more than a few harvests

to recover the initial investment are required for growing asparagus, the area under cultivation declines some time after the price drop. When asparagus production decreased, the area of maize production increased. Maize is an alternative crop to asparagus for small-scale farmers, and ensures them a low but stable profit compared to asparagus. What we can understand from this chart is the behavior of corporate farms and small-scale farmers. When the farm-gate price of asparagus increased, corporate farms as well as small-scale farmers expanded their asparagus production. Corporate farms increased their production by activating land that had not been used before, while small-scale farmers abandoned their production of maize and other traditional crops and switched to asparagus. When the asparagus price dropped, corporate farms maintained their production while small-scale farmers switched back to traditional maize production.

Observing this behavior on the part of corporate farms and small-scale farmers, we can see that the role of small-scale farmers has changed from being the main suppliers of asparagus to that of being supplementary suppliers.

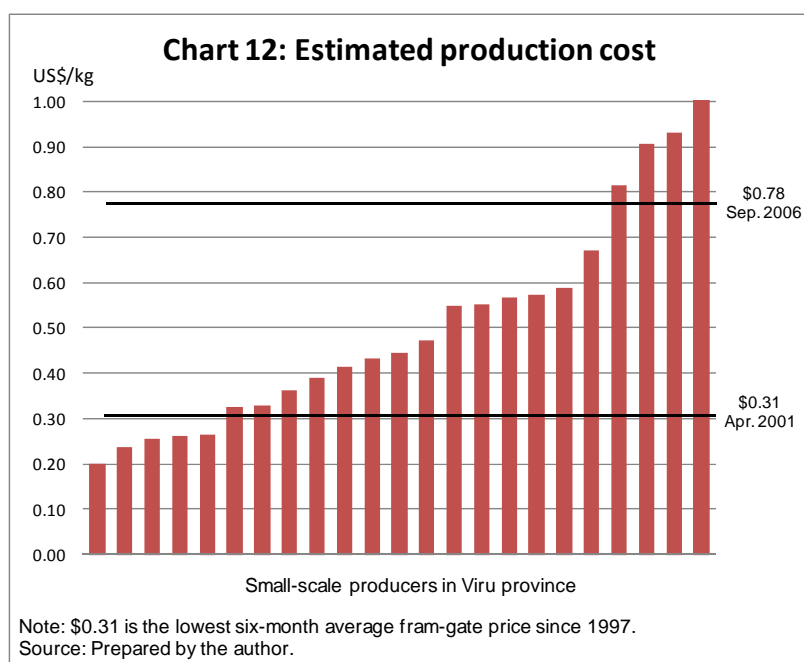
#### 4-2 Profitability

The role of small-scale farmers as supplementary asparagus suppliers can also be confirmed from their production costs. In most cases, their production costs are not as low as those of corporate farms, and they will suffer losses if the farm-gate price drops to the level of 2001, the lowest level since 1997.

Chart 12 shows the production costs of small-scale farmers in Viru province, based on a field survey conducted by the author in September 2006.<sup>6</sup> 28 farmers who grow asparagus on between 1 and 15 hectares were interviewed, and the production costs of 23 of the producers are shown in ascending order. Production costs include the cost of inputs, hired labor, and the labor costs of the farmer himself. At the time of the survey, the farm-gate price of asparagus was US\$0.78/kg. With this price, most of the producers could receive a profit from their production. However, if we assume that the price had dropped to US\$0.31, the lowest six-month average farm-gate price in April 2001, only one fifth of the producers could have gained a profit. Other producers whose productions cost were above the price would have lost money, and perhaps would have been forced to exit production. In fact, out of the 28 producers surveyed, 11 once exited asparagus production because of a low farm-gate price, and they only resumed production when the price picked up again.

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<sup>6</sup> The details of the results of the field survey are described in Shimizu (2007).



This analysis tells us that asparagus production is only viable when the farm-gate price is high. As shown in Chart 11, the price dropped sharply after its temporary hike in the middle of 2007. We can predict that many small-scale asparagus producers will soon switch their production from asparagus to maize and other traditional crops. They are no longer principal suppliers of asparagus. Instead, they are supplementary suppliers who adjust to supply and demand gaps in the international market.

## 5 Conclusion

Asparagus is the star product among non-traditional agricultural exports (NTAXs) in Peru. Exports of preserved asparagus grew from the end of the 1980s. Although there was some stagnation in the mid-1990s, the export of fresh asparagus expanded rapidly at the end of the 1990s. Now, the export of both preserved and fresh asparagus is the second most important agricultural export from Peru after coffee.

One important factor in the shift in exports from preserved to fresh asparagus is the growth in demand in the international market, especially in the U.S. In general, consumers with high purchasing power in developed countries demand fresh agricultural produce rather than preserved products, and they demand this throughout the year rather than just during the harvesting season in their own countries. As a result, imports of off-season fresh agricultural produce from the other side of the



hemisphere have increased in recent years. Fresh asparagus is one of these vegetables.

The other important factor behind the shift is the change in the supply structure for asparagus. In the case of preserved asparagus, small and medium-scale farmers produced white asparagus, intermediaries collected, washed and classified it, and processing plants processed the asparagus into its final preserved state, then exported it. In the case of fresh asparagus, agricultural corporations produce green asparagus in their own large corporate farms, process it in their own plants, and sometimes sell it directly to large retailers in the consumer countries. By introducing modern technology to their own farms, such as drip irrigation, hybrid seeds and management by professional agronomists, agricultural corporations produce asparagus on a large scale and at a low cost. Furthermore, by integrating different processes from the point of production to the time of export, they can ensure the safety of their products and communicate this to their clients. In addition, with investments in their infrastructure to improve their logistics, this integration improves the quality of their products and allows them, through a system of direct sales, to plan their production better.

The corporate farms of agricultural corporations have become the principal suppliers not only of green asparagus for the export of fresh asparagus, but also of white asparagus for the export of preserved asparagus. As a consequence, small and medium-scale farmers have been marginalized as suppliers of white asparagus. In recent years, asparagus production has been concentrated among large corporate farms. Small-scale farmers have become supplementary suppliers of asparagus who repeatedly enter and exit production in response to prices at the farm gate.

This study of the expansion of asparagus exports from Peru has some implications for the expansion of NTAXs from developing countries. The first implication is the competitiveness of NTAXs. According to an analysis of competitiveness by Eduardo Doryan (cited in Gómez 2007), modern commercial agriculture has three stages of development that are driven by different inputs: first, production factors; second, investment; and, third, innovation. This argument can be applied to the development of asparagus exports from Peru. In the first stage, the increase in the production of preserved white asparagus was driven by favorable production factors, such as climate, soil and labor. When these factors no longer became favorable in comparison with China, export growth dropped off. In the second stage, because of economic liberalization, agricultural corporations entered the industry and invested in their large corporate farms with modern production technology, which

allowed them to increase their asparagus production. In the third stage, these corporations innovated by integrating different processes between the point of production and the time of export, and fresh green asparagus exports increased further.

The second implication concerns the participation of small-scale farmers in the production of NTAXs. The expansion of NTAXs often starts with the participation of small-scale farmers. However, as volume grows, entities with access to more capital, like large corporate farms, enter production and replace small-scale farmers as the main suppliers of raw material. This is true for Peru's asparagus. Small-scale farmers become marginalized as suppliers. However, because the investment of small-scale farmers is smaller than that of corporate farms, their fixed costs are lower as well. Therefore they can easily switch crops. By combining NTAX crops and other alternative crops, it is possible for small-scale farmers to stabilize their agricultural income.

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