

The Discovery of New Export Products in Ecuador

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Abstract*

This paper examines export diversification in Ecuador in the cases of fresh cut flowers, canned tuna, palm heart, broccoli and mangoes, using the theoretical framework on “pioneers” and “discoveries” developed by Hausmann and Rodrik (2003), as well as work by Sánchez and Butler (2006) on export costs and related uncertainties. It is found that the discoveries were mainly of traditional competitive advantage, with various degrees of technology adoption. The following policy implications are derived: i) innovative mechanisms to share the costs of new discoveries must be found and intellectual property rights strengthened; ii) cooperation among industry experts needs to improve; iii) deeper collective action to promote public-private partnerships should be undertaken; iv) relevant information and knowledge should be made available to all interested parties; and v) a national-level agenda should be undertaken to increase private investment in promising sectors while promoting the creation of public goods and minimizing rent-seeking behavior.

JEL Classifications: O13, O25

Keywords: Export diversification, Ecuador

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1. Theoretical Framework

The main objective of this study is to identify the determinants and drivers of export diversification in Ecuador, particularly the discovery of new export activities and their diffusion throughout the economy. To this end, we used a theoretical framework developed by Hausmann and Rodrik (2003, henceforth H-R), who argue that new export activities are associated with “discoveries” carried out by “pioneers” who are unable to reap all of the benefits of their discovery investments and hence lack the incentives to carry them out. In “Economic Development as Self-Discovery,” Hausmann and Rodrik also argue that the emergence of new economic activities in developing countries is characterized by a substantial degree of uncertainty about production costs, even if firms are already producing for internal markets or produce elsewhere. Therefore, a pioneer firm needs to take the risk of investing resources in activity that may or may not be profitable. As a result, developing countries suffer suboptimal “discovery activity,” as the potential monopoly rents of pioneers—which could induce investment in those activities—is rapidly dissipated by the early entry of imitators.

It is important to define the components of export costs. They include several incremental costs, such as quality upgrading, meeting product, process, and technical regulations, setting up logistics chains abroad, and others. There exists a rich literature describing the impact of these costs on a country’s ability to export and how much it can export. Although traditional literature had treated these costs as knowable, recent evidence suggests that there exist sizable uncertainties associated with the cost of complying with foreign standards and regulations (Sánchez and Butler, 2006). Therefore, the concept of cost uncertainty will incorporate all of these elements.

The main goal of the theoretical framework is to answer the following questions:

- What kinds of discoveries are we facing when analyzing new exporting goods?
- What were the main uncertainties regarding discovery and diffusion?
- What are the main barriers to discovery and diffusion?
- What are the main market, coordination, and system failures that might limit discovery?
- Does diffusion hurt or benefit the pioneer?
- What are the optimal policies to foster discovery?

We use Hausmann and Rodrik's framework as a starting point of analysis regarding cost uncertainties and market failures related to information externalities, and we use the information from the case studies to determine whether the information gathered supports the drivers and hurdles predicted by the theoretical framework. We also use the case studies to incorporate other features such as demand uncertainty, quality upgrading needs, agglomeration economies, coordination failures, system failures, and others in order to explain the factors that enter into the generation of new export activities in Ecuador.

2. Selection of Case Studies

In selecting the cases for the purpose of this study, we applied the following criteria, using Central Bank non-oil export data from 1990-2005, provided by Corporación de Promoción de Exportaciones e Inversiones (CORPEI):

- Growth (compound annual growth rate, CAGR, and year-to-year average)
- Export share (as a percentage of Ecuador's total non-oil exports)
- Absolute export values (greater than 0.5 percent of total non-oil exports)
- World export share (as a percentage of worldwide exports of the product)
- Rate of diffusion as measured by growth in the number of exporters

The selection process focused on identifying sectors or products that have experienced high rates of growth among non-oil export products, through the following filters: 1) CAGR at 15 years, from 1990-2005; 2) CAGR at 10 years; and 3) CAGR at 5 years (since the adoption of dollarization in 2000). In addition, we used a filter related to the importance of the sector as measured by its share of total Ecuadorian exports. This filter was determined to be 0.5 percent of the total of non-oil export products, which was about US\$2 million in 2005.

The sectors identified using these criteria were compared with global exports with the same Harmonized System (HS) Code. The reason for using this filter was to identify products with a good level of international competitiveness, as measured by their penetration in global markets.

Approximately 15 products met the criteria. Among them were bananas, cacao, coffee, shrimp, passion fruit, vehicles, and wood, in addition to the five products selected for the study. For the final selection of these five, we favored products from both the coastal and highland

regions that showed substantial growth over the last 20 years and products with value added, not simply commodities. Another important factor for selecting products was the number of exporters five years after discovery

Products selected which have an important share of exports in 2005, but were not significant in 1990, are the following:

- Fresh cut flowers
- Canned tuna
- Palm heart
- Broccoli
- Mangoes

Table 1 below shows the filter results for the sectors selected and key data.

Table 1. Filter Results for Various Cases and General Information

Sectors	Filters									Other Information			
	World					Share of non-oil exports Ecuador	Number of Exporters 1990	Number of exporters 2005		Tariff at main destination	Export Value 2005	Market s1990	Markets 1995
	Avg Growth	CAGR 15	CAGR 10	CAGR 5	share								
Fresh Cut flowers	25.3%	24.3%	15.4%	12.8%	6.68%	9.00%	47	674		0	396,567.570	18	86
Tuna	21.6%	20.6%	16.5%	18.1%	9.70%	10.09%	15	41		35.00%	444,622.001	22	54
Broccoli	178.0%	59.7%	19.1%	21.9%	3.78%	0.88%	1	5		0	38,884.320	1	24
Mangoes	113.3%	51.1%	26.9%	9.4%	3.26%	0.43%	11	45		0	17,841.060	9	19
Palm Hearts	60.1%	28.3%	25.3%	10.2%	47.48%	0.91%	6	18		0	40,284.650	4	26
Passion Fruit	285.7%	28.7%	11.6%	7.2%	60%	0.97%	1	18		0	41,566.240	4	33
Bananas	7.5%	5.7%	2.4%	5.7%	23.61%	24.64%		70		0	1,085,464.180		103
Shrimp	5.2%	1.6%	-4.4%	8.5%	5.50%	10.38%		53		3.60%	457,454.050		68
Total Non-Oil	8.6%	7.7%	3.3%	9.7%	0.02%	100%		2400			4,405,504.280		225

Source: Authors' compiled based on Banco Central de Ecuador (BCE), UN Comtrade and other official data.

As the data in Table 1 show, the selected sectors experienced very high rates of growth between 1990 and 2005, which have been sustained in the last five years. Passion fruit grew 296 percent during the 15 year period, broccoli 178 percent, mangoes 113 percent, palm heart 60 percent, fresh cut flower 25.3 percent and tuna 21.6 percent. By 2005, Ecuador was the first global exporter of passion fruit concentrate and palm heart and the third largest exporter of flowers and canned tuna.

3. Research Methodology

Our starting point is to identify the characteristics of the discovery of new export activities, from the standpoint of the “pioneer.” The idea is to conduct an in-depth interview with the pioneer, with the aim of identifying: i) cost uncertainties, such as foreign demand, export processes, technical regulation, logistics, etc.; ii) critical factors that enable the pioneer to export; iii) the level of association with foreign firms, customers, or suppliers; and iv) the effect of public policy on the discovery of new export activities.

Of particular interest to us were the costs of obtaining market access and business development in formation. We suspected these costs to be factors that would hinder the discovery of new export activities. We sought to obtain a detailed recounting of the pioneering firm's discovery, implementation process, and the start-up of its operations, emphasizing the incentives that led to the decision to venture into a certain activity. Above all, we attempted to define the specific factors that made its success possible.

Using this analysis, the characteristics of the diffusion process can be ascertained. We analyzed the pioneer's performance during the diffusion phase, since, according to H-R, immediate diffusion can deprive the pioneer of monopolistic rents, not allowing him to recover discovery costs and therefore inhibiting new discoveries. We also analyzed other aspects of diffusion. We acknowledged its positive side, i.e., that diffusion can result in rising profits through the agglomeration of economies and/or the development of specialized input markets. In this case, the pioneer might prefer a short length of time in order to enjoy the monopoly in a limited time frame, and might prefer to limit entry of imitators up to a certain number, so that, for example, the marginal gains from agglomerations are equal to the marginal losses from losing foreign market share.

We also analyzed the extent to which diffusion can be harmful, such as when imitators are firms with better access to finance, market research, existing trade linkages, and skilled human capital and, therefore, higher productivity than the pioneer. In this case, the pioneer would face uncertainties regarding the number of imitators, their characteristics, and their ability to erode his market share.

We explored whether the pioneer has the option to become a supplier of specialized inputs, which would allow him to take advantage of the diffusion process. Finally, we analyzed

coordination failures that prevent the provision of industry-specific public goods which might limit the payoff from the discoveries and the diffusion process.

In summary, we aimed to gather information on the following factors that might slow down the diffusion process: coordination failures that prevent the development of specialized input markets, policies that prevent entry to the industry, technological or brand barriers set by the pioneer, credit market imperfections, and failures in the national innovation system. We analyzed factors that foster diffusion, such as government provision of technical support, transformation of the pioneer into input provider, fiscal incentives, and others.

The research data consisted of interviews and statistics. Interviews were conducted with “diffusing” entrepreneurs, sector experts, and officers of institutions that provided support to the export development process in each of the cases selected. From this, we attempted to respond to the question and assumptions posed in the H-R theoretical framework.

We evaluated the interviews of pioneers, diffusers, public policymakers, and others to determine for each case the nature of the discovery, critical success factors, barriers overcome, coordination problems, and information externalities, and public policy support and incentives, assessing the magnitude of their importance for discovery and diffusion.

Our aim is to develop a matrix to identify, for each case, the factors that fostered the process of discovery and diffusion, as well as how coordination problems affected them and how they were solved. We then compare these factors to counterfactual cases in order to confirm their importance.

4. Context of Discoveries

The study of each of the five cases selected helps to identify the determining factors in the success of nontraditional export products in the Ecuadorian economy. Nevertheless, it is necessary to point out that macroeconomic conditions affected the performance of nontraditional exports just as it they affected the export of traditional products. The following is a brief examination of some of the policies that contributed to a macroeconomic environment propitious for the growth of nontraditional export products. We focus on three general aspects:

- Trade policy, specifically, the initial processes that had a bearing on the marketing of the selected products.
- Monetary policy, specifically, the influence of the devaluation policy that characterized monetary management of the 1980s and 1990s in the country, and its particular effect on exports.
- Business development policies, including a special analysis of the credit policy set in motion by the public sector and the evolution of business development programs in the country.

The purpose of this section is to describe the macroeconomic environment in which entrepreneurial decisions took place. It helped generate the successful growth of certain export products and provided a general framework for the provision of public goods and business development services, such as access to financing and specific export promotion and market development programs. The impact of public policy and programs is revisited in each case for the discovery and diffusion phases.

4.1. Foreign Policy: Trade Agreements and Liberalization

The 1990s was the period of expansion of global trade openness. Ecuador, as a small open economy, was part of this trend. From 1984 to 2004, the total value of its exports went from US\$2.1 billion in 1984 to US\$7.0 billion in 2004, with a simple average growth rate of 6.8 percent. Throughout these 20 years, export value increased 3.21 times faster than GDP growth. Ninety-four percent of the change (increase in GDP) can be explained by increased exports alone.

Undoubtedly, one of the major incentives for the emergence of new export activities was the implementation of trade agreements that reduced obstacles to the entry of Ecuadorian products into the most important international markets. The two main open-door agreements were global and bilateral.

The trade liberalization and openness process took off in the early 1980s. All governments had moved toward elimination of tariffs. Ecuador's contributions to this trend were integrating into joining the Andean Community and joining the General Agreement on Tariffs and Trade (GATT), later the World Trade Organization (WTO).

Although both of these landmark agreements constitute the most reliable proof of Ecuador's openness to international markets, the main impetus behind the selected export products was the signing of two tariff preference agreements in the principal markets for the new and dynamic export products: the United States and the European Union.

4.1.1 Access to the U.S. Market: from the ATPA to the ATPDEA

The trade agreements which have created the most impact in last two decades are the tariff preference agreements with the United States: the Andean Trade Preference Act (ATPA), from 1991 to 2001, and the Andean Trade Promotion and Drug Eradication Act (ATPDEA) between 2002 and 2006.

Since this agreement went into effect, 75 percent of all tariff items were able to enter the U.S. market duty-free. All of the products selected for this study, except canned tuna fish, benefited fully from this agreement; their export to the U.S. market had a zero tariff rate.

The benefits of the ATPA and the ATPDEA coincide with the take-off of the selected new export activities. Thus, these agreements may be considered as one of the underlying incentives for their take-off. Even when taking into account the example of tuna fish, discrimination against the principal product of the industry—canned tuna fish—led to a progressive readjustment of export supply toward frozen tuna fillet. Nonetheless, it is evident that having these trade benefits has not been sufficient to secure a product's success as an export, since other products also enjoyed this benefit and failed to take off.

4.1.2 Trade with Europe Facilitated by GSP Agreements

The Generalized System of Preferences (GSP) is a program of unilateral tariff preferences granted by industrialized countries to products from developing countries. Each granting country has stipulated the products to benefit and a series of standards at the source that must be met to take advantage of the tariff preferences.

The preferential treatment granted by the different preference programs is mostly applied to the industrial products under headings 25 to 99 of the Harmonized Commodity Description and Coding System, the main exceptions being textile products, leather goods, and petroleum byproducts. In the case of agricultural products, only certain products are included and they vary according to the country granting the preference. Since the ATPDEA goes far beyond the benefits of the GSP, this study focuses only on the effects of the European GSP.

Since 1990, certain Ecuadorian exports have enjoyed access to the European market with preferential tariffs. In general, all of the products selected are favored with a zero tariff under the European GSP. There is only one small stipulation in the agreement that might have a certain adverse effect on exports of broccoli and palm heart to the European market, which is that a total tariff reduction on frozen goods is not authorized.

The ATPDEA and the GSP are without a doubt the most important trade agreements signed by Ecuador in the last few years, and they appear to have been instrumental in consolidating the diffusion process of several of the selected activities. For the five Ecuadorian export products studied, two of the most important markets of the world were opened—at least from the standpoint of tariffs—from the beginning of the 1990s.

4.2. Monetary Policy

The so-called “real devaluations,” which began during the social-democratic administration of Rodrigo Borja (1988-1992), were traditionally used in Ecuador to influence the exchange rate and create temporary competitive advantages. Research conducted by the Central Bank of Ecuador shows that the competitive effect brought about by the devaluations did not last more than five months. However, entrepreneurs consulted assert that this type of devaluation was quite useful to sustain the levels of short-term competitiveness. “The competitive devaluations became the real life-blood of our daily production activity. The devaluations fed our cash flow,” said one of the case pioneers interviewed by our team.

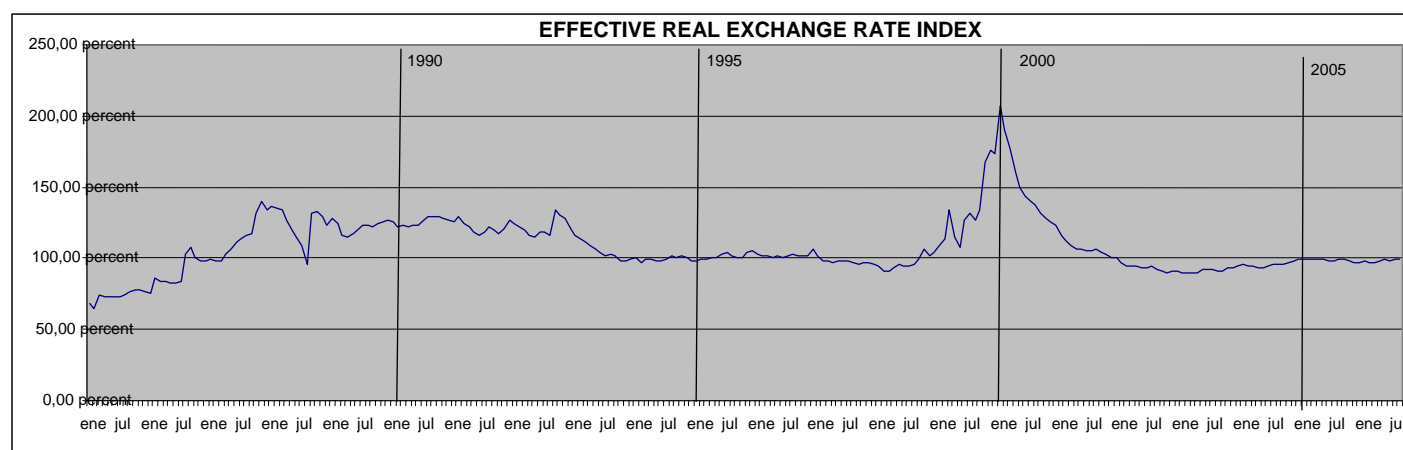
The micro devaluations benefited exporters in two main ways:

- Through a “liquefying” of credit, entrepreneurs sought short-term credits in sucres, the local currency at that time, to finance product-purchasing operations in which the interest rates, normally exceeded by the devaluation, were already fixed. In this manner, going into debt was cost-neutral.
- They lowered production costs. Although factor markets in Ecuador were characterized by their rigidity (labor and transport, among others), they did not adjust at the same rate at which the national currency was devaluated. Since the sectors studied are labor intensive, this was an important effect.

In summary, exporters assert that the devaluations provided a cash cushion for them and masked their inefficiencies. The export sector benefited, as its returns were fixed in dollars and its costs were paid in sucres (and they generally froze their production costs at the beginning of their productive year: labor, suppliers, and transport, among others). At the same time, they could trade by taking on debt, taking advantage of negative interest rates.

The following figure shows the evolution of the effective exchange rate index:

Figure 1. Evolution of Real Exchange Index



Source: Banco Central del Ecuador (BCE).

4.3. Business and Export Development Policies

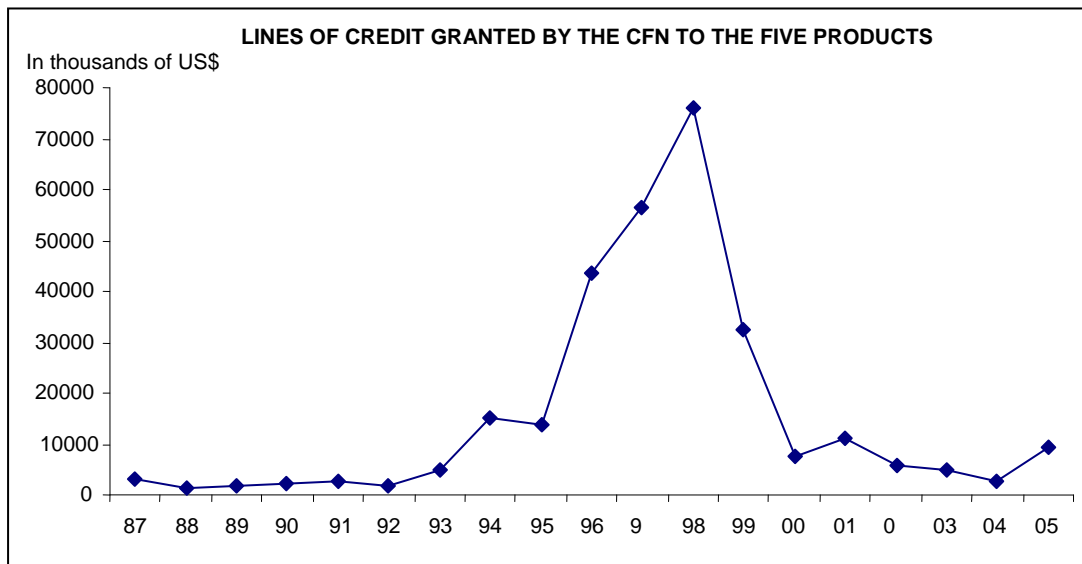
4.3.1 Access to Long-Term Financing

Conducting research on the credit flows that have financed the export activities in question has had some important limitations. Contrary to what one might expect, limitations in information access came mainly from private-sector data. Information on credit provided by private financial institutions to specific economic sectors is considered “classified information,” and the only information we were able to access is that which is available on the website, included in large economic sectors, and available for the 2000-2005 period. Such information is not relevant for the period of analysis. On the other hand, the search for information at the National Finance Corporation (CFN) was highly productive and we were able to access important information that is provided in detail in each case study. A large part of the bibliography consulted casts doubt on the importance of financial-sector support—both public and private—to the development of agriculture in Ecuador.

4.3.1.1 The CFN as a Supplier of Credit to Export Sectors

The CFN provided important support to selected sectors, especially between 1994 and 2000, of the period of consolidation. Thus, it could be inferred that the credit supplied by this institution played an important role in supporting the diffusion of these activities. Figure 2 shows the evolution of credit to the five sectors featured in this study:

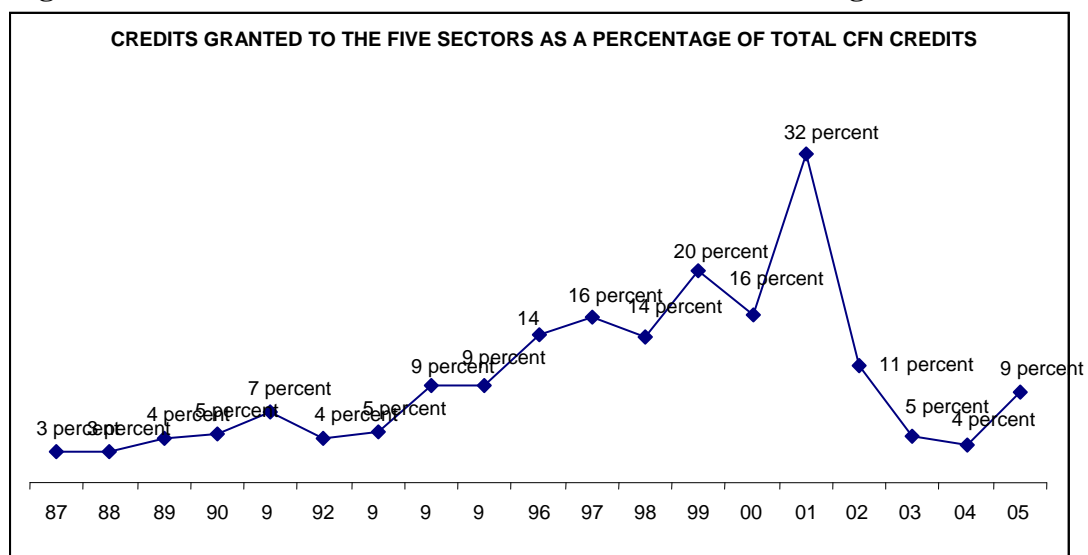
Figure 2. Evolution of CFN Credit to Selected Sectors



Source: Authors' compilation based on CFN data.

It is important to emphasize the ever-greater focus of the CFN on the selected activities, which can be corroborated by the share of credit extended to these sectors out of total credit during the export boom. This trend is depicted in Figure 3.

Figure 3. Share of Credit to Five Selected Cases as a Percentage of Total Credit



Source: Authors' compilation based on CFN data.

4.3.2 Business and Export Development Programs

It is difficult to compile a comprehensive list of the business development programs implemented in Ecuador in the period studied (1985-2005). There is no database that has summarized the multiple efforts carried out by different institutions in the country to bring about improvements in the business climate and to foster the development of the private sector in general and exports in particular.

Still, based on a project commissioned by the Inter-American Development Bank (MULTIPLICA, 2005), it was possible to characterize and evaluate to a certain extent the impact of business development programs in Ecuador. The information available pertains to the 1999-2003 period, and thus may be considered only as an approximation of the general aspects of policies designed to support entrepreneurial development. More than the amounts cited, it is important to bear in mind the types of programs implemented and the main beneficiaries.

The study identified 284 business development programs between 1999 and 2003, which spent a total of approximately US\$138 million. Some 40 percent of those resources were funneled to the beneficiary firms through services provided (consulting and advisory services, studies, among others). It is known that several firms in the sectors studied—especially in the flower industry—were greatly affected by these benefits. The implementation of this kind of assistance can be interpreted very positively, as it enabled technical assistance to be channeled

that may somehow guide (or contribute to diminishing uncertainties for) new activities, such as the ones studied. Some 9.1 percent of the total assistance—that is, nearly US\$5 million in the five years studied—was devoted to the development of commercial fishing (and consequently, tuna fishing) activities.

The information available does not give details on important support provided to the other four activities selected. Still, it is obvious that substantial resources benefited them indirectly through assistance provided by third parties. Around 15 percent of the resources identified by the study were allocated directly to agricultural activities. Thus, the entrepreneurial activities included in our study must surely have benefited in some way.

Some of the most important types of services provided by business development programs between 1999 and 2003 were efforts toward market diversification, market opening, product diversification, quality of supply, and improving corporate supply. In general, it is safe to assume that a large number of business development programs were focused on support for well-established industries or those in a process of growth. Thus, it might be concluded that entrepreneurial processes were not generally encouraged by these programs, though they must have had a considerable degree of influence on the diffusion process.

Table 2 contains information by sector of the only program about which information was available: *Fondos Compartidos*, an export business development program (US\$25 million) financed by the World Bank. The table shows that the five cases analyzed in our study received 39 percent of the total funds.

Table 2. Funds by Sectors

Beneficiary Sectors of Business Development Programs*				
Sectors**	# of companies	%	Amount (\$)	%
Flowers	107	14%	1,920,052	20%
Tuna	57	8%	1,118,946	12%
Mango, Palm hearts	51	7%	754,913	8%
TOTAL of chosen sectors	215	29%	3,793,911	39%
TOTAL	738	100%	9,722,574	100%

Source: Consultancy “Programa de Mejoramiento de la Competitividad: Tipificación y Evaluación de Impacto de Programas de Desarrollo Empresarial en Ecuador”, prepared by MULTIPLICA for the World Bank, October 2004

* Refers to the systematized information of two of the most important programs of business development in Ecuador in the 1990s (FOCEX and PyMES)

** Refers to the category CIU.

4.3.2.1 Specific Support of CORPEI to the Cases Analyzed

In the case of broccoli, CORPEI¹ co-financed activities related to the study and diffusion of best practices in the treatment of soil, water, and pest control. It also allocated funds to foster productive integration among small and medium producers in order to comply with quality standards through the provision of technical assistance. As a result of this program, many alliances were formalized and contracts signed with exporters, which allowed them to implement financing schemes using the credit risk of exporters. Traditional business and market development services were also provided through the *Fondos Compartidos* program with loan financing from the World Bank from 1998-2002, and through EXPOECUADOR with grant funds from the European Union (granted in 2005 for three years.) Finally, CORPEI, through EXPOECUADOR strengthened the business development services provided by the broccoli business association, ASOPROFEL. In this sector, CORPEI has worked with the growers and the exporters, as well as other participants of the broccoli value chain, which accounts for the success in the activities implemented.

In the case of palm hearts, most of the assistance has centered on market promotion services, such as assistance to international fairs for exporters. There has not been a program to work with palm heart growers, as there has been in the case of broccoli.

CORPEI's support to the mango value chain included co-financing to SESA—the phytosanitary agency—in order to comply with market requirements of the United States, Mexico, Chile, and more recently Japan, a new market for mango exports. CORPEI has also contributed jointly with FAO and the International Service for National Agriculture (ISNAR) to co-finance a program which aims to help increase productivity and innovation in the mango value chain through the provision of pest control studies and practices, processing techniques, quality standards, and their dissemination among growers and exporters through FUNDACION MANGO and other private partnerships. CORPEI, through the EXPOECUADOR program is providing technical assistance to FUNDACION MANGO to increase the coverage and efficiency of services provided to mango growers and exporters. Finally, other traditional market and business development services had been provided to this sector.

¹ Corporación de Promoción de Exportaciones e Inversiones. Their mission is to promote exportation and investments of the productive sectors, by making available qualitative technical services, and thus contributing to bring up the image and competitive development of Ecuador to their best potential.

The flower sector is one of the main beneficiaries of CORPEI programs through market development and business promotion services provided directly to firms. Since the flower sector is the most automated export sector, the direct contribution to businesses is higher. In the last two years, it has co-financed technical assistance jointly with IDB-MIF and other donors to EXPOFLORES, the business sector chamber, aimed at fostering the implementation of business network projects and public-private partnerships, such as the creation of a national brand of rose.

Finally, the tuna processing sector has also benefited from CORPEI programs. In this sector, CORPEI efforts have concentrated in the provision of market intelligence, co-financing of promotion activities, and the setting of a quality and certification program to comply with European traceability requirements.

It is important to highlight CORPEI's model of operation, which is based on networks and partnerships. This has allowed this institution to multiply its resources by sevenfold, according to Ricardo Estrada, its president. Additionally, this public-private export and investment promotion agency has a very innovative financing mechanism, consisting of a reimbursable contribution to finance the organization and its promotion effort, financed from levies on petroleum exports (0.0005 percent of FOB value and 0.00015 percent of private exports), other exports and imports. The contribution has to be repaid in US dollars after ten years at zero interest. To ensure repayment, CORPEI invested more than one-third of its income in fixed-term funds. Currently, 90 percent of CORPEI's budget comes from private sources and 10 percent from public contributions.

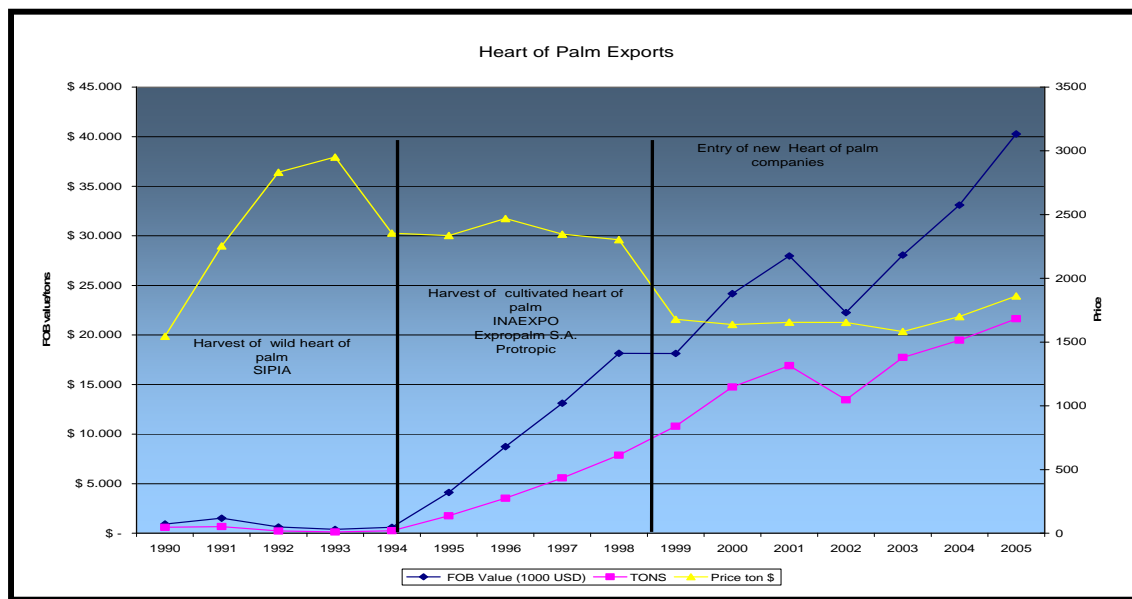
5. Case Studies

5.1 Palm Heart

5.1.1 Trade Dynamics

Palm heart has been exported by Ecuadorian companies since the late 1980s and early 1990s. In 1995 exports increased to a volume of 603 metric tons (MT) in that year, and increased to 21,640 MT in 2005. Halfway through this period, palm heart exports plummeted sharply in 2001, mainly due to a drop in world demand (mostly related to Argentina's economic crisis, one of the large palm heart importers). Notwithstanding, palm heart exports recovered in the following years and increased more rapidly in 2003 (32 percent), 2004 (9 percent) and 2005 (11 percent). During the early 1990s, SIPIA, a canned fruits manufacturer, was the only Ecuadorian exporter.

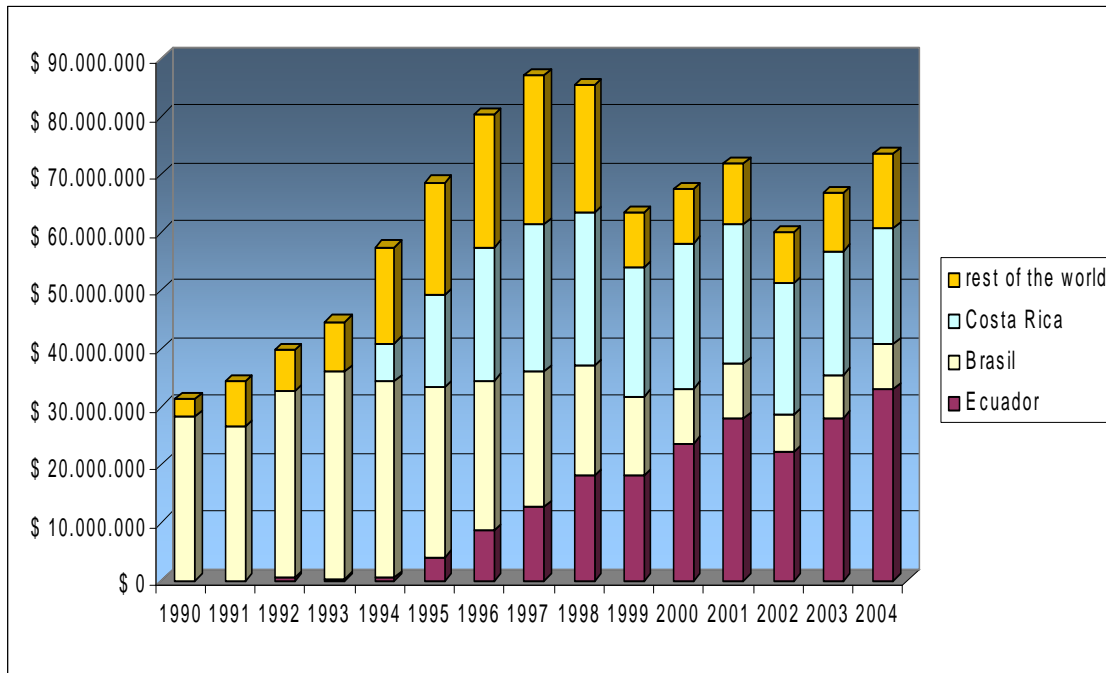
Figure 4. Ecuadorian Palm Heart Exports



Source: Authors' compilation based on BCE data.

At the same time, palm heart global exports had been steadily increasing in the period between 1990 and 1998. In 1999, the market for palm heart declined by 26 percent, but global exports began to recover by 2000, as shown in Figure 5.

Figure 5. Global Palm Heart Exports and Main Exporting Countries



Source: Authors' compilation based on UN Comtrade data.

Global exports of palm heart exhibit competitive and changing dynamics over the last decade. Before 1994, Brazil was practically the only world exporter of palm heart, but things changed in subsequent years. In 1997, Costa Rica was the leader in global palm heart exports, with a market share of 35 percent, followed by Brazil (32 percent), which had been slowing down exports, and Ecuador (17 percent) which entered the market in the mid 1990s and had been increasing its exports. By 2004, Ecuador became the largest palm heart exporter worldwide (45 percent), displacing Costa Rica (27 percent) and Brazil (10 percent). Brazil had been losing market share in exports of palm heart due to its higher rate of domestic consumption of palm heart and because various restrictions were placed on it by environmentalists worldwide. Meanwhile, Costa Rica underwent an important change in its industrial production practices; it reduced agricultural exports and increased technological ones. The abovementioned three countries shared 82 percent of the palm heart export market in the 2000s, with a marginal but consistent participation of Bolivia.

Table 3. Principal Palm Heart Exporting Countries

	2004 Export FOB	percent
Ecuador	\$ 33,071,020.00	45 percent
Costa Rica	\$ 20,046,126.00	27 percent
Brazil	\$ 7,601,998.00	10 percent

Source: Authors' compilation based on UN Comtrade data.

Product Features and Technology

Palm heart is a vegetable obtained from the center of the palm tree. It is extracted from the tender central part of certain palms found in tropical rain forests. In Ecuador, the palm tree is found and harvested in rain forest areas near western Quito and in the jungle region (eastern region). The first harvesting of palm heart takes place 12 months after seeding, and from then on each palm is harvested three times a year.

Within 24 hours of harvesting, palm heart stalks must be transported to industrial plants for processing, canning, storage, and export due to their rapid oxidation process, which makes the product highly perishable. There is an intensive labor requirement in both the agricultural and processing phases, and large extensions of land (at least 20 hectares) are needed for planting so that harvesting periods can be distributed throughout the year.

There are two differentiated stages in the palm heart production process: the first is agricultural and the second is industrial. In Ecuador, very few firms have integrated these two stages; rather, most keep each stage as independent businesses, with palm heart producers harvesting stems and delivering them to processing plants to be canned. Between these two stages, difficult coordination problems arise among the processing plants and the farmers. Palm heart farmers can only sell the product to the processing plants because there is no other way of preserving palm heart. Thus, their negotiating power with industrial plants is quite limited. Industrial processors and exporters need to have a sustained supply of raw palm heart to meet international demand.

In the commercialization process, most industrial plants are world exporters of palm heart, but they are not integrated with local agricultural producers. Processed canned palm heart can last for several years and is shipped by sea to international markets, usually in 20-foot containers weighing about 18 MT and carrying from 1,400 to 1,500 boxes.

5.1.2 The Discovery Process

The first informal operations in palm heart processing date back to 1986, when the raw material was gathered from the country's subtropical forests, especially from the northwest of Pichincha. It was not until 1990 that palm heart exports were registered by the Central Bank and the Companies' Supertintendecy, under item 200891. During the early 1990s, SIPIA was the only firm that exported palm heart, although in reduced quantities, under the leadership of its general manager, Guillermo Narváez, a former production employee of Kennet, a mushroom processing plant. SIPIA is an Ecuadorian firm that began operations in 1981 to manufacture and sell canned fruits in the domestic market, particularly processed mushrooms for the Kennet commercializing brand. In the coming years, SIPIA also offered fruit jams and preserved vegetables, such as asparagus. Since the beginning, SIPIA's marketing strategy was to make quality a distinguishing feature of its products. Its jams had more natural fruit than other brands' jams had, and its canned foods had the exact amount of ingredients that the label promised.

SIPIA's manager was an efficient and innovative leader who was always looking for new products and markets. In the mid-1980s, he wanted to incorporate other products into SIPIA's product lines in order to increase efficiency and reduce fixed unit costs. He first sought to process wild asparagus but was not able to make arrangements with local farmers and growers, so he looked for another vegetable that could be sold to international markets. Finally, he found that producing palm heart was an excellent way to achieve his goal, not only because palm heart's international price was high and there were few world exporters, but also because climate conditions in Ecuador were adequate and it required the same processing technology already used with mushrooms and asparagus. Ecuador was regularly importing palm heart from Bolivia. Thus, SIPIA made arrangements and agreements to purchase palm heart from local growers while at the same time seeking international markets and importers for the product.

5.1.2.1 Initial Uncertainties

Demand Uncertainties

According to SIPIA's general manager, the main uncertainty was about the size of foreign demand and market penetration. The initial overtures were made to Argentina, one of the largest palm heart importers, and with France, where local importers, wholesalers and retailers were visited. There, SIPIA confronted the problem of Ecuadorian exporters' negative image as people and companies who did not fulfill commitments and orders. According to Narváez, "Argentinean importers heard the word 'Ecuadorian' and refused even to listen to proposals... At that time, we were offering a very high quality product, superior to any other in the world, but they did not even want to listen to us; the stereotype was that Ecuadorians offer but do not follow through."

SIPIA tried to improve its image by participating in international fairs and visiting other potential buyers, such as Chile. "We faced that situation by improving the image of our country's exporters through trips abroad to show the quality of our product. That is how we enhanced our image, especially that of our company." In addition, SIPIA knew how exporters from Costa Rica, Brazil, and Bolivia channeled and priced the product, so that pricing was not an issue.

Productivity Uncertainties

In order to process palm heart, SIPIA undertook several trials using different processing techniques. The critical factors to be considered and controlled at that time were the high oxidation rate of the wild variety of palm heart, which made the product rapidly perishable if not processed, and the scarcity of seeded palm trees in the areas around Quito, where the processing plant was located.

SIPIA's expertise in the agro industry business was enough to overcome the difficulties involved in the processing phase and cost estimating, but the shortage of supply of raw palm heart was still a challenge that constrained exports. SIPIA acknowledges that it had no specific arrangements with growers to confront this situation. Its strategy was to look for more palm heart small farmers rather than encouraging intensive production.

Other actors got involved in palm heart cultivation in 1992 with the idea of subsequently establishing their own processing plants. Their efforts were successful to the extent that they provided a substantial supply of palm heart from field production by 1994, but financial constraints and limited access to capital hampered their progress to the processing stage. This situation created a supply of raw palm heart that benefited SIPIA as a processing plant and, coincidentally, prompted the entry of new processing operators.

5.1.2.2 Nature of Discovery

From Local Canned Goods Seller to Exporter

SIPIA realized that it was able to process a different but related product (palm heart), naturally available in Ecuador, and entered the international market with a higher price and demand. This improved SIPIA's knowledge of agroindustrial production, local market channels, and international canned food market conditions, strengthening the firm's capacity to develop new products in less time. It also had sufficient physical infrastructure and human capacity so that the new project did not jeopardize the stability of the firm. The firm's success was based on its capacity to produce at a lower cost compared to competitors, and on the opportunity to export to a more mature market.

5.1.2.3 Key Factors Affecting Discovery

Natural Comparative Advantage

In the late 1980s, some agricultural entrepreneurs, such as Matthias Tapernoux,² wanted to produce palm heart intensively for export but realized that the sources of wild palm in Ecuador were diminishing. They imported seed from Costa Rica, a pioneer in palm heart exports at the time. The Costa Rican palm heart variety was known to grow faster than the one found around Quito, Ecuador, which meant that crops could be harvested more frequently. However, as their research moved forward, they found out that the desired variety was already available in the Ecuadorian Amazon region, where climatic conditions for cultivation were ideal. Thus, easier access to this new palm heart variety facilitated the process of sowing intensive plantations in 1992, producing a considerable shift in national raw palm heart supply for processing operations by 1994.

² He is a Swiss agricultural entrepreneur who owned lands nearby Western Quito and conducted his own research on Ecuadorian agricultural products for export. He currently owns a macadamia nut exporting firm.

This increased supply coincided with local SIPIA's processing efforts and provided sufficient raw material to begin regular palm heart exports in 1990. Exports have increased by 232 percent over the last 15 years, from 603 MT in 1990 to 21,640 MT in 2005.³ Many affirm that the success of this increased output is due to circumstantial factors, considering that when palm heart producers began harvesting palm stalks, there were few processing plants to process them. In effect, processors did not want to run the risk of waiting around for agricultural activity with idle infrastructure, trying to maintain an operation at the start-up of agricultural production, while knowing that harvests would be poor in volume and quality.

Access to Credit and Free Entry

SIPIA's establishment as a business was possible only with a seed capital credit from the International Finance Corporation, in cooperation with the Alliance for Progress. It was a small loan, channeled through the Caja de Crédito Agrícola (Farm Loan Bank) and supplemented by the savings of the entrepreneurs. According to Narváez, without the credit it would not have been possible to undertake the project for lack of investment capital.

Expertise Developed in the Local Market

At first, SIPIA's canned palm hearts were sold only in the local market, where knowledge was built through processing, costing, and marketing. Later, the company's internationalization was initiated through an Ecuadorian friend of Narvaez who was living in Chile. By way of this contact, samples of caned palm heart were sent, and the market was opened for the first exports. SIPIA started exporting palm heart first to Chile and then to Argentina. These new business opportunities gave SIPIA the chance to export not only palm heart but also other food products.

The capacity developed through doing business in the local market was an essential driver for meeting the requirements of an international market. Foreign palm heart imports demonstrated sustainable growth and showed a mature market that aided in export efforts.

³ Total Ecuadorian supply in MT.

Knowledge and Economies of Scale for Processing at Reasonable Costs

For SIPIA, it was not a problem to maintain regular operations, since its main source of income was processing other products and its fixed costs were already covered. One of the fundamental situations mentioned by Narváez was the availability of physical infrastructure and skilled labor to conduct the necessary trials. He acknowledges that without this support, it would have been very costly and difficult to export palm heart. As a serious processor with the requisite technology and knowledge, SIPIA was able to take in all the abundant produce immediately, and process it for exporting.

Other interviewees assert that many producers planted palms on the promise that INAEXPO, a local food processing company, would open a processing plant in the near future, though this did not happen until early 1994. If the SIPIA plant had not existed, farmers would have closed down operations, since their produce was available as early as 1990. In addition, as distinct from asparagus, palm heart is hard to sell and market without prior processing. Thus, investment and barriers to entrance and exit are high. This situation most probably would have bankrupted growers which, in turn, would have endangered the position of Ecuadorian palm heart in the international market.

Development of a Special Processing Technology

SIPIA developed a particular food processing technology in Ecuador, which differentiated its products. According to Narváez, the food industry technology is the key to its success and has been kept up to the present. Some potential competitors used alternative processing technologies imported from Brazil and Costa Rica: SIPIA claims that its processing technology was developed locally and is superior and differs from others throughout the country in the way it precooks vegetables after shucking them.

5.1.2.4 Barriers to Discovery

Supply and Demand of Raw Material

Lack of coordination, communication and trust among palm heart processors and growers caused shortages of agricultural produce in comparison to demand for its processing. “Farmers cannot meet the agreed rate of production at first, and the processor cannot sit back and wait while sustaining costs.” Narváez acknowledged that the factor that managed to reconcile the two complementary activities was coincidental; that is, “the growers could not have sustained their

production if SIPIA had not been conducting trials long before, without knowing that this phenomenon was developing . . . besides the fact that no processor could have withstood the costs if their production depended entirely on palm heart.”

The problem then lay in “the transition that exists between the agricultural and the industrial components, where the product is planted and there is no one to process it. A case like this occurred with strawberries and asparagus.... The Agromor firm started a project to process strawberries and encouraged many farmers to plant the crop. Since strawberries have a short production cycle, the yields were ready in six months. The processor’s feasibility study had been prepared, but there was no financing to build the facility. Medium-term growers could not make good on the debts from their investments and abandoned their crops.” In the case of palm heart, it is also difficult to arrive at a balance between agricultural production and the industrial area in the short term if quantity (availability) and quality do not match up to needs.

5.1.2.5 A Pioneer or a Follower? A Discovery by Matthias Tapernoux

Availability of wild palm heart in the Quito area was seriously reduced due to consumption. In the late 1980s, Matthias Tapernoux conducted research on seed and soil conditions while encouraging local farmers to start planting palm heart. At that time, SIPIA was the only processing company that had been profiting from palm heart exploitation. When the amount of raw material started to fall, Tapernoux initiated a phase of widespread planting so that his associated processors could start exporting.

Initial trials—a Tapernoux initiative—were conducted with seeds imported from Costa Rica. Tapernoux’s research, along with technical assistance on cultivation, was an important contribution to the development of the sector, since it launched a process of widespread planting in Pichincha’s northwestern region. After some research, it was determined that the same seed imported from Costa Rica existed in the Ecuadorian Amazon region. The accessibility of the seed, along with the promise of being able to sell the shoots, prompted the entry of a large number of participants into the sector. Tapernoux had promoted the sowing of crops but was not able to develop the agroindustrial part of the business due to financial constraints, nor was he able to fulfill his promise of buying up the shoots from farmers.

Tapernoux was involved in the palm heart growing phase with the idea of subsequently engaging in agroindustrial production. Attempts to create partnerships with existing processing

plants failed because it was not possible to arrive at a win-win situation. The main problem at that time was lack of credit for new agricultural projects. According to Tapernoux, “the bank was willing to give [him] a consumer loan (that is, to buy a car or a house) with no questions asked, but when [he] mentioned the agribusiness project, the bank proved unwilling, especially concerning the guarantees. The bank explained that if the project did not pan out, they would not be able to do anything with the existing machinery, since no one would want to buy it.”

In any event, Tapernoux was able to fulfill his goal of setting up a processing plant six years after his initial efforts to propagate agricultural production. EXPROPALM was founded in 1996 for the sole purpose of processing palm heart. In order to start the business, it was necessary to put together the capital by taking on ten partners and a bank loan.

Although Tapernoux appears to be a follower in palm heart processing since he entered the business six years after SIPIA, he is also a pioneer on the growing side of the business. He invested in the discovery of seeds that worked locally and created information externalities. Some aspects of his entry into export activities will be considered in the diffusion section of this paper.

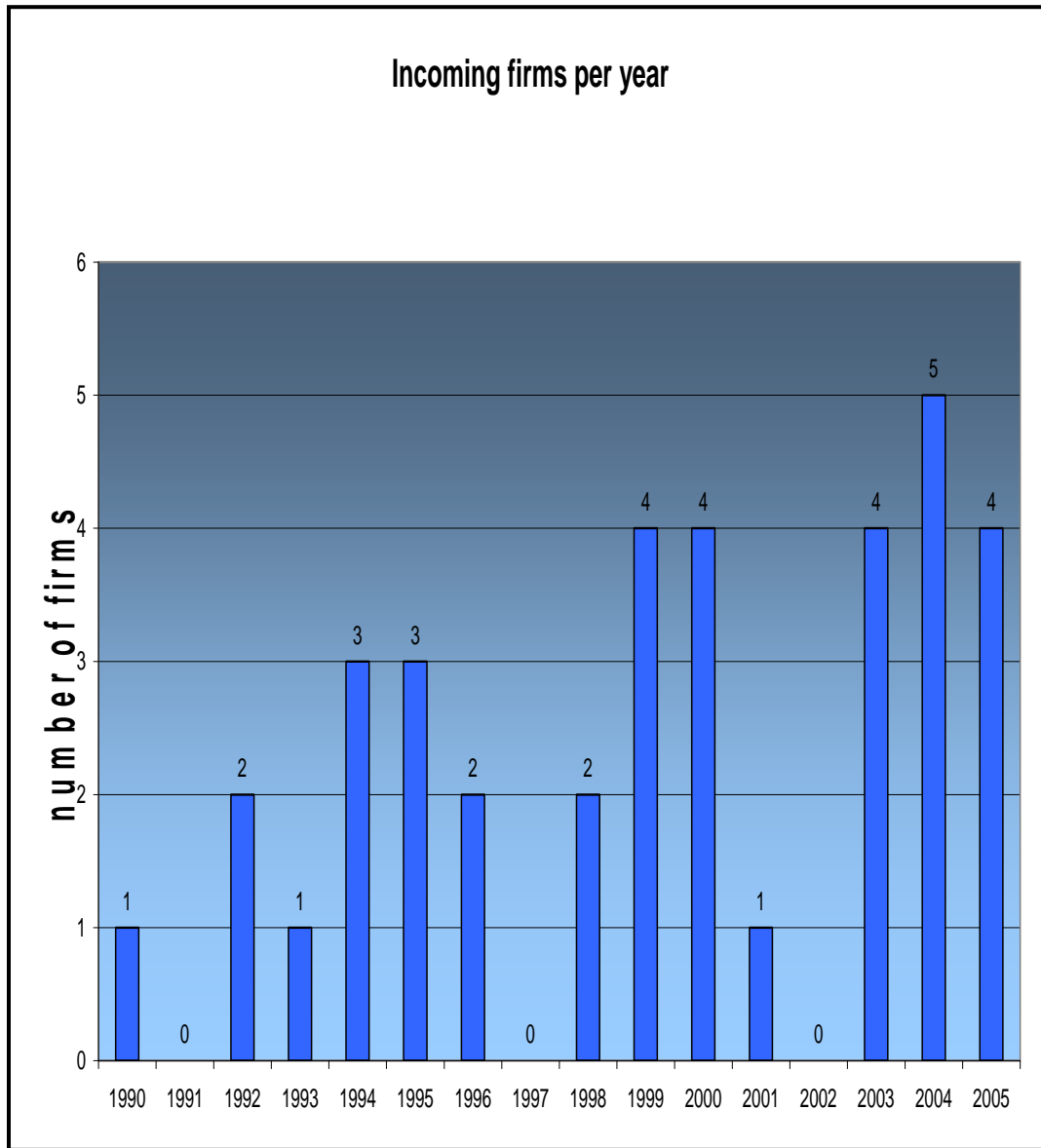
SIPIA, for its part, benefited at no cost from Tapernoux's activities to promote palm heart production. Three years after Tapernoux promoted palm planting (1991), harvests began to materialize and the growers who approached Tapernoux to sell their produce were referred to SIPIA, which had already developed processing expertise. With the availability of the new variety (*Bractris gasipaes H.B.K*), a considerable increase in sales occurred. The growers' supply of palm heart shoots to the market prompted an increase in exports starting in 1995, which has remained high to this date.

5.1.3 The Diffusion Process

Other Participants in the Palm Heart Sector

Following SIPIA's entry in 1990, new participants entered the palm heart processing and exporting business starting in 1992. These included INAEXPO, Industria Conservera GUAYAS, and Expropalsa. Between 1990 and 2005, the number of firms in the palm heart export business grew by 27 percent. According to official records, there are currently 36 firms participating in the market, although field research has shown that the number of firms is actually smaller since many of them have shut down operations.

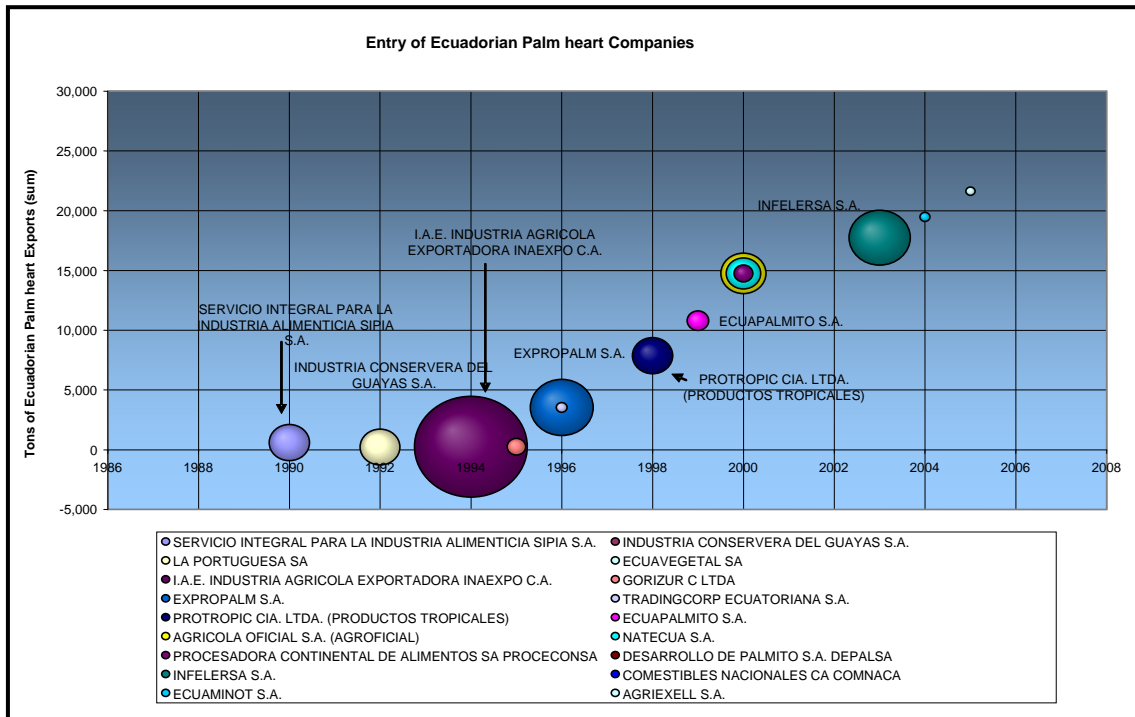
Figure 6. Entry of Palm Heart Exporting Firms



Source: Authors' compilation based on Superintendency of Companies data.

In the first five years after discovery, 10 firms entered the palm heart processing business. After 10 years, 22 firms had entered, and 36 firms were operating 15 years from the outset. The diameter of the circles in Figure 7 represents firms' contributions and importance by volume of exports at 2003. In particular, INAEXPO's entry brought about a substantial increase in Ecuadorian exports starting in 2004.

Figure 7: Palm Heart Export Firms and Entry per Year



According to SIPIA's general manager, other participants knew about the growing international demand for palm heart and the appealing price. In fact, global imports of palm heart have increased on average by 21 percent in the years analyzed, although a 25 percent drop in imports can be observed for 1999, due to a decline in imports by the two most important markets: Argentina (21 percent) and France (40 percent).⁴

The dynamics of the international market for palm heart prompted a proliferation of the companies engaged in the palm heart export business. In the last few years, this growth has accelerated. Fourteen firms initiated activities between 1990 and 1998, and 22 new participants entered the market between 1999 and 2005.

⁴ The effects of the slump in imports, and in the paid price, because of the Argentine crisis were largely passed on by the industrial sector to the agricultural sector in Ecuador. Farmers who had been receiving a price of US\$0.26 per palm heart shoot underwent a price drop to less than half of the previous amount after this crisis, and this affected crop cultivation practices. Nevertheless, the crisis prompted the processors' marketing departments to give special attention to diversifying exporting to alternative destination markets.

5.1.3.1 Characteristics of Imitators and Factors Driving the Diffusion Process

All of the firms involved in the diffusion process were domestic. Many of those established during the period analyzed have ceased operations. The following types have been identified, excluding the ones that cannot be categorized:

- A. Firms growing palm heart that started agroindustrial activities without prior experience in canned goods: three firms.
- B. Canned goods processors that changed to another product (jumping to another tree): 10 firms.
- C. Firms that intended to exclusively process palm heart: 13 firms.
- D. Firms devoted solely to marketing palm heart: 11 firms.

From this classification, it is clear that few growers have successfully gone into agroindustrial processing without prior experience. This is due to the financial barriers to entry (A). Furthermore, the numbers show that most of the participating firms already had infrastructure, experience in canned goods, and a solid financial position and were able to use these assets to jump to other proximate products (B). Some processing plants began operations only to process palm heart but then went out of business due to the dynamics of the market (C). Additionally, some firms have benefited from the export process exclusively as intermediaries (D).

The technology used in palm heart processing is in keeping with general standards for food processing, which might explain the success of new participants with prior experience in canning. This is the case of INAEXPO (jumping to another tree), which obtained specific palm heart processing technologiespalm heart in Costa Rica. However, some other new participants did not have prior experience in food processing but were successful in the international market. Since processing technologies do not vary much among competitors, they do not face important barriers for diffusion.

Few of the firms that entered the business have remained in the palm heart market. Some of the surviving processing companies with the highest volumes of exports are the following:

- INAEXPO (B)
- SIPIA (B)
- ECUAVEGETAL (B)
- ECUAPALMITO (B)
- EXPROPALM (A)
- PROTROPIC (A)
- NATECUA (B)
- GERIC (B)
- PALM TRADE (A)

Other Movers' Contributions

One important mover involved in the diffusion process was INAEXPO. It began exporting palm heart in 1994 and palm heart is currently the largest palm heart exporter in Ecuador and globally. It is part of a group of companies owned by PRONACA, a leading domestic producer of meats and canned goods. INAEXPO credits its success in the palm heart business mainly to its timely entry and to its good management, which is based on a long-term business outlook, development of its production system, and investment in research and development. Gonzalo Moya, the firm's general manager, said that through UNIDO⁵ and its market development program, it was possible to make contact with a large palm heart distributor in France. Through this contact, INAEXPO started exporting to a different market than the first mover (SIPIA), that is Argentina and Chile, and initiated a phase of expanding the horizons of Ecuadorian palm heart exports to include the entire world.

⁵ The United Nations agency for industrial development and competitiveness.

Table 4. New Markets for Canned Palm Heart

year	EXPORT Destinations of Ecuadorian Heart of Palm								
1992	Argentina	Chile	France	Spain					
1994	Argentina	Chile	France	Spain	Colombia	USA			
1996	Argentina	Chile	France	Spain	Colombia	USA	Germany, Israel, Holland, Uruguay		
1998	Argentina	Chile	France	Spain	Colombia	USA	Germany, Israel, Holland, Uruguay	Canada	
2000	Argentina	Chile	France	Spain	Colombia	USA	Germany, Israel, Holland, Uruguay	Canada	Belgium
2002	Argentina	Chile	France	Spain	Colombia	USA	Germany, Israel, Holland, Uruguay	Canada	Belgium
2005	Argentina	Chile	France	Spain	Colombia	USA	Germany, Israel, Holland, Uruguay	Canada	Belgium

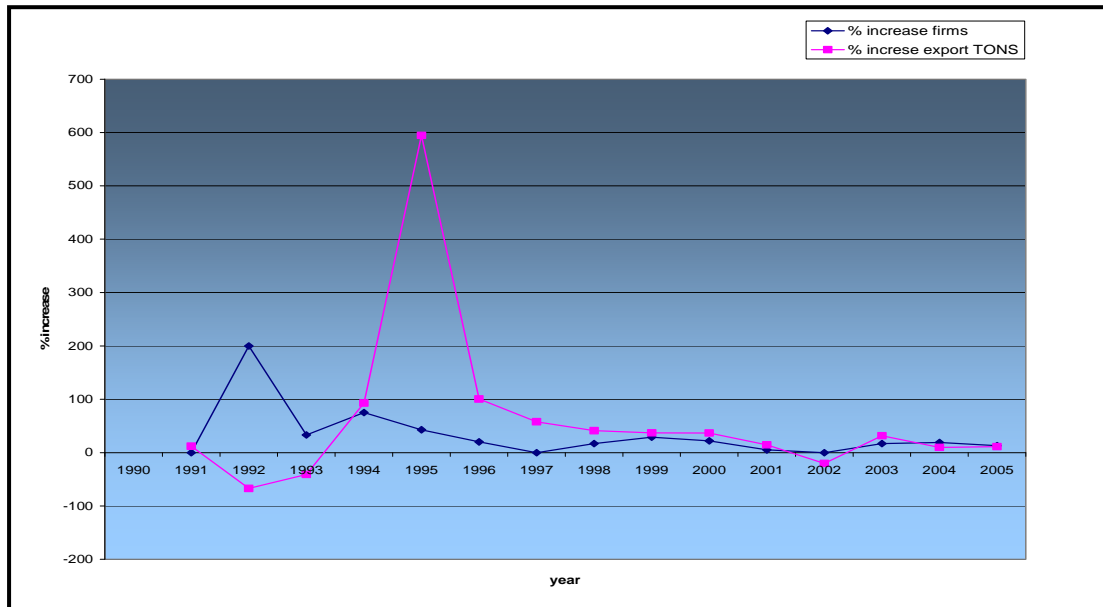
Source: Authors' compilation based on UN Comtrade data.

A change in destination markets for Ecuadorian palm heart exports can be observed over the last decade. By 1998 the main importers were Argentina (44 percent), followed by France (36 percent), while by 2004, Ecuadorian exports were concentrated in France (45 percent), followed by Argentina (13 percent) and Chile (11 percent). Important newcomers, such as INAEXPO, PROTROPIC, and EXPROPAL were able to open and keep new markets because of the growing global demand for palm heart.

Rate of Diffusion and Impact

The entry of new participants into the palm heart business had a definite impact on exports. In particular, INAEXPO's and Industria Conservera Guayas' entry increased exports by 600 percent in 1994-1995, which in absolute terms represented an increase from 254 MT in 1994 to 1,765 MT in 1995. Growth continued over the ensuing years, though less dramatically.

Figure 8. Rate of Diffusion vs. Rate of Export Growth



Source: Authors' compilation based on BCE and UN Comtrade data.

Impact of the Diffusion Process on the First Mover

The entry of other companies into the market affected the first mover and new entrants in different ways. Ecuadorian exporting firms had to moderate prices in order to compete internationally. Meetings were held among exporting firms, but no agreements were reached on sales or price per box. This situation affected companies that had well-established sales in certain countries. However, in the case of SIPIA, it initially enhanced SIPIA's name and position in the international market. Moreover, new markets were opened for new entrants and demand in these markets has continued to grow.

Nonetheless, the sustained entry of new exporting firms with little or no experience in commercialization and eager to sell their products could have contributed to lower prices in the international market. According to interviews conducted with officials at INAEXPO, PROTROPIC, EXPROPALM, and SIPIA, this situation affected incomes and returns in the palm heart business. The volume of palm heart imports increased, but export amounts did not rise in equal proportion due to the previous drop in prices. Moreover, it is thought that Ecuador was not capable of adequately responding to and accommodating the international demand for palm heart because of coordination problems with growers for the availability of raw material. This state of

affairs affected the first mover and initial followers, all of which have steady customers with fixed orders to meet.

For the pioneer, the diffusion process has had both positive and negative externalities. On the one hand, the large number of participants at present helped position Ecuadorian palm heart globally. Ecuador is now the world's main producer of palm heart, with a 45 percent share of total exports. On the other hand, participation of new processing companies in the export market had two negative effects: a drop in the price paid for Ecuadorian palm heart due to the lack of skill in price negotiation on the part of the new firms, and an unsatisfied local demand for raw palm heart for processing⁶ given that existing plantations were operating at full capacity. These effects were the result of the concentrated power that processing companies had on the price of raw palm heart. This situation does not allow Ecuador to respond to the growing international demand for palm heart.

These conditions are caused by a weakness in the production chain. Many palm heart growers assert that the large profits earned by the processing/exporting companies have not been distributed within the system, including farmers. This situation has discouraged growers. Many processing companies recognize their responsibility for this situation. The low prices paid to producers have caused growers to lose interest in expanding their plantations and have dissuaded new participants from coming into the business.

Initial Uncertainties of Imitators

The main uncertainties shared by INAEXPO, PROTROPIC, and EXPROPALM were around securing raw material for processing and obtaining the technology applied in the planting process and in industrial processing.

INAEXPO had been looking for new products for several years. Its production, which included fruit jams, different types of sauces, and meat products, was intended for the domestic market where it had an important position; its management was looking for a star product especially for export. Various options were analyzed and they decided on palm heart considering that it had all the characteristics of a successful product in view of the growing international demand, the country's competitive advantage in climatic conditions, the availability of an inexpensive labor force, and adequate infrastructure for processing.

⁶ That is, fresh-cut raw material.

At first, based on the large demand from France, INAEXPO's uncertainty lay in securing the necessary and constant supply of raw product—the same situation faced by SIPIA. However, they approached it differently: INAEXPO's strategy was to cultivate palm heart themselves while at the same time promoting palm heart planting by other farmers. The initial plan was that INAEXPO would plant 50 hectares of palm heart and endeavor to establish a network of independent farmers as partners (for another 200 hectares), who were to be given technical assistance, seed, and the assurance of the purchase of 100 percent of their harvest. This contracting scheme could have helped them to become solidly established as the leading exporting firm in the country and internationally.

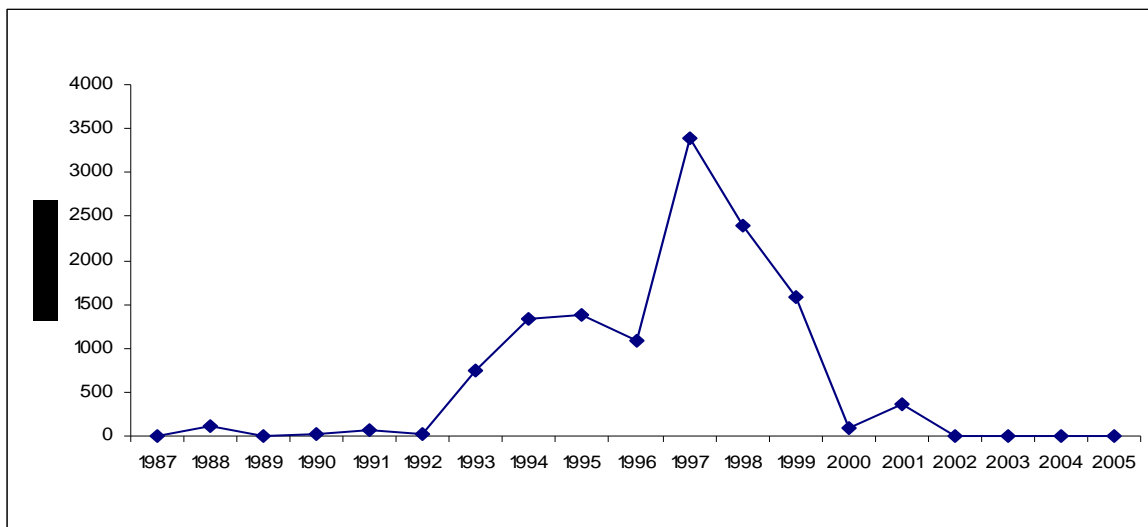
With regard to production, the answers for processing technology were found through their own efforts along with assistance from Costa Rican firms. These solutions and expertise were passed on to the network of partners in order to achieve the required quality and volume of production. The learning process was fast, and they achieved the goals they had set with respect to supplying the French market in the time frame and with the quality stipulated.

The Effects of Public Policy on the Diffusion Process

The National Finance Corporation (CFN), a public entity created to promote production through financing, granted loans to palm heart producers and processors at interest rates of 5 percent to 15 percent and terms of 90 days to five years. Most of these loans and credits were granted between 1995 and 1999 palm heart (see Figure 10), with approximately 15 percent allotted to this sector out of the total amount of loans issued to all sectors. This time frame coincides with the largest rate of growth of palm heart exports in Ecuador. It is safe to assume that this growth was partially a result of these financial initiatives.

At the time of discovery and initial exporting, according to the interviews done, the existence of these loans was not common knowledge. They were only funneled through private banking institutions, which overplayed the risks involved in agricultural investments and required collateral that exceeded the amounts of the loans. Thus, potential producers and processors were discouraged by excessive financial screening and guarantee requirements.

Figure 9. Loans Granted by the CFN for Palm Heart Production



Source: Authors' compilation based on CFN data.

Despite the substantial increase in the number and size of the loans offered by the CFN, many interviewees reported that they overlooked public sources of financing. In their view, the government had only a limited role in promoting palm heart exports, with no beneficial effect on industry development; rather, progress achieved was the result of the companies' own efforts. Moreover, a widely held view is that the government creates hindrances in the form of excessive taxation and red tape, which prevents processes from being more efficient. However, they suggest that private and public loans to palm heart producers and exporters could be highly positively correlated with Ecuador's export volume and the number of processing plants and palm plantations entering the market.

As SIPIA's manager indicated, Ecuadorian agribusiness entrepreneurs need seed capital not only to start up operations, but also to make the transition from the farming to the industrial phases.

In addition, INAEXPO's manager noted that exporters' competition with other countries is unfair because there are no explicit tax incentives or subsidies for palm heart producers and farmers. In contrast, Costa Rican exports enjoy a 16 percent tax exemption for exports, called CAT, in addition to other kinds of subsidies provided to countries such as Bolivia and Colombia for substituting coca crops for palm heart.

Nevertheless, there is wide acknowledgement by exporters of the support received from international agencies. The first such support came from UNIDO, the UN agency for industry development and competitiveness, which was key in providing market intelligence and making contact with importers in potential new markets. The second was PROEXANT (a national office for promoting nontraditional exports, supported by USAID). This agency provided reports and analyses for the palm heart sector, particularly the growers, which included valuable information about best places for planting and how to make seed, grow, and harvest palm heart.

Finally, palm heart trade has profited from the signing of international agreements such as the ATPA (2001) and the GSP (1990). These agreements have allowed duty-free entry of the product into the main destination markets for Ecuadorian exports, such as the United States, France, Canada, Germany, Belgium, Spain, and Italy. More importantly, these international agreements, although critical for the growth of the sector, were not a precondition for discovery, since the original markets were Argentina and Chile.

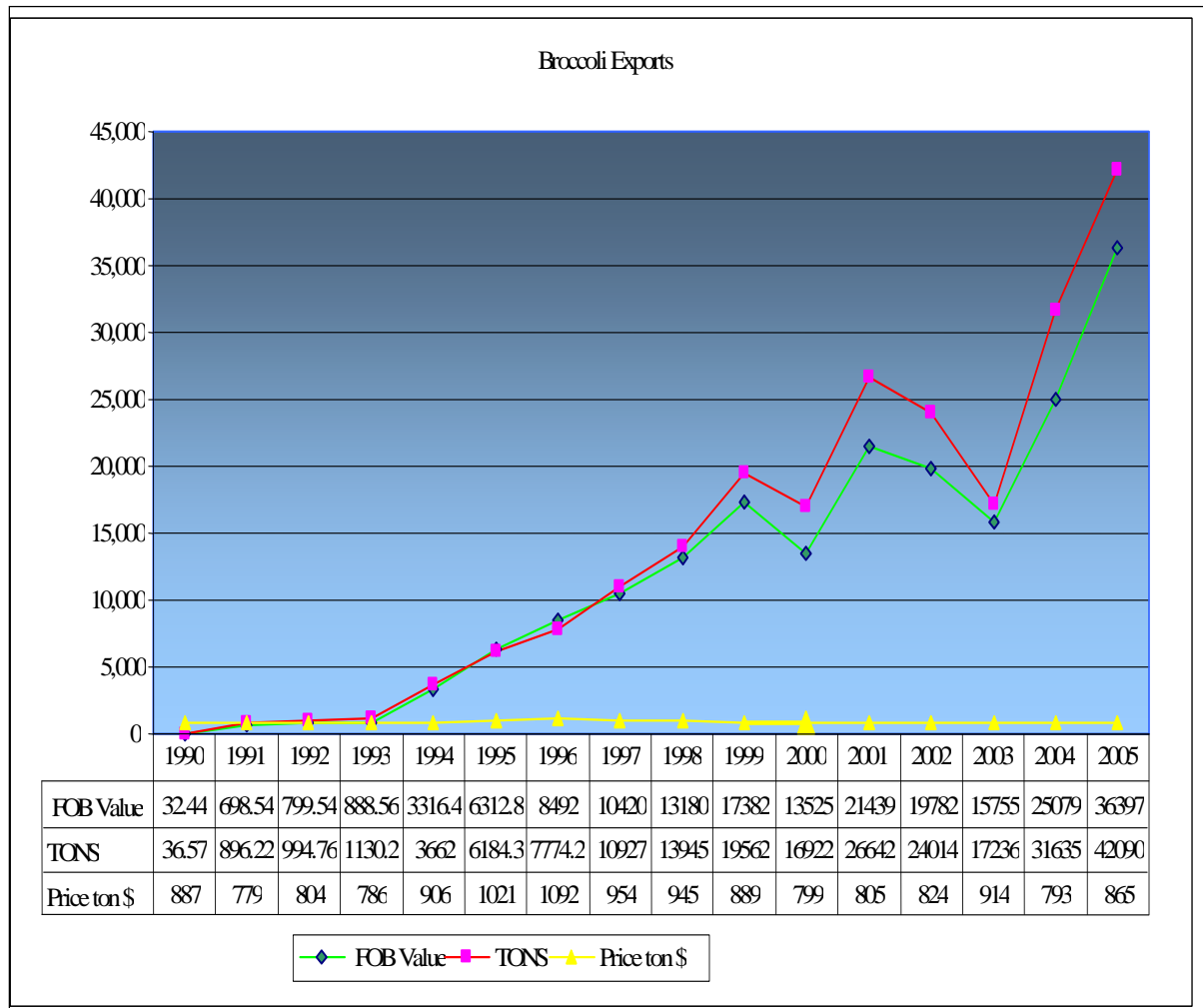
5.2 Broccoli

5.2.1 Trade Dynamics

Ecuadorian Exports

Ecuador began exporting broccoli in 1990, shipping just US\$32,000 worth but marking the beginning of steady growth in exports that has continued to date. By 2005, exports had reached US\$36,000,000 annually.

Figure 10. Ecuadorian Broccoli Exports



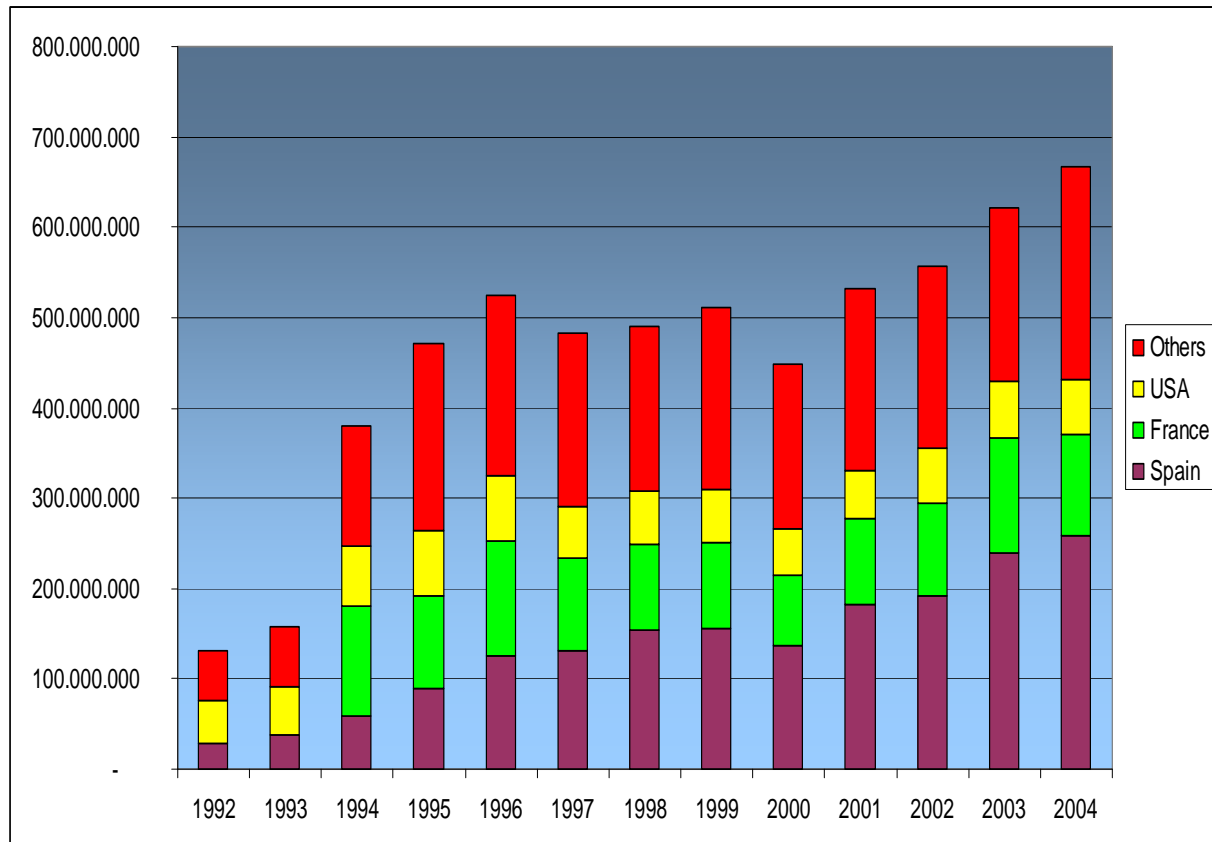
Source: Authors' compilation based on BCE data.

Global Exports

Spain is the largest exporter of broccoli and has remained in that position for the last few years, followed by France, the United States, and Italy, in that order of importance. Ecuador is in seventh place and has maintained steady growth, even though it is far removed from the top positions.

As can be observed in Figure 11, there has been steady growth of supply since 2000.

Figure 11. Global Broccoli Exports



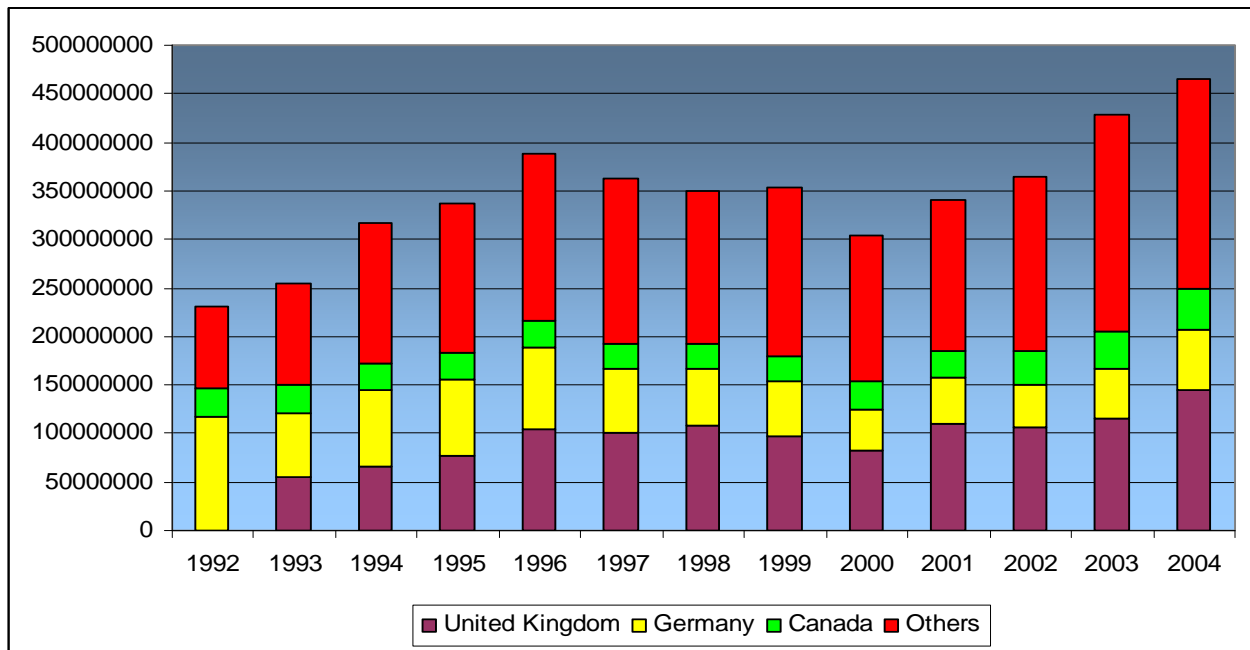
Source: Authors' compilation based on UN Comtrade data.

Global Imports

Worldwide demand for broccoli is quite considerable. In order of importance, the major importers are: the United Kingdom, Germany, Canada, and France. These countries have increased their imports steadily over the last few years.

As can be seen in Figure 12, there has been steady growth of demand for this product starting in the year 2000, consistent with the parallel increase in supply.

Figure 12. Global Broccoli Imports



Source: Central Bank of Ecuador. Prepared by: Stratega BDS

5.2.2 The Discovery Process

PROVEFRUT S.A.,⁷ established in 1989, is an Ecuadorian processing company specializing in broccoli. The stockholders who founded the company are entrepreneurs who can be divided into two groups: the first had an agro-export approach and extensive prior knowledge of agro-exporting; the second had both industrial and exporting experience.

Broccoli exports have been on record in Ecuador since 1990, when PROVEFRUT was the only company exporting the product. PROVEFRUT remained the exclusive broccoli exporter until 1993, when *Alimentos Congelados Agrofrío S.A.* also began to export.

5.2.2.1 The Uncertainties at the Outset

Uncertainty Regarding Production Costs

Luis Miguel Correa, former manager of PROVEFRUT for several years and currently the manager of PILVICSA,⁸ indicated that neither PROVEFRUT, nor *Agrofrío*, another broccoli exporter, were profitable at first and spent their first years in financial difficulties. The main

⁷ Procesadora de Vegetales y Frutas Tropicales Sociedad Anónima (Tropical Vegetable and Fruit Processing Company, Inc.).

⁸ Pílon de la Victoria S.A., a current broccoli producer and exporter.

uncertainty was that there was no prior production, so discovering and understanding costs and processes was difficult.

The development of the new production techniques was at first very complicated. According to Gómez de la Torre, PROVEFRUT's current general manager, there was no broccoli production in Ecuador at the time of product discovery. This became evident, in Correa's view, at the outset of broccoli production, since certain investments were required and financial institutions approached for new loans recommended that PROVEFRUT get expert technical advice in broccoli production as a prerequisite for receiving financing. Funding was eventually provided.

To develop technical production of broccoli and freezing capacity, PROVEFRUT turned to Chilean experts who had immigrated to Ecuador due to circumstances in their own country. With their knowledge and that of other Ecuadorian experts, the company was able to develop the initial technology to produce exportable broccoli.

Discovering the Optimal Seed Suitable to Ecuador's Environmental Conditions

Because there was no broccoli production in Ecuador at the time of discovery, PROVEFRUT, through the initiative of its former president, Francisco Correa, began to look for the most suitable seed for Ecuador's environmental conditions.

Broccoli seed is still not produced in the country; it is imported. Seed imports in Ecuador are not subject to tariffs or customs charges of any kind. The right type of seed—Coronado—was discovered in 1998 with the assistance of Ministry of Agriculture, SICA and CORPEI.⁹ This increased productivity and also fostered export growth. According to APROFEL, an average of 13.5 metric tons of seed was imported between 1998 and 2003, while none was exported.

For operational reasons, production and export activities are separated into two companies: PROVEFRUT, the processing and exporting arm; and Nintanga, the broccoli grower, which sells its entire yield to PROVEFRUT. Both companies are owned by the same stockholder group.

PROVEFRUT's first export crop was provided by Nintanga, but other farmers have been added over time in order to meet demand and take advantage of production capacity. Since 2006, PROVEFRUT has purchased broccoli in the following manner: the entire Nintanga yield, which

⁹ Corporación de Promoción de Exportaciones e Inversiones [Export and Investment Promotion Corporation], www.corpei.org

comes to approximately 800 hectares under cultivation; and that of other farmers, with crops covering some 300 hectares.

5.2.2.2 Type of Discovery: Jumping to a New Product: From Asparagus to Broccoli

PROVEFRUT was set up to export vegetables from the Andean region. Its first export crop was asparagus. According to Correa, although the entire asparagus production was sold, optimum productivity was not reached due to the altitude at the growing site, and yields were far below what was being produced in Peru. Moreover, the market was not receptive enough to asparagus. According to Rafael Gómez de la Torre, importers offered to buy all the broccoli the company could provide.

This was the origin of the first exports of Ecuadorian broccoli, shipped by PROVEFRUT to Germany in 1990. This experience was so successful that broccoli exports increased by a substantial percentage the following year.

From the start, PROVEFRUT was conceived as a company that would export its own produce, though not necessarily as an exporter. Nevertheless, the scant knowledge and interest in broccoli in the Ecuadorian market (which remains small with very little demand, according to Gómez de la Torre) and the favorable reception of broccoli on the international market led them to concentrate on exporting 100 percent of their broccoli production. When there is a surplus, it is sold to other exporters.

High worldwide demand for broccoli in the 1990s was crucial for PROVEFRUT, because it enabled the company to produce broccoli with the assurance that it would be purchased. In the words of Correa, “finding a market was not necessary and it was sold at good prices.”

5.2.2.3 Key Factors Fostering Discovery

Natural Advantage of Broccoli Production

The shift from asparagus to broccoli required not only a demand for it, but also optimal characteristics to furnish the export quality demanded sufficient volume of production. Each hectare of broccoli planted yields between eight and 23 tons of product. The variation depends on the manner of cultivation and the amount of sunlight the crop receives. Supply of produce is steady; it is possible to get as many as three harvests per year, depending on the variety planted and the growing region. This contrasts to the production in other countries at higher latitudes, where this product is harvested just once a year.

According to APROFEL,¹⁰ the broccoli sector in Ecuador produces a first-rate product whose excellent features are due to environmental conditions, farming practices based on global market requirements, and a manual floret-cutting process. The Ecuadorian sierra region is ideal for broccoli growing. According to SICA,¹¹ 99.9 percent of the total area planted is located in the highlands.

Ecuadorian broccoli production and exports have grown steadily, due to such characteristics as the following:

- The nutritional advantages and health benefits afforded by broccoli;
- The possibility of growing it year-round;
- Highly valued features of Ecuadorian broccoli, including its color and compactness, due to altitude and sunlight conditions;
- The hand-cut floret process;
- The Individual Quick Freezing (IQF) process.

The altitude at which broccoli is grown in Ecuador constitutes a natural barrier against certain insects and diseases that in other climates make it necessary to suspend production at certain times.

With the IQF process, foodstuffs are rapidly frozen in individual pieces and then packaged. Thanks to this system, the product does not lose any of its properties (taste, texture and nutrients), nor does it require any artificial inputs during processing, and it is possible to keep it in optimal condition for as long as two years, with no other ingredients or preservatives necessary.

Ability to Switch Products: Same Technological Requirements

To produce and especially to export asparagus, the initial PROVEFRUT operation needed to have machinery that would enable IQF processing. To that end, Francisco Correa, stockholder and founder of the firm, devoted himself to finding used machinery (second-hand equipment at different agricultural companies throughout the country).¹² This enabled him to have the basic

¹⁰ *Asociación de Productores Ecuatorianos de Frutas y Legumbres* (Ecuadorian Fruit and Vegetable Growers Association)) the current association of broccoli exporters.

¹¹ *Sistema de Información y Censo Agropecuario* (Agricultural Information and Census System).

¹² Interview with Luis Miguel Correa.

infrastructure that would allow the company to operate in keeping with the requirements of the international market while reducing the considerable investment that this required.

Despite the above, says Luis Miguel Correa, the investment was quite high, amounting to US\$1 million. This investment was financed through credit from an important private Ecuadorian financial institution as well as through an outlay of capital by the stockholders. The land and the equipment used in the initial production of asparagus facilitated the process of “jumping from one tree to another.”

Access to Credit

As Luis Miguel Correa explains it, they first received a credit to develop PROVEFRUT from a private financial institution, which was facilitated by the stockholder’s credibility. The initial investment was largely financed through the personal funds of PROVEFRUT’s founders. The existence of contracts among producers and exporters facilitated access to credit to small and medium growers based on the credit history of the exporter.

5.2.2.4 Barriers to Discovery

Coordination Problems

According to PROVEFRUT's general manager, Rafael Gómez de la Torre, in the early 1990s, a significant obstacle to exporting was transportation, which was expensive and not regularly available. Transport of broccoli requires refrigerated containers carried on ships. The shipping lines, according to Gómez de la Torre, only gave Ecuador the leftover available space, and in cases where other countries with greater exporting power (such as Chile or Peru) required it, it was even taken away from Ecuador. At first, this caused the country to lose some market share. When there was a demand for transport in other countries with more exports, the shipping lines concentrated on those markets, leaving Ecuador with few options.

Luis Miguel Correa considers, however, that the transport problem was not decisive at first, for one reason: four to seven containers were being exported per month. This very small amount precluded any major problems when the containers were shipped.

According to Rubén Flores, president of APROFEL, transport service posed an important quality problem due to the lack of plant-port security, because it required opening some containers, thus causing the loss of produce. Quality and phytosanitary problems existed among

growers, which were reduced as a result of the contracts signed with exporters. These contracts determined exactly their quality standards, prices and provided them with technical assistance.

Lack of Cold Chain

Broccoli is a perishable food product. Harvesting must be done on the day it flowers; otherwise, it can go to waste from one day to the next, especially on warm days. Once harvested, it must be processed immediately. The freezing process is thus crucial, and processing plants that perform the IQF process require a high investment, making this a decisive factor when new operations are launched.

Lack of Economies of Scale

According to Correa, the greatest problem during the initial years was the low volume of exports. Contrary to products such as cauliflower, broccoli cannot be cut by machine. Broccoli must be cut one stalk at a time so as to eliminate all imperfections and obtain a perfect floret. This process requires a large labor force, but the produce arrived in small amounts, causing many periods of work and machinery stoppage. Initially, very few containers were exported. As a result, it was only possible to reach a break-even point after several years of production. It was only after this stage that they managed to ship a significant number of export containers.

5.2.3 The Diffusion Process

The Growth of the Industry

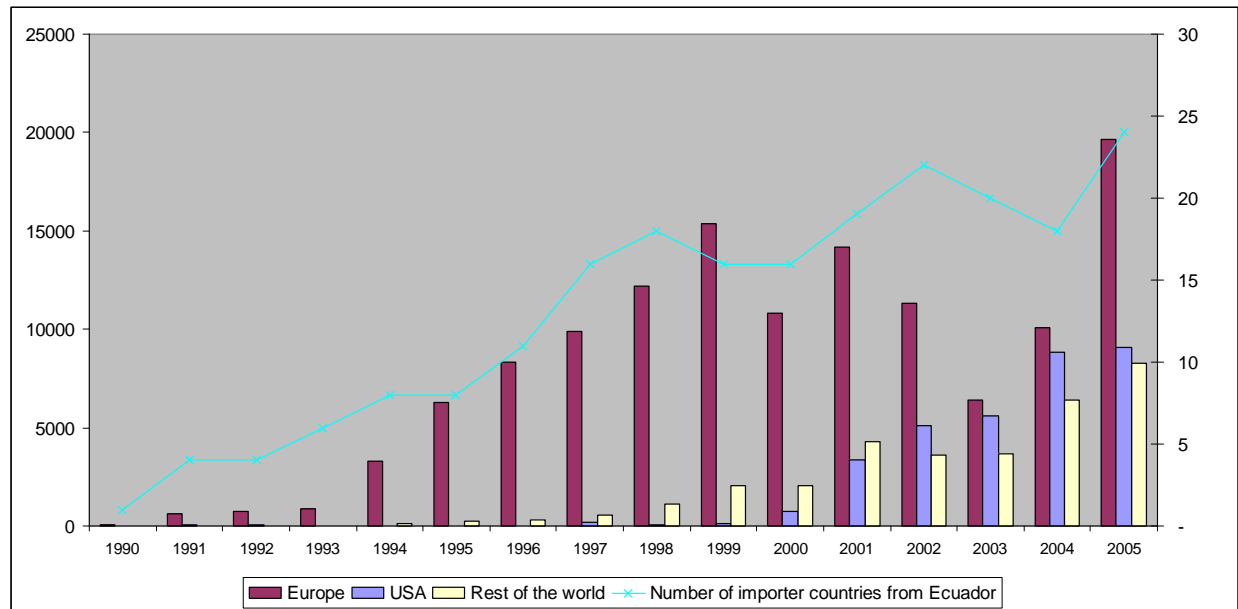
The importance of broccoli as a percentage of non-oil exports has been increasing, reaching tenth place by 2005. Even though it lags far behind the figures for traditional exports such as bananas, shrimp, and cacao, exports have grown very rapidly over the last 15 years, since their outset in the early 1990s.

Export shipments of broccoli grew from four to six containers per month to 20 to 24 containers per month in the first few years of export activity. According to Luis Miguel Correa, this quantity enabled PROVEFRUT to break even. Currently, broccoli exports fill 265 containers a month, 130 of which belong to PROVEFRUT.

Until 1999, an average of 94 percent of Ecuador's exports went to the European Union. Starting in 2000, exports to the EU decreased at a higher rate when compared to exports to the

rest of the world, to the point that the EU took in only 40 percent of Ecuadorian exports. This explains the 22 percent decline in Ecuador's exports worldwide at the time.

Figure 13. Destinations for Ecuadorian Exports



Source: Authors' compilation based on UN Comtrade data.

The European market preference continued until 2000, when exports to the United States became important. However, before considerable exports were made to the United States, produce was exported to other countries, the most important of which was Japan.

By 2000, broccoli was among a number of items given preferential treatment under the ATPDEA¹³ tariff preference system. Instead of carrying a 14.8 percent duty, it could then enter the United States duty-free. This situation explains how broccoli has become the determining factor in export growth. Exports to the United States rose by 466 percent in 2000, and in 2001 exports to that country rose another 322 percent. While exports to the United States continued to rise up to 2005, growth has been more constant since 2002.

¹³ Andean Trade Promotion and Drug Eradication Act.

The Diffusers

From 1990 to 1992, PROVEFRUT was the only firm exporting broccoli. In 1993, *Agrofrío S.A.*¹⁴ appeared as the result of a disagreement among PROVEFRUT partners, according to the group's general manager. The partners who decided to sell their stock in PROVEFRUT formed the *Agrofrío* firm. *Agrofrío* was thus the second company in Ecuador to engage in broccoli exporting. In subsequent years, other firms joined in, though their number has remained small, especially among high-volume exporters.

Despite having arisen as the result of a division within PROVEFRUT, *Agrofrío* experienced some degree of difficulties at its inception, particularly regarding accessing funding for the substantial investment involved in broccoli production. This firm stayed in the export market until 2002, when it shut down. Its assets were acquired by the Valley Foods firm, which had been buying produce from the Zhifoods S.A. firm¹⁵ and exporting it since 2001.

Zhifoods was established with an excellent industrial plant in the Zhical area of Azuay province, where production is difficult because it is so near the bleak and barren high plateau. There was no labor force nearby, so the company had to invest in building living quarters for its workers. Due to these difficulties, Zhifoods stayed in business for only a few years.

Having observed the growth and success of PROVEFRUT and the entry of *Agrofrío*, PADECOSA¹⁶ entered the arena, buying and marketing the production of IQF Agroindustrial of Ecuador. This company came into being by utilizing the infrastructure of a strawberry freezing and marketing company named AGROMOD. IQF Agroindustrial of Ecuador sells its broccoli product to PADECOSA. All production comes from the same processing plant, and all three companies export broccoli, although IQF and AGROMOD export only occasionally.

IQF Agroindustrial of Ecuador was the result of the vision of Carlos Caltallerone, an Italian businessman who observed the large market for broccoli in Europe and PROVEFRUT's substantial production volume. He convinced a group of investors to venture into the broccoli market. He made good use of the knowledge of the industry already developed in Ecuador. A new company, ECOFROZ S.A., appeared in 1996. This company has carried on successful export activities to date.

¹⁴ *Alimentos Congelados Agrofrío S.A.* (Agrofrío Frozen Foods).

¹⁵ Zhical Frozen Foods, Zhifoods S.A.

¹⁶ *Procesadora y Comercializadora de Alimentos S.A.*, PADECOSA (Food Processing and Marketing Company)

5.2.3.1 Characteristics of Imitators and Factors Driving Diffusion Process

High Investment Needs: Moderate Diffusion

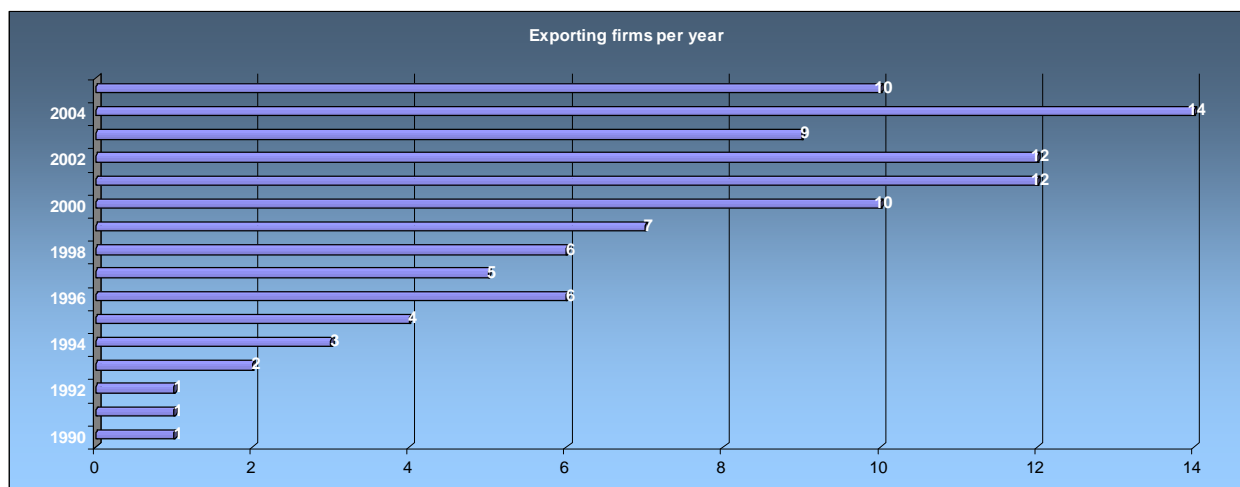
Broccoli has always been exported in frozen form, and the IQF freezing process requires a steep investment. Thus, all exporters have made an investment that allows the maximum freezing capacity per hour. At first, production capacity was 1000 kilos per hour, but PROVEFRUT now has a capacity of ten tons per hour. When production exceeds freezing capacity, surpluses result. These surpluses, which are of optimum quality, are sold to other exporters.

Broccoli requires not only a considerable processing plant investment, but also a large number of workers to process and cut it into florets, since this operation cannot be done by machine. Another important operating cost of exporting companies is transport. At present, around 265 containers are shipped per month at a cost ranging from 25 to 28 cents per kilo.

Broccoli exporting has been limited to a few exporters, although there are around 130 growers. According to APROFEL, there were only 10 exporters in 2005, and only five of these were handling important volumes, while the other five were at an incipient stage. Figure 11 shows the number of exporters per year in the sector.

The high number of growers has had a positive effect on the economy. It also means that firms run fewer production risks, which are principally due to heavy rains, hail or frost. If one grower fails to deliver the produce, or does so in insufficient quantity or quality, the abundance of suppliers enables firms to fulfill their export commitments to customers.

Figure 11. Broccoli Export Firms per Year



Source: Author's compilation based on Superintendency of Companies data.

According to APROFEL, the broccoli trade association in Ecuador, the following companies were members in 2005:

- PROVEFRUT
- ECOFROZ
- AGROMAYA (Valley Foods)
- PILVICSA
- IQF (PADECOSA)

Concentration in a Small Number of Exporters

The number of exporters, comprising those that export only occasionally or are just starting out and those who operate on a steady, high-volume basis, was 10 in 2005, while growers numbered 130 in the same year. CORPEI statistics show that just 7 percent of the large plantations—that is, those with more than 100 hectares—account for 65 percent of the total volume of production.

Most growers have small and medium-size plantations ranging from 20 to 100 hectares. These small growers mostly produce under contract to the processing plants. The modus operandi is the following: the companies sow the seed in greenhouses and five weeks later the seedlings are delivered to the hired growers, along with technical assistance. Farming inputs are the responsibility of the growers. A price is agreed on depending on the quality of the produce. Once harvested, the produce is delivered to the company for processing. Because of this arrangement, growers have grown in partnership with exporters, and their growth is a direct consequence of rising exports.

To cover increasing seedling requirements, nursery operations called “piloneras,” which produce plants in long, elevated seedbed troughs, have been created to provide seedlings ready for delivery to growers.

Two Markets, Two Products

The broccoli sector has understood that its two most important markets, Europe and the United States, are complementary, since these markets seek different presentations. The United States is interested in a long floret with its stalk (heads with different-size stalks), while European preferences lean toward small, compact florets. This makes it possible to get the most out of the product, as waste is much lower with these two different specifications.

According to APROFEL, the main presentations are the following:

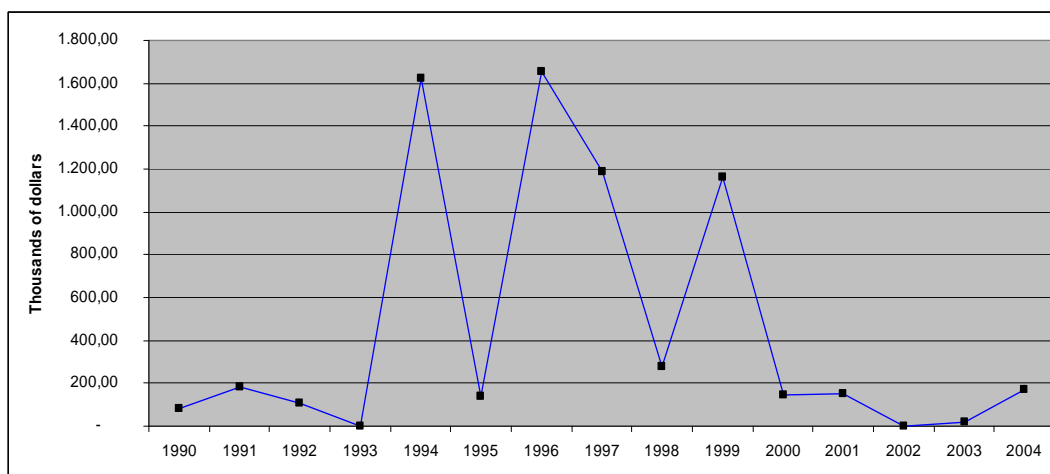
- Broccoli Florets
- Chopped Broccoli
- Broccoli Spears
- Diced Broccoli Stalks

With respect to customs tariffs, the duty paid in the European Community market is 14.4 percent, except for those countries, including Ecuador, that benefit from the GSP tariff preferences, where produce enters duty free. In the United States, Ecuadorian broccoli is free from import duties as long as the ATPDEA preference system remains in effect.

Public Policy Fostering Diffusion

With regard to support from private financial institutions, the CFN has granted credit to the broccoli sector throughout its existence, especially during a four-year period in which the amount exceeded US\$1 million. These loans were issued at interest rates between 5 percent and 60 percent; 77 percent of them were between 5 percent and 15 percent, while 17 percent (that is, nearly US\$1,200,000) were lent at rates between 40 percent and 60 percent. With respect to term, 70 percent of the loans were granted for periods of more than three years.

Figure 14. Loans Granted by the CFN to Broccoli Producers and Exporters



Source: Authors' compilation based on Corporación Financiera Nacional (CFN) data.

Diffusion Effect on the First Mover

The worldwide demand for broccoli is very large and has continued to show steady growth. Since the process of diffusion among broccoli growers has been moderate, this has not posed any competition threats for the pioneer, the first mover.

5.2.4 Counterfactual for Palm Heart and Broccoli: Asparagus

General Characteristics

Despite the differences observed in the exports recorded in our analysis, palm heart and broccoli have a great number of things in common with asparagus. The continued success of these two products, as opposed to asparagus, is notable. In our effort to find the “differences between twins,” we have encountered defining factors with regard to characteristics of demand, form of presentation, and problems of coordination between growers and processors.

To help pinpoint the factors for success, the following table describes the similarities and differences found.

Table 5. Comparison of Palm Heart, Broccoli, and Asparagus

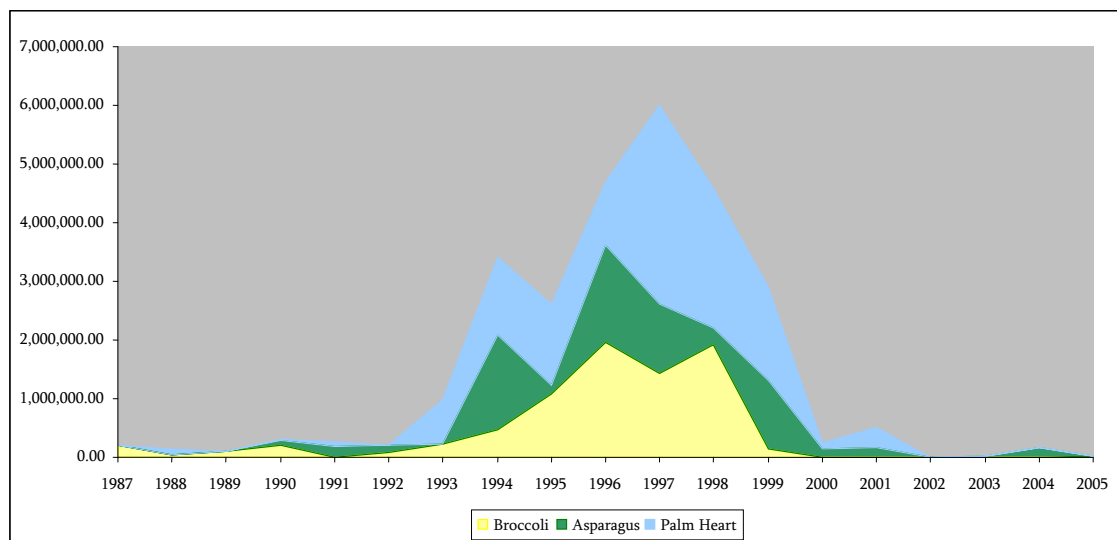
		Palm Heart	Broccoli	Asparagus
Barriers	Phytosanitary	Free	Free	Free
	Tariff	Free	Free	Free
Factors	Labor	Disadvantage	Disadvantage	Disadvantage
	Land	Advantage	Advantage	Advantage
Agronomic Practices	Crop cycle	Perennial	Annual	Perennial
Marketing	Form of sale	Canned	Fresh or frozen (IQF)	Fresh or canned
	Type of shipment	Sea	Air	Air
	Merchandising channels	Wholesalers	Wholesalers	Wholesalers
Hindrances to Entry	Economic	Low	Low	Medium
	Legal	None	None	None
	Technological	Low	Medium	Medium
Public Policies	Credits	Yes	Yes	Yes
Demand	Seasonality	Year-round	Year- round	Seasonal (June to December)

Source: Authors' compilation.

The three products enjoy advantages regarding cultivation, since Ecuador has a broad range of microclimates and provides the characteristics necessary for their proper production. The labor-factor disadvantage is the same for all three products; the hindrances to entry posed are the same, and although palm heart is different in regards to the type of transport required, broccoli and asparagus are the same in this respect.

None of the products has tariff or non-tariff restrictions on its import, and the investments necessary to go into business are relatively the same. There are no legal restrictions to their production in the country, and public policies in terms of credits granted by the National Finance Corporation (CFN) show the same tendency, as is evident from the following figure, since they all increased mainly between 1992 and 2001. As to the amount of money supplied, palm heart operations got an amount practically equal to the sum of asparagus and broccoli projects, with asparagus leading broccoli by around a million dollars.

Figure 15. CFN Loans for Palm Heart, Broccoli and Asparagus

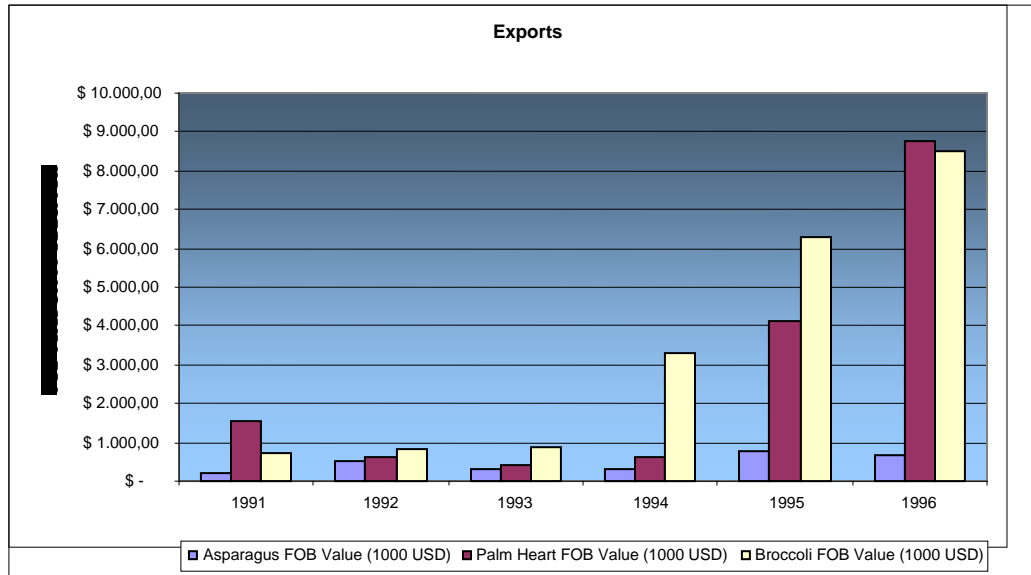


Source: Authors' compilation based on CFN data.

Exports

Asparagus exports shared the lead with palm heart and broccoli exports in the early 1990s, but this situation began to change considerably over the years. Since 1995, palm heart and broccoli exports have substantially surpassed those of asparagus, setting a different growth rate trend.

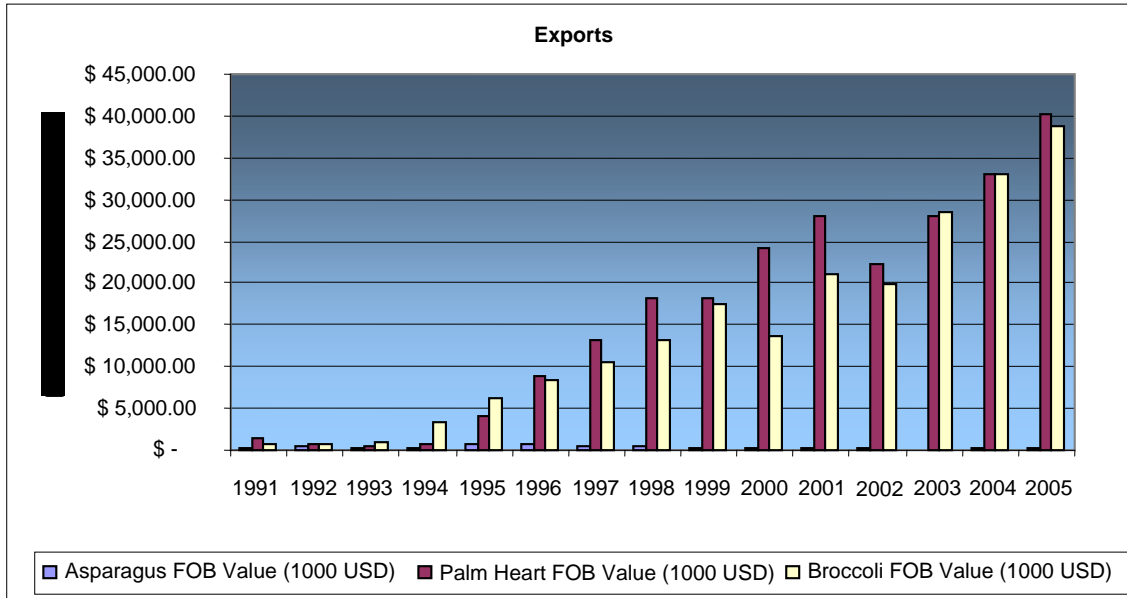
**Figure 16. Palm Heart, Broccoli and Asparagus Exports (1991 to 1996)
from Ecuador to the World**



Source: Authors' compilation based on BCE data.

The differences over time have been quite marked, considering that from 1991 to 2005 both palm heart and broccoli exports showed a dramatic growth rate of 4,219 percent and 5,467 percent, respectively. In absolute terms, palm heart exports went from \$1,525,830 to \$40,284,650, and broccoli exports grew from \$698,540 to \$38,884,320. Asparagus exports, however, showed 76 percent growth in the same series analyzed, going from \$193,200 to \$340,120.

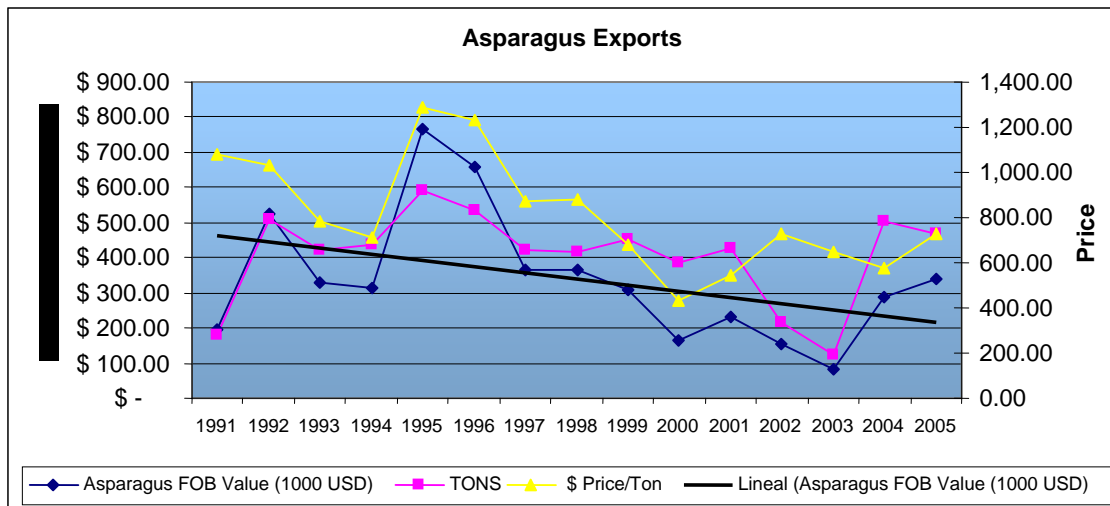
Figure 17. Ecuadorian Global Palm Heart, Broccoli and Asparagus Exports



Source: Authors' compilation based on BCE data.

Asparagus exports have fallen in terms of value, prices, and number of tons. The biggest drops in tons exported were in 2002 (49.85 percent) and 2003 (41.08 percent). Price per ton went from \$1,081.44 in 1991 to \$726.69 in 2005.

Figure 18. Ecuadorian Global Asparagus Exports



Source: Authors' compilation based on BCE data.

Local demand for asparagus is low. It is considered a delicatessen product and is distributed mainly through supermarkets, restaurants, and hotels.

Up to 2005, there were approximately 400 hectares of asparagus under cultivation in Ecuador, and this production was the source of more than 2,000 jobs. There are no trade associations or specialized organizations providing support for this product. Still, there are non-specialized state and private institutions—such as the Ministry of Agriculture and Livestock, the Autonomous National Agricultural Research Institute (INIAP),¹⁷ and the Federation of Exporters and PROEXANT¹⁸ – that can provide some sort of support to the sector.

In contrast to broccoli and palm heart, Ecuador's asparagus exports have to date amounted to a very small percentage of total exports (0.3 percent). Peru leads with 24 percent, followed by Spain (15 percent) and Mexico (13 percent). World exports have shown a positive growth rate of 1.53 percent over the 1996-2005 period, rallying as of 2001. By 2005, world asparagus exports amounted to 6,647,000 metric tons.

Differences in the Twins

The cases analyzed have differences such as the conditions of demand and, especially, their form of sale. The origin of what we consider a problem for the success of the asparagus business can be found in these factors.

Production and Export: Two Links in the Chain

Conversations with Narváez¹⁹ suggest that failure lies in the balance between agricultural and industrial production; that is, a lack of coordination between these stages. The strawberry business is another example of agroindustrial failure. At first, the idea was to export frozen produce, as with broccoli, but it was not possible to achieve the transition between the agricultural and the industrial stages. The case of asparagus is another example in support of this position.

The first challenge consists of the entry of a number of exporters into the farm growing phase, which must then be followed by the agroindustrial complement. The problem lies in that,

¹⁷ Instituto Nacional Autónomo de Investigaciones Agropecuarias (Autonomous National Agricultural Research Institute).

¹⁸ Corporación de Promoción de Exportaciones Agrícolas No Tradicionales (Nontraditional Agricultural Export Promotion Corporation).

¹⁹ General Manager of SIPIA.

when putting the two together, volume and quality do not match up to needs. According to Narváez, it is at this point that help in the form of public policies is needed to provide support for this transition.

Farmers planted large amounts of asparagus, planning to export fresh produce, but at harvest time they did not have continuous demand for it. A key factor in intensifying the problem is the seasonal demand for export asparagus (June and December). Continuous, year-round demand means that a farmer has a constant income that allows him to keep up operations.

SIPIA had a processing plant that was conceived for the purpose of exporting canned asparagus, among other products. They had developed the knowledge to process this produce, which was not very different from the processing required by other products.

Asparagus growers, on the other hand, used farming practices²⁰ for fresh produce export and, due to the seasonality of demand, there were times when they could neither market nor export it. SIPIA would then buy up their production for processing, but the farmers were not happy with the price paid and the processor could not pay what they wanted for their produce. When sold fresh, all agricultural produce commands a better price from the final consumer than that which a processing plant can offer. Lack of communication and incompatible requirements prevented coordinating asparagus production in periods when it could not be exported fresh, and this mismatching was the critical factor for the consolidation of the sector.

The previously described situations cause conflicts between growers and processors concerning price and quality. From the perspective of the farmer, it is easy to understand that it is very difficult to start planting if you do not have an agreement with the industrial processor. According to Narváez, “the solution is to establish the system; if you are going to plant asparagus, you need a formal commitment from the industrialist and specialized teamwork. In any case, the critical part is the point of transition, because when the farmer obtains his first harvests, the quantity will be low and the processor has to receive that small amount and store it, because purchases and exports are handled in high volumes.²¹ No one wants to face up to this gap, and this is where government support comes in; somebody must take charge of that lapse of months, or even years, until the processor can have sufficient volume to export.

²⁰ Depending on the form of sale of the product, there are differences in growing practices, such as the distance between plants. Less sowing distance is required between plants for processing (greater density per hectare). Plants for sale abroad as fresh produce require a greater sowing distance (less density per hectare).

²¹ According to Narváez, buyers never purchase less than one full container.

With respect to broccoli production, according to CORPEI, large plantations—that is, those with over 100 hectares under cultivation—make up just 7 percent of growers and account for fully 65 percent of total production. The remaining 93 percent of growers are small and medium-size operations with between 20 and 100 hectares that account for the rest of the volume of production (35 percent). This is an important factor, since exporters are thus assured of a major percentage of their own export production.

The Product: Export Requirements

A substantial difference that enabled the success of palm heart, in contrast to asparagus, is that it must be processed for sale because of its physical characteristics. This situation, which might be considered a disadvantage, had the opposite effect. The need for the growers' produce to be processed served to promote clearer communication with the processors, since the two parties understood each other as links in the chain of production and decided to work together.

A similar situation applies to broccoli. It must go through the IQF process for its export, so that the produce does not lose any of its properties (flavor, texture or nutrients) or require artificial inputs, including other ingredients or preservatives, during processing, and can stay in prime condition for up to two years. This meant that, even though there were some inconveniences with regard to transport, the product was in no danger of spoiling, thus guaranteeing that despite shipping delays, it would not need to be thrown out, as occurs with fresh export produce.

It is important to point out that even though the IQF process provides a number of advantages for broccoli, it also involves a considerable investment, which poses an important obstacle to an exporter's entry into the sector. As distinct from palm heart, asparagus can be shipped either fresh or processed. The intention at planting time was to market fresh produce²² and this determined field practices; only byproducts and reject material were used for processing. The processing plant had to deal with this problem, since an export business could not be established with characteristics such as lack of uniformity and low quality.

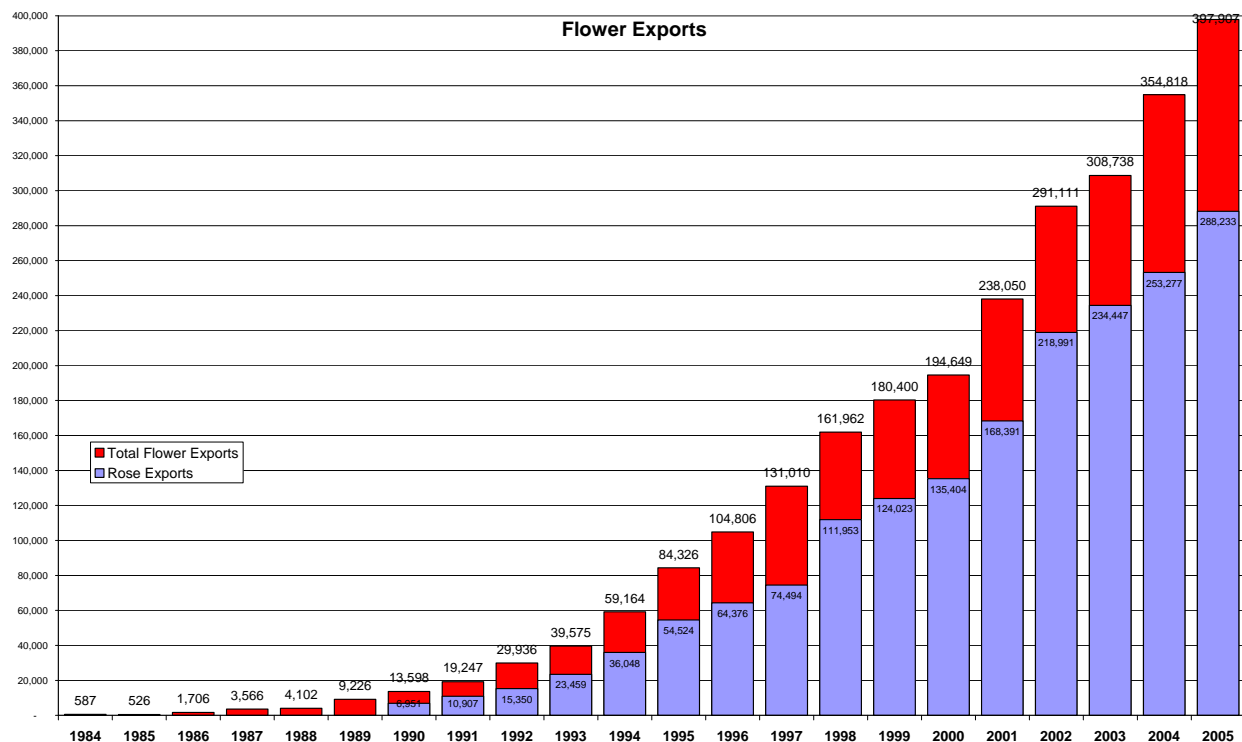
²² Pineapple growing is a similar case of varying density at sowing, depending on the final intent, since it is grown both for fresh consumption and agroindustrial processing.

5.3 Flowers

5.3.1 Trade Dynamics

Ecuador's flower exports have experienced exponential growth since the 1980s. Exports have grown from around US\$500,000 in 1984 to more than US\$400 million in 2006. Figure 20 shows this trend, which also depicts that in the year 1990, exports of roses emerged as the main component and an important reason for the growth in the industry.

Figure 20. Exports of Cut Flowers



Source: Authors' compilation based on BCE data.

The great increase in flower exports has currently placed Ecuador in third place in the world, with 7 percent of all the value traded. The Netherlands dominates the industry, with almost 62 percent of all value traded in the world, followed by Colombia, with 14 percent in 2004. The export value for 2004 was \$4.88 billion worldwide.

On the demand side, the largest importers of flowers are Germany, followed by the United Kingdom and the United States. These three countries represent more than 50 percent of all imports. In fourth place is the Netherlands, followed by France, each representing around 9 percent of the total.

5.3.2 The Discovery Process

The flower business in Ecuador got off to a slow start in the 1960s, when the company *Jardines del Ecuador* began to export flowers from the valley of Cumbayá, 10km east of Quito. Ten years later, in 1976, another company, FLOREXPORT, owned by M. T. González, tried again but did not last long. It was not until 1983 that the industry took off and made Ecuador a major player in the global flower business. Since 1999, Ecuador has been the third largest exporter of cut flowers after the Netherlands and Colombia, surpassing Israel for the first time.

Floriculture in Ecuador began in 1964. It did not grow much or last long. After the first two companies operating between 1964 and 1977, more companies entered the industry between 1978 and 1982, among them La Serena in Cayambe. These companies produced mainly carnations and chrysanthemums. None of these companies lasted after 1984 mainly because of quality problems due to restricted air transportation to the U.S. market and phytosanitary problems caused by production without greenhouses. These problems were exacerbated by the lack of frequent flights.

Table 6. Export of Cut Flowers from Ecuador and Colombia

Commodity Code	S1-29271	
Commodity Description	Cut flowers and buds for ornamental purposes	
Trade Flow	Exports	
Period	Colombia	Ecuador
1963	0	199
1964	14,318	0
1965	19,564	10,686
1966	79,955	125,199
1967	127,975	109,600
1968	276,862	244,199
1969	372,717	225,098
1970	976,237	371,200
1971	1,776,461	279,628
1972	3,076,734	466,934
1973	8,389,325	603,541
1974	15,955,864	550,738
1975	19,310,964	275,781
1976	21,640,895	36,600
1977	32,552,937	5,176
1978	47,580,495	12,229
1979	68,178,754	18,384
1980	97,016,259	45,539
1981	108,573,210	33,600
1982	111,481,843	14,399
1983	120,556,841	154,839
1984	129,492,237	588,000
1985	132,053,806	525,536
1986	148,541,850	1,706,036
1987	145,026,826	3,544,764

Source: UN Comtrade

During the early 1980s, Ecuador exported mainly products produced in the coastal region, such as bananas, coffee, cocoa, shrimp, and fish products. Exports from the sierra region were almost non-existent, and firms and entrepreneurs were looking a product to generate hard currency. Land was abundant and rich in nutrients for agricultural products. In April 1983, Mauricio Dávalos founded Agroflora, a company that would produce and export roses. This company set the pace for what became the new flower industry in Ecuador.

5.3.2.1 The Pioneer in Roses

In 1983, Agroflora's main owner, Mauricio Dávalos, an economist and the Central Bank manager at the time, entered the industry. Dávalos focused on roses. He and his partner, Marco Terán, studied Colombia's successful experience with flower exports and determined that the geographic and climatic conditions of the valleys close to Quito were very similar to those of Bogotá's *sabana*. They contacted a potential partner in the Colombian flower industry, who served as technical manager. The idea began in early 1982 when they developed a project to be presented to the National Finance Corporation.

The project was funded in April 1983, when they legally incorporated the company Agroflora, even though they started to work in August 1983 with their own capital before getting the loan that covered 65 percent of the total capital requirement. The first activity was the acquisition of the land and the procurement of the rose plants from Israel.

Agroflora started with 1.5 hectares of roses, mainly for the U.S. market. Their first client was a Miami importer, who received the flowers in December 1983, and for Valentine's Day in February 1984. Then, the company began providing flowers to a subsidiary of FlorAmerica, Sunburst Farms, for six months and then switched to another buyer. FlorAmerica is the one the pioneers in the Colombian floriculture industry which set up an importing operation in Miami.

5.3.2.2 The Uncertainties Involved at the Outset and Factors Affecting the Discovery

Success in the flower exporting business depends largely on factors such as proximate distance to air transportation, because of the need to keep flowers cold enough for the product to be undamaged; the timely supply of fertilizers, greenhouse plastic films; and most importantly, knowledge of the latest quality techniques and marketing of the industry. These factors became aspects of uncertainty during the development of the flower industry in Ecuador.

One of the main obstacles the new exporter faced was almost nonexistent air transportation to the main markets, including the United States. Dávalos mentioned that one of the most important barriers to export was the number of flights available for the industry. In 1984, Ecuatoriana de Aviación, the national state-owned airline, did not have scheduled cargo flights; the airline flew to Miami only when all the cargo space was sold. This condition caused havoc in the new industry, as flowers are a perishable product. According to Dávalos, the airline cargo manager helped to set up a flight on a specific day for the flower exports. Before, flowers shared cargo space in passenger planes.

According to Dávalos, another important problem was the procurement of materials, especially fertilizers and greenhouse plastic films. Only one company produced the plastic, but it did not protect against ultraviolet radiation, making the plastic unusable in within a few weeks right before the plants were to arrive from Israel. His reaction was to import plastic from Colombia in order to have the greenhouses ready for the arrival of the plants. However, at that time, it was impossible to import plastic films for greenhouses because the industry was protected as part of the import substitution policy. Another obstacle was the availability of fertilizer for flowers. The only available fertilizers were designed for the potato industry and some others which were not as soluble as was needed for the microaspiration irrigation systems used in the flower farms. Dávalos also had to buy those materials as well as key parts of the irrigation system from Colombia. Another important impediment in the industry's incipient stage was obtaining the knowhow to produce quality flowers. Most of the technical personnel were Colombian, and it was difficult to find local engineers or agronomists. The Colombian engineers and agronomists were in high demand, and were commanding high salaries. Sometimes the rate paid to the imported technical labor was more than three times the prevailing rate in Ecuador. Local engineers were trained, and since 1986, Agroflora has been able to hire local agronomists.

Market knowledge was another major uncertainty faced by the pioneer. Even though the Colombian technician knew of a contact in Miami because of his experience with a Colombian farm, the pioneer did not know price levels, credit history, sale conditions, or color preferences of this buyer. It was not until shipping took place that a price was agreed. At that time, roses were primarily red; any deviation from that color was a risky bet. The pioneer had received from the plant breeder 90 percent red varieties and 10 percent other colors, such as yellow and pink. When the first sale took place, the Miami buyer wanted just red, and the farm had to give away

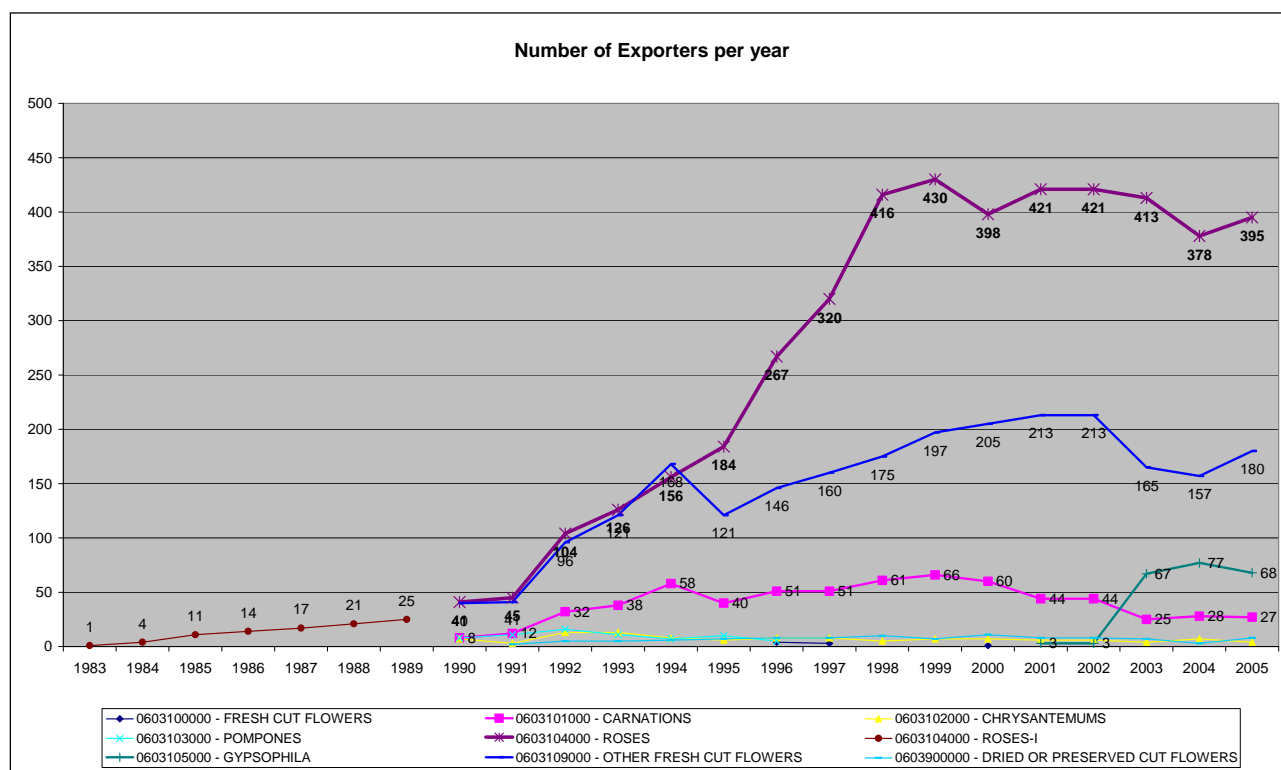
the other colors. It was not until a few shipments later that the color varieties were in high demand for their novelty.

Dávalos discovered that the intensity of light at the equator line, the richness of the soil, and the plentiful source of water in the Tabacundo area produced roses of very high quality. It did not take long for the flowers from Ecuador to acquire a reputation for quality and novelty colors.

5.3.3 The Diffusion Process

After the success of Agroflora in exporting roses, and the previous companies' failure to export carnation and chrysanthemums, the obvious choice was to plant roses in greenhouses. With these experiences, many firms started to enter the market and paid special attention to the production of roses. As can be seen in Figure 21, starting in 1989, the number of firms focusing on roses surpassed the number of firms that produced chrysanthemums.

Figure 21. Exporters by Year



Source: Authors' compilation based on BCE data.

There was an important reason for Ecuadorian flower producers to deviate from chrysanthemums. By 1985, the structure of exports of Colombia was mostly carnations and chrysanthemums, and only around 20 percent roses. This created a niche for Ecuador's flower industry, and it concentrated on roses.

The exchange rate at the time was very volatile and devaluating very rapidly. The reduced cost of labor made it profitable to export products with high labor content. When asked what the main factor was that influenced their decision to export, most flower exporters responded that given the high level of devaluation of the sucre against the dollar, and given the experience with bananas and shrimp on the coast, the entrepreneurs from the sierra were looking for an export activity out of the Quito region. That condition was met by flowers. Additionally, financing through CFN, under the proper terms and conditions, was decisive.

In 1984, a group of agronomists led by a U.S.-educated engineer founded a company to provide counseling to the agriculture industry in general. They incorporated the firm EMPAGRI, *Empresarios Agrícolas*.

At the same time, three Ecuadorian investors created *Agricola Pazcor* in order to plant carnations and mini-carnations. At the suggestion of an Israeli engineer who provided plants to the Colombian industry, they planted carnations in the open without using greenhouses. After a year and a half, the company was almost bankrupt and was acquired by the agronomists of EMPAGRI, who provided technical assistance to the firm. At the same time, another company, *Coprecsa*, owned by Miguel Riofrio and Mario and Marcelo Zambrano, also planted carnations and mini-carnations. This company performed badly and was acquired by the same engineers that had bought *Agricola Pazcor* with a loan from a private bank. In a few months, they set up greenhouses for the cultivation of carnations, incorporated roses, and exported the entire harvest to the United States.

According to Carlos Vallejo, an agronomist and former minister of agriculture, they suffered the same problems that plagued *Agroflora*: lack of adequate air transportation, inputs such as plastic film, fertilizers, and skilled labor. He recalled that in the 1980s there was no cooling infrastructure at or around the airport, and the flowers had to sit on the tarmac waiting for the airplane to arrive.

In 1984, Ricardo Dávalos, brother of Mauricio Dávalos, an architect and the head of the Housing Board, founded *Florisol* to grow pompons and chrysanthemums. He chose these

varieties of flowers because of the characteristics of his land, which was drier than the valley of Cayambe, where the majority of roses were planted.

In 1985, a second wave of companies was founded, including Florequisa, with Colombian capital, El Rosedal, Rosas del Ecuador, and Arbusta. All of these companies concentrated on roses produced in greenhouses. The history of Rosas del Ecuador began with a Colombian agronomist who came to Ecuador to help setup Florequisa but also had family ties with an investor in Guayaquil. He convinced the investor that the conditions in Ecuador were ideal to grow flowers, especially roses, and that the business was very profitable. At the time, the Hurtado administration was about to end, and the investor had a friend who was about to leave office. The three founded Rosas del Ecuador, with the Colombian agronomist as technical manager, and the other as the general manager. The investor did not hold any management position. Here the key element was that Rosas del Ecuador had ample credit because the investor was part owner of a bank, and the company obtained credit to buy the land, plants, and materials. The story told by the owners of Rosas del Ecuador is similar to the one told by others: there was limited air cargo, all inputs had to be imported and skilled labor was scarce. However, the business became profitable.

Table 7. First Wave: Exporters by Date of Incorporation

<i>Year of Incorporation</i>	<i>Date</i>	<i>Exporter</i>
1,983	04/02/83	AGROFLORA S.A.
1,984	03/30/84 07/25/84 12/04/84 06/13/84	EMPRESARIOS AGRICOLAS EMPAGRI C LTDA AGRICOLA PAZCOR SA AGRICOLA LA ANTONIA C.A. FLORISOL C LTDA
1,985	03/06/85 03/14/85 03/21/85 03/29/85 04/24/85 07/24/85 10/16/85 08/08/85	FLORES EQUINOCCIALES SA FLOREQUISA EL ROSEDAL SA ROSAS DEL ECUADOR (ROSEDAL) SA ARBUSTA C LTDA ROSAS DEL MONTE ROSEMONTE CIA. LTDA. INVERSIONES FLORICOLA S. DE R.L. AGRICOLA TABACUNDO, AGRITAB C.L. FLORES DEL AMAZONAS SA AMAFLOR
1,986	09/30/86 02/21/86 08/01/86 05/13/86	CONSORCIO QUITO FLORES SA VELVET FLORES C.L. VITAGRICOLA CIA LTDA ROSINVAR S.A.
1,987	05/21/87 07/07/87	FLORES DEL QUINCHE, FLORQUIN S.A. GUANGUILQUI AGROPECUARIA INDUSTRIAL S.A. GUAISA

Source: Authors' compilation based on Superintendency of Companies data.

Diffusion Effect on the First Mover

At first, the impact of imitators on the pioneer was neutral and at times favorable. For example, it was easier to import inputs when the producers were more plentiful. Also, the proliferation of producers helped position the quality and name of Ecuadorian roses in international markets. There was no effect on price or on the quantity demanded. International demand was growing steadily and the number of companies was too small to have any influence. Price pressure did not occur until the late 1990s, when there were close to 400 farms, which had the effect of saturating the market.

The growth of exporters was initially modest. However, after the reduction of the tariff of 6.8 percent imposed by the US to 0 percent, the number of exporters grew from 40 in 1990 exporters to 166 in 1994. The Andean Trade Preference Act (ATPA) was signed in December 1989, granting zero tariffs to the imports of flowers from the Andean countries. There was another wave of growth from 1994 to 1999, when the number of exporters grew from 166 to 430—fueled in part by the opening up of the Russian market.

Looking for a New Product

Arbusta's owner and manager Miguel Mascaro, who had experience in the soft drink industry, was looking for an export product out of the highlands. He had some knowledge of the flower industry in Bogotá and contacted an engineer in Colombia to help him set up a flower company. When asked if his activity was in any way helped by the pioneer, he responded that he knew of the existence of a flower company (referring to Agroflora), but that this had not influenced the way he set up his business. He indicated that in addition to the pioneer in 1983, a group of closely associated companies should be considered pioneers as well. In his view, there were not many spillover effects from the pioneer; rather, the Colombian experience played a bigger role. Moreover, he had attempted to visit the pioneer farm without success.

Concerning financing, Miguel Mascaro believes that without CFN, the flowers business would not exist. He borrowed \$300,000 at 12 percent in sucres for seven years with one-year grace period.

The United States has always been the most important market for Ecuadorian flowers. The second most important, however, has changed over time. In 2005, the United States remained in the first place, the Netherlands in second and Russia in third place. In 1990, the

United States captured 86 percent of the exports, but by 2005 this share had fallen to only 60 percent, losing share to other markets, especially European countries. By 2006, Russia was in second place after the United States and the Netherlands.

The Ecuadorian rose had made its name based on its size and quality. New companies entered the business helped by the banking system, especially in the sierra area. Financing for export was relatively easy to obtain. Some of the problems encountered by the pioneers were partially resolved particularly air transport. In 1990, Ecuatoriana de Aviación allocated a plane exclusively for cargo. Cargo agencies sprouted up to help move the volume of flowers leaving the companies. The business of selling plants and inputs exploded. There are three main inputs for the industry besides labor: plants, fertilizers, and greenhouses. For packing, the most important input is cardboard boxes. Most of the cardboard companies were owned by banana exporters who prioritized the manufacture of banana boxes, and only manufactured flower boxes after they met the demand for banana packing needs.

5.3.4 Counterfactual: Flowers Two Decades Before

The rapid development of the flower industry in the 1980s was not the first time the industry flourished in Ecuador. Floriculture had existed in Ecuador since the 1950s, although it did not last long. In 1964, Jardines del Ecuador set up a flower farm to export carnations to the U.S. market. The idea came from an U.S. flower producer-wholesaler looking for a cheaper and year-round product to supply its wholesale operation in Maryland. The idea came after a friend, vacationing in Ecuador, found the conditions for growing carnations and pompoms there to be ideal.

The wholesale florist was Claymore Sieck. Sieck visited Ecuador to corroborate the conditions of the country as an ideal place to grow flowers. He contacted some local investors, and found a company interested in investing in this enterprise. The company was the Compañía de Cervezas Nacionales (CCN), the local producer of beer, owned by Americans investors. (Parra, 2001) The Sieck Company was founded in 1918, and by 1966 it already had operations in Pennsylvania and Washington, D.C. Together, they set up Jardines del Ecuador on June 8, 1964, and imported 75,000 carnation plants and 3,500 pompom plants. The farm was located 10 miles east of Quito in the valley of Cumbayá, sector Lumbisí. They setup the farm in a three-

hectare plot under greenhouses and a state-of-the-art irrigation system. Mr. Sieck held 49 percent percent of the capital and the CCN held 51 percent.

The newly formed company hired an agronomist to be in charge of the farm. At the beginning of 1965, they produced enough products to export but faced problems on the agriculture side of the business. The agronomist hired did not have experience producing flowers, and the company had problems with both the quantity and the quality of the flowers produced. Mr. Sieck hired Robert Langhans, a prominent agronomist from Cornell University, to supervise the production with visits to the farm twice a year.

Dr. Langhans' advice proved fruitful, and the farm increased both the quality and quantity of flowers. Two agronomist were hired, a local agronomist with studies in Honduras, and a Colombian agronomist with some experience in flowers.

The problems in producing flowers in the 1960s were very similar to those in producing in the 1980s. Qualified labor, agricultural inputs, air transportation, plastic for greenhouses, and labor problems were all mentioned by Roger Chiriboga who entered the company as an agronomist in 1966 and was the general manager of Jardines del Ecuador until 1975, when it closed operations.

The main problem faced by Jardines del Ecuador in its 10 years of operations was air transport to markets, especially to Miami, where the majority of its production was sold thanks to a joint import operation with Worldwide Imports in Miami. At the time, Panagra and Ecuatoriana de Aviación were the only airlines providing cargo service (in passenger airplanes) from Quito to Miami. The problem with cargo was so bad that Jardines del Ecuador lost more than 30 percent of its production due to lost sales. The difficulty with transport became worse in 1974 when Ecuatoriana de Aviación was nationalized and some routes were lost, including the one to Miami. Jardines del Ecuador and its owners knew of the magnitude of the transport problem and were arranging a buyout or joint venture with a nascent airline owned by Alfredo Franco Del Monaco.

Why Did Jardines del Ecuador Stop Producing Flowers?

Beside transport problems, in 1974 there were some labor problems within the farm. A worker was trying to establish a labor union in the company. With close to 300 workers at the farm, and more than a thousand at the beer company, the company administrators deemed it prudent to

close the farm before unionization efforts spread to other companies in the group. The company closed in June of 1975.

Did Spillovers Exist from This Company?

Even though this was the first company to export flowers out of Ecuador, the harvests that they could not export satisfied a growing local market. After closing operations, many of Jardines del Ecuador's workers continue to grow flowers for the local market in small plots. In this way, the practice of growing flowers was diffused, which explained the subsequent availability of certain agriculture skills.

Differences in the Flower Case in the 1980s vs. the Case in the 1960s

Analyzing the cases, we found that the main factor contributing to success of the industry in the 1980s and not in the 1960s was air transportation. While in the 1960s this coordination problem could not be resolved, by the 1980s, collective action through the Flower Association—EXPOFLORES—was successful in getting the government, through its airline, to provide the transportation needed. In this regard, diffusion was useful because it allowed collective action, and the role of the state was crucial in providing an input that the markets did not.

Although financing was not a problem for the pioneer in the 1960s, its availability was not sufficient to spark imitators. No diffusion occurred in the 1960s. The next flower company would not be founded for another 10 years.

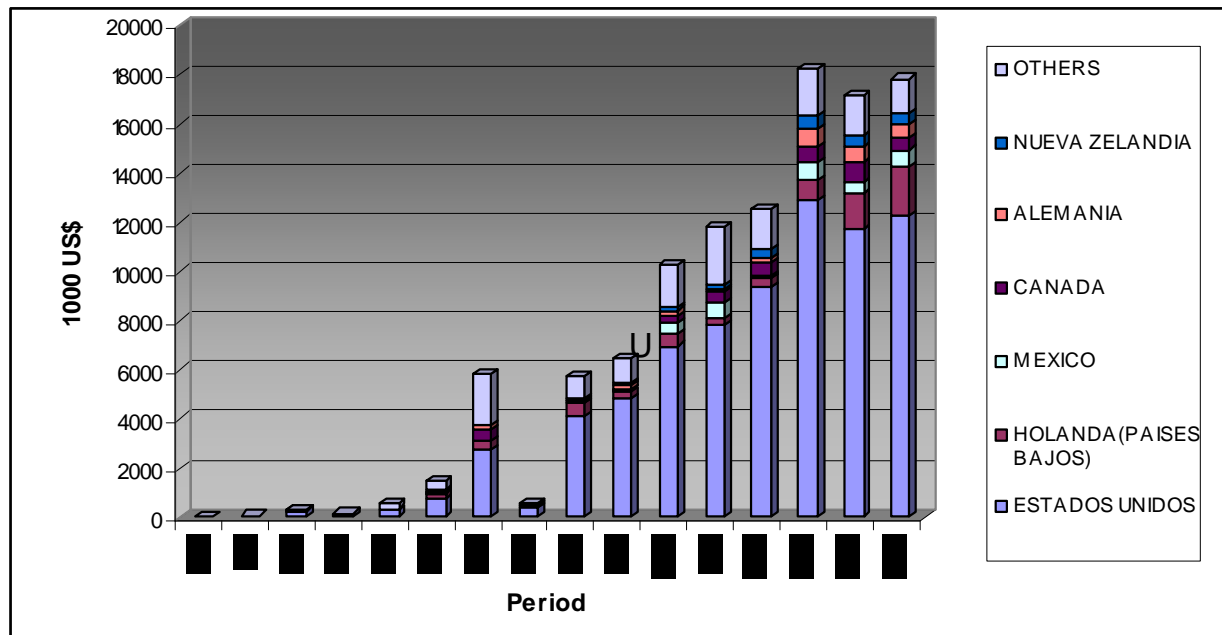
5.4 Mangoes²³

5.4.1 Trade Dynamics

Mango exports from Ecuador have been increasing significantly since the early 1990s. From an almost nonexistent export volume in 1990, total Ecuadorian mango exports reached a record 41,941 metric tons in 2005, which amounted to an income of about US\$17 million. This trend is depicted in Figure 22. Mango exports increased significantly in 1996 (180 percent), 2000 (83 percent) and 2003 (30 percent). Market diversification has been attributed partially to the growth in this industry.

²³ This section is written by Iván Prieto, team member, who was a promoter and former general manager and stockholder of Durexporta, the first Ecuadorian company to export mangoes to the United States.

Figure 22. Ecuadorian Mango Exports by Destination



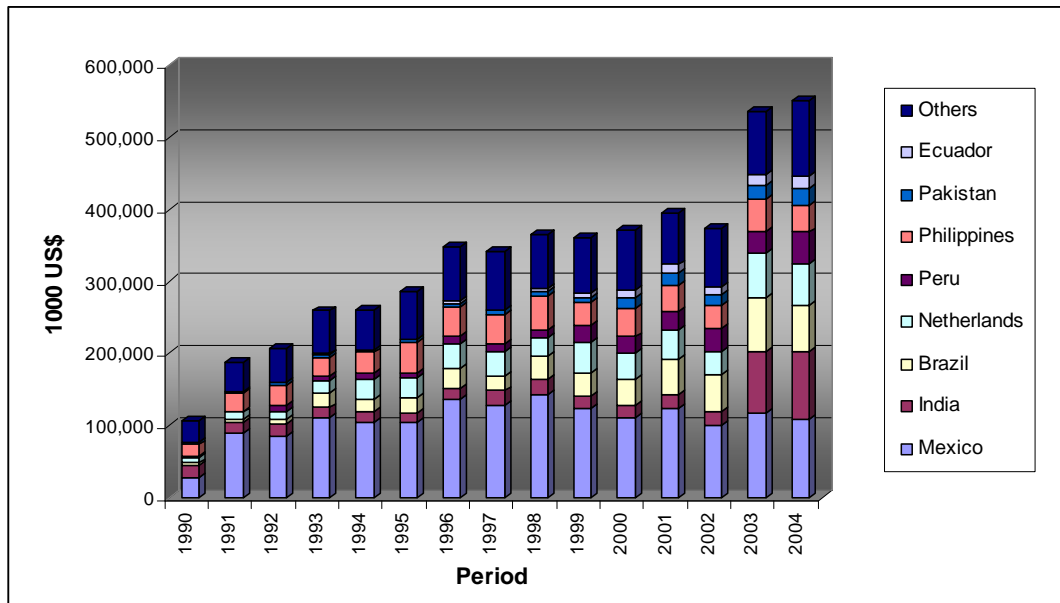
Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

The main destinations for Ecuadorian mangoes in 2005 were the United States, with 65 percent, followed by the Netherlands (11 percent) and Mexico (4 percent).

5.4.1.1 Global Exports

Global mango exports show a substantial increase in the series analyzed. Exports have risen considerably since 1990, with worldwide exports exceeding US\$583 million in 2004. The average rate of export growth for the period 1990-2004 is 14.45 percent. Figure 23 shows an important decline in 2002 (6 percent), followed by an impressive recovery in 2003 of a 43 percent increase in total exports.

Figure 23. Global Mango Exports



Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

Global mango exports exhibit interesting dynamics. Mexico has been, undoubtedly, the world leader in exports, with an average market share of 33 percent for 2004, though declining from a 46 percent market share in 1991 to 18 percent in 2004. Table 8 shows that in 2005, India surpassed Mexico as the number one exporter. Brazil, Peru and Ecuador showed remarkable gains in market share. Ecuador was among the top 12 world mango exporters in that year.

Table 8. Main Mango Exporting Countries

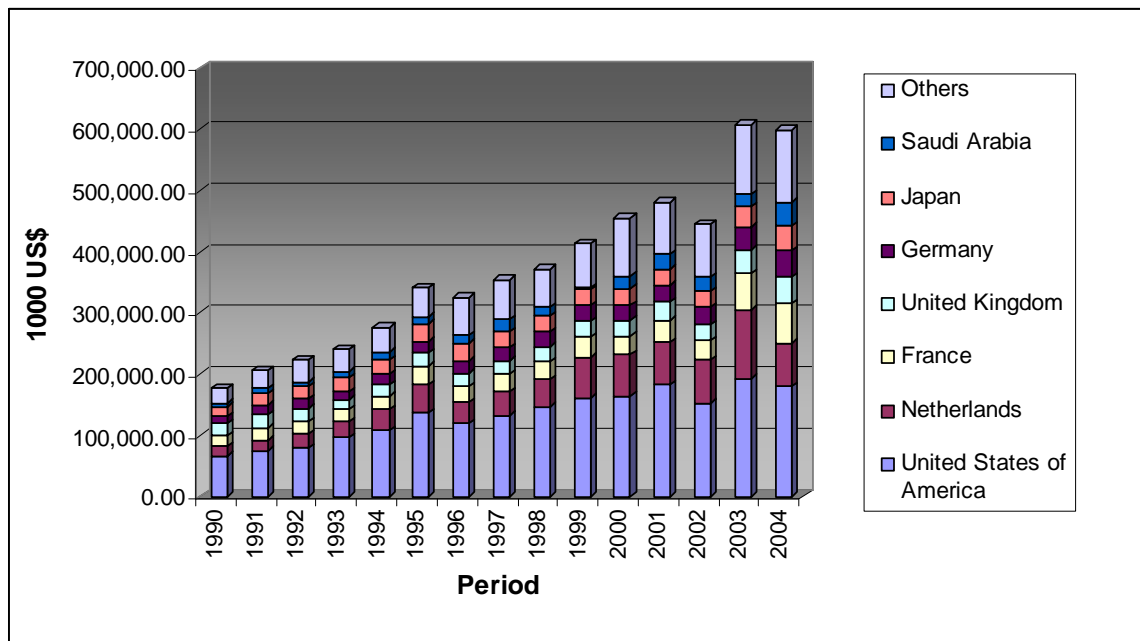
Exporter	2005	Share
India	122,661,107	18.2%
Mexico	86,564,634	12.9%
Brazil	72,653,998	10.8%
Netherlands	70,655,243	10.5%
Peru	38,395,588	5.7%
Philippines	33,050,392	4.9%
France	29,732,269	4.4%
Pakistan	27,673,518	4.1%
Thailand	23,543,577	3.5%
USA	21,018,805	3.1%
China, Hong Kong SAR	18,427,804	2.7%
Ecuador	18,173,269	2.7%
Belgium	13,793,517	2.0%
Israel	13,625,000	2.0%
Others	83,104,078	12.3%
Total	673,072,799	100.0%

Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

5.4.1.2 Global Imports

By 2004, the top mango importing country was the United States (27 percent), followed by the Netherlands (10.37 percent) and France (9.52 percent).

Figure 24. World Mango Imports



Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

5.4.2 History of the Mango Industry in Ecuador

Mango was introduced to South America from India during the Spanish colonial period. Different varieties of mango have been grown in Ecuador for centuries. During the mid-1980s, Ecuador only exported minimal amounts to Europe. These exports were composed of local varieties and were consumed almost exclusively by ethnic groups in European cities.

Entrepreneurs did not have any incentives to increase exports because prices in Europe were not sufficiently attractive due to a preference for other varieties, higher transportation costs and an ample supply of African mangoes. This was the state of the industry just before the discovery process began.

Mangoes were not allowed entry into the United States from South American countries because of certain insects of concern in plant protection. In 1990, the Plant Protection and Quarantine Division of the U.S. Department of Agriculture (USDA) approved a process called

“hot-water treatment” for importation of South American mangoes. This treatment involved submerging the fruit in hot water for a certain time to eliminate the risk of pest propagation.

Ecuadorian mangoes were finally allowed entry into the United States in 1990. Mango exports have increased considerably since then, positioning Ecuador as one of the main suppliers of the product worldwide.

5.4.3 The Discovery Process

Like many Ecuadorian entrepreneurs in the mid-1980s, I was searching for export activities to invest in and take advantage of the high nominal devaluation rate of local currency. Coming from a family that had long been in the agricultural sector, and with an academic background in agribusiness, I intensively sought a nontraditional agricultural product with some potential in foreign markets.

At the time of discovery, I was working as a bank officer for the Citicorp subsidiary in Ecuador, in charge of export-related corporate account segments. This position gave me the opportunity to keep informed on foreign trade developments and opportunities.

I received information that the U.S. government, through the USDA, would approve a special fruit treatment to allow mangoes into the United States from selected Latin American countries. The hot-water treatment had been recently approved for Haiti, and a protocol was to be signed with Peru. I anticipated the potential for a protocol signed with the Ecuadorian government and contacted the Ecuadorian Ministry of Agriculture. By further researching the U.S. market for mangoes, I realized that there was a real opportunity to export the fruit to that country.

I was informed by the Ministry of Agriculture that the process of getting the permit from the USDA to install a hot-water treatment system required the backing of a U.S. importer. I contacted the Florida Mango Forum for information on local importers and sent some native Ecuadorian varieties for consumer tests. The forum referred me to J.R. Brooks and Sons, a major importer of tropical fruit in Florida. I sent an investment proposal document to the company outlining a joint venture to install a hot-water treatment plant in Ecuador.

After some negotiations, the tropical fruit importer agreed to join in a partnership in Ecuador. At the same time, some local investors interested in the mango business contacted me and offered to invest the capital required to build the plant. For its part, the U.S. partner agreed to

broker the product in the United States. We incorporated “Durexporta” as a company, starting operations in late 1991 after getting the plant certified by the USDA. Durexporta designed an integrated operation that included mango cultivation, processing, and packing the fruit in the hot-water treatment plant and exporting it to our U.S. partner, J.R Brooks and Sons.

5.4.3.1 Uncertainties Involved at the Outset: Factors Fostering Discovery and Barriers

Some important uncertainties needed to be addressed in the early phases of the Ecuadorian mango industry. The first issue was deciding which varieties of mangoes to plant and export. There was a definite demand for mangoes in the United States, but it had to be matched with the Ecuadorian supply. At first, there was some interest in trying to export selected local varieties. However, most local varieties in Ecuador contained turpentine, an enzyme that makes for a tart taste pleasing to most Latin American and Asian consumers, but of lower acceptance in the U.S. and European markets.

To solve this uncertainty, I decided to send samples of local varieties to the United States for consumer tests and to the Florida Mango Forum. The results were negative. Although some of the varieties were satisfactory in terms of size and color, the turpentine flavor was not. In the early 1990s, improved varieties, all developed and propagated in the state of Florida, began to be introduced in Ecuador for grafting. We realized that the U.S. market, as well as some European markets, was being supplied with these varieties, so consumers had developed a special taste for them. This change of variety, although expensive, led to the successful introduction of the product to these markets. All imitating firms, more or less, adopted the improved varieties, with mixed success.

Even though all varieties imported had been developed in Florida, not all shared the same commercial success. Some varieties introduced were the Tommy Atkins, Haden, Kent, Keitt, Van Dyke, and Irwin. Of these, only the first three enjoyed real success. Some imitators tried to differentiate themselves by adopting a more prolific or easier-to-handle fruit or tree, but soon they had to re-graft the trees and adopt the more conventional Tommy, Haden, and Kent varieties. In the meantime, until the new crop was available, they had to cope with a lower price. This lesson was learned the hard way.

At present, there is considerable interest among mango producers around the world in finding and developing markets for new disease-resistant varieties with better taste and ease of

management. Some have started to use the Ataulfo mango variety, initially pioneered in Mexico. The present better-than-average prices for this mango have prompted increasing re-grafting of this variety among Ecuadorian farmers, in another cycle of imitation. How long the prices will hold, how well this tree will adapt to local environment, and how it will affect local farmers remain to be seen.

Another uncertainty faced by pioneer Durexporta was that the operation of hot-water treatment plants involved having a USDA inspector throughout the mango season, and few were available at that time. For this reason, only two plants were initially approved for Ecuador. Mango farmers planning to export to the United States understood the need to integrate their operations with one of the plants already in service or establish a new one.

A race began among local entrepreneurs interested in getting USDA approval to install these plants. This ended in disputes among potential investors who wanted to grow and process fruit for export to the United States, since the procedure for selecting which groups would get Ecuadorian government backing for treatment plant approval was left unresolved by the authority in charge, and assignments were made on a discretionary basis. This state of affairs eventually changed when four more plants opened their doors. In the meantime, a number of small-scale farmers decided to invest in mango production for sale to exporters who owned or had shares in the first two plants and needed the fruit. The local ex-works price for mangoes was attractive enough to consider this a good investment.

Another important risk that pioneers faced was the potential price they could get for their mangoes. Mango trees produce seasonally, normally from two to four months a year. Ecuador had the potential to start producing in October, and during those early years, it was the only country in the Western Hemisphere with this window for production. However, at the time of discovery, the mango supply from improved varieties in October and early November was minimal.

The price risk proved to be a major factor for future returns in the mango business. When operations began at Durexporta in 1991, mangoes could sell in October for prices as high as US\$4.00 per kilo FOB. Quantities supplied were low—less than 10,000 boxes (4 kilos each) a month—due to the lack of improved varieties at the time. When Peru started shipping mangoes in November of that year with a supply of something under 200,000 boxes a month, prices declined to US\$2.00 per kilo FOB.

Some mango exporters and producers in Ecuador were aware of large new mango orchards being developed in northeastern Brazil, a region that could potentially produce in October. Peru also planted new varieties of mango after its economic recovery in 1995. The major concern for pioneers, however, was the extensive areas being planted in Ecuador in the years following the mango boom. In fact, areas with new mango varieties increased from less than 200 hectares in 1990 to over 10,000 hectares by 1994. Even though sufficient export volume was needed to operate efficiently and pay for the hot-water treatment plant, the increase in supply would affect price.

With my academic experience in agricultural price analysis, I developed a price model that estimated that ex-works prices at the farm level in Ecuador would gradually decline from an average of US\$0.90 per kilo in 1991 to US\$0.25 per kilo by 1999, and continue decreasing to a price floor of US\$0.20 a few years later. In actuality, prices reached an average of US\$0.25 per kilo in 1998 and slightly lowered after that, finally returning to the US\$0.25 average, where they have held rather steadily since 2001.

Another important challenge met was the need to find adequate marketing alternatives and distribution channels. Although Ecuador is a major exporter of bananas to the United States, mangoes were still considered an exotic fruit during the early 1990s and were not normally handled in the conventional channels for distributing bananas. Even for shipping companies, mango exports in containers were not very common, as most shipments to Europe and other countries were made by air. Reserving the space to ship containers of mangoes during the high season for bananas (December to February) was sometimes difficult. Eventually, increased volume justified particular attention from these service providers, and this produce is now a standard item for them.

Coordination problems that could arise for the new venture were anticipated by pioneer Durexporta, which worked closely with local service suppliers. Coordination problems were probably more adequately faced as local suppliers of inputs such as cardboard boxes, plastics, and pallets were familiar with agricultural product exports by their long experience in bananas and other products. Besides, some supplies and equipment used for packing and transportation of mangoes were the same as those previously used for mangoes exported to Europe.

Information problems were reduced significantly by the importer partner. In fact, at the beginning of operations and first shipments, a representative of J&R Brooks came to assist Durexporta. The importer also handled all requirements at the port of arrival.

The final uncertainty faced involved the real vs. projected productivity of mango crops in the dry tropical climate prevailing at Ecuador's mango farms, and the corresponding return on investment to farmers and exporters. Although the literature and studies available at the time claimed productiveness of up to 40 metric tons per hectare for fully mature trees, the average yield in Ecuador amounted to only around 7 MT/ha, with the most productive farms getting about 20 MT/ha. Since mango trees reach maturity around the tenth year after planting, and considering the high investment in fixed assets, there is a considerable barrier to leaving the industry, even though returns are not as high as expected. Local mango productivity levels are currently the subject of research and new best practices are being tested to increase productivity. The hope is that these efforts will be successful in the medium term. To date, this uncertainty has not yet been definitively resolved.

In summary, this discovery was the result of access to information, market development efforts of entrepreneurs, and demand-driven support. Among the key factors affecting the discovery were arrangements with importers who facilitate the exporting process, competitive advantage at producing good quality of mangoes, and overcoming phytosanitary barriers.

5.4.4 The Diffusion Process

As the pioneer, Durexporta had different objectives with regard to the diffusion process. On the one hand, there was interest in promoting the planting of new mango varieties. Since mango trees take four years to start producing in substantial quantity, the plant needed more produce to reach equilibrium levels. However, we realized that with extensive mango planting, there was a chance that oversupply of the product would lower prices, which is what actually happened.

Any income provided by the hot-water treatment plant as a monopoly was limited to two years, after which time the second approved plant was established. Nonetheless, the potential benefits of being the only mango processor in a condition to export mangoes to the United States at the time were reduced by the low volumes of improved mango varieties available for processing. The increased yields required to have sufficient availability of fruit came rather slowly, because of the four-year initial producing period mentioned above.

By the time more production of improved varieties became available, four more hot-water treatment plants had been approved. This ended the possibility of the pioneer's benefiting from monopoly rent income on the investment, but it benefited mango growers, as more aggregate processing and marketing services were supplied and derived demand at the farm level increased. This probably explains why prices at the farm level recovered from their lowest point in the 1998–2000 period.

Diffusion in this case was guaranteed by the pioneer's own intention to promote mango growing among a vast number of farmers with the objective of supplying the product to the hot-water treatment and packing plant for export to the U.S. and other selected markets.

In summary, the diffusion process had both positive and negative impacts on pioneers. On one hand, it helped by increasing the availability of product for treatment and export, but the impact on prices was negative because of oversupply. The impact on margins was also negative, especially when more hot water treatment plants opened and increased farm-level demand.

5.4.4.1 Characteristics of Imitators and Factors

The following table shows the evolution of firm's exports by year.

Table 9. Firms Exporting by Year

Y e a r	N u m b e r o f f i r m s
1 9 9 0	1 1
1 9 9 1	1 2
1 9 9 2	1 5
1 9 9 4	1 2
1 9 9 5	2 3
1 9 9 6	2 5
1 9 9 7	9
1 9 9 8	2 6
1 9 9 9	4 7
2 0 0 0	5 8
2 0 0 1	4 6
2 0 0 2	4 6
2 0 0 3	4 6
2 0 0 4	4 3
2 0 0 5	4 5

Source: Authors' compilation based on BCE data.

As the numbers show, the mango export industry in Ecuador experienced a high rate of diffusion, with an increase of 34 firms exporting during the period 1990-2005, or a change of 309 percent.

Some of the imitators surveyed declared that they had been in some way involved with the pioneer, but they mostly joined the business because they heard it was a good investment and owned land, or were involved in some other agricultural undertaking. Almost all of them said that the fact that someone else had exported before was a significant help.

One of the major impacts of the pioneer on diffusion, besides the promotion of the process with the related group of producers, was the development of a specific technology for production and hot water processing. In fact, irrigation and hot water treatment facilities were copied from the one implanted by the pioneer.

Most imitators said they had not received subsidies of any kind to get into business, but some acknowledged that they had benefited from a tax exemption for the import of supplies and equipment. Bud stocks of improved varieties were imported in vast quantities and different companies provided services to the new mango growers. Irrigation equipment suppliers, water well drillers, engineering and construction firms and other agricultural suppliers all aligned with the efforts of imitating firms to start production rapidly.

Modern agricultural practices and infrastructure are necessary for commercial mango cultivation because of volume and quality requirements. Without intensive agricultural techniques, the yields required to justify the effort financially cannot be achieved and the quality requirements of external markets cannot be met.

Agricultural practices include irrigation, fertilization, and phytosanitary and post-harvest control, among others. The implementation of these cultural practices required the installation of basic infrastructure, of which irrigation equipment is the most expensive, with a cost of over US\$2,000 per hectare. All investments required—including infrastructure and capital amortization over a five-year period in which the mango trees are developing and do not produce significant amounts—could add up to over US\$8,000 per hectare, which is much higher than what is required for alternative crops for the local market. For instance, infrastructure to grow rice or corn, under the same soil conditions, will cost less than US\$1,800 per hectare, on average.

Most imitating orchard owners adopted adequate modern technology for their new planting. The area of mango planting rapidly increased, from less than 500 hectares under cultivation in 1990 to over 10,000 hectares in 1994.

With regard to hot-water treatment operations, the second plant, Agriproduct, owned by a mango growers and exporters association, was authorized and certified to operate by the USDA in 1992. This association put in place an assistance program for its members that facilitated the efforts of newcomers.

Other hot-water treatment packing plants opened in the 1997-1999 period. There are now six plants operating in the country. Pioneer Durexporta and Agriproduct have since made significant increases in plant processing capacity. Independent local exporters, having no share in the hot-water treatment plants, have signed co-packing agreements with these facilities. This market for their services has created a new source of revenue for plant owners.

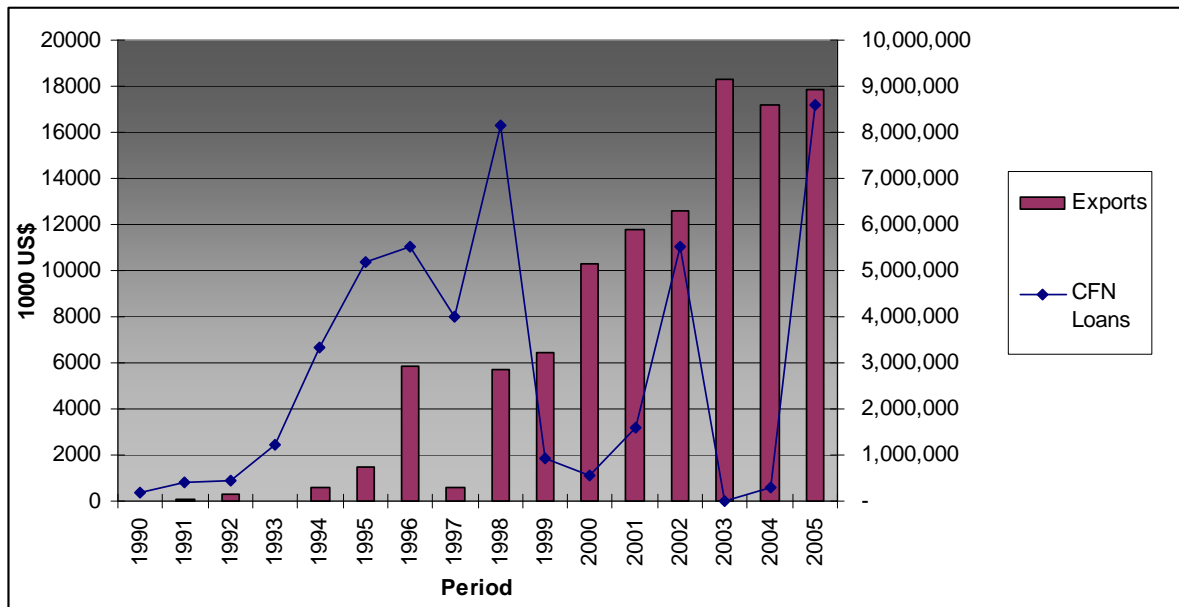
Analysis of Public Policy and other Key Elements for the Success of New Exports

Technical assistance was provided by CORPEI and different independent nonprofit development agencies in charge of promoting new exports, such as FEDEXPORT, FUNDAGRO, and PROEXANT. All of the aforementioned institutions received grants from multilateral organizations and international aid agencies that were very active at the end of the 1980s and early 1990s in providing assistance to new export development activities. As pioneers, we benefited from seminars and other assistance provided, especially with regard to agricultural practices and the adequate location of mango plantations. Nonetheless, a large number of growers surveyed did not identify technical assistance received as a key element to successfully entering the business, though some acknowledged a benefit.

Long-term financing was available for both pioneer and imitating firms. This type of financing was available almost exclusively from resources provided by multilateral financial institutions to the National Finance Corporation, which acted as a first-tier bank to the local financing system.

As shown in the following figure, loans granted to mango producers apparently had an important impact on the expansion of planted area and exports. In the early 1990s, credits given by the CFN to this sector enabled state growth in exports until 1997.

Figure 25. Ecuadorian Mango Exports vs. Yearly CFN Loans



Source: Authors' compilation based on CFN and BCE data.

In the preceding figure, it is interesting to note the logical gap between credits loaned for new planting and export growth experienced from 1990 up to 1997, when heavy rains interrupted growth in mango exports. Credit amounts shown for the period from 2001 to 2005 primarily correspond to financing of short-term pre-export working capital.

All of the growers and processors surveyed identified credit access as a key element to getting into the business. In fact, all received a long-term loan for planting and fixed-asset financing from the CFN second-tier system. Although long-term financing was available, it was not always adequately structured for development of mango plantations. Lenders defined up to a two-year grace period for capital repayment and then demanded biannual interest payments, even when the mango plantations were not in production. It takes four years after planting for grafted mango trees to start production, and that at very low levels (two to four metric tons per hectare). It is estimated that at today's prices, it takes a yield of 12 to 14 tons per hectare to repay a loan. This level of productivity may be reached only around the sixth or seventh year, if ever.

This situation created a financing gap between income and expenses that eventually resulted in serious financial problems for producers. By 1997, many growers simply could not fulfill their cash flow obligations and they defaulted on loans. This situation was aggravated in the same year, when "El Niño" induced heavy rains and subsequent floods, hampering the

mango tree blossoming process, which in turn caused a loss of over 90 percent of the season's fruit harvest relative to the previous season.

The situation worsened as mango prices continued to fall because of new entries in the market, particularly Brazil. This country increased plantings in its northeast region, where peak production is in October, reducing the market window that Ecuador had at that time. Peru also increased its planted area that year.

Devaluation of the local currency provided some short-term relief to farmers during this crisis period, as real prices paid for labor steadily decreased from 1997 to 1999. Labor costs represent close to two-thirds of total operating cost for mango production.

Financial difficulties led to a cutback in expenses to the bare minimum. Both the inability to raise funds and an unwillingness to invest further resources had an effect on agricultural practices. Phytosanitary controls were relaxed; fumigation cycles were reduced in number, sometimes to the point of no fumigation at all; and pest and weed controls were not applied. Some farms were simply abandoned instead of sold since persistent problems meant that few, if any, potential buyers would appear. The proximity of some of these neglected farms to others still in operation only worsened problems, because pests, especially the fruit fly, suddenly proliferated in the still-functioning orchards.

This in turn raised costs to surviving farms, while fruit quality and productivity deteriorated. In round numbers, production area went from a peak of 10,000 hectares in 1997 to its current area of 6,500 hectares. The productivity of the remaining plantations has shown a modest upturn, however, which has led to a yearly increase in the value of mango exports throughout this decade. This phenomenon points to a moderate growth trend in the industry over the last few years.

After the financial, production, and quality crises, the industry has reached a certain degree of stability. Today, there are 45 exporters supplying Ecuadorian mangoes to the world, as shown in Table 8. The most important buyer is the United States, with a 71 percent share of total mango exports for the 2005-2006 seasons, according to Fundación Mango Ecuador statistics. The USDA has established that mango consumption in the United States increased 100 percent from 1995 to 2004, holding twelfth place in U.S. fresh fruit consumption in 1994, at 1.97 pounds per capita. Last year, however, only 30 percent of U.S. households consumed any mangoes.

The most significant hurdle to negotiate will be the end of the ATPDEA preferences and the uncertain signing of the Free Trade Agreement between the United States and Ecuador. In fact, although most of those surveyed think that there are no significant differences in tariffs that they will pay compared to those that will be paid by their main foreign competitors, they nonetheless believe that a zero tariff preference will be crucial to remaining in business.

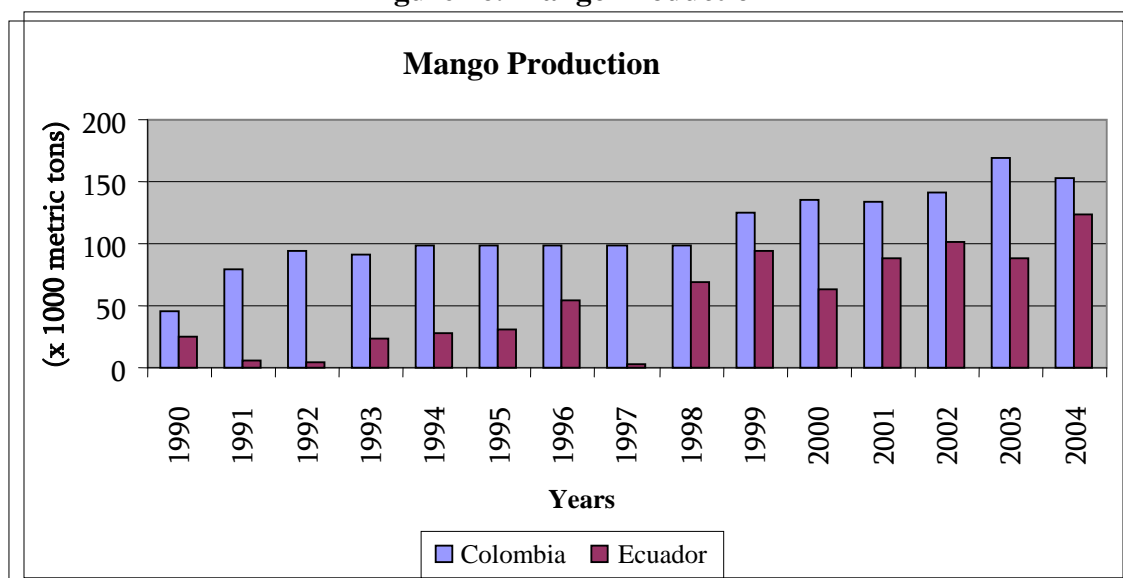
5.4.5 Counterfactual – the Mango Industry in Colombia

5.4.5.1 Characteristics: What the Twins Have In Common

Both Colombia and Ecuador are tropical countries suitable for agricultural production. Both have diverse regions. The presence of the Andean mountain range in their territories has provided them with enormous biodiversity and microclimates, many of which are favorable to mango production.

International mango trade has experienced steady growth over the last 15 years, increasing from around US\$100 million FOB in 1990 to more than US\$500 million FOB in 2004. The growth of worldwide mango trade and consumption may have furthered the emergence of a mango export industry in these countries. In the aforesaid period, both Ecuador and Colombia have seen their mango production rise to similar levels.

Figure 26. Mango Production



Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

5.4.5.2 Brief History of the Mango Industry in Colombia

Mangoes have been grown under noncommercial conditions in Colombia since colonial times. Commercial mango growing in the country probably dates back as far as in Ecuador. Colombia has its own set of native varieties, like the “mango de azúcar” (sugar mango) that Colombians have consumed since the colonial era.

According to Espinal et al. (2005), some years ago a number of mango growing projects were started up with improved varieties from Florida with the idea of exporting. These efforts, however, did not prosper, and Colombia failed to become a significant exporter of the fruit, even regionally.

According to a study conducted by Corporación Colombia and quoted by Espinal, exporters pointed out the following problems:

- Too many highway checkpoints, negatively affecting preservation of the Colombian produce
- Delays in establishing the lifespan of plantations
- Low volumes of export quality produce
- Long distances between plantations and seaports, with associated high cost and risk.

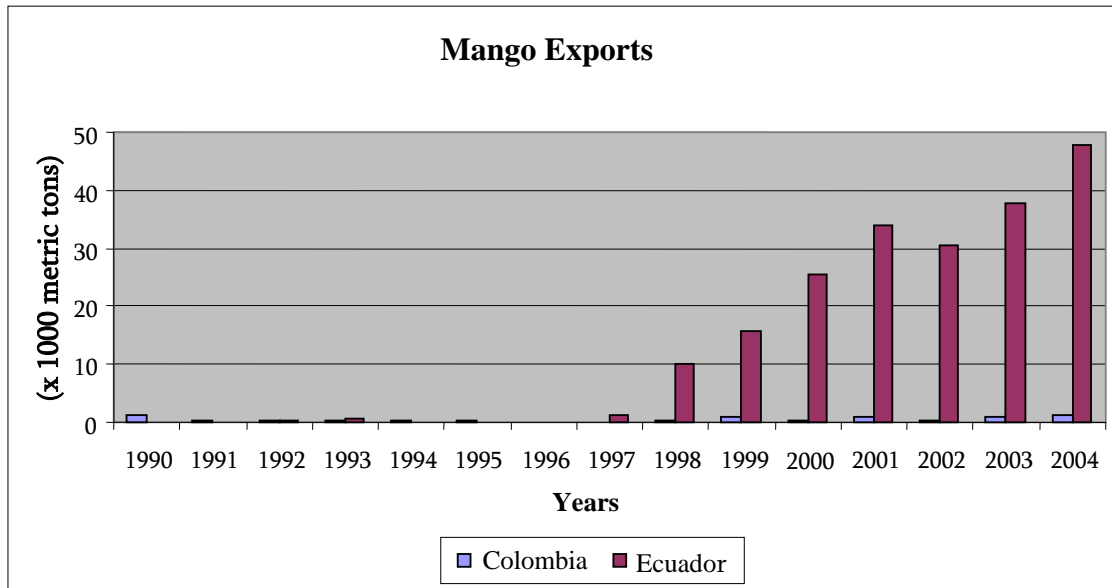
The validity of these explanations is analyzed below, along with other factors that might have affected the Colombian case.

5.4.5.3 Differentiating Factors

Intended Market

Most of Ecuador’s mango production is intended for export, while most of Colombia’s is for domestic consumption. Figure 27 shows how both countries’ exports evolved between 1997 and 2004. Ecuador’s production was seriously affected by the 1997 El Niño event. (The FAO provided no data in 1996.).

Figure 27. Colombian and Ecuadorian Mango Exports



Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

The results observed show the relevance of the Colombian case as counterfactual with respect to the Ecuadorian situation.

Distance from Production Zones to Shipping Ports

Both Ecuador and Colombia have reported a significant increase in the area under mango cultivation. Data provided by the SICA²⁴ project in Ecuador indicate that in 1980 these two countries had an average of 1,350 hectares under cultivation, but by 1995 they had both reached well over 7,000 hectares.

In Ecuador, there were 10,000 hectares in production in Guayas, Los Ríos, and Manabí provinces by 1999. According to information obtained from Fundación Mango Ecuador, Guayas province is the main grower of this fruit. By 2005, Ecuador had an area of approximately 7,700 hectares, of which some 6,500 were devoted to export produce, the rest being slated for the local market, the Andean Pact countries, or processing of mango juices and concentrate.

In Colombia, the department of Cundinamarca was the largest mango producer in 2003 with 3,687 hectares, followed by Tolima with 3,114 hectares and Magdalena with 1,443. The total area under cultivation in the country that year was 13,893 hectares.

²⁴ Sistema de Información y Censo Agropecuario (Agricultural Information and Survey System).

The distance from a typical mango growing zone in Ecuador—such as Daular in the province of Guayas—to a packing plant and from there to the port of Guayaquil is around 100 km. The distance from a typical growing zone in Colombia, such as Tolima, to a port such as Santa Marta, is nearly 800 km.

Kinds of Mango Produced

In 1994, the National Survey of Technified Mango Growers, held in Colombia, found that out of the 3,689 hectares of mango involved in the survey, 41 percent were of the Tommy Atkins variety, 15 percent were Kent, 12 percent Van Dyke, 9 percent Haden and 8 percent Keitt.

In Ecuador, the varieties of mangoes grown for export are Tommy Atkins, Kent, Haden and to a lesser extent Van Dyke, Irwin and, more recently, Ataúlfo. All of these are “technified” mango varieties. Thus, the distribution of varieties planted is similar in both countries.

Destination of Mango Exports

The United States, Europe, and Canada are the main market destinations for fresh mango exports from Ecuador. Ecuadorian mangoes have an average 58.85 percent share of the U.S. market. The primary buyers in Europe are Belgium, Holland, Spain, Germany, and the United Kingdom. In 2004, Ecuador accounted for 3.11 percent of total global exports.

Colombia’s annual exports amount to only 0.5 percent of the country’s total production and are destined for European countries. The United Kingdom has been Colombia’s main buyer since 1998.

Tariff and Para-Tariff Barriers

The United States is prominent among mango buyers worldwide, accounting for 39.2 percent of global imports in 2002. The rise in its imports came to 9.5 percent that year, but entrance of mangoes into this market is contingent upon phytosanitary control measures on the part of producing countries. Colombia does not have the infrastructure for hot-water treatment, nor has it signed the phytosanitary agreements necessary to export to the United States.

The situation of Ecuador is different, since the country has signed a phytosanitary fruit fly control agreement with the United States, and has set up the infrastructure for hot-water treatment, enabling the admittance of Ecuadorian mangoes at any U.S. port of entry.

Both countries have been granted ATPDEA (previously ATPA) tariff preferences and enjoy a zero tariff rate for mango imports in the United States.

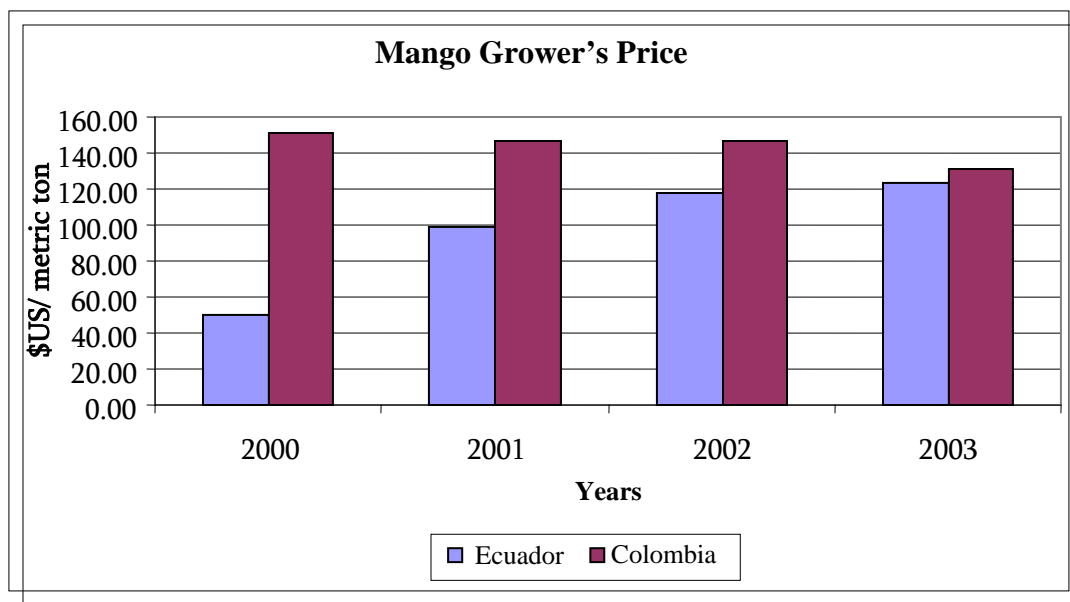
Harvesting Season

Because of its geographic location, Ecuador has an advantage over other mango-producing countries like Mexico and India, since it does not produce in the same period as they do. Ecuador harvests mangoes from late September to late January or early February. December is the month of highest production. Colombia, for its part, can produce almost all year round due to the wide range of microclimates it has. Still, production peaks for the Tommy Atkins variety in that country are between December and January, and from May to August, depending on the region.

Colombia, like Ecuador, could thus very well supply mangoes to international markets in December and January.

Grower's Prices

Figure 28. Prices Paid to Growers



Source: Authors' compilation based on United Nations Food and Agriculture Organization data.

As shown in Figure 28 above, it is obvious that the Colombian grower, despite mostly producing for the domestic market, gets better prices than the Ecuadorian grower, who mostly produces for foreign markets. This phenomenon affords an explanation of why Colombia imports Ecuadorian mangoes, even though the two countries produce in more or less the same season. In 2001, Colombia imported some 4,062 metric tons of mangoes—almost all from Ecuador—and in subsequent years its imports have been in the range of over 2000 tons annually.

Conclusions

In both Colombia and Ecuador, pioneers discovered that producing the right variety of mango could be profitable. Nevertheless, only Ecuadorians saw exporting to international markets as a profitable business. Colombia's few attempts to export were mainly unsuccessful, probably due to the effects of the distances from growing zones to shipping ports and the lack of other infrastructure and facilities needed for exporting with the right quality needed and at reasonable costs. The very little exporting that Colombia does involves only 0.5 percent of total Colombian yield.

Another cause of the lack of export could be the scant difference between the price received by the grower in the local market and the price received in export markets. High local demand would keep this difference from becoming greater. The risk of loss of quality caused by the distances and insecurity involved, as well as the additional costs and efforts required for phytosanitary control, would have discouraged both growers and potential exporters.

5.5 Tuna in Airtight Containers

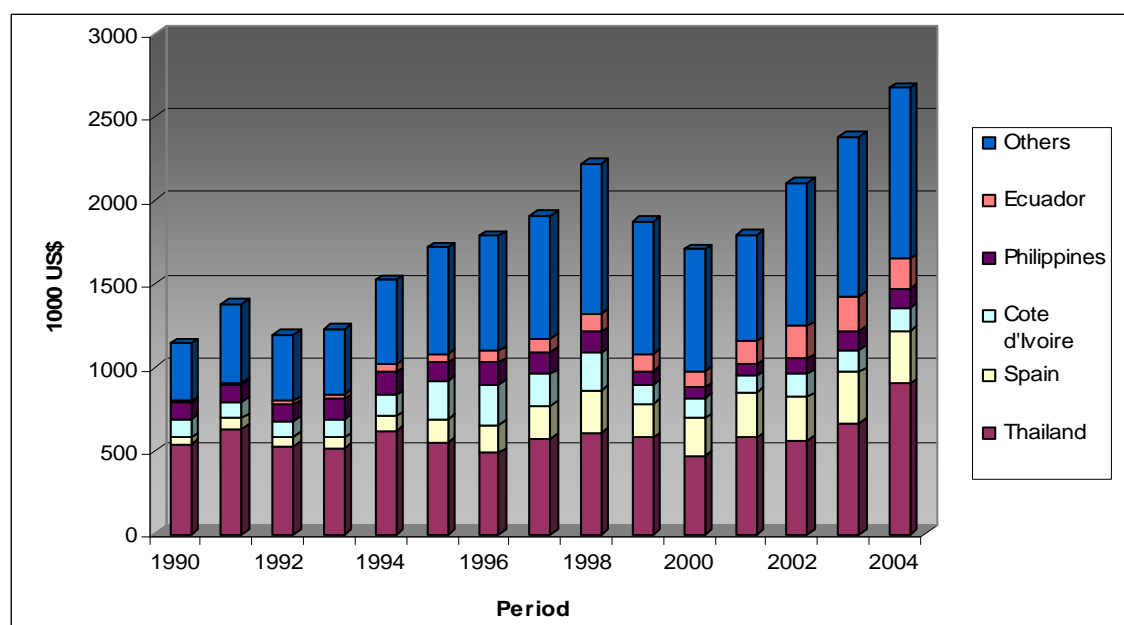
5.5.1 Trade Dynamics

Tuna packed in airtight pouches is a recent offshoot of the canned-tuna business. In this section, we will briefly review the trade status of canned tuna as the scenario where the new product made its appearance.

5.5.1.1 World Exports

Global exports of canned tuna show a substantial increase in the series analyzed. In 1990, world exports amounted to US\$740 million; by 2004, they were over US\$2.6 billion. The following figure shows the evolution of total export value and country share.

Figure 29. Global Canned-Tuna Exports



Source: Authors' compilation based on Globefish data.

Thailand remains the world's main exporter of canned tuna, with exports exceeding US\$900 million in 2004. Other exporting countries have been achieving a stronger foothold in the market in recent years. Spanish canned-tuna exports, for example, went from US\$41 million in 1990 to around US\$314 million in 2004, a nearly eightfold increase (see Table 10e below).

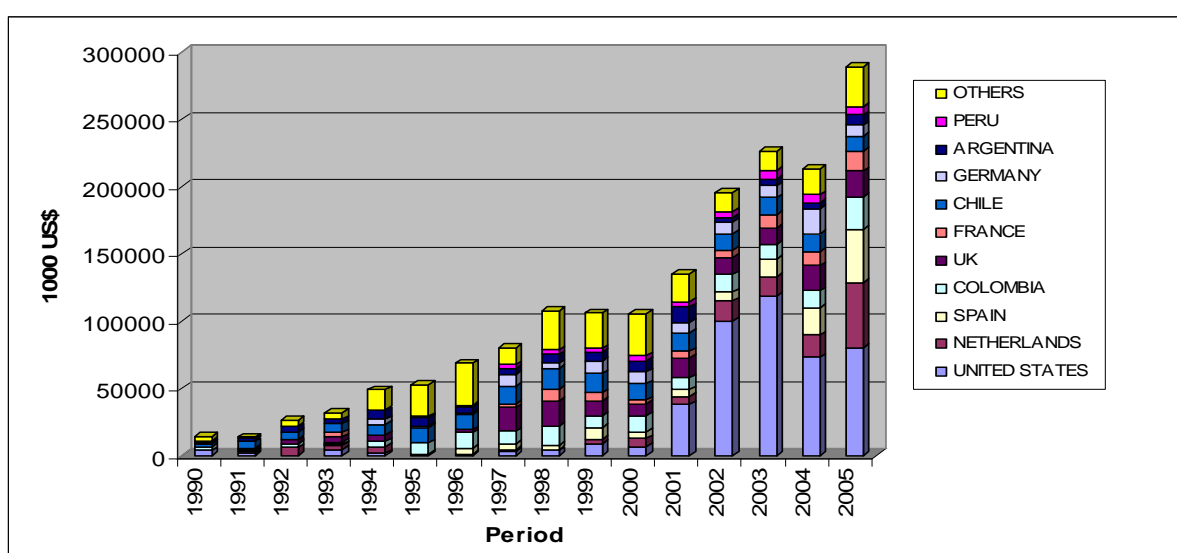
Table 10. Principal Canned-Tuna Exporting Countries

	2004 Export Value (USA million)	percent
Thailand	\$ 901	33.68
Spain	\$ 314	11.74
Ecuador	\$ 182	6.80
Cote d'Ivoire	\$ 140	5.23
Philippines	\$ 114	4.26
Others	\$1024	38.28

Source: Authors' compilation based on Globefish data.

The United States continues to be the main market for Ecuadorian canned tuna. In 2005, the U.S. imported over US\$80 million worth of this product from Ecuador, representing 27 percent of its total canned-tuna imports. Other important markets for Ecuador are the Netherlands (16.75 percent), Spain (13.78 percent) and Colombia (8.26 percent). It is interesting to note that Spain is a big consumer of Ecuadorian canned tuna, even though it is, at the same time, a strong competitor.

Figure 30. Ecuadorian Canned-Tuna Exports by Destination

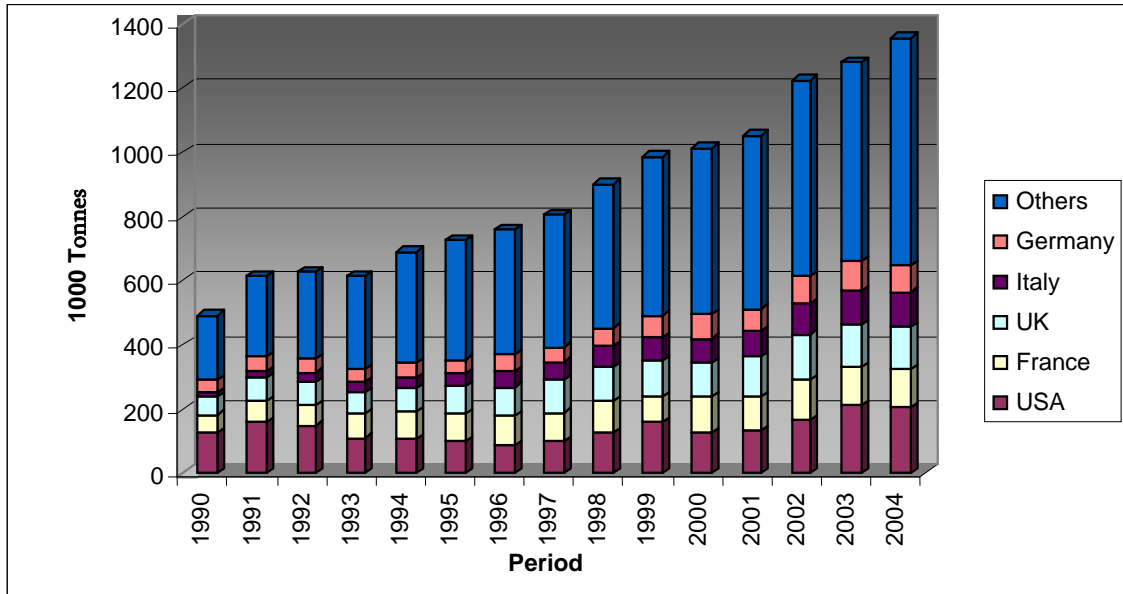


Source: Authors' compilation based on BCE data.

5.5.1.2 World Imports

Total worldwide preserved-tuna imports have grown consistently since 1994, reaching approximately 1.3 million tons in 2004. The United States is the main importer of canned tuna, with annual imports in excess of 200,000 tons. European countries are among the top preserved-tuna importers, with the United Kingdom (9.8 percent), France (8.7 percent) and Italy (8.11 percent) all showing important increases in the last few years.

Figure 31. Global Preserved-Tuna Imports

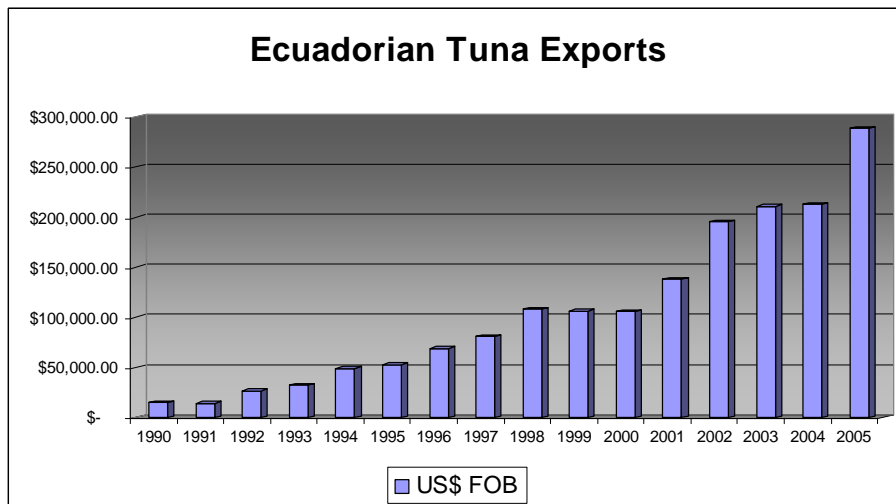


Source: Authors' compilation based on Globefish data.

5.5.1.2 Ecuadorian Exports

Ecuadorian canned-tuna exports grew sharply in the 1990-2005 period. Exports of canned tuna amounted to 5,700 tons in 1990, reaching a record 112,650 t in 2005, for a total value of over US\$280 million.

Figure 32. Ecuadorian Canned-Tuna Exports



Source: Authors' compilation based on BCE data.

5.5.2 The Discovery Process

5.5.2.1 History and Background of the Discovery

Fishing has been a traditional activity for native Ecuadorians since prehistoric times and continues to be a principal means of livelihood for coastal populations to date. Tuna is a highly migratory species, and large schools periodically arrive in Ecuador's coastal waters. This phenomenon has made the species one of the main catches of traditional fishing in this country.

In Ecuador, tuna was caught entirely for fresh domestic consumption up to the late 1950s. In the early 1960s, U.S.-based Van Camps built a tuna-canning plant in the coastal city of Manta to supply the domestic market and export to the United States. Other companies established canning facilities in Ecuador in the 1970s. Tuna-canning facilities demanded more inputs and encouraged local entrepreneurs to build fishing vessels with advanced fishing equipment. The slow introduction of vessels with improved fishing techniques brought on gradual growth in tuna catches up to the mid-1990s.

Up to the 1980s, the U.S. tuna market was mostly supplied by the American fleet operating out of San Diego, California and tuna-canning facilities installed in that area. As stocks in the northeastern Pacific were depleted, this fleet had to fish farther out to sea, making the industry more sensitive to labor and other increased operating costs.

Continually rising operating costs led to a prolonged crisis in the San Diego canning industry. A number of investors decided to move processing facilities to Thailand (Chicken of the Sea) and Puerto Rico (StarKist and Bumble Bee) to benefit from subsidies given to industries set up there. Later, StarKist and Chicken of the Sea built processing plants in American Samoa.

In the mid-1980s, a longtime Ecuadorian tuna-export entrepreneur, Agustín Jiménez, anticipated opportunities arising from the California tuna-industry crisis and offered StarKist a joint venture to operate in Ecuador. In the proposed venture, Jiménez would invest in a new canning facility (Empesec) and supply the venture with tuna through a production-management contract with associated vessel owners. StarKist agreed to manage the plant, partially finance the acquisition of new vessels for ship owners and distribute the product in the United States and other selected markets.

In an interview, Jiménez explained that a primary incentive for the American company to join the venture was the convenience afforded by pre-cluster developments in the Ecuadorian tuna industry. He said that the availability of labor, infrastructure and raw material supply—and

even of other businesses already working in the tuna industry—guaranteed efficiencies for the new venture’s operations. As he suggested, this may be why international tuna processors have chosen to set up operations in Ecuador rather than Peru or other Latin American countries having the same proven shoals of tuna arriving seasonally off their coasts (as later described in the counterfactual case).

5.5.2.2 The Discovery: Looking to Aggregate Value

In the mid-1990s, an international equipment manufacturer and supplier had been doing research on the use of airtight pouches for packing different food products, including tuna. This company offered StarKist the opportunity to work on the development of the new process for this type of product packaging. StarKist brought the opportunity to the Ecuadorian venture. The partners decided to work with the equipment supplier in developing the new process for tuna packing in Ecuador.

The equipment supplier worked closely with the Ecuadorian venture to develop the new packing technology, solving some technical problems that, according to Jiménez, lasted almost five years. Prior to this innovation, pouches had been used exclusively for preserving uncooked food products such as dried fruits or pasta. In Jiménez’s own words, Ecuadorian tuna became the first cooked product to be preserved in this new type of container. As will be shown later, this was an important discovery that introduced positive industry changes.

The partnership between Agustín Jimenez and StarKist is identified as the pioneer in the discovery of airtight tuna packaging, although their pioneering effect was not clear for some industry players interviewed. Some recalled Van Camps as the tuna-industry pioneer in Ecuador, as in effect it was for canned tuna in the 1950s. Nonetheless, as will be shown later in this paper, the impact that the Jiménez-StarKist venture and their introduction of airtight packaging had in revitalizing the tuna industry in Ecuador should be recognized.

Soon after the opening of the venture’s Ecuadorian tuna-processing facility, the ATPDEA²⁵—covering covering Ecuador, Colombia, Bolivia, and Peru—was approved by the U.S. Congress, after intensive lobbying by StarKist, Jiménez, and other Ecuadorian businesspeople and government agencies. These trade preferences applied a zero tariff to tuna in

²⁵ Andean Trade Promotion and Drug Eradication Act

airtight containers but kept high duties or quotas on canned-tuna imports from these countries in order to continue favoring the interests of American companies in Samoa.

In 2001, Jiménez and StarKist finished installing the new equipment to pack and export tuna in airtight pouches. The new packing technology significantly enhanced the value-added in tuna products. In fact, the pouch made it possible to pack different mixes of tuna, such as tuna salad and tuna pasta, among other combinations. An important advantage of these new products is that tuna can be packed free of added liquids (water or oils), keeping its natural dry texture and providing ease of handling for consumers.

For StarKist, the new value-added products fit in well with a market segmentation scheme, where the high-quality tuna is marketed with this type of packaging and lower-priced products continue to be packed in cans. This strategy is consistent with the perception that some varieties of tuna caught in the eastern tropical Pacific (ETP) have better characteristics because of cold sea currents passing through the region.

5.5.2.3 The Uncertainties Involved at the Outset, Key Factors and Obstacles Affecting the Discovery

Jiménez and his partner faced major uncertainties that could have harmed the potential venture. As expressed by Jiménez, these uncertainties considerably increased his personal risk and would have left him with a tremendous loss in case of failure, as he was financing the tuna-processing facility on his own. Major risks he identified were the U.S. trade policy regarding tuna imports and Ecuador's compliance with fishery-management regulations. In the first case, the competitive position of Ecuadorian tuna exports was partially dependent on the tariff imposed by the United States. At the time of discovery, negotiations were in progress with the United States to determine the tariff that would be imposed on Ecuador through the ATPDEA agreement. The second uncertainty involved the ability to get actual access to the U.S. market, which depended not only on whether Ecuador could comply with all IATTC²⁶ fishery-management regulations, but also on its adherence to the APICD²⁷ agreement for dolphin protection.

Ecuador became a member of the IATTC in 1961. This regional fishing-management organization, set up with the backing of the U.S. government, serves as technical secretary and administrator of the AIDCP agreement. Jiménez anticipated that since Ecuador was already in

²⁶ Inter-American Tropical Tuna Commission

²⁷ Agreement on the International Dolphin Conservation Program

the IATTC, there was a good chance of getting Ecuadorian authorities to sign the agreement. In fact, this entrepreneur and his business circle of fishing vessel owners worked hard to get the Ecuadorian government into the agreement. He and other Ecuadorian entrepreneurs prompted the Ecuadorian government to enter into negotiations to join the AIDCP in 1996, and the goal was achieved in late 1998.

At the time of investment decisions, the U.S. Congress was already debating the conditions and the list of products that would benefit from the ATPDEA. Considering the additional cost involved in pouch-packed tuna processing, it was important for the product to be granted a low tariff so that prices could remain low enough to keep consumer demand and margins high.

When interviewed, Jiménez did not recall any major surprises during the early stages of discovery. The reason for this could be that both partners were veterans of the tuna industry and knew most of its critical success factors. The impact of any coordination problems at the outset was diminished by the knowledge and capabilities of the venture itself. Besides their long experience, both Jiménez and StarKist had contacts and financial resources in place for suitable, opportune use.

Nevertheless, some coordination problems had to be solved to export the airtight-packed tuna, most of them related to supplies and equipment not locally available. These items were exclusively provided by the equipment supplier working on the development of the airtight tuna container. Even today, almost all ingredients used in tuna salad, tuna pasta, and other tuna mixes packed in airtight containers are imported from the United States. Jiménez explained that the local food industry still lacks the homogeneity and quality standardization required. Nevertheless, he hopes for further development by local food processors that would free the tuna industry from having to import these items, thus lowering costs. As to other nonspecific pouch-related products and services, there were adequate suppliers in Ecuador, according to Jiménez.

As pointed out earlier, an important coordination problem solved by the pioneers was getting the government to sign international agreements and pass certain internal regulations that would enable Ecuador to comply with these agreements. Among these regulations are those involving the payment of the annual IATTC fee, which, along with other measures, is a compliance requirement for eligibility to receive the “affirmative finding” status granted by the

U.S. State Department's Marine and Fisheries Services and necessary to allow imports of certain tuna products.

The domestic market was of secondary importance to the StarKist partnership in Ecuador. Although canned products were sold to local supermarkets almost immediately after operations were initiated in 1998, Jiménez said that competition in the domestic market—with over 10 brands of canned tuna—was high, and prevailing prices did not merit devoting important quantities of product that could be exported. It was not until recently that a promotional campaign was launched to try to get a larger market share for their products locally.

The pioneers realized from the start that, regardless of their contribution to the development of pouched tuna products, the property rights of any invention belonged to the machinery manufacturer. They knew that this company would try to sell its equipment and supplies to their competitors, but also realized that the major constraint for diffusion was the cost of the machinery itself. This would limit the number of competitors acquiring the technology, as it did, in fact. Jiménez felt that this was the most important limiting factor for his competition and safeguarded his investment.

In fact, only NIRSA, a local brand, acquired the equipment in Ecuador. This company is currently supplying the U.S. and other markets with tuna in airtight pouches. However, other worldwide competitors—mostly major brands—acquired the machinery and are currently supplying the main import markets, especially the United States, where this type of food container is most widely used.

The degree of new knowledge and improvement in productivity achieved through the introduction of the airtight container was significant. The new process considerably increased the value added to fresh tuna.

In fact, the whole concept of processing tuna to include mixes of other food products gave rise to similar initiatives by other processors who, using either airtight containers or other packing techniques, tried to add mixes and preparations that would improve tuna's appeal to consumers and, thus, the price and the return to the entire production chain.

It can be concluded that at the time of discovery, the partners benefited from externalities that contributed to the success of the future venture. The crisis of the San Diego industry, Ecuador's ATPDEA benefits, and its membership in the AIDCP are all examples of important positive externalities that confirm the above assertion. Moreover, the prevailing positive

conditions in the Ecuadorian tuna industry helped the pioneer in the discovery of the new packing process, which substantially enhanced the value added in tuna exports.

5.5.2.4 Possibility of Benefiting from Monopoly Rent

StarKist was a pioneer in developing and marketing tuna pouches. This technology was developed in conjunction with an equipment manufacturer and supplier that, in turn, made it available to other packers. StarKist did not have the monopoly on the technology, but had a jump-start in marketing the new product.

According to Jiménez, he was fully aware from the start that there would be no way to keep the suppliers of airtight technology from selling their equipment elsewhere, but the profit from being first in the U.S. market would produce sufficient benefits to justify the investment.

The development of tuna pouches spawned the idea of using the new packing material to diversify the product by adding vegetable mixes and making tuna salads. This, in turn, encouraged local imitators; not to imitate tuna pouch technology, which involves a high level of investment that is hard to justify, but to develop canned tuna or glass-packed tuna with tuna mixes. Actually, tuna salads may be cheaper to produce, since most vegetables used are less expensive than the tuna of equivalent weight, but can be sold at the same or a higher price than the same volume of an all-tuna can. Consequently, imitators paid attention to early market developments and grabbed the opportunity to jump into the market for packed tuna salad, both locally and abroad.

As previously mentioned, out of all Ecuadorian tuna packing firms, only NIRSA—a wholly Ecuadorian-owned company—invested in tuna-pouch technology, taking advantage of its availability as well as StarKist’s lobbying for ATPDEA duty preferences in the United States. NIRSA started production two years after StarKist; nevertheless, StarKist’s brand awareness among consumers has enabled their product to hold a much better position than their NIRSA competitor does.

In other regards, tuna packers and marketers—among them Bumble Bee and Chicken of the Sea—in Thailand and other countries have also imitated the technology and made somewhat successful inroads into this market.

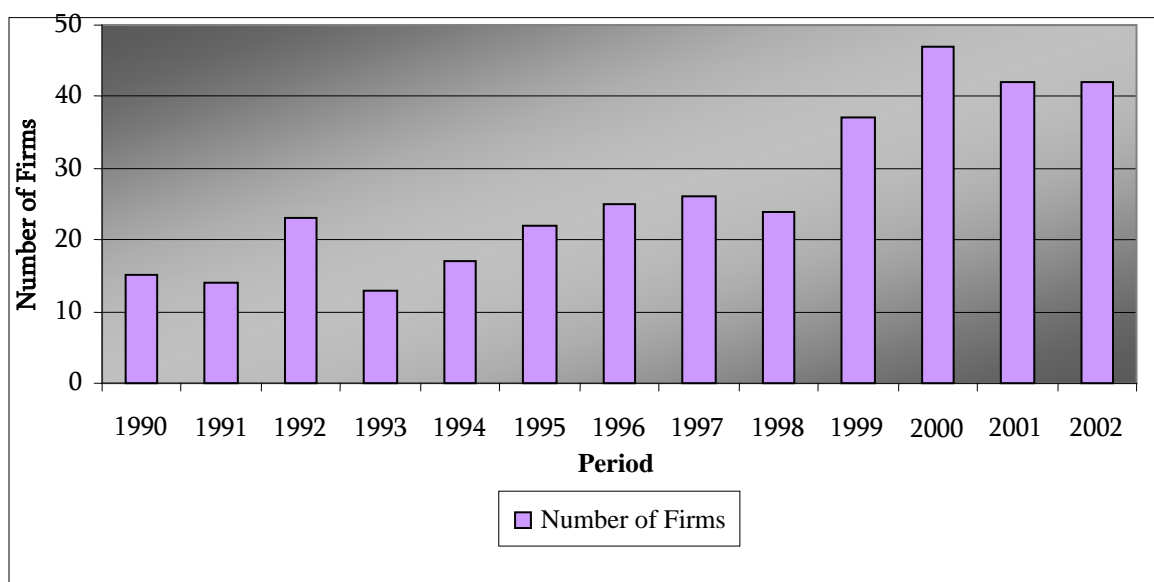
Apparently, StarKist's early start and virtual two-year monopoly, added to its brand position, have been enough to maintain its superiority over Ecuadorian and other international competitors in the Tuna Pouch and Tuna Mix segments of the U.S. market.

5.5.3 The Diffusion Process

5.5.3.1 Characteristics of Imitators and Determining Factors

As previously noted, the tuna industry began to grow at a rapid pace in the mid-1990s. Jiménez and other fishing-vessel owners interviewed agree that the opening of the StarKist facilities had a lot to do with boosting exports. In fact, StarKist's entry generated expectations of new demand for tuna that induced boat owners to buy new vessels or update existing ones (see Figure 33 for the evolution of Ecuadorian tuna-exporting firms).

Figure 33. Number of Ecuadorian Tuna-Exporting Firms



Source: Authors' compilation based on BCE data.

Many fishing vessels introduced in the mid-1990s were financed through foreign capital, either through direct capital investment or through commercial bank loans based on production-management contracts with processing plants (StarKist, for instance). At the same time, the Spanish interest in Conservas Santa Isabel (Garavilla Group) formed its fleet of new high-tech vessels—some of which were subsidized by loans from the Spanish government—built in the

shipyards of the Basque country, in Spain. These ships have the latest technology in computerized systems and satellite- and helicopter-based tuna tracking. The Garavilla Group also incorporated mother ships into the fleet, with a freezing capacity of up to 10,000 tons to carry frozen tuna for later processing in Spain.

Another part of the purse-seine fleet established in Ecuador had its origin in the divested ships of the San Diego fleet. These second-hand vessels were rebuilt and/or overhauled in Panama and other shipyards in the region, where their equipment was serviced and updated.

Ecuador increased its registered fleet from a total carrying capacity of less than 20,000 tons in the 1980s to close to 80,000 tons by 2002. In 2003, the world's largest tuna-fishing fleet, Spain's Albacora group, also built a shipyard and other facilities to operate its foreign-flag fleet out of Ecuador.

Although it is typically difficult to define new entries into specific groups, most fell into the following categories:

1. Ship owners that had been in the fishing business before the new era of investments.
2. Ship owners that had been fishing somewhere else other than Ecuador's coastal waters.
3. Investors who lived in the country's coastal cities where diffusion took place.
4. Investors who were either somehow associated or had previous contact with the pioneers, foreign investors or other imitators.
5. Other investors from different industries.

Based on our research, categories 1 and 2 of these groups seem to have been the most successful and that remain in business, while categories 3 and 4 have had varying degrees of success, depending on how well they adapted to the competitive climate of the fishing industry. Investors in the fifth category, according to our research, were the most affected by the recurring crises in the Ecuadorian economy and by problems in the tuna industry itself. The majority left the industry in 2001, following a prolonged economic crisis in the country.

The technology for airtight tuna packing could have been more widely distributed locally by the machinery developers themselves, in their own self-interest, but this equipment was very

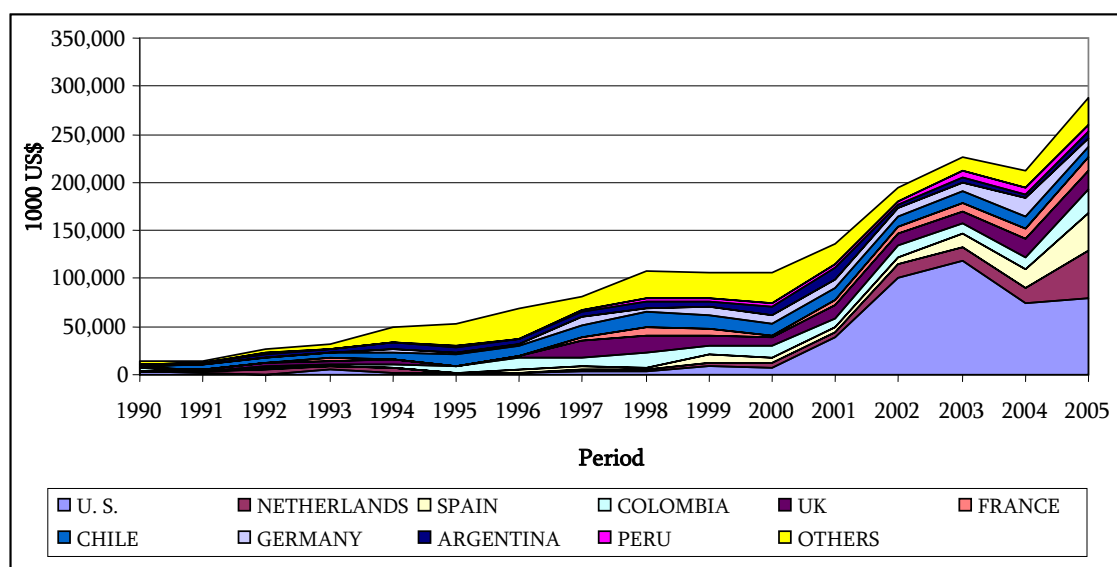
expensive as compared to traditional canning methods, lower-priced glass-packing systems, or new additives for mixing other products with canned tuna.

NIRSA acquired the airtight tuna packing equipment in 2002. Their expectation was to be able to export their tuna through different distribution channels, including their own brand, and to co-pack for other companies.

Around this time, another local investor, Industrias Yeli, built a high-tech tuna-processing facility with equipment for processing tuna with substantial value added, packing mostly in glass containers. Other tuna processors also increased their capacity and upgraded their equipment to improve their product lines with new items, such as cooked tuna loins and briskets.

Technological and capacity improvement in tuna-packing infrastructure had an important positive effect on the industry by increasing the value added to tuna products and, therefore, demand and prices paid to both processors and the tuna-fishing industry. Better returns for fishermen encouraged new entries into this sector. Exports increased to most important markets after 1998 (see Figure 34).

Figure 34. Ecuador's Canned-Tuna Exports by Country

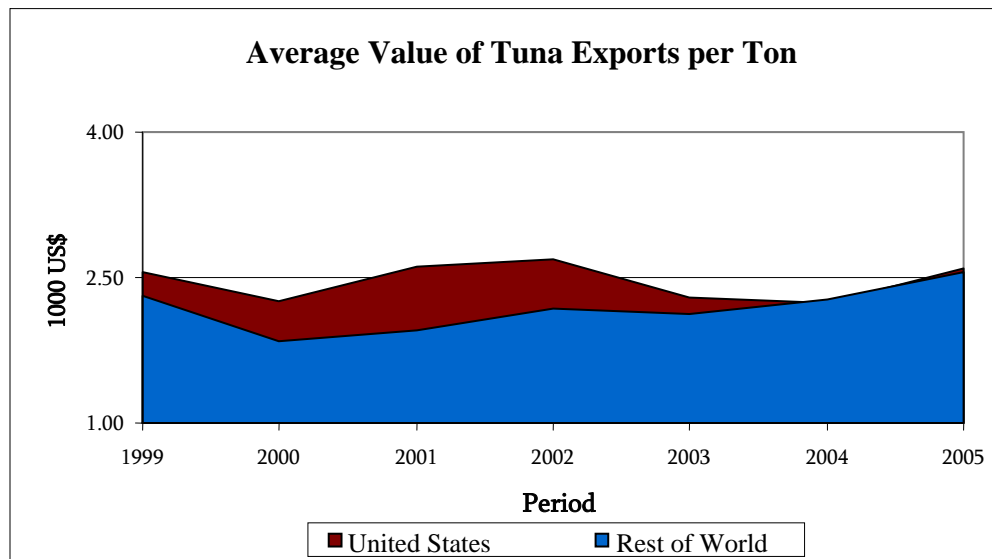


Source: Authors' compilation based on BCE data.

After the introduction of the new value-added products, product prices to the U.S. increased, followed a few years later by an increase in the value of tuna products exported to other principal markets. This can be seen in Figure 35 below, where the increase in the price of

exports to destinations other than the United States is shown in relation to the value of U.S. exports. Regardless of price fluctuations due to market conditions, the gap between the prices received for product exported to the United States vs. those received from other markets is seen to narrow, practically disappearing over time.

Figure 35. Average Value of Tuna Exports per Ton



Source: Authors' compilation based on BCE data.

Then, the IATTC banned the entry of new fishing vessels in ETP waters in 2002. This prohibition restricted fishing capacity to those vessels that were registered at the time the resolution was issued. The decision, though generally accepted for the sustainability of the tuna industry, limited the potential growth of Ecuadorian tuna exports.

In summary, since the technology developed was not the property of the pioneers, the only diffusion barriers were the relatively high level of investment needed to install it and go into production. The pioneers identified diffusion as inevitable and of a negative impact to their investment. There was no practical way for them to limit or discourage the diffusion process. All they could do was manage its outcome with good marketing and establish a preference for their tuna-pouch brand items firmly in the U.S. consumer's mind, thus raising a barrier to marketing by new entrants; which is what they did in the two years of monopoly they had. The main channel of diffusion was, of course, the owner of the technology.

In conclusion, there were positive externalities that had an impact on the diffusion process, such as the free availability of the new technology, whose development costs were

incurred by the pioneers; the signing of the ATPDEA preferences for zero-tariff entrance to the U.S. market; and, indirectly, the availability of the divested San Diego fleet. In time, new entrants got a slice of the market, though a relatively small one, even in the case of companies not operating out of Ecuador, like Bumble Bee and Chicken of the Sea. Their entrance may have had some slight impact in lowering market prices and, coupled with the restriction on tuna catches, a minor effect on raw-tuna costs.

5.5.3.2 Analysis of Public Policy and Other Key Elements in the New Export's Success

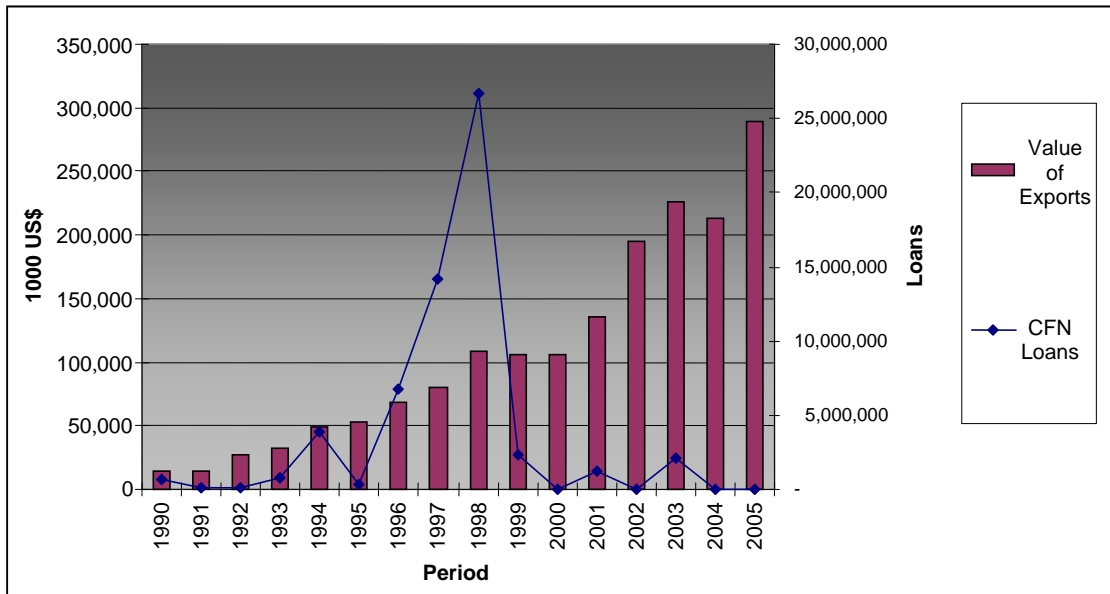
By lobbying for the ATPDEA inclusion of tuna pouches and making financing available through the National Finance Corporation, public policy had a definite impact in the export discovery and diffusion. It seems to have had no impact on information diffusion or in solving coordination problems.

Initial leverage ratio, capital structure and integration in processing plants—along with prior experience and expertise—have been identified as critical success factors in all cases.

As to financing, a large part of the requirement for the acquisition of new vessels came from abroad, through operations with foreign banks by partners who put up their own vessels as collateral. Long-term financing was also available locally. In fact, pioneer Jiménez used it to build the processing plant for the joint venture. This type of financing was available almost exclusively from resources provided by multilateral financial institutions to the CFN, which acted as a first-floor bank to the local financial system.

The country's financial system recognized the feasibility of new vessel investments and the positive cash flow of subsequent fishing operations, and increased the availability of funding for ship owners. Loans granted to vessel owners were apparently an important factor in increasing carrying capacity, total catches and exports. Some vessel owners and processors interviewed identified credit access as a key element for the expansion of the business. Most received long-term CFN loans (see Figure 36).

Figure 36. Ecuadorian Canned-Tuna Exports vs. Yearly CFN Loans



Source: Authors' compilation based on CFN data. n; Central Bank of Ecuador. Prepared by Stratega BDS

Technical assistance and training to acquire the necessary know-how were partially provided by international companies that supplied new equipment for the industry. In many cases, vessel owners were compelled to bring in specialized personnel to operate the high-tech equipment in modern vessels. In fact, a large majority hired foreign crews and other personnel to be able to operate their vessels efficiently. Some of these people, mostly crew members, continue to work in the country. The majority of entrepreneurs surveyed identified technical assistance as important and indicated that they had received no subsidies or assistance from the Ecuadorian government.

In the case of the pioneer, all key technicians for the processing plant were StarKist personnel. Jiménez said that this was part of the joint venture's management contract.

No entrepreneur interviewed identified local currency devaluation as a key element for success. Nonetheless, as expressed by one of the imitators in the survey, "it helped." By this, he was probably referring to the short-term gains produced by having part of production costs, as well as suppliers' credit, fixed in local currency.

Consumer demand also contributed to the new export products' success. As already explained, tuna pouches provide tuna in a natural state, free of oil or other additives, sometimes in combination with salad or other mixes. This type of product reached a new segment of

consumers that previously did not buy canned tuna because of the need to drain the oil or water before consuming, or because of the change in taste and texture caused by the added liquid. Consumers having little or no time to prepare food appreciated the new product. Pouched tuna competed favorably not only with canned tuna, but also with other ready-to-eat meals (hamburgers, hot dogs, and pizza) and had the added appeal of being low in fat and free of additives and carbohydrates. In consequence, the introduction of this product led to a market increase for Ecuadorian tuna products in general.

Finally, all of the entrepreneurs surveyed identified market access as a key element for tuna-industry development. In fact, they said that without the ATPDEA and the EU's Generalized System of Preferences, there would not have been any important growth in tuna exports.

In conclusion, this new export development case illustrates the revitalization of an industry by a pioneer, new entrants and technological advances (introduction of new packaging) and shows how these new activities depended on positive externalities and the actions taken by entrepreneurs themselves or the government.

5.5.4 Counterfactual: The Tuna Industry in Peru

5.5.4.1 Characteristics: What the Twins Have in Common

Ecuador and Peru have similar fishery characteristics, principal among which are the natural conditions where their extraction activities are carried out. In fact, Peru and most of the Ecuadorian coastline are bathed by the Humboldt Current, a cold current that characterizes the marine life on which their fisheries are based. Both countries have substantial stocks of small pelagic species that make up the main food supply of different tuna species.

Tuna fish are highly migratory species whose movement patterns are nevertheless tied to the biological resources they feed on. Many of these resources stay off the territorial coasts of Ecuador and Peru, causing the systematic appearance of schools of tuna.

The presence of tuna off the coast of Peru encourages fishing-vessel operators from other countries, especially Ecuador, to continue to buy Peruvian fishing licenses. These licenses are sold at international prices that are significantly higher than the ones paid by Ecuadorian ship owners for fishing licenses in their own country. Nevertheless, many Ecuadorian ship owners

acquire them annually, given the considerable numbers of tuna species in these tropical waters. Despite this, Ecuadorian vessel operators unload their catches for processing in Ecuador.

Both Ecuador and Peru have populations whose traditional livelihood is fishing. In fact, the native populations of these countries had commercial exchanges and political integration that are reflected in the similarity of current fishing-related livelihoods of coastal populations. According to different members of the industry consulted, human resources in these countries meet conditions suitable for fishing activities, which explains in part the development of the fisheries in this region.

As to business climate and macroeconomic factors, conditions in Ecuador have not been any better than in Peru. Peru underwent important structural changes in the early 1990s. Ecuador, on the other hand, underwent one of the most severe crises of its history at the end of the same decade (coinciding with the reactivation of the tuna industry).

5.5.4.2 Brief History of the Development of the Peruvian Fishing Industry

The Peruvian fishing industry got its start at the outset of the Second World War, when the country began to export salted fish to the United States to meet the rising need for foodstuffs caused by the conflict.

In the post-war years, the canning industry was mainly hurt by competition from producing countries such as Japan and by U.S. tariff restrictions. Thus, in the 1950s, the Peruvian fishing industry concentrated on the production of fish oil and fishmeal. By 1955, there were more than 1,000 vessels devoted to anchovy fishing.

In the 1960s and 1970s, great technological progress helped to establish numerous plants with new equipment and processes throughout the entire coastal area. Fishery production was growing and Peru became the number one fishmeal and fish-oil producer and exporter in the world, benefiting such industries as shipbuilding, packing and labeling, among others.

The anchovy catch began to decline in 1972 due to overfishing, the effects of El Niño, ignorance about school-movement processes, and an improper selection of young anchovies. This situation brought on a crisis, and in the mid-1970s Peru lost its top place as a fishing country, bringing grave consequences to the economy, since many fishermen lost their jobs, processing plants cut back on personnel and the various fishing-based industries were hurt.

In the 1980s, fishing for direct consumption increased due to the presence of sardines in Peruvian waters. This presented a new opportunity for canning industry, but it was cut short by a political measure issued by the Ministry of Fishing at the time.

In the early 1990s, the fishing industry began to recover. Peru again became one of the top fishing countries in the world. Fish oil, fishmeal, canned fish, and frozen fish accounted for 20 percent of the value of Peruvian exports.

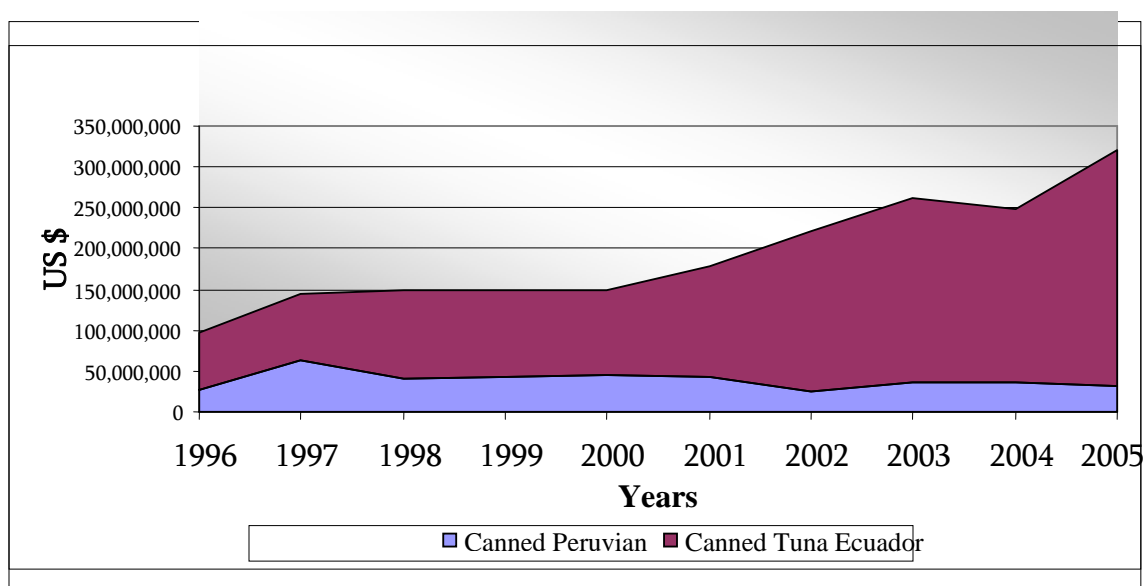
In the last few years, the Peruvian government has handed down a series of measures designed to encourage the development of the tuna industry. Many of these measures have been aimed at getting the Ecuadorian tuna industry to shift towards Peru. In fact, the Peruvian government has sent trade missions to Ecuador to achieve this objective.

Another advantage Peru offers, through Act No. 28462, in force since January 14, 2005, to encourage foreign tuna-fishing vessels to unload at Peruvian ports is exemption from the Selective Excise Tax for fuel and lubricants for licensed fishing vessels.

5.5.4.3 Differentiating Factors and Principal Obstacles

In spite of the presence of substantial schools of the species, infrastructure, and the Peruvian population's fishing tradition, the tuna industry in Peru has had relatively limited development in comparison to Ecuador.

Figure 37. Peruvian vs. Ecuadorian Exports, in Dollars



Source: Authors' compilation based on BCE and Ministry of Production of Peru data.

A number of factors, described below, led to the differing performance of the tuna industry in Ecuador and Peru, including the following.

Characteristics of the Biological Resources

Although similarities exist between Ecuador's biological resources and those of Peru in terms of types and quantity, there are also differences that may have had some impact on the development of the Ecuadorian tuna industry. One of the principal differences to highlight is the enormous amount of small pelagic species that exist in Peru (relative abundance of factors).

Table 11. Landings of Main Pelagic Fishing Species

	1994	1995	1996	1997	1998	1999	2000
Ecuador	276,068	421,934	623,515	421,509	189,085	256,280	417,170
Peru	11,399,000	8,204,000	8,772,000	6,999,000	3,696,000	7,788,000	9,212,000

Source: Authors' compilation.

The abundance of resources in small pelagic species gave rise to the processing industry for indirect human consumption, which kept Peruvian fishing companies busy, probably lessening the attraction of entrepreneurs toward the investments required for the development of the tuna industry.

Indeed, the crises that befell Peruvian fisheries may have reduced the attraction of capital to tuna fishing as well as the entrepreneurial spirit for fishing required to develop this high-risk (human factors) industry. To add weight to the argument, it is important to emphasize that Peru has quite a large industrial fish-processing capacity that is only partially used. The idle capacity runs around 50 percent of effective capacity.

Table 11. Use of Processing Plant Capacity (2001)

<i>Factor</i>	<i>Meal</i>	<i>Canning</i>
Effective capacity (t/day)	173,520	4,110
Days of production	160	210
Yield (percent)	22.2	43.1
Annual transformation capacity (in thousands of t)	6,170	372
2001 production (in thousands of t)	1,638	79
Plant capacity usage	26.5	21.3

Source: Ministry of Fisheries of Peru.

Foreign Investment and the Externalities of Information and Coordination

It is possible that because of the amount of resources required to invest in tuna-industry infrastructure an important dose of direct foreign investment would have been needed. According to The Golden Book of Peruvian Fishery, investment in Peruvian fishing infrastructure is essentially domestic. This is contrary to the situation in Ecuador where, from the start of tuna-industry development, important resources were provided by foreign investors.

Direct foreign investment not only brought financial resources but also helped to solve potential coordination and information problems that would otherwise have become a considerable hindrance to very rapid industry development. In fact, many of the investments in the tuna industry in Ecuador were made by the same processors-importers who own the distribution channels in consumer markets (Van Camps, Garavilla Group, Bumble Bee, Salica, etc.).

Geographic Location

The development of Ecuadorian tuna-industry infrastructure—the ship-owning sector, in particular—occurred in specific geographic locations. . This may be largely related to the need for specialized services required for the extraction activity to function properly; that is, everything from port infrastructure to trained personnel to carry out specialized tasks. In Ecuador, the tuna industry has been exclusively situated at the ports of Manta and Posorja. In Peru, on the other hand, the indirect fish-processing industry developed along most of the coastline, comprising a very extensive geographical area that is difficult to provide with suitable infrastructure for basic and specialized services required by the tuna industry (ports with ports with appropriate docks, landing cranes, access roads to plants, etc.).

Market Characteristics

Another important characteristic that may have some relation to the development of an industry in Ecuador and not in Peru would have to do with some aspects of the demand for fish products in both countries. From the beginning of the development of the Peruvian fishing industry, there was an attempt to promote local consumption, but the market proved reluctant to consume frozen and canned fish products.

In Ecuador, on the other hand, there seems to be no particular resistance to consuming canned fish products. In fact, canned sea products (tuna and sardines) are fully integrated into Ecuadorian diet and we believe that local demand conditions may have benefited the growth of the industry to a large degree. In addition, the development of the industry for domestic markets may also have contributed to producing exportable surpluses which, in turn, brought about whole supplying industry for both inputs and services.

6. Conclusions and Public Policy Implications

6.1 Conclusions

From the five cases analyzed, it can be concluded that their discoveries were mainly of traditional competitive advantage, with various degrees of technology adoption. In most of the export products studied, the companies' owners had achieved advantageous levels of production and knowledge, enough to lead them to take a further step, compared to other producers in the market. In the case of broccoli and tuna in airtight containers, there was a higher degree of technology investment and adaptation. For palm heart, mango, and flowers, finding the right product (like a variety of seed) was crucial to achieve levels of productivity which would facilitate exporting at competitive prices.

The costs of discoveries fell in the low to medium range. In most cases, these costs were related to finding the right seed variety, adapting technology, upgrading, and marketing development costs. In the cases of broccoli and palm heart, the costs were associated with switching to another agro-export product, and in the cases of flowers and mangoes, the main goal was to overcome transport and phytosanitary regulation, respectively. For the case of tuna in airtight containers, the producer was already in the business looking for better opportunities, and

in this case, this was achieved by upgrading its product—tuna—which already was being exported.

The five cases show that information spillovers were prevented with medium to high barriers of entry, which granted monopoly rents to pioneers for up to three years. Afterwards, most of the cases experienced oligopoly rents up to 10 years. In no case did the government subsidize the cost of the discoveries.

Coordination problems were common to all cases. One coordination problem was the need to reduce tariff and non-tariff barriers to markets. The private sector, through business associations, worked together with the public sector to get the first ATPA approved by the U.S. government and then to its extension named ATPDEA in 2001.

In the case of flowers, air transport was crucial to assure exports. It was resolved by collective action of some exporters associated through EXPOFLORES, led by the pioneer, and the participation of the state, to provide the required numbers of flights through the state airline.

Finding the right seed and the right quality product and setting phytosanitary practices were common coordination problems for palm heart, broccoli, and mangoes. Broccoli and mangoes are clear cases of private-public collective action facilitated and fostered by public-private agencies, such as: CORPEI, FUNDAGRO, SESA, SICA, MICIP, the broccoli association initially named CORPROCON and now APROFEL, and the mango association, Fundación Mango. Most of the programs set up to provide technical assistance to increase productivity and to implement phytosanitary practices were financed by international aid. CORPEI is the major receptor of international aid because of its technical expertise, public-private scope, and political stability.

In the case of broccoli and palm heart, the existence of the canning and IQ plants was crucial to their discoveries. For broccoli, palm heart and mangoes, labor does not need specialized skills in primary production, but requires particular training for their processing. For flowers, specialized skilled labor is crucial. Recently, those surveyed repeatedly indicated that labor turnover is a problem that is affecting their productivity. It is important to note that in the agro-export sector, labor represents about 45 percent of total costs. After dollarization, training has regained importance because of its direct impact on productivity.

The process of diffusion has differed among the cases analyzed, although it is possible to identify three clear periods of diffusion. The first was moderate from 1984 until 1990, where the

number of firms grew to 20. This period was neutral in terms of price erosion and pioneer market share and was beneficial in terms of collective action, which resolved transportation problems. There was a second period of high diffusion from 1990 to 1997, where the number of firms grew to around 150, and where the market share and earnings of pioneers were hurt and prices declined. Also during this period, the cost of land and skilled labor increased. Since 1998, the industry has gone through a restructuring period, with several firms getting out of the business. Low margins forced many firms to refocus on downstream or upstream activities, such as providing inputs or to conducting marketing activities.

In the case of flowers, the diffusion was very high, reaching 180 firms in 2005. After 2000, small and medium flower enterprises started to work together to buy inputs at a lower prices, to benchmark costs, and to work with private-public agencies such as CORPEI and EXPOFLORES. It was only after 2000 that the industry worked together to develop Ecuador's rose brand and to develop joint initiatives with the support of international cooperation from the IDB/MIF and the European Union.

The cases of palm heart, mangoes and broccoli are of moderate diffusion because pioneers needed large investments to set up treatment and IQ facilities, which were in turn barriers of entry for other producers. The case of tuna in airtight containers had an even lower diffusion rate because of the massive initial investment needed. In countries with mature financial markets, these barriers are easily overcome, but in Ecuador there is no seed capital available for such investments.

The country went into deep financial crisis in 1998. Moreover, current banking regulation does not allow private banks to finance "discoveries" without appropriate guarantees, which amount to 150 percent of capital needed because of current collection problems. The CFN was actively providing loans to agribusiness and export activities until 1998, but because of collection problems and inefficiency, before and after the crisis, its coverage has been dramatically reduced.

In general, the discoveries required low levels of collective action to resolve coordination problems. The role of the state has been clearly identified with: i) reduction of tariff and non-tariff barriers to markets; ii) access to financing up until 1998, iii) provision of business development services and market promotion activities after 1998, with the creation of CORPEI and SICA in MAG, and iv) phytosanitary services through the leadership of CORPEI, MICIP

and MAG. In the cases of broccoli and mangoes, there is a clear and documented public-private intervention, with the participation of several actors both public and private: CORPEI, ASOPROFEL, FUNDACION MANGO, MICIP, SICA financed by donors such as the European Union and IDB/MIF. In the following table we summarize principal aspects of the discovery and diffusion process.

Table 12. Relevant Factors for Each Sector

Factor	Palm Hearts	Broccoli	Flowers	Mangoes	Tuna in airtight containers
Type of Pioneer	Entrepreneur already in a canned food industry looking to switch to another product to export. Information of new discovery came from abroad.	Entrepreneur already in an agro-export industry looking to switch to another product. Information of new discovery came from importers	Public officer with access to key market information.	Entrepreneur with access to key market information	Partnership of an international investor and local one already in the tuna industry.
What was discovered?	Traditional competitive advantage (TCA)	Traditional competitive advantage in a new product.	Traditional competitive advantage in a new product Growing markets	TCA	Value added product
Cost of discovery	Low level. Principal costs: finding right variety of palm heart to can and market channels of distribution.	Medium level. Principal costs: How to produce broccoli, best variety imported since 1998 allowed explosive growth, IQF plant.	Medium level. Principal cost: technical expertise, transport, market discoveries to import inputs.	Medium level. Principal costs: right variety, Hot-water treatment plant.	Medium level, but risky. Principal cost: Technology adaptation
Pre-conditions	Treating and Canning knowledge. Canning Plant. Right palm heart variety	Right variety of seed IQF plant	Available land.	Overcoming of phytosanitary barriers that open US market Hot-water treatment plant	Tuna processing plants Port infrastructure
Barriers	High costs of setting a canning plant (economy of scales). Low to growers	High barrier to exporter because of lack of risk capital and freezing technology Low to growers	Medium because of lack of risk capital.	Medium	Medium-High
Information Spillovers	High barriers to entry prevented diffusion. Only for 3 years, then oligopoly	High barriers Only exporter for 3 initial years. Then oligopoly: 5 firms until 1999. Now 10 firms	Medium barriers Pioneer enjoyed one year of being solely exporter, then 10 years of only 20 enterprises.	Monopoly of hot-water treatment for 2-3 years.	First mover advantage and solely firm for couple years.
Supply /Demand Problems	Supply and demand of raw production	Supply and demand of raw production	None, because most growers were exporters. Miami was already setup as the port of entry of flowers because of the Colombian industry. Language helped.	Yes	No

Table 12., continued

Solution to problem	Vertical integration (medium intensity)	Contracts with fixed prices among small and medium producers and exporters			
Coordination Problem		Quality Sanitation	Air Transportation Import of inputs	Phytosanitary Quality	
How coordination Problems were solved		Contracts Technical Assistance to small and medium growers	Collective actions lead by pioneer and flower association, to get state airline to provide initial flights.		investors which own downstream and upstream operations
Type and intensity of diffusion	Imitators were mostly other monkeys in food industry trees. Low rate of diffusion Number of exporters: 18	Low Then oligopoly: 5 firms until 1999. Now 10 firms	Moderate up to 1990 (25 firms) Very High from 1990-1994, (156 firms). Moderate from 1994-2005 (180 firms)	Moderate From 1 to 45 firms	Low at the initial period then moderate
Effects of diffusion in the pioneer	Hurt market share of pioneer.	Neutral	Neutral first five years Moderate 5-10 High after 10 th when diffusion was higher.		Neutral at initial period then moderate
Price erosion	Yes	No	When diffusion was high period 1990 an on, yes		Yes
Cost Increase	Yes	No	Yes in land and labor		Yes
Role of collective action		Yes Contracts among producers and exporters had reduced problems with quality and access to finance.	To resolve transport cost and to lobby for ATPDEA. After dollarization focused on increasing productivity.	Yes, to get technical and phytosanitary assistance.	To lobby for ATPDEA

Table 12., continued

Role of State	<p>Elimination of trade barriers through ATPDEA.</p> <p>Access to finance to producers at the diffusion period.</p> <p>Market information through UNIDO Programs</p>	<p>SICA has provided technical information.</p> <p>International cooperation to help small and medium agriculture to increase productivity</p> <p>CORPEI has provided market information, BDS and foster association among producers to increase quality and productivity.</p>	<p>Elimination of trade barriers through ATPDEA.</p> <p>Access to finance through CFN, 1990-1997</p> <p>Transport problems</p> <p>BDS services and market promotion through CORPEI and international financing (World Bank).</p> <p>After dollarization, CORPEI and international donors (FOMIN, EU, focused on increasing productivity.</p>	<p>Access to public finance until 1997 ATPDEA.</p> <p>CORPEI, FEDEXPORT and others associations with technical assistance to solve phytosanitary , productivity problems and market promotion.</p>	<p>ATPDEA</p> <p>CORPEI market development intelligence and phytosanitary technical assistance particularly to EU markets.</p>
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Source: Authors' compilation.

6.2 Policy Implications

One key factor for the discovery of the exports of the five products, and furthermore, to the diffusion within each industry, was the access to financing through the CFN. The CFN provided loans through a second tier of private banks using specific processes to finance the agro-export business.

The main lessons drawn from the analysis of the cases include the following:

- 1) In order to promote Ecuador's export products, the government needs to find innovative mechanisms to share the costs of new discoveries, while strengthening intellectual property rights for more innovation. Also, finding the right type of financing is critical; therefore there is a role for the state fostering the establishment of seed capital funds as well as agriculture risk insurance processes to foster long-term private financing.
- 2) Cooperation among industry experts needs to improve. An important conclusion from this analysis is that successfully entry and competition in each market requires knowledge of complex and specific requirements. The complexity not only comes from the long list of requirements for exportation, but also from the fact that the export industry is relatively specific to each sector. Furthermore, information sharing requires the interaction of several private and public institutions, which demand high levels of cooperation and long-term vision of each sector.
- 3) Deeper collective action to promote public-private partnerships should be fostered in order to overcome problems, such as specific needs of infrastructure or logistics, specific sector quality standards, particular phytosanitary requirements, certifications, value chain tracking, and technical training, among others.
- 4) Information and knowledge should be made available to everyone. Market intelligence was critical to the discoveries. Marketing information is a public good, which should be provided with high standards and through the appropriate channels of distribution.
- 5) Finally, an agenda should be initiated at the national level, with the intervention of private and public actors in order to design and implement a

set of instruments that will increase the levels of private investment in new highly potential sectors. This agenda should also have clear institutional arrangements to promote the creation of public goods and minimize rent-seeking behavior.

In the following section we provide some ideas for the set up of this “discovery agenda” for Ecuador.

6.2.1 Towards a Public-Private Agenda to Promote New Discoveries in Ecuador

Ecuador has developed recently many business innovation programs, although sporadically. In 2005, the CEREPS funds were created, with the allocation of the 5 percent difference between budgeted and received oil prices to science and technology. The Secretariat of Science and Technology (SENACYT) managed these funds, which in 2006 amounted to US\$20 million and were used to co-finance the adaptation of new technologies of private enterprises, and to foster association among micro and small enterprises. There is not a formal evaluation of this program; but it is clear that mechanisms used to allocate the funds are not transparent, which have left distribution of funds to the discretion of public officers.

CORPEI has a US\$25 million program called EXPOECUADOR, which is financed by the European Union and aims to increase competitiveness and access for small and medium enterprises to export to the European and Canadian markets. The program provides matching funds for business and market development services. In addition, EXPOECUADOR aims to strengthen key institutions for phytosanitary and certification services, as well as private business associations. Finally, the program has developed a curriculum to train international negotiators in order to facilitate trade agreements.

Other private and public actors, such as MICIP, CORPEI, and the Ministry of Economy, under the leadership of the National Council on Productive Reactivation and Competition (CNPC), had agreed on the creation of a fund named FUNDEPYME. This fund aims to provide competitive resources to promote productive integration and innovation among small and medium enterprises through the management of a specialized operator and under principles of competitive bidding and declining co-financing over time.

Despite these efforts, there is no national public-private agenda to foster private investments in “innovative and new activities” which would solve the problems that investors

face in the process of discovery and diffusion and that had been highlighted in this work. These problems are related to information acquisition, coordination, and training externalities, which have required tailored interventions. The following table summarizes the problems mentioned and potential solutions.

Table 13. Discoveries, Externalities and Potential Solutions

<i>Externalities</i>	<i>Problem</i>	<i>Potential solutions</i>
Information Externalities	<ul style="list-style-type: none"> ➤ Costs of discovering are assumed by pioneer despite success or failure and fast imitation do not allow reaping all benefits of innovation. Because of this, the private returns from engaging in innovative activities are lower than the social benefits and the market incentives for self-discovery are inefficiently low. 	<ul style="list-style-type: none"> ➤ Mechanism of risk sharing such as provision of partial guarantee to finance new discoveries projects. ➤ Deepening and consolidating market intelligence information, and increasing coverage and diffusion of CORPEI programs and SICA at MAG. In addition, the creation of one-stop, client-friendly information portal for potential export investments.
Coordination Failures	<ul style="list-style-type: none"> ➤ Coordination failures occur when the return on an investment depends on whether some other investments are also made. For discoveries to be successful, other simultaneous investments are necessary, some of them public such as infrastructure, customs, phytosanitary installations, quality standards, etc., and others private upstream and downstream, such as energy, transport, logistics, and inputs. 	<ul style="list-style-type: none"> ➤ Design of financing mechanism for upstream and downstream activities. ➤ Setting up a seed fund capital to invest new discoveries and upstream and downstream activities. ➤ Strengthening of SESA, the phytosanitary agency and setting of adequate coordination mechanisms with CORPEI, SICA and the National Council of Quality. ➤ Strengthening the private sector association to help resolve coordination problems and others where collective action is needed.
Training Externalities	<ul style="list-style-type: none"> ➤ On-the-job technical training can be severely hurt by high employee turnover, particularly of skilled labor, since employers do not have incentives to finance training. ➤ In the case of Ecuador, the CNCF provides on the job training financed by private contributions, but the mechanism is highly centralized and concentrated in general courses because of lack of enough incentives to encourage specific technical training. Also there are problems with quality because lack of an effective accreditation mechanism. 	<ul style="list-style-type: none"> • Reform of the current National Council of Professional Training (CNCF), which provides co-financing to training services, but which does not have sufficient incentive to train organizations to provide “specific technical” training courses.

Source: Authors’ compilation.

The “discovery agenda” needs to take into consideration not only “market failures” like the ones described in the table above, but also “governmental failures.” In fact, government discipline is a prerequisite to implement this type of agenda in order to avoid rent seeking. Additionally, incentives are needed to overcome the already mentioned externalities. Thus, there is a need to achieve “... a delicate balance between the Scylla of private capture and the Charybdis of bureaucratic ignorance...” (Rodrik, 2003).

This is easy to say but extremely difficult to implement in Latin American and particularly in Ecuador, where institutions have suffered a setback in terms of constant change and have introduced political clientism in government institutions in the last few years. Also, there is a long history of mistrust between the public and private sectors, and even a fear of government expropriation. Another factor is the low level of trust on the part of society in general, and particularly the private sector. The economic implications of dollarization have played a crucial role in forcing private actors to work jointly in some cases for the first time, in order to initiate programs to help them increase productivity and compete internationally. This interaction has also created a window of opportunity to implement a discovery agenda.

Discovery activities are processes full of uncertainty and highly unpredictable. Their results will depend on the capacity to take advantage of circumstances and opportunities. They are, as Hausmann and Rodrik have indicated, “...consequences of historical choices and serendipitous choices by entrepreneurs...” (HR, 2002, page 25). We had found this true in the majority of cases analyzed, where there is a “luck, circumstantial factor” difficult to measure.

A discovery agenda cannot be implemented alone. It needs to be part of a larger “growth agenda,” which will help to overcome the binding constraint to growth (Rodrik, Hausmann y Velasco, 2005) and a third agenda to foster product specialization (Rodríguez-Clare, 2005). A good example of how this agenda needs to connect to a more general growth agenda is the work needed to facilitate access to financing and to reduce its costs, not only of new activities but also to downstream and upstream, needed for new discoveries to be successful. The scarcity and high cost of finance are due to several factors such as the high cost and low quality of financial information and an insecure legal basis for financial transactions (collateral seizure is costly and sometimes impossible), the absence of a lender of last resort in a dollarized monetary system, and insufficient incentives for the adoption of technologies that will lower the cost of risk and

financial services. Therefore, reforms to solve these problems need to be implemented, and other instruments need to be developed, such as risk capital suitable for discoveries.

Hausmann and Rodrik (2006) defined industrial policy as a predicament, since the areas of participation are many, highly specific, and deeply interacting with each other and with the markets in existence. The complexity comes not only because of the long list of requirements but also because the market mechanism does not work properly in the provision of these inputs. We had found in the cases analyzed, that even though they are mostly agricultural products, they require specific rules and requisites, which also vary according to the different markets they access. For example, in the last several years, in order to sell tuna to European markets, a government certification is required of the proper management and tracking ability of the whole tuna chain, which has forced the public and the private sectors to work together with the Fishery Research and Certification Authority to set up a national quality and certification plan. With this vision, as the authors conclude, industrial policy is not a choice but an imperative, which requires high levels of coordination between public agencies and the private sector. Nevertheless, that policy makers are doomed to choose does not mean that they should impose rigid structures in order to guarantee the provision of specific inputs. On the contrary; it is necessary to maintain flexibility, foster self-organization and emphasize transparency and accountability in the process of developing policy.

Finally, there is a clear need to develop an industrial policy that includes incentives to solve all the self-discovery externalities and problems already analyzed, as well as the challenges posed by the process of structural transformation toward the production of more specialized goods. It is not a simple task; it requires commitment not only from the public but also from the private sector to work in tight networks with high levels of interaction, communication, coordination, and transparency. This is a challenge that Ecuador's government should not avoid, if it is committed to promoting and fostering optimal levels of private investment needed to sustained growth, which will benefit everyone.

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