Uncertainty in the Search for New Exports

Bailey Klinger

CID Graduate Student and Postdoctoral Fellow
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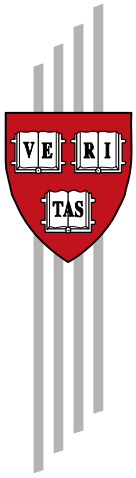

Working Papers

Center for International Development at Harvard University

Uncertainty in the Search for New Exports

Bailey Klinger

Kennedy School of Government &
Center for International Development

Harvard University

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Abstract: This paper explores the role that uncertainty plays in the emergence of new products or services for export in developing countries. Using a comparative case study method, I explore the degree to which those entrepreneurs who discovered new export activities faced uncertainty, and what the nature of this uncertainty was. I then document how this uncertainty, when present, was resolved, and how this affected subsequent diffusion of the newly discovered activity. The cases suggest two important dimensions of uncertainty in the emergence of new export activities: productivity characteristics and demand characteristics. A new activity could feature one, both, or neither types of uncertainty. The reasons for lower inherent uncertainty in these cases suggest a new theory of product similarity that is heterogeneous, multi-dimensional, and operating at a highly disaggregated level. Furthermore, the degree of uncertainty has implications for the expected 'triggers' of discovery, and these are born out in the cases. Finally, when uncertainty was present, its resolution often provided significant benefits to subsequent entrants, and the manner in which high uncertainty was overcome suggests potential avenues for policy.

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1. Introduction

For many developing countries, growth entails finding new products or services for export (Evenett & Venables 2002, Feenstra & Kee 2004, Feenstra Madani Yang & Liang 1999, Funke & Ruhwedel 2001a & 2001b, Hummels & Klenow 2004, Imbs & Wacziarg 2003, Khan 2004). Yet many policymakers express dissatisfaction at the speed with which these 'discoveries' are occurring.

In an Arrow-Debreu world of complete information and well-defined markets, entrepreneurs searching for new export activities would face no uncertainty. At first glance this appears to be a reasonable approximation of reality: A potential entrant to a new activity could observe world prices in order to forecast revenues, combine observed domestic factor prices with freely-available blueprints to calculate costs, and then make an entry decision based on profitability. Therefore, the emergence of new products or services for export will depend on fundamentals like the real exchange rate, factor endowments, and wages.

However, if entrepreneurs face significant uncertainty in prices and productivity, this could retard the process of searching for new export activities. This uncertainty would have to be resolved through study or experimentation before the new entrant could know if the activity is profitable, and unless this learning is costless, firms may make sub-optimal decisions. They may individually be highly risk averse, meaning that even when resolving uncertainty is quite profitable in expected value, firms don't make the investment because of uncertainty. Another possibility is that this learning spills over to other subsequent entrants, meaning that the social returns to resolving this uncertainty may high even if private returns are low.

There is a burgeoning literature suggesting that uncertainty is present in this search process, with significant consequences for structural transformation and growth. For example, Hausmann & Rodrik (2003) focus on the role of uncertainty of production costs for new entrants in an export activity that has not yet been attempted in a particular country. In this model, entrepreneurs do not know *a priori* what productivity will be in their unique national context, and must experiment in order to learn their productivity. This model is an extension of Jovanovic (1982), who modeled the same process at the firm-level. But when this uncertainty is at the national level, its resolution by the first mover creates benefits for subsequent entrants as well, who can imitate and free-ride on initial investments in experimentation.

Productivity isn't the only potential source of uncertainty that could affect the search for new export activities. Although world prices are fixed and known with certainty in theory, Schott (2004) finds that unit prices vary widely even within highly disaggregated product lines. That is, even for very narrowly defined goods there is a wide range of international prices. Therefore, it is quite possible that a potential producer does not know what demand curve they will face once they successfully produce a product and learn their productivity. Mayer (1984) and Vettas (2000) model this situation, where productivity is known but the characteristics of foreign demand are initially unknown and

can only be learned through experience. Egan & Mody (1992) show that "industry information for narrowly specified market segments is not easily acquired", and this industry information goes well beyond production technology to include market and trading knowledge, which is echoed in the emerging literature on the importance of information and networks in determining trade flows (Rauch 1999, Portes & Rey 2005). Nicita & Olarreaga (2000) find empirical evidence that the resolution of this demand uncertainty in one international market spills over to other markets. Other sources of uncertainty, such as the ability to meet foreign standards, have also been proposed (Granslandt and Markusen 2000).

The presence of uncertainty in the search for new export activities has been suggested by theory and fits with intuition, but is not well-understood empirically. Yet many public interventions, such as public support for export promotion or experimenting with new products, are based on assumptions of a certain type of uncertainty existing and inefficiently hampering discovery. Knowledge as to the nature of uncertainty, how it can be most effectively resolved (if present), and how this resolution affects subsequent entrants would provide important guidance to future potential policy interventions. This is the goal of this paper.

2. Methodology

It is extremely difficult to quantitatively test for the presence of uncertainty in the search for new export activities, let alone explore the nature of this uncertainty and how its resolution affects subsequent entrants. Sufficient data simply don't exist. Furthermore, uncertainty in product adoption at the national level is a new and understudied topic that is not well understood, suggesting that methods of grounded theory building (Glaser & Strauss 1967), rather than formalized quantitative hypothesis testing, are more appropriate.

As such, the present work follows a comparative case study approach (Eisenhardt 1989). A set of case studies have been researched in the field, examining instances of the emergence of new export products in great detail. These cases are compiled from a series of detailed interviews with the first movers, subsequent entrants, industry analysts, and relevant government and non-government agencies in three countries: Peru, Morocco, and Egypt.

The initial research question in studying these cases was simply to understand the extent and nature of uncertainty in the discovery of new products for export, both for first movers and subsequent entrants. The countries were selected based on opportunity for lengthy in-country research, and the individual cases were selected from the population of all new merchandise exports that emerged in the past 10 years identified with international trade data, as well as media reports and interviews with local export authorities. Although specific case selection was somewhat random, I purposively chose product markets that were not overly similar, in order to identify features generalizable to

new export activities as a whole. Such theoretical sampling is well established in the literature (Glaser & Strauss 1967).

A potential weakness of using a case study approach to examine this search process is that we can only observe successes. All of the cases considered here were, at least temporarily, successful export activities. One comparative case is produced where a new export activity succeeded in one country but eventually failed in a similar country (Paprika in Peru and Morocco), however a real failure would take the form of an entrepreneur never even attempting a new export activity because of uncertainty. It is possible that the degree and nature of uncertainty facing first movers is much different in cases when the first mover did not even attempt the new activity.

Nevertheless, no-variance research designs such as the present study are common in the literature (Munck 2004). The goal of this research is not to explain why some attempts to enter new activities succeed and others fail. It is simply to determine if, in cases of success, there was significant uncertainty facing the first entrant, and if so what the nature of that uncertainty was, how it was resolved, and how that affected subsequent entrants. If a perfect information & well-defined market view of the world was a reasonable approximation, then you would not expect much uncertainty, even among successes. Yet if uncertainty is observed in some cases, then it is useful to understand its nature and how it was resolved in order to generate new theory in this area.

3. The Cases[1]

Eight cases spanning three countries and two continents are presented:

a. Wiring harnesses in Morocco
b. PETS in Peru
c. Call centers in Morocco
d. Contract Furniture in Egypt
e. Artichokes in Peru
f. Paprika in Peru (Box- Paprika in Morocco)
g. Catheters in Egypt
h. Brakes in Egypt

Each case is descriptive, focusing no the following broad questions:

a. Was there significant uncertainty facing the first mover?
b. If so, what was its nature? If not, why not?

[1] The case studies in Morocco and Egypt were funded by the World Bank, and will first appear in the 2007 World Bank study "Export Diversification in MENA Countries" (forthcoming). I have attempted to cite particular individuals when appropriate. The entire list of interview subjects can be found in section 8. Attempts were made to have the case study research conform to the practices promoted in King, Keohane & Verba (1994). Audio recordings of the interviews in Peru are available upon request. Recordings of the interviews in Morocco and Egypt were not possible for cultural reasons, but these interviews were conducted in three person teams, with the cases drawing on notes from all three interviewers, which are available upon request.

c. How was this uncertainty resolved, when present, and how did this affect subsequent entrants?

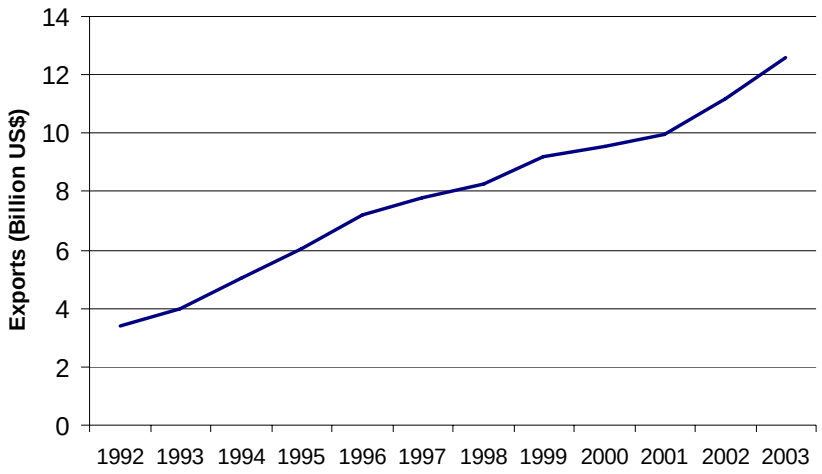
A clear antecedent to this work is Rhee & Belot (1999), who construct 11 self-discovery success case studies (what they call 'firm-level export success stories'). The authors single out the importance of a 'catalyst' in their cases, and suggest that "tremendous externalities" exist from the catalyst's efforts to the diffusion process. But they do not document the nature and role of uncertainty in these cases in great detail, nor do they analyze subsequent entrants in the industry to explore how the resolution of uncertainty affects imitation and diffusion. This is the main contribution of the case studies in this paper.

Wiring Harnesses in Morocco

Wiring harnesses are one of the most labor-intensive components of an automobile. Simple copper wires are connected with terminals and housings, and threaded together to form a single harness. This harness forms the electrical backbone of an automobile, consisting of more than 700 wires (1km total length) and over 2000 individual components. Each harness requires approximately 8-10 hours for assembly and testing (all of which is done manually), and weighs approximately 20kg. The harnesses are then shipped to automobile manufacturing plants, usually as part of a just-in-time system in developed countries, requiring immediate reaction to orders and fast delivery. As with other automobile components, world trade in wiring harnesses is booming due to the global fragmentation of automobile production chains.

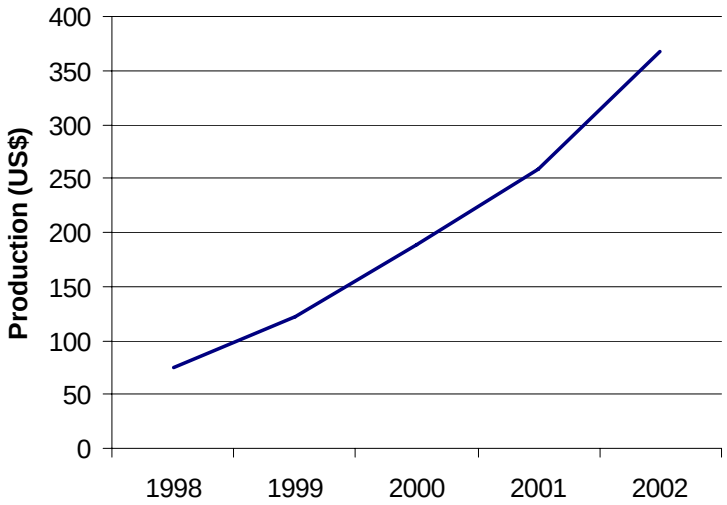
As show in Figure 1, exports of wiring harnesses from Morocco have exploded over the past 10 years, particularly after 2000 with the establishment of many multinational producers in the Tangier Free Zone (TFZ). Since that time, production in Morocco has more than doubled every two years (Figure 2).

Figure 1: Worldwide Exports of Wiring Harnesses



Source: UN COMTRADE

Figure 2: Production of Wiring Harnesses, Morocco



Source: AMICA.

Although the boom is recent and the product appears as 'new' in the country's official export statistics, the export of wiring harnesses actually has a longer history in Morocco. In 1982, the 'Integration / Compensation Act' required that all automobile assembly lines in Morocco have 60% of their components either sourced domestically or offset through the export of domestically-produced components. Given Morocco's relative factor endowments, it is no surprise that manufacturers used wiring harnesses to meet this requirement (60% of the cost of a wiring harness is labor[2]). As such, this Act lead to the

[2] AMICA

rapid creation of several harness assembly plants in the Casablanca area, both for local automobile plants and for export (mainly to France) to offset the import of more complex components used in the assembly of automobiles for the domestic market.

The Act, as well as other strict government regulation in the automobile industry, was eventually relaxed, as car prices rose and imports of second-hand cars soared. In the 1990s, the government reduced regulation. Some incentives remained for sourcing domestic components, but they were much more benign than the Integration / Compensation Act. As such, the industry in the Casablanca area consolidated during the 1990s, as a large number of the smaller-scale producers were purchased by one larger firm (Valeo). The Integration / Compensation Act was finally repealed in full in 2002.

At the same time, another government initiative was undertaken to attract FDI: the Tangier Free Zone. This export processing zone featured a host of tax incentives for foreign investment, and has attracted some of the world's largest harness manufacturers, such as Yazaki and AWS. It is these firms that are behind the recent increase in Moroccan exports of wiring harnesses.

One could observe the timing of this industry's evolution and conclude that the industrialization policies of the government in the 1970s and 1980s were successful in creating a modern, competitive, export-oriented cluster in the TFZ. Furthermore, the fact that these firms in the TFZ faced very little uncertainty (discussed below) could be attributed to the pre-existing cluster in Casablanca. Yet, there is actually a disconnect between the current industry and earlier phases, and little evidence that previous incarnations of the industry reduced uncertainty for first movers in the free zone.

Yazaki was the first firm to enter the TFZ and export wiring harnesses. It is one of the world's largest privately owned automobile component manufacturers, with operations in over 30 countries. In order to source components for European production from a base with low labor costs, the firm decided to establish production in the Middle East & North Africa region, and selected Morocco in 2001 after comparing all of the possible bases for their production.

The main reason for this decision was Morocco's political stability and proximity to Spain. Proximity was a particularly important consideration: their German customers are supplied from Eastern Europe, but they needed a closer supply base for France and Spain for just-in-time manufacturing. In addition, they had some familiarity with the business environment in Morocco, as one of their Spanish factories had been subcontracting some labor-intensive assembly in Casablanca since 1996.

When asked if the previous phase of harness production in Morocco due to the Integration / Compensation act was important in their decision, the firm described Morocco's experience as, at best, an added bonus. There were some spill-ins, particularly in the area of management. Among their first group of local managerial staff, almost all had previous experience in harness manufacturing firms around Casablanca. Of new managerial hires today, almost one third have similar experience. Yet the vast majority of

their 1400 workforce is composed of shop floor workers: a low-skilled position, with all employees trained in-house and no real benefits of previous industry experience. Few, if any, shop floor workers had any previous industry experience. The firm stressed the centrality of financial incentives and geographic proximity to Europe as the two key issues that brought them to Morocco, and if there had been no history of harness manufacture in the country, they claim that their investment decision would have been the same.

Even with careful planning and attractive incentives, learning how to operate in the Moroccan environment was not always easy for Yazaki. The Moroccan plant was originally run by the company's Portuguese subsidiary, which imported an all-foreign management team. There were some cultural clashes and human resource issues which lead to below-projected productivity during the first year of production. In 2002, the company decided to make the Moroccan plant independent of the Portuguese operation. A new manager, Mr. Tischner, was brought in, and the remainder of the management team was localized. Yazaki as a firm, and Mr. Tischner as a manager, were not new to adapting operations to different cultures. Yet, Mr. Tischner reports that learning how to operate and manage employees in Morocco is the most difficult of any foreign investment he has been involved in. After a couple years of learning and adapting, the firm has now achieved projected productivity levels. This learning remained largely internal to the firm: there was neither spill-ins from the poaching of local managers from other firms that had undergone such a transition, nor spill-overs to subsequent entrants through lost managers. Rather, this appears to have been an internal process of learning-by-doing.

Automotive Wiring Systems (AWS), the other large entrant to the wiring harness export market, reported a very similar experience to Yazaki. Although they entered the TFZ only a few months later, management claims that it was not due to any demonstration effects of Yazaki's investment, nor any expected agglomeration economies by locating near other harness manufacturers. Rather, it was similar economics: particularly the tax incentives of the TFZ and geographic proximity to Spain. In fact, when selecting among their shortlist of potential locations (Romania, Bulgaria, Tunisia and Morocco) they chose Morocco because of a large contract to supply a factory in Pamplona, Spain, which their products could reach in less than 24 hours from Tangier.

AWS had similar human resource management problems to those faced by Yazaki. In addition, AWS has also faced problems with regulatory volatility, as rules regarding the tax incentives of the TFZ have been reinterpreted by local authorities, causing significant uncertainty for management. This remains a key complaint of AWS, which they are sure to voice to investors touring the TFZ.

The firm's general manager, Mr. Miess, states that the country's history with harnesses had 'absolutely nothing to do with their investment decision'. They do employ some managers with experience from textile plants, which Mr. Miess suggests is a very similar business to wiring harness assembly (Mr. Miess is one of two senior managers in the firm, and his entire professional experience before working at AWS was in the textile

business rather than automotive components). Yet, it is clear that the firm's investment decision would have been the same if the Integration / Compensation Act had never existed. Another wiring harness manufacturer we met with in the TFZ was not only dismissive of the importance of this pre-existing experience with harnesses in Casablanca, he was totally unaware of it. His staff were all trained internally, and had no prior experience in the sector.

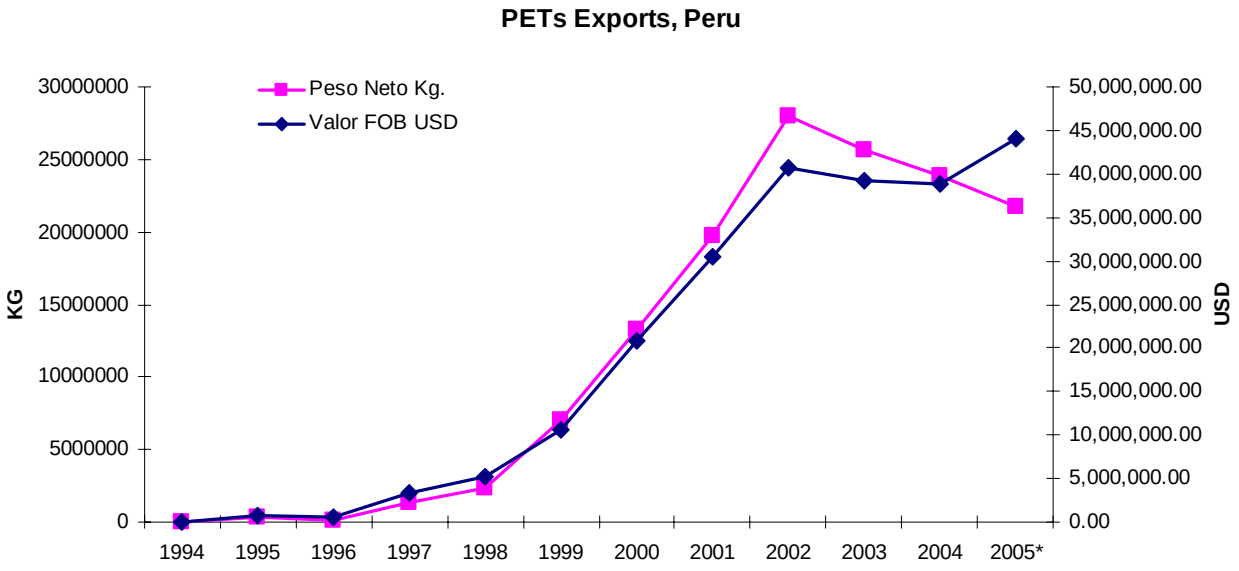
The experiences of these firms responsible for the booming exports of wiring harnesses from Morocco are interesting, in that the degree of uncertainty they faced before entering Morocco was very low. According to them, this was not due to the fact that wiring harnesses had been produced in Casablanca before. Wiring harnesses are a simple product produced with knowledge that the firms brought with them from overseas. Although some adjustment to local business practices was required, this was relatively small. The firm was able to bring its network of customers and scientific management techniques to Morocco, and only after a year of adjustment achieve its projected cost and sales figures.

Plastic Bottles in Peru

Historically, consumer drinks in Peru were packaged and sold in returnable glass bottles. However, in the early 1990s, Latin American countries such as Mexico, Brazil, and Argentina began demanding the newest types of beverage containers that were quickly becoming the standard in developed countries: plastic bottles made from PolyEthylene Terephthalate, or PETs. PETs, also used to make synthetic fibers, represented a great leap forward as unlike previous containers used in these countries, bottles made from PETs are light, durable, hygienic, and fully recyclable.

In tandem other Latin American countries, demand for PETs began to rise in Peru. At first this demand was met entirely through imports, mainly by the multinational Johnson Control (later sold to Schmalbach Lubeca), which imported PETs manufactured in the United States. However, in 1995, production began within Peru to serve the domestic market, and very quickly the external market as well. By 2002 Peru was exporting $40 million dollars worth of PETs per year, primarily to neighboring Andean countries, Central America, and the Caribbean (Figure 3).

Figure 3



Source: PROMPEX. *: projection for annual figure based on exports as of June 2005.

The multinational giant Alcoa was one of the two first movers in plastic bottles using PETs for the South American market. In 1991 it had PET plants producing preforms (which are later inflated to take their shape as plastic bottles before they are filled with liquid) in Brazil and Argentina. This expansion in the Latin American market continued, and in August 1995 they opened a plant in Peru through their subsidiary, Alusud.

While this product was completely new to Peru's productive structure, it was hardly new to Alcoa. Alusud's engineers were sent to Alcoa's manufacturing plants throughout South America for training, and the supplier of injector machines (Husky) provided training, technical information, plant specifications, and other assistance. In addition, experienced Alcoa engineers from other plants came to help during the early days of operation to make sure they could capitalize on all of the firm's knowledge and experience in the production process from other countries.

As a result, productivity for the first batch was almost exactly as projected in the planning phase of the project. There was a slight problem in the first few runs with the bottle lids, which are technically more complex than the simple preforms. Nevertheless, the firm basically characterizes their learning curve as flat: productivity was exactly as predicted in their business plan. Furthermore, the plant was integrated into Alcoa's worldwide production and distribution network, meaning that international demand was known and established before the first run. Furthermore, there was a large and growing domestic demand for PETs being met with imports, many from Alcoa, which Alusud could easily capture. In short, this was a safe expansion rather than a risky experiment for Alusud.

San Miguel Industrial, a Peruvian firm, was the other PET pioneer in Peru. In addition to bottles, PETs are used in the production of polyester fabrics. Prior to 2001 San Miguel had been producing polyester fiber for over 10 years, using the same raw material as

plastic bottles, albeit with a different viscosity. The firm was quite familiar with PETs, and in the early 1990s detected an opportunity to leverage this familiarity to take market share from importers of preforms.

In late 1995, less than five months after Alusud opened the first PET plant in Peru, San Miguel industrial opened their own production plant. Even though market entry was almost simultaneous, there are some indications of information spillovers from Alusud to San Miguel. First, the engineer that built Alusud's plant, Alfredo Huarcaya, also built San Miguel's plant. According to AMCOR (which acquired Alusud), this allowed San Miguel to benefit from Alcoa's experience in other countries that it had transferred to its Peruvian operation. Furthermore, San Miguel purchased its injectors from Husky, which provided the same high levels of technical assistance, data, and design specifications that it provided Alusud. In fact, Husky brought San Miguel's engineers to other plants to train them in the operation of the manufacturing technology. Finally, a consultant that worked for San Miguel, Claudio de Castillo, visited the Alusud plant when it was first opened. Alusud provided him with a tour and explanation of the basics of the plant.

The current management of San Miguel is not familiar with these interactions with Alusud, suggesting that they were perhaps not critically important in their early days of production. In addition, Alusud describes this type of interaction as typical in the industry. Alcoa was never very closed, and always worked to maintain friendly relationships with other firms in the industry. Regardless, it seems that at least some small learning was obtained by San Miguel from Alusud's operations, albeit much less than was obtained from their equipment supplier, Husky, and from their previous work manufacturing polyester fibers using PETs.

Even with these learning spillins, San Miguel's early experiences manufacturing PETs were not quite as smooth as Alusud's. The firm had to climb a learning curve from its first days of production, particularly in learning how to produce new sizes and shapes of containers for a wide range of liquids. Yet their technical experience in PETs from their polyester fabrication business, combined with established supplier relationships, implied that productivity was not very difficult to estimate ex ante.

What was more difficult, however, was learning how to connect with clients and anticipate their needs. Although the imputs are the same, the types of clients and marketing chains for plastic bottles are quite different than for polyester fabrics. Even with booming domestic demand met with very expensive imports, the firm was not very sure what kind of sales it could achieve, describing initial estimates as a 'shot in the dark'.

During the first two years of production, these two firms continued to compete with importers, as domestic demand continued to outstrip domestic supply. In 1996 and 1997, domestic demand grew even more a result of the El Niño phenomenon. El Niño basically brought two years of uninterrupted summer to Lima and the northern half of the country, stimulating demand for cold softdrinks. Furthermore, floooding in the north had a negative effect on water quality, creating an expansion of demand for bottled water.

AMCOR/Alusud suggests that this spike in demand caused by El Niño was critical for the expansion of PET production in Peru. However, the management of San Miguel downplay its importance, suggesting that substitution of PETs for glass and other containers was the key source of the demand boom between 1996 and 1998.

Regardless of its source, the sharp increase in domestic demand clearly had an impact on the industry. Domestic production boomed as new producers entered the market. Filamentos Industriales opened a plant in 1998, also purchasing its equipment from Husky and benefiting from its technical assistance. Husky went as far as providing Filamentos Industriales with engineer training and blueprints for their plant, which aren't hugely sophisticated, but shortened their learning curve. As Filamentos Industriales started to capture more of Schmalbach's clients, Schmalbach moved to set up their own production in Peru, but quickly decided instead to partner with Filamentos. Their plant started with two injectors, but they quickly increased capacity to three, then four, while at the same time importing preforms from the United States and Mexico to meet booming domestic demand.

A fourth firm entered the market in 1999: Plastic Product International (PPI). They started with two injectors and quickly doubled capacity, but by that time the El Niño phenomenon was over and domestic demand was returning to its normal growth rate. The firm did not have much success, and started a subsidiary operation of the same name in Venezuela where they eventually moved their Peruvian injectors.

Schmalbach's joint venture with Filamentos was the first firm to export significant quantities of PETs, due mainly to Schmalbach's network of clients throughout Central and South America. From the early days of their existence, approximately 50% of their production went abroad, at first to Bolivia and Ecuador, but also quickly to Central America. Within a year, Schmalbach established production in Argentina, Brazil, Mexico, Colombia, and Venezuela, shifting their model from US-based production and exports to in-country production combined with inter-Latin American trade.

AMCOR purchased Schmalbach Lubeca, and their Peruvian joint venture remained outwardly focused, with 50-60% of production exported, until 2003 when AMCOR purchased Alcoa's pet production arm, including Alusud. That same year AMCOR purchased the parent corporation of PPE, CNN, and completed the shift of their injector machines to their Venezuelan arm. The combined AMCOR firm is now slightly more focused on the domestic market, with only 40% of its production going abroad.

After these purchased by AMCOR, the industry was back to its original state of two producers: San Miguel Industrial, now with 12 injectors, and AMCOR with 9. AMCOR exports around 40% of its output, and San Miguel 30%. San Miguel is also opening a plant in Bogota in August 2005, but will continue to serve their Bolivian and Ecuadorian clients with exports from Peru.

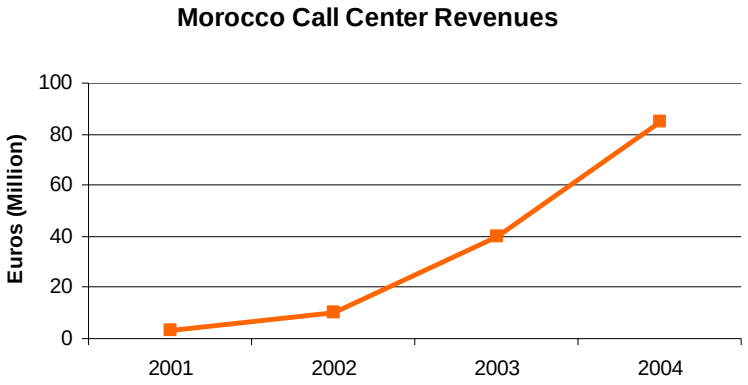
Scaling up to meet the demand bubble during El Niño created some persistant advantages for Peruvian producers in the international market. First, Peruvian firms import larger

quantities of resin and have more established relationships with suppliers, allowing them to purchase and import this raw material cheaper (resin represents 75% of the cost of a PET bottle, and is imported from Asia and the United States). In addition, these firms have acquired experience serving the Peruvian market, which is a sophisticated consumer of PETs. This has generated knowledge within these firms of market characteristics, as well as the ability to adapt their products in response to new trends. Because of these advantages, Peru now has a comparative advantage in PETs *vis a vis* their Andean neighbors, the Central American countries, and the Caribbean.

Call Centers in Morocco[3]

Call centers are a recently-emerging export activity in Morocco, driven primarily by large firms from France and Spain. Spanish telecommunications giant Telefonica and French telecom operators Cegetel and Transcom established call centers in Morocco in 2000, to serve their European customers. Other foreign firms such as Webhelp quickly followed, and some smaller domestic firms have also made inroads into this sector, leading to exponential growth of the sector (Figure 4).

Figure 4



Source: ANRT (estimates) 2004

Webhelp entered Morocco because of its low labor costs, which are around 1/6th of those in France, its high-quality telecommunications infrastructure, and language characteristics, as the Moroccan accent is comparatively weak, making it more attractive to firms in France. Another advantage cited was geographic proximity, traditionally not seen as relevant for call centers and business process outsourcing. Even though telecommunications technology implies that these centers can locate anywhere, industry insiders cite it as an advantage that a client can fly quickly to the call center to monitor a new service, help launch a new marketing initiative, or simply 'kick the tires' of the operation.

[3] This case in particular was written with substantial input from Mariem Malouche of the World Bank, to whom I am grateful.

Mr. Dirk van Leeuwen, the general manager of Webhelp, explained that there was some uncertainty when establishing operations in Morocco. The firm came to the country with deep knowledge of the market and their own established customers, but they had no experience operating in Morocco, and had to act carefully to adapt to the local business environment. In particular, they had to learn local management styles and characteristics of the Moroccan labor market. The two founders of Webhelp had no experience in Morocco, and therefore the level of uncertainty in adapting to the local environment led them to enter into a joint venture with a Moroccan partner. After some initial adjustments, they became comfortable operating in this environment and bought out their partner.

Webhelp acknowledged that there were potentially some benefits in terms of reduced uncertainty from the earlier entrants into this market, which had paved the way in terms of government and telecommunications providers learning how to serve call centers. That is, the government knew what such firms were and how to regulate them, telecommunications providers already had call center clients and could therefore give accurate cost forecasts to the firm, and so on. Yet the firm did not characterize these spill-ins as significant, as the largest source of uncertainty (human resource management) was not resolved by previous entrants.

Outsorcia is a smaller player in this market, and unlike the other major firms in Morocco, it is a locally-owned operation. The founder, Mr. Chraibi, attended university in France, and with a partner opened a marketing firm in France for telecommunications firms. This experience allowed him to learn about the industry and sense the potential of relocating call center activities from France to Morocco. He and his partner opened their call center in Casablanca. This is a relatively small operation with 100 stations, compared to Webhelp's 1500.

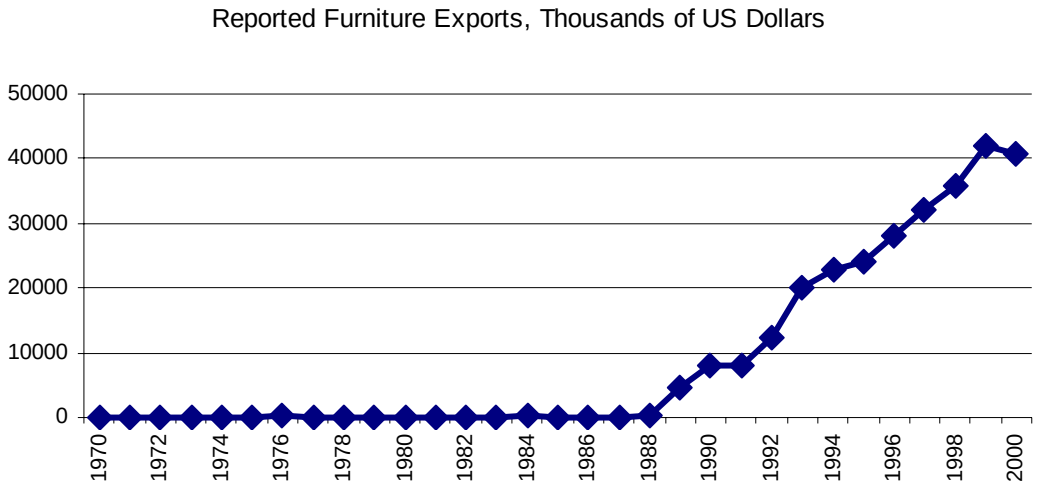
Mr. Chraibi was quite concerned in the early days of the business with revenues. He did not know what clients he could capture and at what price. He was quite familiar with the business environment in Morocco, and prior to investing was able to accurately forecast operating costs and productivity. But demand was a significant source of uncertainty. When asked why more domestic players aren't entering the market, Mr. Chraibi indicated that the advantage of knowing local business practices is not nearly enough to outweigh the disadvantage they face from foreign firms who enter with a rolodex of large clients. Finding foreign clients is very difficult, and very expensive. He was successful only because of his previous work in his marketing service company serving telecommunication firms in France.

Contract Furniture in Egypt

The furniture industry in Egypt has a long history, traditionally in the small-scale production of hand-crafted pieces. Exports of modern (as opposed to artisan) furniture are, however, a relatively recent phenomenon. While official export numbers are much

smaller (Figure 5)[4], industry leaders estimate 2005 exports were around 200 million Egyptian pounds, and are expected to be over 300 million in 2006.

Figure 5



Source: World Trade Flows (Feenstra et. al. 2005)

The majority of these exports are to the EU and USA. The first firm to penetrate these markets was Nadim Furniture. Although this company had been exporting since 1978[5], exports before the late 1990s were exclusively of small-quantity hand-made furniture to the Gulf region. This had been a profitable enterprise, but 98% of the company's exports were to Kuwait, where demand disappeared overnight due to the 1991 occupation. This demand shock revealed to Mr. Nadim the danger of having sales concentrated in only one market, and he set out on a drive to export to the US and EU.

While his firm had generations of knowledge on production techniques, he knew almost nothing about these markets. He started by attending international trade fairs, where he saw both significant potential for his firm, but also that he would have to change his production methods and offering to meet the demands of the market. He spent three years and a significant portion of his capital to upgrade his production and learn about the international market, making significant use of international consultants, and by 2000 began exporting to France.

In addition to working on his own firm, Mr. Nadim quickly realized that the potential existed for many other furniture producers in Egypt to export to Europe, and that his own business would be greatly helped by the emergence of an internationally-competitive furniture cluster in Egypt. This was because there needed to be an Egyptian reputation in the international market, which he could not build alone. In addition, he reqiored the ability to subcontract locally due to the wide array of highly differentiated components

[4] It is widely acknowledged that official export figures are not representative of actual flows, due to underreporting and inaccurate documentation by the government. The difference can be on the order of a multiple of 10. See IMC (2003)

[5] These exports do not appear in national export accounts (see point above)

used in the furniture sector. As such, Mr. Nadim used ExpoLink, an association of exporters initially funded by USAID, to help other Egyptian firms enter the export market. ExpoLink became the main catalyst for the furniture sector, taking small domestic producers with export potential to international fairs, bringing in international consultants, and organizing a support network of successful exporters to work with new entrants and help them penetrate the US and EU markets. ExpoLink, and now the Industrial Modernization Center, pay 85% of the cost to attend international trade fiars, and 50% of the cost of international consultants. Most firm-level success stories in this industry are of domestically-focused producers that were 'pulled' into the export market by ExpoLink. The say that knowing what they know now, they would have made these investments even if they had to pay 100% of the costs. But without this financial support, they never could have made the investments *ex ante* due to the uncertainty of benefits and high costs of capital.

One such case is Meuble El Chark. This is a family firm that traces its history back to 1944, but was always focused on the domestic market. As of the mid-1990s, it was producing entirely for the domestic contract market (international restaurants and hotels in Egypt). But in the late 1990s, growth in the tourism sector slowed. Ahmed Helmy, the new CEO of El Chark, felt that that the firm had to look to the export market for future growth. His father, the previous CEO and current Chairman, had negative experiences in the past when he evaluated the international market, and described it as a waste of time. Furthermore, Mr. Helmy was completely ignorant of the characteristics of foreign demand. His initial thoughts were that with his company's deep knowledge of furniture production and Egypt's status as a mid-technology manufaturer, he might be able to compete in other Middle East and North African markets, but not in the modern and competitive European and American markets. Nevertheless, Mr. Helmy had no idea how to begin, and felt that his idea to enter the international market would never get off the ground.

But based on the promotion efforts of Mr. Nadim and others through ExpoLink, Mr. Helmy was contacted and invited to a meeting with other similar firms that had export potential. Mr. Helmy was quite encouraged by this meeting, as most of the firms at the table were quite similar to his own: family firms with a long history in the domestic market, headed by a new generation with its eyes on the export market. Benefiting from the experiences of Mr. Nadim, trips to trade fairs in Europe and the USA, and international consultants organized by Expolink, Mr. Helmy learned that instead of the Middle East, Europe was a market where his firm could thrive. While Mr. Helmy's original goal was to export a small percentage of his output in order to diversify market risk, he now exports over 65% of production, a figure which is growing annually.

The story of La Roche furniture is quite similar. A family firm with over 20 years experience in the domestic contract market, La Roche did not export any of its output as of 2000. But Expolink contacted the firm and brought their young CEO, Mr. Derias, to an exhibition in the USA. Mr. Derias had never considered exporting before, as his company was quite comfortable in the domestic market, but at this exhibition he saw the potential. La Roche made extensive use of Expolink's services. In addition to attending several

international trade fairs, the firm brought in a French consultant for six months, who helped revamp their entire finishing process. In 2001, La Roche had its first success in the foreign market, exporting to a French firm. These successes have continued, and as of 2006 almost 100% of the company's output is destined for the foreign market.

First-movers in this market have made extensive investments of their own time and money in promoting diffusion, motivated by the benefits of having a large cluster of furniture exporters that will attract more foreign buyers to visit Egypt and create a national image for the country in international markets, as well as the need to outsource a diverse set of components in small quantities. Mr. Nadim spends more time in his roles as Treasurer of ExpoLink and chairman of the furniture export council than he does working in his own company. He, as well as other recent entrants to the export market like Mr. Helmy of El Chark, spend a great deal of time meeting with small domestic producers, encouraging them to come to international fairs, familiarizing them with the characteristics of the foreign market, helping them make contacts, and organizing consultants to help upgrade quality. These efforts have greatly reduced the uncertainty for other Egyptian firms seeking to enter the export market.

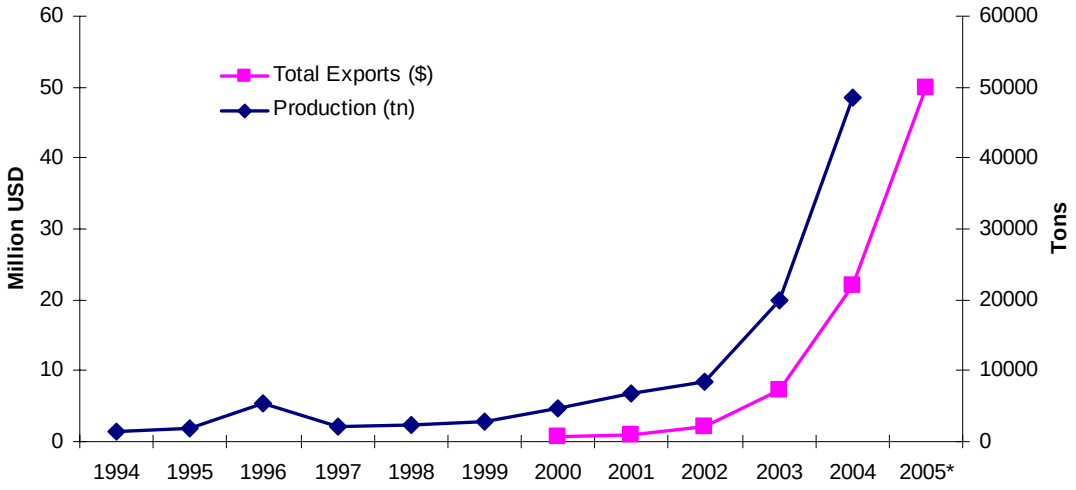
Artichokes in Peru

The artichoke is an edible thistle originating from Mediterranean Asia and Africa. The heart of an artichoke is the most popular piece, although the bottoms and leaves are also consumed in some countries. The principle uses of the plant are for gourmet cooking and cocktails, but alternative uses in natural medicine and as animal feed are also growing.

Exports of canned and frozen artichoke hearts from Peru have grown exponentially. The takeoff began in 2000, when the product represented only 0.1% of exports. As of 2004, artichokes were the eighth largest agricultural export in Peru, and are expected to more than double in 2005 to $50 million (see Figure 6).

Figure 6

Artichoke Production & Exports, Peru



Source: Technoserve 2005. *: ADEX estimate

Although a new export, Artichokes were not completely foreign to Peru. The plants had been introduced in the highlands by Italian missionaries over 50 years ago, and there was a small domestic demand for this production in Lima. However, these varieties had good bottoms but poor hearts, and therefore were never consumed in large quantities or commercialized as an export.

But in the late 1990s, Peruvian agro-industry firms, principally asparagus producers, started to detect an opportunity in another market. In the asparagus business, clients are large multinational food firms with longstanding and stable relationships with their suppliers. Each of the large asparagus growers in Peru had firm relationships with their customers, and after years of successfully supplying asparagus these customers began asking their Peruvian suppliers what other vegetables they could supply. Specifically, these multinational firms made it clear that they would purchase artichoke hearts from their Peruvian suppliers if they could be produced at a sufficient quality level.

As such, these large asparagus producers were being 'pulled' into the market. They already had clients willing to purchase large quantities of artichoke hearts at a certain price. But while they had the demand side of the market sown up, these firms knew nothing about artichoke production. Varieties with exportable hearts had never been grown in Peru, and these firms did not know how productive their plots would be. Therefore, these firms had to experiment. Many of the largest asparagus producers undertook their own small-scale trial plots. However, these firms did not know of one another's trials: there was no information sharing, and none of the test plots were particularly successful.

At this point, the artichoke experiment was either doomed to failure, or at least an extremely long incubation period. However, the diffusion process received a significant boost from Santiago Fumagalli Galli. Mr. Fumagalli was a 'vivero' in many crops, buying seeds from abroad and growing them to small plants that he then sold to agricultural producers. His nursery business, SF Alamacigos SAC, had supplied asparagus to most of the major producers in Peru for some time, giving him many opportunities to interact with the managers both formally and informally. Through these interactions, Mr. Fumagalli heard mumblings regarding the artichoke experiments and detected an interest in the crop, along with some frustration with the individual trial plots.

Sensing an opportunity, Mr. Fumagalli began his own study of artichokes. He spent five weeks collecting all of the information he could on artichoke varieties, seed suppliers, prices, characteristics of the global market, and the basic ABCs of crop management. After creating this dossier, Mr. Fumagalli invited the heads of each of his important asparagus client to a meeting at his office, and to his surprise every single one attended[6].

In this meeting, Mr. Fumagalli presented his dossier, with the expectation that each firm would place an individual order for the varieties of their choice and expand their individual trials. But during this meeting, the managers expressed interest not only in expanding their own trials, but figuring out some way to work collectively and share costs & results. This approach made sense, as the power of the tests increases significantly with the number and diversity of trial plots, as it allows for more iterations, and therefore more comparisons of latitudes, soil types, management techniques, and so on.

The attendees agreed to a second meeting that would also include other major agro-producers who were not existing SF Almacigos clients, as well as agro-exporters and processors. In this meeting, the attendees finalized the joint project. It would be a large-scale simultaneous test with trial plots on each of the 22 participant's farms, using different artichoke varieties which provided comparative geographic and plant type data not available to any single firm. Each firm would pay for its own test crop, but in order to ensure that each firm was participating in good faith, the participants agreed to jointly hire an agronomist who would go from plot to plot compiling results and verifying that proper fertilizing, irrigation, and sanitary practices were being followed. This was necessary so that each plot's results, good or bad, could be attributed to the unknown factors they wanted to test, such as soils, plant varieties, temperature, humidity, and precipitation, rather than due to deficient crop management. Every participant that met these basic standards as monitored by the group's agronomist would receive the finalized (and confidential) book presenting all the results and data.

Given that these firms were competitors, they looked for someone to head up this joint trial that they all trusted. The natural and unanimous choice was Mr. Fumagalli, who acted as the 'musical conductor' making sure each piece of the project was coordinated. The participating firms met every 3 to 5 weeks to share results. If one firm was having a

[6] The attendees were Agroindustrial Backus, Viru, DanPer, and IQF, which are large players in their industry.

problem with a particular pest on their plot, they would find out who else was having the problem and who wasn't, allowing them to narrow down the set of possible causes and learn best practice in crop management. These meetings were also used and monitor compliance of the group members. During this project, 2 of the 22 participant firms were dropped from the group as their trial plots were not meeting minimum standards.

At the end of these trials in 2000, the results were compiled into a confidential manual that was distributed to all participants. This manual, along with the real-time information sharing during the trials, allowed firms to scale up from their half-hectare to two-hectare trial crops to 200 to 500 hectare commercial crops using the best aspects of each trial plot, and possessing an extremely valuable resource for solving problems as they arose in the cultivation process. Productivity on the trial crops was from 10 to 13 tons per hectare, but the average firm now achieves around 17 tons per hectare, with the better producers reaching 20-22 tons per hectare. There was a very steep climb in productivity as a result of this joint trial.

Not all of the trial participants decided to commercialize the crop after the trial was completed. Financing was not a constraint, as the participant firms were already established in other crops with significant cash flow and had access to credit. One major reason for dropouts at this point was the project's finding that although the cultivation of varieties to be processed and exported in canned form were quite productive, the cultivation of fresh artichokes for export was not well suited to the coast. Even though the experiment clearly illustrated the potential for canned exports, many firms that were only fresh producers and exporters did not proceed because the processing and canning step is particularly costly and difficult, and was viewed by fresh exporters as another business altogether[7].

The firms that decided to commercialize the crop then went their separate ways, and have since achieved great success. However, they continue to share results with one another, particularly in crop management. As these firms were already asparagus producers, they added one more letter to their industry association's acronym (the Peruvian Asparagus Institute became the Peruvian Asparagus and Vegetable Institute, going from IPE to IPEH), and also formed an asparagus subcommittee in the exporters association ADEX, to ensure there were forum for further information sharing. However, as with the trial crop, the information shared is limited to crop management. Issues such as market characteristics, pricing, and clients are much more closely held secrets.

The contents of the joint trial manual are now widely known facts. Any firm wishing to enter the artichoke production business can easily hire as a consultant an agronomist that worked for the participant firms (including the agronomist that coordinated the entire trial) and appropriate all of the lessons learned. In fact, the group has made the manual publicly available through the ADEX subcommittee.

[7] Some firms, however, were able to successfully commercialize the export of fresh (frozen) artichokes, such as IQF.

One potential explanation for this openness is that the major artichoke producers consider other large international firms from other countries as their competition. The management team from DanPer said that they are worried about China, but not Camposol, as Peruvian producers represent a small fraction of total exports and have ample market to capture from other countries such as Spain. The manager of IQF reported that "while the American market is 60 thousand tons per year, we [Peru] currently supply only 10 thousand tons to them. The rest comes from Spain, so there is still ample room to grow before we start competing with each other." Furthermore, the nature of the business is one of a small number of long-term clients, so Peruvian firms do not bid against one another to the same buyer.

And what of Mr. Fumagalli, the force of diffusion that coordinated this project? He feels that his investment of time and effort in the coordination process has garnered a sufficient return through sales of artichoke plants to his clients. In fact, he continues in his role as coordinator through the ADEX subcommittee, organizing conferences and bringing international agronomists, buyers, and suppliers to Peru.

It is a natural question to ask why this boom began in 2000 and not in 1990, as at that time Peru faced the same international demand and enjoyed the same natural advantages. The answer to this question arises from the scale required for artichoke production combined with the limited number of firms with the necessary factors of production. Unlike Paprika, artichoke production and processing requires much larger capital investment, as can be seen by the concentration of production in a relatively small number of firms. In 1990, the firms that had the capacity to produce at this scale were placing all of their managerial attention and capital into asparagus exports: a crop that was developed in the 1980s and since had grown exponentially. They had no interest in entering new and uncertain crops when they already had a product where international demand dwarfed their production capacity. The artichoke opportunity was there, but given limited resources the only firms with the capacity to capitalize on it firms weren't interested.

Paprika in Peru

Paprika are small, sweet red peppers measuring 8 to 12 cm. These members of the Capsicum family are used primarily as a natural colorant in foods, cosmetics, and textiles, as well as for flavoring and direct consumption.

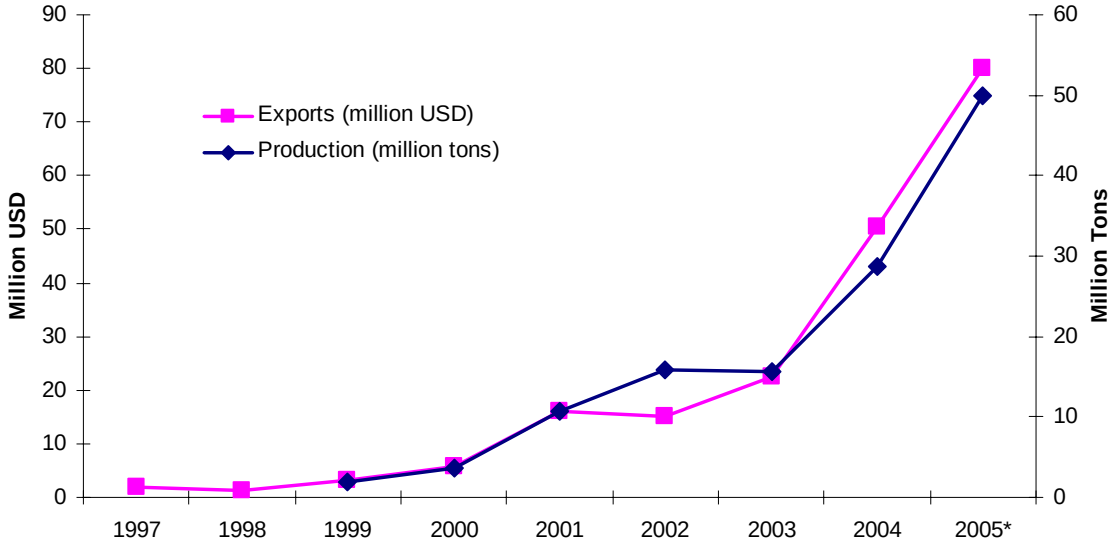
The global market for paprika has grown steadily since the 1960s. Over the past ten years, global production has grown by 3% p.a (2.5 million tons in 2004) and global sales have grown 6.6% during the same period (522 million US dollars in 2003, Technoserve 2005). Global demand continues to grow in part because global health standards increasingly prohibit chemical colorants, increasing the demand for natural colorants (particularly ones with other health benefits like paprika, which is high in Vitamin C).

Unlike in the other major paprika-producing countries, there is no domestic paprika market in Peru. Although the country has a long history with other capsicums, paprika is

completely new to the country, having never been grown there prior to 1991. But it has since expanded significantly. The crop went from 0.2% of the country's agro exports in 1997 to 4.5% in 2004, making it the fourth largest agro export behind coffee, fresh asparagus, and processed asparagus. Exports as of July 2005 had already exceeded sales for all of 2004, and total exports for the year ending December 2005 are projected to be around $90 million dollars (see Figure 7). Peru went from zero production in 1990 to being the world's largest exporter of paprika in 2004 (La República 2005).

Figure 7

Paprika Production & Exports, Peru



Source: Technoserve 2005. *: projected by ADEX (exports) and Miski/Savarin (production)

The first paprika crop in Peru was planted by Jorge Chepote in 1991. Mr. Chepote was not new to the agricultural industry: for over 20 years he had been the Peruvian distributor for Seminis, a North American producer of vegetable seeds. In addition, he had his own small-scale farm. While traveling in the late 1980s, Mr. Chepote learned of paprika production through a personal friend, Raul Navaro, who was a producer and exporter of the crop in Chile. Mr. Chepote soon realized the potential of this crop for Peru, as its natural advantages in paprika production exceeded those of Chile. Specifically, Peru has a milder climate with smaller temperature variation between seasons, a warmer spring and summer, and more steady precipitation levels as compared to Chile.

In addition to other vegetable seeds, Mr. Chepote's supplier Seminis sold paprika seeds. Mr. Chepote combined the idea from his trip to Chile with his own supplier's seeds and set out to create a 5 hectare demonstration plot in 1991. Although Mr. Chepote had the feeling that the crop could be productively grown in Peru, he had very little idea what productivity would actually be, let alone where he could export. But while this plot was under development, Mr. Chepote was contacted by a friend in Peru who had been approached by a French businessman looking for a Peruvian supplier of paprika. Mr.

Chepote's friend was not interested in the crop, but knew of Mr. Chepote's experiment and passed the contact on to him. From his initial plots, Mr. Chepote made a few small shipments (50-70 tons) to the Frenchman who acted as a broker in France. These were the first exports of paprika ever from Peru. Because there was no local market for the product, Mr. Chepote could not learn from domestic demand before exporting: he had to enter the international market immediately. Mr. Chepote did not know much about the foreign market and claims that he would have had difficulty finding purchasers for his paprika abroad without the participation of the French broker.

In 1992, the French brokers became minority investors in Chicaso SA, a joint venture formed with Mr. Chepote, and paprika production was scaled up. The first crop was 170 hectares. In addition to their investment in Chisaco and purchase of the exported paprika, the French investors assisted in the transfer of paprika processing technology to Chisaco. The first crop was only slightly processed (dried) and exported in bags. For the second crop of 200 hectares, Chisaco imported high-tech processing equipment through the French investors, established a processing plant, and exported a higher value-added product: paprika powder pressed into blocks. All of Chisaco's financing beyond the investment by the French partners was Mr. Chepote's own savings and new debt in his name.

In the planning process, the biggest uncertainty facing Chisaco was the productivity of the crop. Their feeling was that productivity of 4,000 kg/hectare would be quite good for the first try, and they achieved that in the first crop. Subsequent crops featured increases in productivity each time (to 6,000 kg/hectare in the second year) because they learned right combinations of water and fertilizer, the correct spacing of the plants, and other features of crop management. Although it was a major source of uncertainty before the experiment began, there was now little uncertainty of foreign market demand, due to the connection with the French distributors.

Because of this early success, Chisaco expanded significantly when it planted its third crop. This crop was 800 hectares: four times larger than the previous one. This significant increase in scale revealed a new challenge to paprika production in Peru: viruses. Peru is home to some 27 plant viruses, and the risks of infection increase with scale. Transmitted via both insects and humans, these viruses can be prevented, but not cured. Once a plant is infected it must be pulled and burned before the virus is spread to the rest of the crop.

Although some viruses are present in Chile, there are fewer insects to transmit it to crops, making the risk of mass infection less acute. The higher risk of virus infection in Peru, particularly in large-scale crops, was a lesson that had to be learned through experience, and that burden fell on Chisaco. The entire third crop was destroyed by three viruses, resulting in a loss of over $2 million US. The French investors, aware of the virus infection and resulting financial difficulties for Chisaco, did not pay their final four letters of credit, and were thus able to recoup their investment. Chisaco's losses fell squarely on Mr. Chepote, as all of Chisaco's loans were in his name.

Mr. Chepote was faced with two alternatives: take out even more new loans for another attempt, or close down and pay off Chesaco's debt. He decided to close down. He would have needed $500,000 for another attempt, which at the time would have been at an interest rate of 18-24%, with absolutely no guarantees that the next crop could avoid the virus problems.

Mr. Chepote decided that he could not take on that risk on top of the already significant outstanding debt, and instead should re-focus on the seed distribution business, which generated income with little investment and risk. In parallel with the Chesaco venture, he was aiming to become the leading seed supplier to the Peruvian paprika industry, which he believed had significant potential. To this end, even before Chesaco's crop failure, Mr. Chepote actively shared his experiences with paprika and touted its potential to other firms, hosting many visitors to his farm and processing plant. Thus, even before the disaster, Mr. Chepote started to generate greater interest in paprika among agro-industrialists, who went on to undertake their own analysis of the market and its potential.

This process of diffusion from Mr. Chepote to new paprika producers was greatly accelerated after Chesaco's failure. Mr. Chepote's attention was now completely focused on the seed distribution, and the financial burden of Chesaco's failure created a sense of urgency. Mr. Chepote had to create demand, and held numerous of technical meetings with fellow pioneer Renzo Gomez (see below) to potential paprika producers throughout Peru. In these meetings, he passed on all of the lessons learned by Cheasco, including market demand, processing, and most importantly, virus prevention. In efforts to generate demand for paprika seeds, Mr. Chepote became the primary vehicle for dissemination[8]. While he continues to produce paprika on a very small scale, he had to sell much of his land to pay for Chesaco's debts.

After Mr. Chepote harvested his first crops, but before the virus debacle, an NGO in southern Peru named CIED (Centro de Investigación, Educación, y Dessarrollo, funded by USAID and the Dutch government) was also investigating paprika as a part of their strategy to spur development in the zone of Tacna by finding new non-traditional export crops. CIED facilitated a few test plots, and quickly organized a small group of producers with 100 hectares between them to grow paprika.

One of the key personnel in this NGO was agronomist Renzo Gomez, who happened to be friends with Mr. Chepote. In the early 1990s Mr. Chepote contacted Mr. Gomez and sent him numerous paprika samples and information on growing techniques and market potential. Mr. Gomez then introduced the crop to the Tacna zone via CIED.

The first crops under CIED's coordination were quite difficult. Tacna is an arid zone not ideal for paprika production, and the irrigation methods used by CIED were inadequate. These plots were abandoned by CIED, and eventually sold. Nevertheless, the CIED plot was very important for two reasons. First, the lessons on crop management that were

[8] Around 2002, the ministry of agriculture started the PSI (Programa Sectoral de Infrastructura) program for paprika, which provides irrigation systems and medium-term financing, but only to small producers with less than 15 hectares.

learned became extremely important for subsequent firms, as most agronomists involved in the project have since become employed by what are now the largest paprika producers in Peru. Second, it was through CIED, and not Chesaco, that the second key piece of the paprika innovation was discovered: the Spanish market.

Mr. Chepote's contacts were French investors, making France his only market. However, France buys very small quantities of paprika. The real boom for Peru has come from exports not to France (nor to the US, which is a market only recently infiltrated) but to Spain. It is sales to these Spanish firms, who purchased paprika for further processing, that drove the export boom.

Paprika has been produced in Spain for over 100 years, mostly by small-scale firms. After wages and costs started to rise in Spain, Spanish paprika firms looked abroad for supply of the raw plants to import and process. Their efforts in North Africa, most notably Morocco, ware unsuccessful. Imports from Southern Africa had early success, particularly from Zimbabwe, but stability of supply eventually became a problem as social unrest in Zimbabwe increased[9]. The Spanish firms then attempted to be supplied from South America, at first from Chile and Argentina (the paprika processors in Spain are smaller family operations rather than large multinationals, and their connections to suppliers are usually made through personal networks. It is therefore not surprising that the first South American countries where paprika production was attempted were those with the largest population of Europeans). However, the growing seasons in these two countries are too short. The next stop in this search was Peru.

While Spanish firms were looking for suppliers, CIED was looking for a market that its cooperative of small producers could serve. Unlike Chesaco, CIED did not have a ready-made market, and there was no domestic demand for paprika, so one of the NGO's employees, Renzo Gomez, had to find international buyers. According to Mr. Gomez, determining the characteristics and dimensions of foreign demand was hugely difficult, particularly at the time without internet connections in every major city. Luckily, Mr. Gomez had a brother living in Spain, to whom he mailed paprika samples from the CIED plot. Mr. Gomez's brother used the yellow pages to identify paprika firms in Spain and basically went door-to-door looking for buyers. It is not clear whether it was directly related to this effort, but one of the first Spanish firms visiting Peru ended up in Tacna, and saw Peru's potential with the crop from this small collective. By 2000 there was a flood of Spanish paprika processors combing Peru for raw materials.

The first follower firm to take up paprika production on a large scale was Miski S.A., an agro-industry firm. Miski's owner Jesus Amora used to work for Peru's largest bank, had a lot of international contacts, and knew about the international market. Mr. Chepote successfully sold the paprika idea to the firm in one of his first technical meetings to sell seeds, and the firm went from 10 hectares in 1997 to 150 hectares in 1999. But their

[9] See, for example, the story of Dirk Visagie. He was a foreign investor who, even though having received a letter of 'no interest' from the government of Zimbabwe when he purchased his land, had his land seized and was given only four days notice to vacate his million euro a year Paprika farm. Zimbabwe Standard (2006).

crops were quite unproductive, yielding only 1700 kg/hectare, and were located in a zone not ideal for paprika production. Nevertheless, the firm undertook a very detailed study of the international market and saw Peru's potential. They aimed to be a vertically-integrated producer, so they began building a processing plant in Lima in 1998 that would process both their own paprika and paprika bought from other small-scale farms.

That same year, Renzo Gomez left CIED and moved to Lima. He began leveraging his connections in Spain and worked as a broker for a few Peruvian paprika exporters, including Miski. But quickly, Miski saw the benefit of having his experience and contacts in-house, and hired Mr. Gomez in 1999. That same year, with Mr. Gomez's input, Miski decided to abandon its farms and concentrate on processing.

Miski still had to secure steady supplies of high-quality paprika plants for processing, so like Mr. Chepote it became a national paprika promoter among potential producers. Miski sent their newly acquired expert, Renzo Gomez, on a tour of technical meetings and promotion activities along with Jorge Chepote. Together they represented the deepest knowledge of in-country paprika production, a stable supply of inputs for growers (Mr. Chepote's seeds) and a stable purchaser for output at fixed prices combined with free technical assistance on production techniques (Mr. Gomez & Miski).

Miski liquidated all of its farms by 2000, and now has 3000 hectares under subcontract that are processed in its Lima factory. But while working to create a network of suppliers, Miski also had to work hard on the international market. Mr. Gomez's Spanish contacts were looking to buy raw paprika to process and market themselves, so Miski went from being their supplier to being their competitor. The firm had to make huge investments of time and money to develop an acceptance internationally of processed Paprika from Peru, which was only known as a Spanish export. In the words of Mr. Rosadio of Technoserve, "when you are new to the international market, you have to show up to the party in a tuxedo even though everyone else is wearing suits". Building this reputation and international acceptance has been critical, as Peru has gone from supplying a raw input to only one buyer (Spain) to selling processed paprika directly to firms in the United States and Mexico, which now represent almost half of total exports (Technoserve 2005). Mr. Gomez feels that other paprika exporters, as well as agro-industry exporters more broadly, have received huge benefits from Miski's investment in penetrating foreign markets and developing international acceptance of processed paprika exports from Peru.

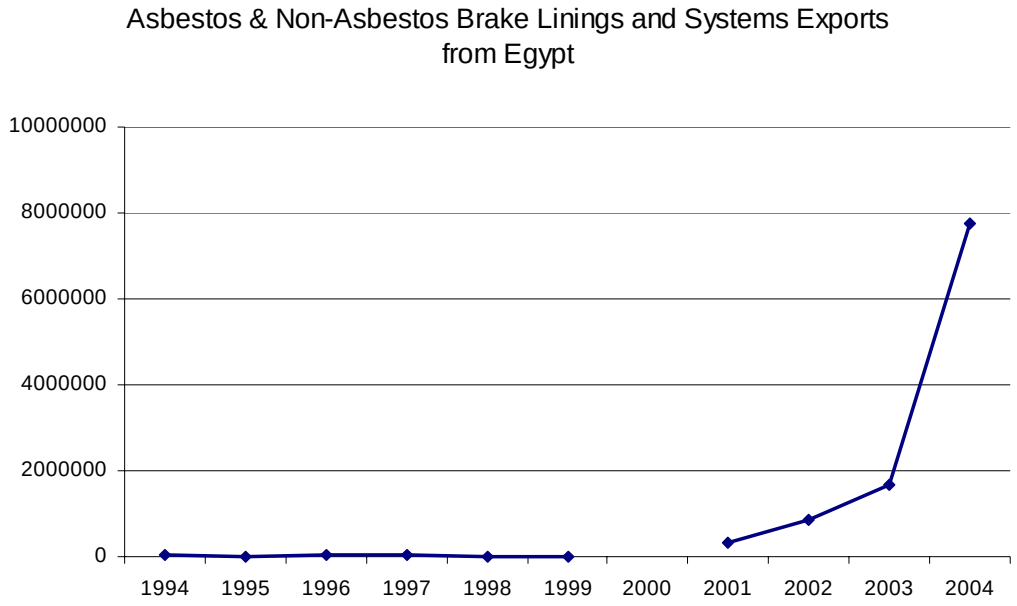
Going from zero production in 1990 to becoming the world's largest exporter in only fourteen years makes paprika in Peru a very interesting success story, particularly because Peru had neither a history of paprika production nor connections to the international supply chains for paprika. Overcoming all of this uncertainty was a difficult undertaking and costly undertaking, particularly to the first mover, Jorge Chepote.

Brakes in Egypt

The export of automobile brake pads and linings is a very recent development in Egypt (see Figure 8). In the past there were some producers for the domestic market, but over

the past decade these producers have all but disappeared as the domestic market turned to imports. The only large-scale producer in the country, and the only exporter, is a relatively new firm named MAK Brake Lining Company. It began to produce for the domestic market in the 1990s, but quickly moved into the export market with great success.

Figure 8



Source: UN COMTRADE

MAK Brake Lining Company was started by Ahmed Abdel Wahab, an engineer and professor of management science. After some time teaching and consulting, Dr. Wahab decided he wanted to enter the private sector, and set out to identify a product. He considered a wide array of possibilities, concentrating on products that would leverage his technical capacities as an engineer. At the same time, there were reports in the media that General Motors was considering a major investment in Egypt as a production hub for the entire Middle East, and Dr. Wahab detected an opportunity. Believing his production would enjoy a ready-made market with GM's investment, he decided to produce brakes for the original equipment manufacturer (OEM) market in Egypt. However, after deciding in forming a brake company, General Motor's investment in Egypt fell apart, forcing Mr. Wahab to refocus on the domestic aftermarket.

Although he was an engineer by training, Dr. Wahab had little knowledge about the specifics of braking systems. He had little information on production techniques, and therefore sought out a foreign firm under which he could become a licensee. This would provide him with an international brand name for sale in the domestic market, and even more importantly, technical production knowledge. After approaching a host of international players, he became a licensee of Ferodo to produce asbestos-based brakes for the domestic market. Ferodo provided MAK with assistance on all aspects of the

production process, including materials, production techniques, general plant organization, and product packaging. All sales were under the Ferodo brand, which provided MAK with market recognition. Importantly, the agreement was limited to asbestos-based products, as Ferodo did not want to share their asbestos-free production technology under a license.

In 1994, Dr. Wahab obtained the rights from Ferodo to export to the aftermarket in Europe under their brand. This was a major step, as his firm only had a 10% share of the Egyptian market. This share was relatively steady with little growth potential, because domestic consumers tend to associate foreign-manufactured component with higher safety and quality, which is a key consideration in the aftermarket for brakes. Prior to exporting to Europe the firm had yet to break even. But exports brought financial success, and caused the firm to focus their efforts on international sales expansion.

Over time, Dr Wahab learned more about the foreign market for brakes, and saw a limit to his firm's export growth as well. Asbestos-based brakes were falling out of favor in developed markets due to safety concerns, yet his firm only had a license to produce asbestos-based products, and did not have the expertise to produce other brake systems. As such, Dr. Wahab began exploring a joint-venture with Ferodo to produce more advanced non-asbestos based brakes for export. But when Ferodo's parent company was suddenly bought out in 1998, the new ownership put an end to joint venture discussions, and informed Dr. Wahab that his license, set to expire in 2000, would not be renewed.

Dr. Wahab was faced with a difficult dilemma: he could continue with Feroro until 2000, he could become a licensee or partner with another firm, or he could establish his own brand name. His predicament was made more difficult because his accumulated production and marketing knowledge was only in asbestos-based brakes, which faced falling demand. Dr. Wahab took the difficult step be becoming a direct supplier to the large component suppliers in Europe and establish his own brand of non-asbestos brakes. This move was quite risky for two reasons. First, Dr. Wahab was not sure that he could successfully produce non-asbestos brakes, and second, he did not know if the market would accept his own brand of brakes, as all his prior sales were under the Ferodo brand name.

Although it received no direct assistance from Ferodo in this transition, MAK did get technical help from suppliers of friction materials. Friction materials are one of the main inputs to brake pads, and many suppliers of these materials also lost out from the merger of Ferodo's parent company and were therefore eager to work with MAK. In addition to this technical knowledge, MAK acquired much of its market knowledge and customer network by hiring ex-Ferodo employees, such as his marketing manager in Europe, who had been made redundant by the merger. These two pieces were critical in overcoming the great uncertainty that MAK faced when it decided to establish its own brand. As can be seen below, Dr. Wahab's gamble has been quite successful. Exports from Egypt, which are almost entirely from his firm, have grown significantly over the past 5 years.

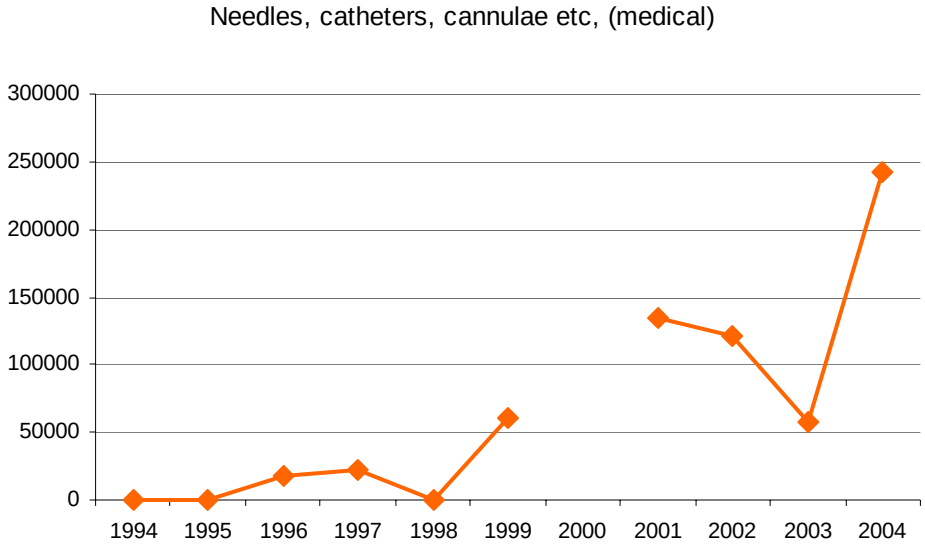
There was significant uncertainty regarding production technology and the ability to acquire brand recognition when MAK began operations in the early 1990s, but this was largely resolved when the licensing agreement was formed with Ferodo, which provided technical and marketing assistance. This uncertainty returned when MAK lost the Ferodo name and had to build its own brand, and at the same time had to learn how to produce asbestos-free products. While both were significant, Dr. Wahab indicated that the market uncertainty was the most significant challenge.

There has been no diffusion within the brakes industry in Egypt. Imitation was not a concern when Dr. Wahab formed his firm, because the costs to learn production methods and penetrate the foreign market would also have to be born by any subsequent entrants. That is, they could not free ride on Dr. Wahab's learning, as it was learning internal to the firm rather than a discovery about the country's productive characteristics. Due to high levels of uncertainty and the fixed costs required to overcome them, Dr. Wahab believes the likely form of imitation will be a large multinational producer with established production methods and customers that installs a factory in one of Egypt's export processing zones. He does not foresee a new domestic producer following his footsteps, given the economics of this business.

Catheters in Egypt

The export of medical components is a new activity in Egypt. Catheters are one of the components meeting early success, even in its infancy. There are currently 3-5 firms exporting catheters, principally to Europe but also to the Middle East and North Africa. Most of these firms started by serving the domestic market, but some were set up exclusively for export.

Figure 9: Egypt Exports



Source: UN COMTRADE

The first firm to export catheters, and currently the largest and most successful exporter, is Amecath. This firm was established in 1996 to produce dialysis catheters for the domestic market. Amecath was started by Dr. Sami Hambouli, a medical doctor, and his brother, an engineer. The two brothers searched for a product that would combine their areas of expertise. In addition, Dr. Hambouli was himself a dialysis patient, which gave him a personal connection to dialysis catheters. He therefore decided to enter this market.

Rather than entering a licensing agreement with an established foreign firm, Dr. Hambouli produced under his own brand, even though he knew little about how to produce and market the product. Catheters are not new products, and compared to other medical components they are relatively simple. However, safety regulations mean that even simple medical components are difficult to manufacture, as the strict production and sanitary rules required for certification are difficult to meet. Uncertainty in demand was also a major barrier for Dr. Hambouli, as he was the first to attempt to export medical components from Egypt, and had no experience with international sales and marketing. He was uncertain as to his ability to penetrate foreign markets, but his connection to the product lead him to attempt it. He attended international medical fairs, where he was able to connect with new clients. This was done at first at his own expense, but he quickly became involved with Expolink, and now participates in international fairs with the export council. Most importantly, the Industrial Modernization Center connected Dr. Hambouli, as well as all of the other medical components manufacturers in Egypt, with the Center for the Promotion of Imports from Developing Countries, or CBI.

The CBI is an organization funded by the Dutch government that provides firms from developing countries with market knowledge, product and production improvement, quality control, export marketing and management, and market entry assistance so that they can export to the EU. The amount of assistance provided by CBI is substantial, estimated to amount to 50 to 75 thousand euros per firm that qualifies for support. Given the high barriers to entry in this export market, most notably the cost and complexity to achieve certification and establish a reputation among safety-conscious purchasers, the assistance of CBI has been instrumental. CBI supported Amecath's participation in international trade fairs, and connected them with a firm that would eventually become their European distributor. CBI has also funded international consultants to help other component manufacturers in Egypt upgrade quality and achieve certification.

In 2002, Amecath opened a new factory to manufacture CVC, dialysis, and urology catheters. From the beginning, this factory was designed to produce for export. Dr. Hambouli acquired ISO and CE certification, which was a long and expensive process. But these certifications allowed his firm to export to the United States and Europe. Although not reflected in the aggregate national trade data, Amecath's exports to these markets topped $2 million in 2005.

Amecath is the only complete manufacturer of catheters in Egypt, but other firms export catheters using imported components. One such firm is Euromed. This firm has a 25 year history as a trading company in Egypt. They imported a variety of goods to sell in the domestic market, including medical components. These experiences provided their

general manager, Wael Reda Abdou, with experience in international trade and global supply chains, as well as some exposure to the demand characteristics of foreign markets. Mr. Abdou decided to leverage this knowledge and enter the manufacturing business directly. He surveyed the wide variety of products that his firm distributed in Egypt, and identified IV catheters and syringes as promising opportunities. These products were attractive because he only required one machine to assemble and sterilize them all, as well as a variety of other components. This implied a smaller minimum efficient scale, allowing him to start small.

Unlike Amecath, Euromed entered the industry using a licensing agreement with an experienced foreign firm. Mr. Abdou approached KDM, a German manufacturer of medical components that they were already distributing in Egypt. Under this license, Euromed imported the components from KDM which they then assembled, sterilized, packaged, and sold under KDM's brand. This was all done in an export processing zone, as Mr. Abdou expected to export 100% of the firm's output to North Africa and the Middle East. In 2004, Mr. Abdou decided to stop producing under license (although he is still an agent for KDM in Egypt), and he now imports components from a variety of suppliers and exports under his own brand. Euromed has also moved upstream to manufacture some of the components himself. In addition, Euromed is seeking CE certification in order to export to Europe, and like Amecath, it is being assisted by CBI.

The first movers in the medical components industry have invested significant time and energy in promoting diffusion. The firms in this sector do not view one another as competition, because both the international market and the pool of required factors of production in Egypt is so large that new entrants do not affect either sales or factor prices. The firms interviewed suggested that each additional imitator helps existing firms rather than hurts them, as a larger medical components cluster in Egypt improves the image of each firm in the international market. For this reason, all firms interviewed attend international fairs under the umbrella of Expolink, where they take along smaller domestic producers that have the potential to export and help them upgrade quality and find potential clients. That is, these firms work actively to reduce the level of uncertainty facing new entrants.

There have not been many explicit spillins from Amecath to other catheter exporters such as Euromed. However the fixed cost to enter the foreign market is much higher for the very first mover, as Egypt had no reputation abroad in this industry prior to Amecath. Dr. Hambouli had to establish this reputation from scratch, first on his own, and subsequently with the support of the CBI and Expolink.

4. Discussion

There were three motivating questions in examining these cases:

a. Was there significant uncertainty facing the first mover?
b. If so, what was its nature? If not, why not?

c. How was uncertainty resolved, when present, and how did this affect subsequent entrants?

Was there significant uncertainty facing the first mover?

Among these cases one can see a wide variance in the degree of uncertainty facing first movers. In some cases there was very little uncertainty. The first movers in wiring harnesses in Morocco had to perform some adjustments of their business practices to local conditions, but it was less than a year before their productivity and sales projections were achieved almost exactly. A similar experience was reported by Alusud, the plastic bottle manufacturer in Peru that was a subsidiary of Alcoa. Their first run in the new factory was exactly as planned, with sales contracts pre-arranged through their local and global market presence. Production costs, quality, and revenues were realized almost exactly as planned.

Quite the opposite was reported by the catheter and brake producers in Egypt, and the Paprika producers in Peru. The first movers in these industries had little to no familiarity with the products they attempted to produce, and had to learn production techniques as they went along. They described their planning process as basically 'shots in the dark', and prior to their first experiences with trial batches or their acquisition of experience through partnerships and licensing agreements, they did not know how productive they and what kind of demand they would face. Jorge Chepote, Ahmed Wahab, and Sami Hambouli had no idea if they could successfully produce their products, let alone where and for how much they could sell them, making their survival highly uncertain.

Somewhere between these two extremes lie the remainder of the cases. The first entrants into Morocco's call center industry faced some uncertainty. Webhelp did not know how to navigate the local business environment and manage a Moroccan workforce, and Outsorcia did not know if it could capture foreign clients. Plastic bottle producer San Miguel and the Egyptian contract furniture producers also faced an intermediate level of uncertainty. They were familiar with production techniques, but were in the dark with respect to demand, and did not even attempt to forecast sales during their initial planning. Finally, artichoke producers in Peru faced a very similar situation to Webhelp in Morocco. They had a list of willing clients and secured prices, but no idea what their output and production costs would be, as artichoke hearts were an unproven crop in Peru's coastal growing areas.

If there was significant uncertainty, what was its nature, and if not, why not?

These findings reveal that uncertainty can be on one, both, or neither sides of the income statement, suggesting a two-dimensional typology of uncertainty. The features of the cases that lead to their placement in this typology also suggest a theoretical notion of 'proximity' between products at a highly disaggregated level. Finally, the typology has implications for the expected triggers of new discoveries, which are born out in the cases. These three topics will be discussed in turn.

A Typology of Uncertainty

One of the most valuable uses of the comparative case study method is to observe and document heterogeneity and consider typologies (Munck 2004). As alluded to above, the types of uncertainty facing first movers searching for new export activities in these cases was predominantly of two types: productivity uncertainty and market uncertainty. Some cases featured neither dimension of uncertainty, while others featured both. Even more interestingly, some cases included productivity uncertainty but no market uncertainty, or vice versa. While there are varying degrees of uncertainty present in each case, they can be categorized in terms of these two dimensions.

Figure 10
A Typology of Uncertainty in the Search for New Exports

		Productivity Uncertainty *What will production costs be?* *What level of quality can be achieved?*	
		LOW	**HIGH**
Demand Uncertainty *What are the characteristics of foreign demand?* *What market will the product compete in, and what price will it garner?*	**LOW**	- Wiring Harnesses in Morocco - PETS (Alusud) in Peru	- Artichokes in Peru - Call Centers (Webhelp) in Morocco
	HIGH	- Contract Furniture in Egypt - PETS (San Miguel) in Peru - Call Centers (Outsorcia) in Morocco	- Brakes in Egypt - Catheters in Egypt - Paprika in Peru

The cases in each quadrant of this matrix share certain structural features that explain reasons for low or high uncertainty. These features are only suggestive and can not be taken as conclusively proven causal linkages. However, they are quite intuitive, and suggest avenues for future research.

Cases with low demand uncertainty were primarily instances of FDI where the entering firm already had operations in other countries, and therefore significant market experience with established customers. The only exception is the case of artichokes in Peru, where the entering firm was a domestic firm with no experience in this particular international market, but a long and successful history in the international market for a highly similar good with the same customers: asparagus. This experience provided them with the necessary knowledge to be quite sure as to what demand curve they would face once they successfully produced the product. Information barriers to learning foreign demand characteristics are emerging in the literature as a major determinant of trade flows (Rauch 1999, Protes & Rey 2005). Cases of FDI where parent companies already in possession of market information, or cases where experience in similar markets

provides such information, is a logical way for such barriers to be overcome in the process of discovery.

Cases with low productivity uncertainty were often cases of FDI where the entering firm had production experience, and their production processes required little adaptation to new local conditions. In the cases examined here, little adaptation was required because there were few domestically-sourced factors of production, and those that were required were relatively homogenous (i.e. unskilled labor, as compared to complex and unproven machinery or local climate and soil). The other cases where productivity was more or less known before production began were due to deep local experience in producing the same good or similar goods for sophisticated international firms in the domestic market (contract furniture and PETS, San Miguel), or familiarity with local management practices from one former experience combined with familiarity with international production practices from another (Outsorcia).

This suggests that when local heterogeneous factors of production are a significant part of the input mix, one might expect greater uncertainty. Furthermore, discovery by domestic firms that are familiar with these local heterogeneous factors, and enter the new activity laterally from producing a similar product, is likely. This is particularly true when the domestic firm has also acquired market knowledge through success in similar goods. Conversely, when very few heterogeneous domestic factors of production are required and firms can import standardized inputs, market knowledge, and production techniques from abroad, one would expect discovery by foreign firms that do not face product or market uncertainty. Factor heterogeneity and its consequences for productivity and market uncertainty and the expected source of entry is signaled by these case studies as an avenue for future research.

'Similarity' Between Products

As discussed above, the reasons for each case falling in a particular quadrant often were due to reduced uncertainty through experience in a 'similar' product. Even through artichoke producers in Peru were not foreign firms with established marketing chains for the product, they did not face high demand uncertainty because of their experience with a similar product: asparagus. Even though San Miguel was not familiar with plastic bottle production, they did not face high productivity uncertainty because of their experience producing polyester, which uses the same chemical inputs. Even though the local labor force in Morocco employed in by AWS did not have any experience in wiring harnesses, workers from the textiles industry had all of the requisite skills, both shop floor producers as well as managers like Mr. Miess. Experience in 'similar' products was often the cause for lower uncertainty.

Economic theory has featured notions of similarity between products based on intensity in similar broad factors of production (e.g. Leamer 1984), similar technological sophistication (e.g. Lall 2000), input-output relationships (with I/O tables, e.g. Van Pottelsberghe de la Potterie 1997) and broadly defined clusters (e.g. Porter 1998). However, these categorizations are usually along only one dimension of similarity. Lall

stresses technology, Leamer stresses factors of production, and Porter stresses a combination of markets and technology.

Yet these cases show a multi-dimensional concept of uncertainty, where broad factors, production techniques, technology, marketing chains, and a host of other dimensions are all present, and are more or less relevant depending on the particular products. Focusing on one dimension at the exclusion of the others would in many cases miss the essential features that two products share.

Furthermore, these cases suggest that product similarity can't be summarized at a highly aggregated level. Both Lall and Leamer would have placed asparagus, artichokes, and paprika as equally 'similar', but we have found that this is not the case. An input-output table, which is usually at a higher level of disaggregation, would not have related any of these three goods to one another. Porter may have correctly placed asparagus and artichokes, but not paprika, in the same cluster. However, such 'Porterian' cluster classifications are not systematically identified.

These cases suggest a hypothesis: country experience in similar goods appears to reduce uncertainty, and therefore one would expect that new discoveries will be more likely to emerge if they are similar to what is currently produced in the country. Identifying such product-level similarities is, however, a significant empirical challenge given the features of these case studies. Any analysis of the linkages between products must be done at a highly disaggregated product level, and the multidimensionality of this similarity implies that one particular dimension can not be chosen *a priori*. This hypothesis is tested thoroughly in subsequent work (Hausmann & Klinger 2006).

Triggers of Discovery

A consequence of this typology relates to the expected triggers of new export activities. One would expect that in cases featuring little uncertainty on both dimensions, the emergence of the new activity would be explained by a more standard economic model of full information, where some external change in expected profits triggers the discovery. This prediction is born out in the case studies. Firms began producing wiring harnesses for export in large quantities first because of the Moroccan local content requirement law, and then because of the package of incentives in the Tangier Free Zone. Similarly, the production of PETS in Peru began in response to a demand shock caused by El Nino.

Conversely, in cases where both types of uncertainty were present, the emergence of the new activity may be less easily explained by a change in expected profits, and instead may conform to more stochastic models of export discovery such as that of Hausmann and Rodrik (2003). Again, this expectation is confirmed in the cases examined here. In each of the cases in the lower-right quadrant of Figure 10 did not have an intuitive external trigger to expected profitability. In these cases, the emergence of the new export activity seemed to be the outcome of a haphazard process where individual personality and providence featured much more strongly. Again, the cases with uncertainty along one dimension lie between these two extremes.

How was uncertainty resolved, when present?

In cases where there was uncertainty in any dimension, the ways it was overcome were quite varied. In the case of artichokes, the firms got together and formed their own institution to share the costs of resolving production uncertainty. In Egypt where there is an active public presence in industrial development and export promotion, many of the cases featured uncertainty resolution through a public organization. This was particularly true for market uncertainty facing contract furniture and catheter producers, where the process of resolving market uncertainty was directly subsidized by ExpoLink, CBI, and the IMC.

There were also cases where uncertainty was resolved through partnerships with firms who had the requisite knowledge. Dr. Wahab entered into a formal licensing agreement in order to resolve production and market uncertainty. Webhelp in Morocco entered into a joint venture with a local firm accustomed to the Moroccan business environment, and Outsorcia used experience from a previous venture that provided contacts and knowledge of the foreign market.

There were also cases where the first mover simply bore the risk themselves. In the case of Dr. Hambouli's initial foray into the medical component market and San Miguel's entry into the plastic bottle market, this bet paid off. Subsequent entrants in Paprika received some benefits from an NGO's experimentation in the south, yet the bulk of uncertainty was simply born by Mr. Chepote, and in his case the bet did not pay off.

Finally, in many cases the process of resolving uncertainty was subsidized by an input supplier. In the cases of artichokes, paprika (in both Peru and Morocco), and plastic bottles, discovery and diffusion costs were willingly born by input suppliers in order to cultivate downstream demand. In the context of Hausmann & Rodrik's model of self-discovery, this would make sense: it is the firms at the most concentrated portion of a disaggregated production chain that will capture the greatest percentage of the final up/downstream market and suffer the least from spillovers to competitors in cost discovery. They will therefore have a large incentive to coordinate, finance, or assist the discovery process in other parts of the production chain. For example, while there are multiple firms producing plastic bottles in Peru, all of their injector machines were provided by one firm, Husky. Therefore, the generation of information that spills over across bottle producers is internalized more by Husky than by any individual bottle producer, as Husky earns revenues based on the entire sector. It is no surprise that Husky provided technical assistance to new bottle manufacturers, just as Mr. Chepote was willing to bear diffusion costs and give technical presentations for an industry that would benefit his seed business, Mr. Fumagali was willing to organize a joint trial to fuel his nursery business, and McKormick was eager to provide Lukus with technical information to fuel its paprika sales.

This suggests a potentially inexpensive and effective policy intervention to stimulate the emergence of new product exports. Rather than directly subsidize the process of discovery, as suggested by Hausmann and Rodrik (2003), public bodies might instead coordinate international input suppliers in the most centralized part of the production chain to subsidize discovery. This should apply equally to firms upstream or downstream in the production chain. Such a policy would require much more study, yet these case studies suggest it as an avenue to be considered.

How did the resolution of uncertainty affect subsequent entrants?

The experiences of benefits to followers from first movers resolving uncertainty were varied. In some cases, the resolution of productivity uncertainty by the first mover generated significant benefits for subsequent entrants. This is most clearly seen in the case of paprika in Peru, where Mr. Chepote's experiences and subsequent diffusion efforts resolved much of the productivity uncertainty for subsequent entrants. All the follower firms indicated that the experiences of Mr. Chepote directly helped them in the area of crop management and virus protection. The entire cost of this learning was born by Mr. Chepote, who continues to suffer financially while the follower firms are experiencing great success.

In the case of artichokes, firms other than those that participated in the joint trial, who subsequently entered this market, also benefited from the resolution of productivity uncertainty by the first movers. Peru's artichoke 'bible', the output of the joint trial, is now in the public domain. A similar experience is found in the contract furniture sector in Egypt, where the group of first movers benefited from Mr. Nadim's investments and the assistance of Expolink in the learning of foreign demand characteristics. These lessons are freely shared by the large exporters in this sector in an attempt to stimulate a successful sector that will benefit their own activities as well.

In the cases of PETS in Peru, call centers in Morocco, and catheters in Egypt, it is possible that there were benefits of a demonstration effect from first movers to subsequent entrants, but no explicit evidence was found linking the first mover's resolution of uncertainty to subsequent entrants. Finally, in the case of brakes, there has been no subsequent entry, and therefore no significant benefits of Dr. Wahab's resolution of uncertainty.

On the whole, therefore, these cases do document some evidence that the discovery activity of first movers creates benefits for subsequent entrants, yet this is not shown in all cases. It is important to reiterate that these cases studies were all 'successes' in the sense that the new activity did emerge, at least temporarily. It is quite possible that the potential benefits created by the resolution of uncertainty by first movers would be quite different in those cases where potential first movers simply decided not to enter the new activity.

5. Conclusion

This study used a comparative case study method to explore the role of uncertainty in the search for new export activities. Through this analysis, new grounded theory was proposed. First, in the cases examined, uncertainty was found to be present along two primary dimensions: productivity uncertainty and demand uncertainty. Productivity uncertainty appears to be low in cases where few local and heterogeneous factors of production are needed, and discovery in these cases was often triggered by external changes in expected profitability. In addition, productivity and market uncertainty tend to be lower when firms have the requisite knowledge from other similar products. It is in these types of situations where a full-information view of discovery seems to be a reasonable approximation.

In cases where either or both types of uncertainty were high, there were few obvious external triggers to external profitability, and instead individual characteristics, haphazard discovery, and sheer luck seemed played a more prominent role in the emergence of the activity. In these cases, alternative models featuring learning and uncertainty may be more appropriate.

Uncertainty when present was overcome in a wide variety of ways, including private investment, partnerships, private and public coordination, and support from other firms in the production chain. Finally, the resolution of uncertainty, when present, often generated benefits for subsequent entrants, although this was not always found.

As discussed above, these findings suggest avenues for future research. The relationship between the importance of heterogeneous domestic factors in producing the new good and the origins of the pioneer firm has promise, and is amenable to more systematic, data-driven analysis. Most interesting is the finding that experience in similar goods reduces uncertainty, which suggests that the emergence of new export activities will be partially path-dependent. This question is taken up in Hausmann & Klinger (2006).

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- Jorge F. Chepote G., Owner and Manager, Fundo Escondido S.A.C.
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- Emilio Pinedo Arévalo, Senior Business Analyst, Technoserve Peru.

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- Santiago Fumagalli Galli, General Manager, SF Almacigos S.A.C.
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- Ing. Fausto Robles R., Counsellor, Agro and Agro-industry division, Commission for Export Promotion (PROMPEX Peru).
- Arturo Rosadio Quevedo, Business Development Manager, Technoserve Peru.
- Emilio Pinedo Arévalo, Senior Business Analyst, Technoserve Peru.

Plastic Bottles (Peru)

- Pramod K. Mittal, General Manager, Amcor PET Packaging del Perú S.A.
- Julio Villalobos Morillas, Sales Manager, Amcor PET Packaging del Perú S.A.
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- Amr Abdel Latif, Executive Director, Egyptian Exporters Association.
- Dr. Mona Toema El-Garf, Trade Agreement Advisor, Ministry of Foreign Trade & Industry, Government of Egypt.
- Dr. Ashraf El-Araby, Senior Economist, Ministry of Trade & Industry, Government of Egypt.
- Nagui T. El Fayoumi, Director, Export Development Division, Industrial Modernisation Center.

Catheters (Egypt)

- Dr. M.H. Kaffas, Customer Service Manager, Ameco Medical Industries.

- Khalifa Arisha, Projects Manager, Ameco Medical Industries.
- Wael Reda Abdou, General Manager, Euromed for Medical Industries S.A.E.
- Sherif Ezzat, Chairman, Federation of Egypt Industries Medical Industries Union.
- Eng. Abdel Monem Kamar, President, Merry Moon Egypt & Vice-President, Federation of Egypt Industries Medical Industries Union.
- Eng. Mohamed Abu Samra, Chairman, Abu Samra for Medical Equipment.
- Amr Abdel Latif, Executive Director, Egyptian Exporters Association.
- Dr. Mona Toema El-Garf, Trade Agreement Advisor, Ministry of Foreign Trade & Industry, Government of Egypt.
- Dr. Ashraf El-Araby, Senior Economist, Ministry of Trade & Industry, Government of Egypt.
- Nagui T. El Fayoumi, Director, Export Development Division, Industrial Modernisation Center.
- Yehia El Agami, President, Small Enterprise Development Organization, Social Fund for Development, Arab Republic of Egypt.

Contract Furniture (Egypt)

- Adham Nadim, Chairman and Managing Director, Nadim Furniture.
- Ihab M. Derias, Managing Director, La Roche Furniture Industries.
- Ahmed Aly Helmy, Chief Executive Officer, Meuble El Chark.
- Amr Abdel Latif, Executive Director, Egyptian Exporters Association.
- Dr. Mona Toema El-Garf, Trade Agreement Advisor, Ministry of Foreign Trade & Industry, Government of Egypt.
- Dr. Ashraf El-Araby, Senior Economist, Ministry of Trade & Industry, Government of Egypt.
- Nagui T. El Fayoumi, Director, Export Development Division, Industrial Modernisation Center.
- Yehia El Agami, President, Small Enterprise Development Organization, Social Fund for Development, Arab Republic of Egypt.
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- Mohamed Lahlou, Membre du Bureau, President de la Commission-Competitivite de l'Entreprise. Confederation General des Enterprises du Maroc.
- M. Mohammed Benayad, Secrétaire Général, Conseil National du Commerce Exterieur.
- Ali El Alaoui, Secretary General, Centre Marocain de Promotion des Exportations.
- Mohammed Chahoub, Chef du Département Recherches et Etudes de Marchés, Centre Marocain de Promotion des Exportations.