Working paper

International Growth Centre

Born-to-Export Firms

Understanding Export Growth in Bangladesh

Bernando Díaz de Astarloa
Jonathan Eaton
Kala Krishna
Bee Yan Aw-Roberts
Andrés Rodríguez-Clare
James Tybout

October 2012

When citing this paper, please use the title and the following reference number:
F-3007-BGD-1

DIRECTED BY LSE UNIVERSITY OF OXFORD

FUNDED BY UKaid from the British people

Born-to-Export Firms:

Understanding Export Growth in Bangladesh[1]

Bernardo Díaz de Astarloa, Jonathan Eaton, Kala Krishna, Bee Aw Roberts,

Andrés Rodríguez-Clare, and James Tybout

October 2012

[1]This project is partially supported by the International Growth Centre. Eaton and Tybout acknowledge support from the National Science Foundation (Grant SES-0922358). We thank Anik Ashraf and Ravid Chowdhury for help and guidance in accessing and collecting data in Bangladesh. Bibhuti Sarker provided excellent research assistance.

1 Introduction

Standard thinking about firms starting to export is that they have already developed a strong position at home.[1] An implication is that changes in total exports arise either through the expansion of exports by incumbent exporters or by entry into exporting by established domestic firms.

Evidence from Bangladesh suggests that this pattern does not apply to the rapid expansion of its apparel exports during the period 1983-2010: Exporting firms emerge *de novo* and sell considerable amounts to new foreign markets without selling much or anything at home. To exploit the combination of cheap labour and non-binding MFA quotas, most Bangladeshi apparel producers were established to export. Foreign sales by these firms far exceeded what they sold domestically (Rommel and Klepper, 2009). As a consequence, firms that sell substantial amounts in foreign markets are not particularly large sellers at home, if they have any presence there at all.[2]

These "born to export" (BTE) firms often emerge in industries for which there is little or no domestic demand in the exporting country, what we will call "orphan industries." If limited domestic demand means that few incumbent firms exist, and entrepreneurs nonetheless become aware of exporting opportunities, they often must create new establishments to exploit them. When they do, most of their production will be dedicated to foreign sales. But this type of foreign market entry entails two types of entry cost: the familiar cost of establishing one's products in a foreign market, and the presumably much larger cost of creating a new establishment.

These extra costs are likely to generate export dynamics quite distinct from those generated by firms that are created initially to serve domestic consumers. For one thing, since this much larger start-up cost must be amortized over a relatively lengthy period, the current period pay-offs to exporting will matter relatively less than expectations about future payoffs in driving exporting decisions. For another, a large sunk cost creates a large option value of remaining in an export market once this cost is incurred. Thus, BTE firms are more likely than other firms to remain in foreign markets once they enter.

We assess the importance of BTE firms in apparel exports in Bangladesh and compare it to the experience of other apparel exporting countries for which we have the necessary data, in particular China, Colombia, and Taiwan. Using micro data from these four countries, we first document different patterns of export growth. In particular, we explore whether the creation of new firms was a key dimension of export growth, whether new exporters tend to be BTE firms, and the role of Export Processing Zones.

[1] See, for example, dynamic models of entry into export by Impullitti, Irarrazabal, and Opromolla (2012) and Arkolakis (2012).

[2] Other investigators have noted similar patterns in other developing countries, for example, in some Chinese manufacturing sectors (Lu, 2010), in Colombian, Ethiopian, and Kenyan cut flowers (Mendez, 1991; Gebreeyesus and Iizuka, 2010) and Chilean salmon farmers (Katz, 2006; Iizuka, 2005, 2009). Such observations are in contrast with what's been observed in developing countries, e.g., Bernard and Jensen (1999) for the United States and Eaton, Kortum, and Kramarz (2011) for France.

Our findings can be summarized as follows: Exports from Colombia and Taiwan adhere to patterns of export dynamics implied by the standard model: (1) Net entry makes a relatively small contribution to overall export growth, which is primarily driven by expansion of exports on the part of incumbent exporters. (2) New exporters sell much less than incumbents and are more much likely to disappear from exporting after one year. (3) The average age of a firm when it starts to export is over 10 years. Bangladesh is the opposite in each dimension: (1) Looking over a six year horizon, net entry accounts for over half of export expansion. (2) Firms that jump into exporting sell almost as much as incumbents and are more likely to survive to the next year. (3) The mean age of an exporting firm is under two years, and the median new exporter has never sold before. The picture for China is mixed: (1) Entry makes an even more important contribution to growth than in Bangladesh. (2) New exporters sell only negligibly less than incumbents and are more likely to survive. (3) But the average new exporter is nearly seven years old.

In the second part of our paper we develop a BTE model of exporting, arguing that it can account for the features we observe in Bangladesh. We then go on to generalize the search and learning model of export dynamics developed in Eaton, Eslava, Jinkins, Krizan, Kugler and Tybout (2012, henceforth EEJKKT) to characterize the distinctive features of export dynamics when firms are born to export.

2 Some stylized facts

We first discuss some features of export growth in the individual countries we examine and then turn to a description of our firm-level datasets.

2.1 Countries studied

We study apparel producers in four countries: Bangladesh, China, Colombia, and Taiwan. Figures 1 and 2 summarize some kew features about exports of apparel and other manufactured products over the last four decades. All have gained in terms of their world market share, although none as spectacularly as China (Figure 1). For all countries except Taiwan in the second part of the period, growth in apparel exports was a component of this overall export growth (Figure 2, panel (a)). For all four countries, apparel was a significant share of exports at the beginning, although for Bangladesh it was pretty much all of exports. The share of apparel declined although for Bangladesh the decline is slight. Apparel remains 90 percent or more of total Bangladeshi exports throughout the period (Figure 2, panel (b)). All four countries also experienced growth in exports of machinery and equipment, although for Bangladesh and Colombia the initial level was so low that even at the end of the period exports in the category were only a small share of total exports. For Taiwan and China, however, machinery and exports became a

major share of total exports (Figure 2, panels (c) and (d)).

Bangladesh The case of Bangladeshi apparel exports is well known in development policy circles (Rhee and Belot, 1990; Hausmann and Rodrik, 2003; Mostafa and Klepper, 2009). It begins in 1979, when Daewoo Corporation of South Korea, a company, with considerable experience in apparel exports, signed a collaborative agreement with a Bangladeshi firm (Desh), with the intention of avoiding import quotas to the United States and European markets imposed by the Multi-Fiber Agreement (MFA) . At that time Bangladesh was not restricted by quotas. The apparel producers it had at the time produced garments, such as saris, for the local market. It thus had very low exports of Western-style apparel covered under the MFA. As part of the Daewoo-Desh agreement, 130 Bangladeshi workers were sent to Korea for training in technology, quality control, and management (see Rhee and Belot, 1990). Daewoo also helped Desh absorb key management and marketing techniques for garment export. Once Desh succeeded, many of its workers left to start up other firms, spurring the growth of the industry.

In our discussion below, it is important to keep in mind panel (b) of Figure 2: apparel remains the overwhelmingly dominant export of Bangladesh.

China Like Bangladesh, China experienced a dramatic growth in apparel exports. Here, however, the boom came from an industry that already served a domestic market, and several policy reforms played a major role. First, China initiated several key market-oriented reforms in 1992 which improved the efficiency of the apparel sector (China Textile University and Harvard Center of Textile and Apparel Research, 1999). Second, after 15 years of negotiations, China joined the World Trade Organization (WTO) in 2001. In doing so it benefitted from the phase-out of the MFA product and country specific quotas on textiles, yarn and apparel, which was completed by 2005.[3] As a member of the WTO, China also obtained Most Favored Nation (MFN) status (so that Chinese exporters to any WTO-member destination faced the lowest tariff applied to any exporter there).[4] Finally, under the terms of its accession to the WTO, China agreed to remove its domestic restrictions on exporting. These restrictions, which were lifted in a series of reforms between 1999 and 2004, prevented firms (other than large producers and intermediaries, state-owned enterprises, and foreign firms) from exporting directly; they had to go through other firms or intermediaries who were permitted to export.[5]

Apparel exports have grown extremely rapidly, especially since 1992, and China now has the largest

[3]See Brambilla et al. (2007) for a historical discussion of the MFA and its precursor, the Agreement on Textile and Clothing (ATC). These authors argue that China was more constrained by such quotas than other suppliers, resulting in the surge in Chinese exports post MFA.

[4]However, most Chinese exports already had de facto MFN status.

[5]Bai, Krishna, and Ma (2011a) use the variation in time and space of these reforms to argue that these reforms were responsible for a good part of the surge in exports. Bai, Krishna, and Ma (2011b) suggest (based on estimates from a dynamic structural model) that the inability to export directly adversely affected such firms.

apparel sector in the world. Furthermore, most apparel exporters are strongly oriented toward foreign markets, and ship well over half of their output abroad (Lu, 2010). China's apparel boom would have been even larger if it were not for the China Containment Agreements (CCAs) that were implemented under China's WTO accession agreements of 2001. Under the CCAs, China agreed to constrain import surges voluntarily until 2013. The US invoked the CCAs in mid 2005, after the phase-out of the MFA triggered a surge in its Chinese apparel imports. The EU followed suit in the fall 2005 and since then a host of other countries have done so as well, including Canada, Mexico, Turkey, and some lower income countries.[6]

Colombia Colombia followed a different path. It too managed to expand its apparel exports over the past 30 years successfully. But it did so much more gradually than China and Bangladesh. Also, unlike Bangladesh, its export growth was largely driven by the re-orientation of its established apparel sector toward foreign markets.

Taiwan Finally, Taiwan combined elements of Chinese and Colombian experiences. After implementing export subsidies and other industrial policies in the early 1960s, this country enjoyed a period of rapid growth in apparel exports. However, these exports peaked at 9.5 percent of total Taiwanese exports in 1986, and by 2004 their share had declined to less than 0.8 percent. Like their Colombian counterparts, most Taiwanese apparel producers who continue to export derive the majority of their revenue from domestic sales.[7]

2.2 Data

Several data sets support our analysis. To document producer-level patterns of export market participation, we rely on transactions-level data for the universe of exporting producers in Bangladesh, Colombia, and China (no such data are available from Taiwan). These data are collected from customs declarations in each country. For each shipment we observe an exporter's ID, date of the customs declaration, declared value in domestic currency, HS 8-digit code of the item being shipped, verbal descriptions of the exported items, quantities traded (gross and net weight measured in kilograms and units measured in pieces), and destination country. It's important to note that the data from Colombia and China are for firms while for Bangladesh and Taiwan are for establishments. While we use the term firm to apply to all countries this distinction should be kept in mind.

[6]The growth rate of the CCA quotas is higher than that of MFA quotas they replaced, though the coverage is similar or even greater in some cases. See Dayarathna-Banda and Whalley (2007) for more on this.

[7]Establishment-level data from 2000-2004 show that, among Taiwanese apparel exporters, roughly 80 percent of production has been directed to the domestic market.

To study the relationship between firms' birth and their participation in export markets, we need to augment customs records with additional information. For Bangladesh, these extra data come from tax registries, which provide tax IDs and a tax registration date. Since tax IDs also appear in the customs declarations, the registration date allows us to construct a measure of exporter's age. Additionally, tax registries allow us to distinguish firms by activity. For each exporter in the tax registries we observe whether it belongs to any combination of the following five activities: manufacturer, exporter, importer, trader, or service renderer.

For Colombia, China and Taiwan, comprehensive tax registries are unavailable. However we have access to annual manufacturing survey data that cover essentially all establishments with at least 10 workers and provide standard information on age of the plant, inputs, production and value of sales by destination (home versus foreign markets). Confidentiality constraints prevent us from linking these establishment data with the transactions data. Nonetheless, since the establishment survey data include information on foreign sales and year of birth, we are able to infer plants' age when they enter export markets.

2.3 Margins of growth

We begin our descriptive analysis by using the transactions-level data from Bangladesh, China, and Colombia to study the margins of export growth. Specifically, following Eaton, Eslava, Kugler, and Tybout (2008, Henceforth EEKT), we decompose the growth of total exports into the contribution of pairwise continuing, entering, and exiting firms. Letting $X(t)$ denote aggregate exports in period t and $x_j(t)$ denote exports by firm j, we use the following decomposition:

$$\begin{aligned}\frac{X(t)-X(t-1)}{[X(t)+X(t-1)]/2} = &\left\{\frac{\sum_{j\in C_{t-1,t}}[x_j(t-1)+x_j(t)]/2}{[X(t)+X(t-1)]/2}\right\}\times\left\{\frac{\sum_{j\in C_{t-1,t}}[x_j(t)-x_j(t-1)]/2}{\sum_{j\in C_{t-1,t}}[x_j(t-1)+x_j(t)]/2}\right\}\\ &+\frac{N(EN_{t-1,t})\bar{x}(t-1)}{[X(t)+X(t-1)]/2}+\frac{\sum_{j\in EN_{t-1,t}}[x_j(t)-\bar{x}(t-1)]}{[X(t)+X(t-1)]/2}\\ &-\frac{N(EX_{t-1,t})\bar{x}(t-1)}{[X(t)+X(t-1)]/2}-\frac{\sum_{j\in EX_{t-1,t}}[x_j(t)-\bar{x}(t-1)]}{[X(t)+X(t-1)]/2},\end{aligned} \tag{1}$$

where $Y\in\{C_{t-1,t},\ EN_{t-1,t},\ EX_{t-1,t}\}$ indicates the set of firms $C_{t-1,t}$ that exported in $t-1$, and t (pairwise continuing), the set $EN_{t-1,t}$ that exported in t but not $t-1$ (pairwise entering), and the set $EX_{t-1,t}$ that exported in $t-1$ and not in t (pairwise exiting). The term $N(Y)$ represents the number of firms in set Y. The term $\bar{x}(t-1)$ indicates average firm export sales in period $t-1$.

The decomposition works as follows: The left-hand side measures the growth in the value of total exports between year $t-1$ and t. The right-hand side of the first line represents the contribution to growth of pairwise continuing firms, decomposed into the share of those firms in total sales in $t-1$ and

the growth in their sales. The second line decomposes the contribution of entrants as the sum of two terms: the increase in exports by entering firms if entering firms sold the same as the average firm in period $t-1$ and the sum of the differences between exports of entrants and that of the average exporter in $t-1$. The final line computes the contribution of exiting firms in similar way, as the sum of the decrease in exports if exiting firms had exported the same as the average firm in period $t-1$ and a term that adjusts for the differences in sales between exiting firms and the average firm. The decompositions thus separate the contribution of entry and exit purely through the number of different categories firms from differences in the mean size of the different categories.

Table 1 applies the growth decomposition to apparel and textiles exports for Bangladesh (2004-2009), Colombia (2000-2006) and China (2000-2006).[8] It reports cross-year averages of year-to-year growth rates, and cumulative growth rates between the first and last years of the sample. For example, in the case of Bangladesh our cumulative growth figures take $t-1 = 2004$ and $t = 2009$. The column labeled "Contribution" reports the figures for each line in the right-hand side of equation (1) for each country. In all countries, data limitations force us to miss the early years of rapid export growth. Nonetheless, since differences in domestic markets persisted within each country, patterns of apparel exports presumably continued to reflect each country's distinctive circumstances.

The results in Table 1 highlight the role of entry in explaining growth patterns in Bangladesh and China relative to Colombia. On average, net foreign market entry accounted for $38.9-11.6 = 27.3$ percent of export growth per year in Bangladesh, and $56.8-15.4 = 41.4$ percent of net export growth in China. In Colombia, however, this margin was only $36.4-28.3 = 8.1$ percent. Furthermore, the relative importance of net entry in Bangladesh and China did not reflect a relatively high rate of new exporter arrival. On the contrary, new exporters accounted for approximately 45.2 percent of all exporters in Colombia, but only 25.9 percent in Bangladesh and 38.7 percent in China. Instead, the large role of entry in driving Bangladeshi and Chinese export growth reflected two facts: entrants' shipments relative to incumbents' shipments were much larger in these countries than in Colombia (refer to the "relative exports" column under "Pairwise entering firms"), and the exporter exit rate was much lower in Bangladesh and China than in Colombia (refer to the "dropped firms" column under "Pairwise exiting firms"). These effects were only partly offset by the fact that exiting firms were relatively small in Colombia (refer to the "Relative exports" column and recall that this figure is the negative of relative size).

2.4 Export intensity

Why are the shipments of new exporters relatively large in Bangladesh? Part of the answer lies in the fact that, like incumbents, they devote most or all of their productive capacity to foreign sales. Industrial

[8]We are grateful to Jiandong Ju and Hong Ma for allowing us access to the Chinese data.

survey data show that Bangladeshi garment producers reaped more than 99 percent of their total sales revenues from exports in 2005, and this sector alone accounted for 63 percent of total exports (Table 7). Similar comments apply to producers of woolen jumpers, who were entirely oriented to foreign markets and accounted for an additional 4 percent of exports.[9] Thus, as argued above, apparel exporters in Bangladesh could be said to operate in "orphan industries" for which domestic demand is essentially missing.

Figure 5 contrasts the cross-firm distribution of export shares in Bangladesh with share distributions in other countries. Graphs for China, Colombia and Taiwan are based on industrial survey data, while for Bangladesh the graph is based on customs data; all graphs exclude non-exporters. Clearly, the dominance of pure exporting firms in Bangladesh is extraordinary. However China also shows an unusual concentration of firms that specialize in exports, as previously noted by Lu (2010).[10] On the other hand, Taiwan, and especially Colombia, show the more common pattern of exporting firms generating most of their sales from domestic markets.

2.5 Cohort survival

The high cumulative contribution of entrants to export growth in Bangladesh and China suggests that new exporters managed to survive at a relatively high rate in these countries. Further detail on survival patterns emerges when we organize exporting firms according to the number of years they have been exporting, and we examine their survival rates in export markets as they age.

Following EEKT (2008), we can chronicle the progress of different cohorts of exporters from Bangladesh (Table 2, for apparel and textiles), China (Table 3 for apparel and textiles and Table 4 for electronics, machinery, and equipment), and Colombia (Table 5, for apparel). They are arranged with the year of entry in the column and the year of participation in the row. The top panel reports the number of firms from that cohort in that year, the second panel the total exports of that cohort in that year, and the third panel exports per firm (i.e. the second panel divided by the first). Since we do not have data before the first year, the first "cohort" is simply all firms exporting in the first year regardless of when they entered.[11]

The top panel of tables 2-5 shows that, on average for apparel and textiles, Bangladeshi firms had a 66 percent chance of lasting past their first year as exporters and new Chinese exporters had a 79 percent chance of surviving their first year in foreign markets. In contrast, Colombian firms had only a 45 percent

[9] The table includes only selected products; hence the percentages reported in the second and third column do not sum to 100.

[10] We exclude Chinese firms that are engaged in processing trade. Including these firms increases, but not significantly, the share of firms that specialize in exports.

[11] A cohort is defined by the first year of a foreign sale in our data; firms that quit exporting and re-enter foreign markets later do not change cohorts.

chance. The gap in survival rates between Bangladesh and China disappears, and between these and Colombia is reduced significantly, for firms with at least two years of exporting experience, so it looks like the early shakedown period is simply missing in Bangladesh and China.

The lower rows of the second panel reveal an equally remarkable difference between Bangladesh and China, on the one hand, and Colombia, on the other. For Colombia, 80 percent of total exports (in the last column) are from firms that were there at the beginning of the period. The figure for Bangladesh is 64 percent and for China 22 percent (apparel and textiles) and 40 percent (electronics, machinery, and equipment).

The third panel reveals another striking difference between the two sets of countries. Not surprisingly, in all cases younger firms are usually smaller than older ones, and exports per firm tend to grow as a cohort ages (through a combination of firm growth and the exit of smaller firms). But in Colombia the size disadvantage of new exporters is enormous. In 2006, for example, the firms that had always exported remain more than four times larger than the firms that entered in 2001, and twelve times larger than firms that entered in 2005, the previous year. For Bangladesh and China, however, new firms are not nearly as small relative to older ones, including in the first or second year of exporting.

In sum, apparel export growth in Bangladesh and China was derived largely from firms that enter foreign markets on a large scale and, once in, tend to stay there. These patterns contrast with those found in Colombia, where entry into export markets is frequent, but mostly done on a small scale and relatively unimportant for cumulative export growth. In the case of Bangladesh, this finding suggests that, in cases of export growth in orphan industries, a substantial portion of export growth comes from firms that are immediately committed to export markets, while firms that simply "test the waters" abroad are relatively less common.

2.6 Are firms born to export?

One explanation for the large role of entry in Bangladesh and China relative to Colombia is that, in the first two countries, entry into export was by newly-created export-oriented firms, while in Colombia new exporters were existing domestically-oriented firms testing out foreign markets.

This interpretation seems to fit Bangladeshi experiences. The domestic market for western apparel was limited in this country, and most entrepreneurs who tapped into foreign apparel markets could not do so by re-orienting existing production capacity toward foreign consumers; they needed to create new establishments.[12]

As we show in the next section, the BTE explanation fits the Bangladeshi experience very well. For

[12]Mostafa and Klepper (2009) report that, in 1978, there were only "a handful of garment producers," while the number in 2009 was over 4,000. Their Figure 1 shows how the number of garment factories in Bangladesh closely tracked total exports, suggesting that these factories weren't producing much for the domestic market.

China, however, the evidence is mixed.

2.6.1 Firm creation and exporting

To explore further the importance of BTE firms, we now turn to firms' ages at the time they begin exporting. For Bangladesh, we compute each exporter's age by using the date at which it registered its tax ID and we identify its entry into export markets using our shipment-level data.[13] All firms at least 20 years old are assigned an age of 19 years, since the tax registration date in our data is truncated at July 1st 1991. To calculate age in Colombia and China, we use annual establishment survey data which show both the foundation date for the plant and the value of exports, year by year.[14] Finally, since we also have establishment survey data for Taiwan, we include figures for this country to broaden the basis for comparison.

Table 6 shows the basic patterns. Note that in Colombia and Taiwan, the median age of an establishment when it enters the export market is 7 years or more. In Bangladesh, however, the median age never exceeds one year. China is in between, but looks more like Colombia and Taiwan.[15]

Figure 3 provides more details on the distribution of exporter firm ages in Bangladesh. It shows the histogram of the across-year average firms' ages at entry into export markets. If exporters are born to export, we should expect to see that entrants are young. Indeed, Figure 3 shows that the age distribution at entry is remarkably skewed for Bangladesh. This pattern contrasts sharply with those observed in China, Colombia, and Taiwan, where the median age at entry is at least six times higher than in Bangladesh.[16]

The fact that young Bangladeshi exporters are numerous and export substantial volumes suggests that a large fraction of total sales is supplied by newly created firms. Figure 4, which presents total exports by age of the exporting firm, confirms this. Most exports in Bangladesh originate from firms less than five years old. But in China, Colombia and Taiwan, the older, established exporters are the dominant source of foreign sales.

2.7 Export Processing Zones in Bangladesh

One possible explanation is that Bangladesh's distinctive exporting dynamics, and in particular the prevalence of BTE firms and the finding that exporters tend to sell very little in the domestic market, is an artifact of the Export Processing Zone (EPZ) regime: If this regime provides large benefits to exporters

[13] Since a typical exporter ships more than once during any given year, an exporter's age is the mean over the ages that would result by taking the dates of every shipment during the year.

[14] It should be noted that the establishment survey data cover only plants with at least 10 workers, so they miss very small exporters, which are also likely to be very young.

[15] Looking at year-by-year figures, the median age drops to 3 years in China after 2003. Notably, this is the period during which the quantitative restrictions of the Multi-fiber Arrangement (MFA) were phased out, internal restrictions on exporting were eliminated, and Chinese apparel exports boomed.

[16] For all countries we restrict the data to the apparel and textiles sector.

but prevents them by law from selling a significant share of their output in the domestic market, then the BTE phenomenon is bound to arise for EPZ firms. We examine this possibility in this section.

Bangladesh has 8 operating export processing zones located in different districts in four divisions: Dhaka, Chittagong, Khulna and Rajshahi. Only one of the EPZs, the Chittagong EPZ, has been in operation since the 1980s. The Dhaka EPZ was opened in 1993 and the remaining 6 were opened between 2001 and 2007. There are fiscal benefits of opening a plant in an EPZ, as well as benefits in access to water, gas and electricity, together with warehouses and dormitories for workers.[17]

Exports from EPZs grew 172% between 2000 and 2010. But their overall role in Bangladesh's export boom is surprisingly small. Their share in total exports (which are heavily dominated by apparel) was 18% in 2010, down from a peak of 21% in 2005 (see Figure 6). The share of employment in EPZs remains low. Only 0.7% of total employment was in EPZs in 2005 (see Figure 7).

Our customs and survey data each give further evidence on the role of EPZ's. Customs data provide more accurate information on the location of plants in EPZs, while survey data allow us to investigate employment, export intensity and other characteristics of plants located in EPZ districts.[18]

Table 8 summarizes what the customs data indicate about where total exports and apparel exports originated during 2004-2009. Overall, foreign sales from EPZs averaged only 10.9% of total exports during this period. Moreover, the share didn't change much: exports from EPZ's and from outside EPZ's both slightly more than doubled over the five year period.

Inside EPZ's export growth was much more at the extensive than the intensive margin. While the number of plants in EPZs increased from 146 in 2004 to 238 in 2009, exports per firm rose only 26%, from US$5.3 million to US$6.7 million. Outside EPZ's growth was more evenly balanced between the two margins.

We also see little difference between EPZ exports and non EPZ exports in terms of the representation of apparel. Table 8 indicates an apparel share of EPZ exports hovering between 90 and 95 percent, in line with apparel's share in overall exports shown in Figure 2, panel (b).

The most notable difference between plants inside and outside EPZ's is their size. Exports per EPZ plant were about three times higher than from plants outside EPZs. Apparel and textiles producers in EPZs are larger than other producers in EPZs, as measured by exports per plant.

Finally, we look at plant age to investigate whether EPZs have a distinctive role in explaining the BTE phenomenon. Table 9 shows that there are not significant differences in plant age in and out of EPZs.

[17] See Aggarwal (2005) for a thorough description of the development of EPZs in Bangladesh, and how it compares with those in India and Sri Lanka. He argues that plants located in EPZs are at a huge advantage both in terms of fiscal and non-fiscal incentives compared to units outside EPZs. Also Bangladesh seems to offer greater fiscal incentives to locate in EPZs relative to India and Sri Lanka. See the Appendix for an extended description of EPZs in Bangladesh.

[18] See the Appendix for details.

In 2009 plants in EPZs were around one year older than their counterparts not in EPZs, irrespective of whether they belong to the apparel and textiles sector.[19] Table 9 also shows that there were no significant age differences on average between plants in and out of EPZs at the moment of entering export markets in 2009.[20] That the median plant age in EPZs was one year is not surprising, however, given that firms who want to operate in an EPZ must open a new plant there, usually registering a new plant ID.

This evidence suggests strongly that BTE plants are not something exclusive of EPZs. In fact, if we define a BTE plant as one that entered the foreign market within one year of start-up, Table 10 shows that, if anything, the share of born to export plants is higher outside EPZs. Moreover, the share of total exports accounted for by BTE plants is lower in EPZs than in non-EPZs (23% compared to 31% in 2009), and the percentage of exports by BTE plants that are apparel and textiles is roughly similar for EPZ and non-EPZ plants.

In summary, while EPZ's have played a significant role in Bangladesh's export boom, they were not the central factor, as they account for a relatively small share of total exports which has remained fairly constant over the period we look at. Moreover, we cannot find significant differences in their role in the born-to-export phenomenon.[21]

Given the apparent benefits of locating in an EPZ, a puzzle is why more plants haven't located in them. We speculate that, for many plants, the administrative fees or price of land in EPZ's offset these benefits. The one significant difference that we do observe, that plants in EPZ's are about 4 times larger, is consistent with a fixed cost of locating in one that only a larger plants can recover.

3 Export dynamics with born-to-export firms

Among the four countries we've examined, new exporters account for a large part of export growth in Bangladesh and China, and in Bangladesh these new exporters tend to be BTE firms. In this section we provide a model that captures the key feature of BTE firms, namely the existence of large sunk costs associated with the decision to start exporting.

As discussed in the introduction, an entrepreneur who starts up a BTE firm must not only incur the startup cost of exporting, but the presumably much larger startup cost of the firm itself. This much higher startup cost has several implications for export dynamics. Relatively large start-up costs make firms' exporting decisions relatively forward-looking, given that a significant fraction of these costs are sunk and

[19] A t-test for the difference in means cannot reject the hypothesis that plants in EPZs were older than plants outside EPZs, but the difference in mean age is less than a year. This result holds even if we control for apparel and textiles producers in EPZs.

[20] When we pool all years, a t-test for the difference in mean age rejects the hypothesis that mean plant age is different in and out of EPZs.

[21] The Appendix presents some evidence that exporters located in districts where there is an EPZ (not necessarily within an EPZ) seem to be younger than those located outside EPZ districts (although this difference is absent for non-exporters). Since the quality of the data is not as good as the customs data, we do not consider this piece of evidence as conclusive.

must be covered in expected value by a substantial stream of future export profits. Furthermore, when entrepreneurs lack experience in their home market, they face more uncertainty about their prospects for profits abroad. This uncertainty makes their entry decisions and subsequent efforts to meet foreign clients relatively dependent upon whatever signals are available about foreign market conditions. Also, once they have created a firm, they are relatively committed to remaining in foreign markets.

3.1 Adapting the EEJKKT model

To explore numerically these distinctive features of born-to-export firms, we now adapt the search and learning model of export dynamics developed in EEJKKT.[22] This model is based on the following assumptions:

- Firms experience ongoing, serially-correlated shocks to their own productivity which are independent across firms.
- Firms experience common shocks to aggregate demand at home and abroad, with exchange rate shocks incorporated in the foreign demand shock.
- Firms pay an ongoing search cost for buyers in their domestic and foreign markets.
- Firms know their product's popularity in their home country, but they are initially uncertain about its popularity abroad.
- Taking stock of their acceptance rates among home market buyers and foreign buyers they have met (if any), firms formulate beliefs about their products' popularity abroad.
- As they update their beliefs, firms adjust their search intensity for foreign clients.
- Firms drop foreign clients when the expected operating profits from the match fall below the fixed costs of maintaining the relationship.

We modify these assumptions in two ways. First, we eliminate the home market, and thus force entrepreneurs to make their initial exporting decisions without any prior information about the appeal of their products. Second, we assume that, before an entrepreneur can begin exporting, she must incur a fixed cost of setting up a firm, and this investment is only partially recoverable if the firm shuts down.

3.1.1 Search and matching

Firms choose how intensively to search for potential clients in each market where they wish to generate sales. If they wish to meet a client with probability $\lambda \in [0, 1]$ during the next time interval, they must

[22] Nguyen (2012) and Albornoz et. al. (2010) are other papers that looks at the implications of learning about markets for the pattern of exports.

incur costs $c(\lambda)$, where $c(0) = 0$ and $c(\cdot)$ is increasing and convex in λ. Depending on search intensity, these costs might include the expenses of maintaining a web site in a foreign language, attending trade fairs, researching and contacting potential buyers on the internet, sending sales representatives to the doors of potential clients, and/or maintaining a foreign sales office.

Simplifying EEJKKT, we assume that some fraction $\theta_j \in [0, 1]$ of the buyers in foreign markets are willing to do business with firm j, where θ_j is distributed beta with parameters (α, β) across potential exporters.[23] Firms that have not yet exported know only the distribution from which their θ_j values were drawn, but they learn about their particular θ_j values as they meet new clients abroad and update their beliefs according to Bayes' rule. Updating yields a posterior distribution for θ_j that depends upon the number of potential clients firm j has met (n_j), and the number of these meetings that resulted in successful business relationships (a_j), as well as the parameters (α, β). Call the mean of this posterior distribution $\widehat{\theta}_j(n_j, a_j)$.

3.1.2 Profits from a successul match

If firm j chooses search intensity λ_{jt} during period t, the probability it will establish a successful new business relationship abroad is $\lambda_{jt}\theta_j$. Supposing this relationship is with client i, it generates period t profits of:

$$\pi(x_t, \varphi_{jt}, y_{ijt}) = x_t \varphi_{jt}^{\sigma-1} y_{ijt}. \tag{2}$$

where x_t captures market wide demand shocks (inclusive of exchange rate effects), φ_{jt} is the firm-specific productivity shock, and y_{ijt} is a shock specific to the match between buyer i and seller j. Here $\sigma > 1$ is the elasticity of substitution. We are assuming that the seller sets a price equal to the Dixit-Stiglitz markup $\sigma/(\sigma - 1)$ over its unit cost.

3.1.3 Present value of a successful match

Successful matches endure until the buyer and seller are separated by an exogenous shock or until the seller determines it is not worth the fixed cost of maintaining the business relationship. Accordingly, the expected value of the profit stream associated with client i is:

$$\begin{aligned} \widetilde{\pi}(x_t, \varphi_{jt}, y_{ijt}) &= x_t \varphi_{jt}^{\sigma-1} y_{ijt} \\ &\quad + \frac{1-\delta}{1+r} \max E \left\{ \int_{x'.} \int_{\varphi'} \int_{y'} \widetilde{\pi}(x', \varphi', y') dG(x', \varphi', y' | x_t, \varphi_{jt}, y_{ijt}) - F, 0 \right\}. \end{aligned} \tag{3}$$

[23] In EEJKKT, this "success rate" is a convex combination of a variable that is general to all markets, $\theta_j^g \in [0, 1]$, and an unknown variable that is specific to the foreign market, θ_j^f: $\theta_j = \gamma\theta_j^g + (1-\gamma)\theta_j^f$, $\gamma \in [0, 1]$. Since θ_j^g is assumed to have been learned by incumbent firms, their exporting decisions are informed by their experiences in their home market.

where δ is the per-period probability that a successful match will break up for exogenous reasons, F is the fixed cost incurred by the firm to maintain the relationship, and $G(x', \varphi', y'|x_t, \varphi_{jt}, y_{ijt})$ is the joint transition distribution for the model's exogenous stochastic variables. Of course, firms don't know *ex ante* with whom they will match next, so when choosing its search intensity in period t, firm j considers the expected payoff to a successful match to be:

$$\widetilde{\pi}_0(x_t, \varphi_{jt}) = \int_y \widetilde{\pi}(x_t, \varphi_{jt}, y) dG_0(y|x_t) \tag{4}$$

where $G_0(y|x_t^m)$ is the distribution of buyer types when marketwide conditions are x_t.

3.1.4 Search intensity

We are now ready to characterize a firm's exporting decisions when it has no experience in its domestic market. Suppose an up-front investment of K is required to create a firm, and upon shutting a firm down one can recoup some fraction $\phi \in [0, 1)$ of the initial investment. Then, suppressing firm and time subscripts, the value of an incumbent firm that has n had encounters, a of which were successful, is:

$$\begin{aligned} & V_I(\varphi, x, a, n) \\ = & \max_{\lambda} \Big\{ -c(\lambda) + \lambda \cdot \widehat{\theta}(a, n) \left[\widetilde{\pi}_0(\varphi, X) + \beta E \max \left[V_I(\varphi', x', a+1, n+1), \phi K \right] \right] \\ & + \lambda \left[1 - \widehat{\theta}(a, n) \right] \beta E \max \left[V_I(\varphi', x', a, n+1), \phi K \right] \\ & + (1 - \lambda) \beta E \max \left[V_I(\varphi', x', a, n), \phi K \right] \Big\}, \end{aligned} \tag{5}$$

where expectations are taken over next period's realizations on (φ', x') given (φ, x). Equation (5) determines the optimal search and exit policies of incumbent firms. It collapses to the EEJKKT value function when $K = 0$ and/or $\phi = 0$.[24]

Given that potential entrepreneurs know the macro state x_0 and their initial productivity φ_0, they will view the value of an entry opportunity as:

$$V(\varphi_0, x_0) = \max \left[V_I(\varphi_0, x_0, 0, 0) - K, 0 \right]. \tag{6}$$

Equation (6) determines the entry policy of potential exporters.

[24] To be strictly correct, we require that exiting firms are able to "sell" their current business relationships to other firms at full value. Relaxing this assumption would have little affect on the behavior of the model but would require us to keep track of ongoing business relationships when the exit decision is characterized.

3.2 Calibration

To explore the role of firm entry costs in driving export dynamics, we now implement a quantitative version of this model. To do so we follow EEJKKT in assuming that $dG(x', \varphi', y'|x_t, \varphi_{jt}, y_{ijt})$ is characterized by a first-order vector autoregression with mutually independent variables, and we take the estimated values for this VAR from that paper. Likewise we adopt EEJKKT calibration of the remaining model parameters. This calibration is based on various cross-sectional and dynamic features of the micro data. Parameters that govern search intensity are identified by the relative frequency of firms with one foreign buyer, two foreign buyers, etc., and by the rates at which firms transit across numbers of buyers in foreign markets. The exogenous match failure rate δ and the fixed costs of maintaining a match F are identified by the rates at which buyer-seller relationships fail as a function of the age of the relationship. The parameters that characterize the relative size of the domestic and foreign markets are identified by the average share of exports in a firm's total sales. Parameters of the beta distributions for θ_j's and γ are identified by dispersions in log export volumes and log domestic sales volumes, conditioning on firm-level productivity, as well as cross-firm correlations in log total sales and log domestic sales.

For our base-case simulations, we choose the start-up capital investment to be $K = 3,000$. This figure implies a capital-output ratio of three for the average firm, which is similar to what one finds in establishment level survey data. For comparison we also generate results under the assumption that $K = 0$, implicitly assuming, as in EEJKKT, that all potential exporters have already established their productive capacity. Finally, we experiment with several values of ϕ to explore the role of scrap values. The smaller is ϕ, the less entrepreneurs recover by scrapping their firms, and the more incentive they have to remain in exports markets once they have entered.

3.3 Experiments

Our primary interest is in the effect of K and ϕ on export dynamics. When K is large and ϕ is small, we expect that firms will abstain from casual explorations of export markets, entering only when the expected long run profit stream more than covers the sunk costs of creating a firm. Also, once firms have committed to export markets, we expect them to stay in with high probability, since exiting and re-entering is costly.

To quantify these effects we first look at firms foreign market entry and exit decisions as functions of the number of successful matches (a) and unsuccessful matches ($n - a$) they have experienced in foreign markets. We do this first assuming that $K = 0$ (the EEJKKT specification), then we introduce sunk start-up costs by assuming $K = 3,000$ and $\phi = 0.3$. Finally, we examine the case of $K = 3,000$ and $\phi = 0$, which further discourages entry but also eliminates any incentive firms have to leave export markets once

they have entered.

3.3.1 Policy functions

We begin by looking at the effects of sunk start-up costs on firms' optimal search intensity, taking as given that they are already in the export market. Figure 8 presents the *change* in the search policy function $\lambda(\varphi, x, a, n)$ (left hand panels) and the change in the value of search $V_I(\varphi, x, a, n)$ (right hand panels) when we go from $K = 0$ to $K = 3,000$ and $\phi = 0.3$. The top two panels take expectations over all (φ, x) realizations; the bottom two panels characterize $\lambda(\cdot)$ and $V_I(\cdot)$ for an average value of x and a high value of φ, since high-productivity firms account for most exports, as will be seen. All panels take the cumulative number of successful matches (a) and cumulative number of unsuccessful matches $(n-a)$ as horizontal axes.

Incumbent search intensity Figure 8 confirms that sunk entry costs increase the sensitivity of firms' search intensities to the arrival of information, especially among high-productivity firms. In particular, firms that receive negative signals about the fraction of potential buyers who like their product react more dramatically when scrap values are present. This result reflects the fact that meeting potential clients generates information about θ_j, and information is particularly valuable when sunk costs create an option value to sticking around. Note that the biggest effects of sunk costs obtain for high productivity firms that have not yet acquired much experience in foreign markets.

Sunk costs and entry Let $\chi_e(\varphi_0, x_0) = 1_{V_I(\varphi_0, x_0, 0, 0) - K > 0}$ be the entry policy function defined by equation (6). Figure 9 presents the change in $\chi_e(\varphi_0, x_0)$ when start-up costs are introduced. Since potential entrants have not yet experienced successes or failures in foreign markets $(n = a = 0)$, we focus here on the relationship between initial profit determinants (φ_0, x_0) and entry decisions. Figure 8a shows that when $K = 0$ all firms always search at least a little bit in foreign markets, but when $K = 3,000$ and $\phi = 0.3$, only the highest productivity firms enter. Further, sufficiently poor market-wide conditions keep even these firms out. Figure 9 (b) confirms reducing the scrap value of firms to zero further discourages entry by reducing the expected value of creating a new firm.

Sunk costs and continuation A similar graph can be constructed to demonstrate the effect of sunk costs on persistence in export markets. Define the continuation policy function implicit in equation (5) to be $\chi_c(\varphi, x, a, n) = 1_{V_I(\varphi, x, a, n) > \phi K}$. Figure 10 shows how this function changes when we go from an environment in which $K = 0$ to an environment in which $K = 3,000$ and $\phi = 0.3$. Like figure 9, productivity φ and market-wide demand x are on the horizontal axes. However, since a different surface obtains for each a, n combination, we focus here on firms with products that are not well-loved in foreign

markets: $a = 1$, $n - a = 10$. The message is simple. Firms with unpopular products have a reason to stop searching altogether when their scrap value is positive. Only those with exceptionally high productivity find it worth their while to slog onward. Of course, even when K is large, this exit incentive goes away if $\phi = 0$. Thus orphan industry firms that face thin secondary markets for their capital stocks are likely to soldier onward in foreign markets, even when their profits are small.

Another way to visualize the effect of entry costs on export market participation is to ask: over what range of (φ, x) values would non-exporters refrain from entering, yet incumbent exporters refrain from exiting? This question can be answered by graphing the difference between the continuation policy function and the entry policy function: $\chi_c(\varphi, x, 0, 0) - \chi_e(\varphi, x)$. Figure 11 presents this difference for the case of $K = 3,000$ and $\phi = 0.3$. It shows that, while very favorable conditions are required to induce entrepreneurs to create firms (refer to Figure 9), incumbent exporters may experience large deteriorations in their productivity or in market-wide demand before they are induced to liquidate them.[25] This is the hysteresis band discussed in Dixit and Krugman (1989) and Baldwin and Krugman (1989).

3.3.2 Export trajectories

Simulation assumptions Having characterized policy functions, we are ready to explore the effects of sunk entry costs on aggregate export trajectories. To do so we simulate aggregate matching patterns (successful and unsuccessful), aggregate export trajectories, and the aggregate number of exporters for a hypothetical population of 2,000 potential exporters over a 50 year period. In the first set of simulations (case 1) we set sunk entry costs and scrap values to 0, as in the EEJKKT model. In the second set (case 2) we assume $K = 3,000$ and $\phi = 0.3$, so that sunk entry costs are important, but relatively unprofitable exporters have an incentive to liquidate their firms. Finally, in the third set (case 3) we assume $K = 3,000$ and $\phi = 0$, thereby eliminating any incentive to exit foreign markets, once in.

All three sets of trajectories are constructed using the same set of simulated realizations on (x, φ, y), which in turn is generated using the estimated transition distribution $G(x', \varphi', y'|x_t, \varphi_{jt}, y_{ijt})$ from Eaton et al (2011). Time-invariant θ_j 's are also common to the two sets of trajectories. These are drawn from the calibrated beta distributions discussed above and randomly assigned to entrepreneurs. Thus, comparing cases, the only sources of difference in outcomes are differences in K and/or in ϕ.

By assumption, entrepreneurs always know their current-period φ realization and the current macro state, x, regardless of whether they are currently operating a firm. But entrepreneurs do not know their θ_j draws ex ante—these they learn about through their foreign market experiences. Further, to highlight the role of learning, all entrepreneurs are assumed to hold pessimistic priors about the foreign

[25] Here we consider only firms that have yet to meet any potential buyers. Learning will of course change the shape of the hysteresis band.

market. Specifically although the θ_j's are drawn from a beta distribution with expected value of $\alpha/(\alpha+\beta)$, entrepreneurs with no experience in export markets assume that the θ_j's are drawn from a beta distribution with mean $0.5\alpha/(\alpha+\beta)$.

Period 0 is the first period in which exporting opportunities arise, either because of policy reforms (as in China) or because new technologies become known to domestic entrepreneurs (as in Bangladesh). Our simulations therefore begin from zero exports and characterize the emerge of a new exporting sector. Period by period, each entrepreneur endogenously creates or shuts down exporting firms as innovations in the (φ, x) process arrive, choosing optimal search intensities and updating her beliefs about her success rate (θ_j) as matches occur.

Selection and search intensity Figures 12 (a)-(c) show the aggregate numbers of successful and unsuccessful matches, $\sum_j a_{jt}$ and $\sum_j (n_{jt} - a_{jt})$, through time, for the three cases described above. Not surprisingly, experience accumulates in the foreign market much more slowly in cases 2 and 3, when start-up costs are present (note the units on the vertical axes in these graphs.) But more interestingly, the gap between unsuccessful (green line) and successful (blue line) matches is much smaller in case 2 ($K = 3,000$, $\phi = 0.3$) than in case 1 ($K = 0$). The reason is that entry costs generate selection effects. That is, as exporters with low success rates (modest θ_j values) learn their type through experience, they discover it is best drop out and collect ϕK. For this reason, as learning takes place, the population of exporters is increasingly dominated by high-productivity firms that export relatively large volumes. Case 3 ($K = 3,000$, $\phi = 0$) is different still because no exporter ever liquidates her firm when scrap values are 0. Thus although there is strong selection on productivity when entry occurs, there is no selection on product appeal (θ_j) once new firms are created. This means the gap between failure rates and success rates evolves in a manner similar to case 0.

The fact that the trajectories for case 2 and case 3 are concave upward implies that aggregate experiences accumulate at an increasing rate when sunk costs are present. In turn, this reflects the fact that the number of exporters ramps up gradually when sunk costs are present.

Total number of exporters Figure 13 shows the associated trajectories for total number of exporters. It also shows the simulated time series for market-wide shocks, x, which happens to start below low its long run expected value and evolve upward over the early sample years. Notice that without sunk start-up costs (case 1), the number of exporters is immediately close to its long-run average of around 150. However, sunk entry costs cause far fewer firms to participate initially (recall the difference in entry policies discussed above). And rapid entry takes place as market-wide demand improves, especially in the case 3, where *no one* enters at all until period 15.

Here, then, is one sense in which the need to create productive capacity can affect export dynamics. When incumbent producers already exist (case 1), they participate in foreign markets on a limited basis, even when foreign demand is limited. But when sunk entry costs are important, and productive capacity has not been created, such participation is limited (case 2) or missing altogether (case 3).

Aggregate exports Figure 14 brings the margins of response discussed above together, and shows how they translate into aggregate export trajectories for our three cases. The simulated trajectory for our market-wide demand index x is also presented.

Focussing on the first 20 years of simulated exports, note that when $K = 0$ (case 1), total exports are substantial from the beginning and they grow by about 250 percent by over the next 20 years. But when $K = 3,000$ and $\phi = 0.3$ (case 2), exports don't really take off until year 13, and thereafter grow about 200 percent over a 7 year period. The boom is phase is even more dramatic when $K = 3,000$ and $\phi = 0$, since exports begin from 0 in year 16, and reach the same aggregate levels attained in cases 1 and 2 over a 4 year period. The simple message is that start-up costs can lead to export booms driven by born-to-export firms, especially when scrap values are low.

A number of forces lie behind these patterns. As seen in Figure **??**, when $K = 0$ the number of exporters is immediately near its long run average. Accordingly, the only reasons exports grow during the early years are that x is improving and new exporters are building up their client bases. In contrast, when $K = 3,000$ and $\phi = 0.3$, low values of x during the early years discourage participation. As x improves, firms are drawn in, and those that come in are firms with relatively high productivity, so each contributes relatively dramatically to export volumes. Further, those exporters whose productivity deteriorates after entry continue to participate in foreign markets, reflecting the hysteresis effects summarized by Figure 11. Finally, sunk entry costs make the value of information relatively high, and thus induce new exporters to search for clients relatively intensively (Figure 8). All of these effects are stronger when scrap values are negligible (case 3 versus case 2) because the lack of an exit payoff makes selection on initial productivity stronger, eliminates incentives to liquidate firms, and increases the role of information by increasing the option value of incumbency.

4 Summary

Trade economists usually think about growth in manufactured exports as coming from established firms that diversify into foreign markets and/or increase the share of their output they ship abroad. But this pattern doesn't describe Bangladeshi experiences, where new exporters have typically been new firms that were born to export. These firms have survived in export markets at relatively high rates, and most

have sold all of their output abroad. The first portion of this paper documents these patterns, shows that similar but less-striking patterns appear in Chinese data, and finds the patterns to be missing in Taiwan and Colombia.

The remainder of the paper interprets these patterns. Specifically, it argues that they are not a consequence of the fact that export processing zones require firms to specialize in foreign sales (most Bangladeshi exports do not originate in EPZs). Rather the distinctive features of Bangladesh's exporting experiences can be explained by the fact that its exports have come from "orphan industries" with very limited domestic markets. Thus, when profitable exporting opportunities have arisen, entrepreneurs have been unable to exploit them by simply re-directing existing productive capacity toward foreign customers. Rather, they have needed to create new establishments.

Using a variant of the EEJKKT model, we show precisely how start-up costs can influence exporting patterns. First, when entrepreneurs must create productive capacity in order to export, only those producers who expect to sustain large export volumes are likely to enter—that is, sunk entry costs make Melitzian selection effects relatively strong. Second, new exporters are relatively likely to survive in foreign markets. This hysteresis effect obtains because firms in orphan industries cannot reorient their production to domestic consumers when they experience negative shocks to their export profits, nor can they completely recoup their investment in productive capacity by shutting down. Third, it can take an exceptionally large market-wide shock to expected exporting profits before there is much of an export response. But once such a shock has occurred, rapid export growth may follow. This last result obtains partly because potential exporters face similar entry hurdles and, without any domestic market experience, they hold similar expectations about the scope of the market for their products. Thus they are likely to enter in large numbers, if at all. It also reflects the fact that once orphan industry exporters appear, they tend to survive, devoting their entire productive capacity to foreign sales.

5 Toward policy implications

By itself, the BTE phenomenon that we document in Bangladesh is not indicative of a market failure in need of a policy response. However, in what follows we go beyond the confines of our data and our theory to make some observations about the bigger picture. We distinguish three interrelated dimensions along which to organize the discussion: lack of existing manufacturing capacity, uncertainty about profitability of new ventures and homogeneity of beliefs among entrepreneurs. We then discuss policy implications that would be suggested by reflecting on these considerations.

The lack of a domestic market, and, more generally, the absence of a developed manufacturing base, makes orphan industry exporting a particularly risky venture. First, entrepreneurs must sink substantial

investments in productive capacity in order to export, rather than simply experiment by re-directing existing production toward foreign markets. Second, they must commit these resources without the benefit of production experience or feedback from domestic consumers about the appeal of their products. Thus efforts to promote risk-pooling or venture capital markets may encourage this type of exporting.

Lacking idiosyncratic experiences in domestic markets, all potential orphan industry entrepreneurs are likely to hold similar beliefs about their prospects in export markets. Thus they are likely to move as a herdor not at allin response to market-wide shocks, be they informational (e.g. signals generated by pioneer firms) or economic (e.g. changes in trade barriers). When they do move, orphan industry entrants commit their entire capacity to foreign sales. . So these industries can generate dramatic export surges, but they can also be stubbornly unresponsive to modest export stimuli.

Finally, the fact that potential entrants are uniformly inexperienced makes them particularly sensitive to signals about market potential and best practices. As Ricardo Hausmann and Dani Rodrik have argued, this can create a coordination failure in which no entrepreneur wishes to generate information spillovers by being the pioneer entrant in an orphan industry. In the case of Bangladeshi apparel, this problem was surmounted by a joint venture between the Korean multinational Daewoo and the Bangladeshi firm Desh, which demonstrated the viability of exports and familiarized many Bangladeshi managers with production techniques and business practices. But the fact that Bangladesh has failed to diversify away from apparel suggests that it is difficult to replicate these conditions in other industries.

In terms of policy, two main issues arise. First, how can Bangladesh develop institutions that encourage exploration of new business opportunities and help spread the information gathered from it to other entrepreneurs? This does not necessarily mean moving away from apparel, at least in early stages, but may include taking advantage of capabilities developed after 30 years of experience in the foreign market for apparel. For example, Bangladesh could aim at incorporating the design and intermediaries stages of the value chain, which are mostly done by foreign parties. Making entrepreneurs in industries with little export participation familiar with successful foreign practices adopted in the apparel sector is another example.

The second issue is to recognize that the single most successful story of industrial development in Bangladesh emerged not from a particular policy of industrial or export promotion, but from private agents that exploited a business opportunity. Moreover, our analysis of EPZs suggests that, although Bangladesh has been successful in attracting new export oriented enterprises outside apparel, these still represent a tiny fraction of exports and do not seem to be sustainable, given the high level of benefits they are subject to as part of the EPZs regime and the size of the domestic market for the products they produce.

Appendix

Export processing zones

Fiscal incentives provided to firms locating in EPZs consist of a 10-year holiday for firms established before January 1, 2012, while for firms established after December 31, 2011 the tax holiday schedule is 100% for the first 2 years, 50% for the next 2 years and 25% for the following (fifth) year. Additional fiscal incentives include duty free import of construction materials, machineries, office equipment, raw materials and finished goods, and exemption from dividend, municipal and regional taxes. Further non-fiscal incentives include allowance of 100% foreign ownership, full repatriation of capital and dividends and off-shore banking for foreign owned and joint-venture firms. Plants in EPZs also enjoy higher quality of governance relative to plants outside EPZs in terms of issue of trade licenses, security and access to utilities. Moreover, specific labor regulations apply in EPZs. Minimum wages and benefits for workers are established by law, formation of labor unions is forbidden and strikes are prohibited. This is a big deal in Bangladesh where strikes are common and costly.[26]

Bangladesh's tax registration data allow us to observe exporter plants' addresses, which indicate when a plant is located in an EPZ.[27] Looking at plants' addresses we are able to identify which plants were in an EPZ at the moment of entering the tax registration database. Given the nature of tax registration data, however, we cannot identify exporters moving in and out of EPZs over time. The number of plants in EPZs changes in our data as firms enter or exit from exporting altogether.[28]

The 2008-2009 report of the Bangladesh Export Processing Zones Authority (BEPZA) identifies 305 firms operating in EPZs, of which 185 (60%) were 100% foreign owned, 48 (15%) were joint ventures and 74 (25%) were 100% local ventures. The number of exporters whose address is in an EPZ in our tax records is 460. When we merge these records with customs data we are left with 287 firms that were in an EPZ in at least one year. We are able to account for between 50% and 85% of total EPZ exports. [29]

Survey data prevent us from identifying exactly which firms are located in an EPZ. However, since we see the zip code for each manufacturing establishment in the survey, we can identify which plants are in districts where an EPZ is located. Table 11 presents some summary statistics. By 2005, 45% of surveyed plants (2,367) were located in EPZ districts, and they accounted for 67% of total employment. Of these, 628 were exporters and accounted for 74% of total exports. In contrast, in non-EPZ districts there were

[26]The government has allowed the formation of Workers Welfare Committees (WWC), however. In a WWC, workers and management representatives meet to discuss workplace related issues. In a survey of manufacturing plants, Rahman, Battacharya and Moazzem (2008) found that 21 out of 38 EPZ factories had WWC in 2006.

[27]This is indicated directly, so we do not have to infer an EPZ location by the plant's zip code, say. For example, consider the following address of a plant located in the Adamjee EPZ: "Plot-38 & 55 Aadamjee EPZ."

[28]As an example, consider a firm that was set up in 2000, then applied for a VAT in 2005 and started exporting that same year, but was not in an EPZ. Then its address in the VAT registration data would indicate the firm is not in an EPZ. We have no way of telling whether the firm moved to an EPZ in 2007, say, and continued to export.

[29]We take total EPZ exports from BEPZA official data as of 2010.

only 154 exporters out of 2,850 plants in 2005. Plants in EPZ districts tend to be larger, as total sales per plant were US$2.0 million compared to US$1.2 million for plants located in non-EPZ districts.

To further compare producers in EPZ districts with those in non-EPZ districts, we compute difference in plant characteristics within the same four-digit BSIC industry pooling all years. Table 12 reports that, on average, establishments in EPZ districts pay higher wages, sell more and employ more workers. Being located in an EPZ district does not appear to be significantly associated with differences in variable cost and labor productivity.[30] However, exporters located in an EPZ do show higher labor productivity.

Since in our EPZ districts we include two main industrial regions, Dhaka and Chittagong, where factors other than proximity to an EPZ can affect plant characteristics, we compute differences in plant characteristics excluding plants located in these two districts. The results are presented in the last three columns of Table **??**.

Table 11 also shows that EPZ districts export 77% of what is sold, compared to 58% for non-EPZ districts. Table 13 further shows that individual exporters in EPZ districts are almost fully devoted to exporting, as should be expected given EPZ regulations. Mean export intensity in EPZ districts is greater than 95% in any year of the survey. Export intensity in districts with no EPZs is lower, but still high, with plants selling 87% of their sales abroad in 2005. Moreover, around 95% of plants in EPZ districts sold more than 95% of their sales abroad in 2005, while 75% of plants in other districts did so in 2005.

The age profile of establishments in EPZ and non-EPZ districts for 2005 is described in Table 14.[31] Non-exporting establishments in EPZ districts do not seem to be significantly younger than their counterparts in non-EPZ districts. This is also the case if we focus on apparel and textiles producers, although these are 6 year older on average than establishments producing other products. However, non-apparel and apparel exporters in EPZ districts are 7 and 8 years younger on average than exporters in non-EPZ districts, respectively. A simple regression of age on EPZ districts location and exporter indicators confirms that being in an EPZ district and exporting is strongly associated to a lower establishment age (see Table 15).

[30] We define variable cost as expenditures in raw materials, energy use and employment cost divided by gross output. Labor productivity is defined as gross output over number of workers. Both variables are constructed only for 1999 and 2005 since we do not have data on gross output for 2001.

[31] 2005 is the only survey year for which we have the year of start-up, from which we compute establishment age.

Table 1: Contribution of pairwise entry and exit to the growth of exports between t and $t-1$.

		Pairwise continuing			Pairwise entering			Pairwise exiting		
Year (t)	Growth	Share in $t-1$	Growth	Contribution	Added firms	Rel. exports	Contribution	Dropped firms	Rel. exports	Contribution
	(1)	(2)	(3)	(2)×(3)/(1)	(5)	(6)	[(5) + (6)]/(1)	(8)	(9)	[(8) + (9)]/(1)
Bangladesh (apparel and textiles)										
Annual Average	15.0	96.5	11.1	72.7	25.9	-20.3	38.9	-17.0	15.7	-11.6
2004-2009	71.9	70.8	44.7	44.0	63.5	-14.2	68.6	-25.9	16.8	-12.6
Colombia (apparel and textiles)										
Annual average	8.5	95.6	8.5	91.9	45.2	-40.6	36.4	-39.3	35.1	-28.3
2000-2006	50.2	79.2	53.6	84.5	78.7	-54.0	49.2	-50.9	34.0	-33.7
China (apparel and textiles)										
Average 2000-2006	25.8	91.8	16.6	58.5	38.7	-25.2	56.8	-15.1	12.2	-15.4
2000-2006	130.4	30.1	44.5	10.3	131.4	-3.0	98.5	-19.2	7.8	-8.8
China (electronics, machinery and equipment)										
Average 2000-2006	31.6	95.9	27.2	81.6	40.8	-33.9	23.7	-14.7	13.4	-5.3
2000-2006	148.8	45.2	109.4	33.3	117.2	-12.8	70.2	-12.6	7.5	-3.4

Note: Pairwise continuing firms in year t are those that exported in $t-1$ and t. Pairwise entering firms in t are those that exported in t but not in $t-1$. Pairwise exiting firms in t are those that exported in $t-1$ but not in t. Percentage contribution of each group to the growth of total exports is reported in columns 4, 7 and 10. All computations use values in USD.

Table 2: Firms by initial export year cohorts. Apparel and textiles, Bangladesh.

Year	Cohort						Total
	2004	2005	2006	2007	2008	2009	
A. Number of firms							
2004	3,197						3,197
2005	2,654	830					3,484
2006	2,406	567	967				3,940
2007	2,239	501	601	1,183			4,524
2008	2,083	435	511	825	1,026		4,880
2009	1,906	400	454	682	663	971	5,076
B. Value of exports (USD million)							
2004	6,660						6,660
2005	7,797	999					8,796
2006	8,521	866	419				9,806
2007	9,055	1,043	1,040	416			11,554
2008	9,447	1,147	1,269	1,151	365		13,380
2009	9,006	1,162	1,374	1,406	829	358	14,135
C. Exports per firm (USD million)							
2004	2.1						2.1
2005	2.9	1.2					2.5
2006	3.5	1.5	0.4				2.5
2007	4.0	2.1	1.7	0.4			2.6
2008	4.5	2.6	2.5	1.4	0.4		2.7
2009	4.7	2.9	3.0	2.1	1.2	0.4	2.8

Note: a firm is classified as belonging to cohort x if the firm first reported exporting in year x. If a cohort x firm exits in a given year and re-enters in the future, it is still treated as belonging to cohort x. Altering this classification to allow firms to switch cohorts as they re-enter does not significantly change the results.

Table 3: Firms by initial export year cohorts. Apparel and textiles, China.

Year	Cohort							Total
	2000	2001	2002	2003	2004	2005	2006	
A. Number of firms								
2000	13,644							13,644
2001	11,040	4,177						15,217
2002	9,475	3,195	6,393					19,063
2003	8,507	2,804	5,299	8,790				25,400
2004	7,630	2,462	4,649	7,154	13,539			35,434
2005	6,852	2,242	4,183	6,090	10,368	14,981		44,716
2006	6,114	1,991	3,803	5,334	8,745	11,566	20,063	57,616
B. Value of exports (USD million)								
2000	25,672							25,672
2001	26,128	2,103						28,231
2002	25,490	4,807	3,842					34,139
2003	26,611	5,831	9,238	6,059				47,739
2004	27,172	6,159	10,634	13,398	9,012			66,375
2005	26,919	6,385	11,972	15,844	18,508	9,501		89,129
2006	27,095	6,822	13,005	16,529	20,357	20,061	17,923	121,791
C. Exports per firm (USD million)								
2000	1.9							1.9
2001	2.4	0.5						1.9
2002	2.7	1.5	0.6					1.8
2003	3.1	2.1	1.7	0.7				1.9
2004	3.6	2.5	2.3	1.9	0.7			1.9
2005	3.9	2.8	2.9	2.6	1.8	0.6		2.0
2006	4.4	3.4	3.4	3.1	2.3	1.7	0.9	2.1

Note: a firm is classified as belonging to cohort x if the firm first reported exporting in year x. If a cohort x firm exits in a given year and re-enters in the future, it is still treated as belonging to cohort x. Altering this classification to allow firms to switch cohorts as they re-enter does not significantly change the results.

Table 4: Firms by initial export year cohorts. Electronics, machinery and equipment, China.

Year	Cohort							Total
	2000	2001	2002	2003	2004	2005	2006	
A. Number of firms								
2000	12,517							12,517
2001	10,166	4,589						14,755
2002	8,919	3,360	6,806					19,085
2003	8,204	2,965	5,532	9,597				26,298
2004	7,577	2,690	4,868	7,608	14,518			37,261
2005	6,959	2,445	4,413	6,679	11,011	16,696		48,203
2006	6,369	2,228	4,034	5,994	9,394	12,787	22,912	63,718
B. Value of exports (USD million)								
2000	60,637							60,637
2001	66,482	4,044						70,526
2002	81,134	10,422	5,750					97,306
2003	103,176	21,838	20,469	10,154				155,637
2004	130,074	28,444	34,113	28,121	14,553			235,306
2005	154,491	30,242	42,812	35,270	38,628	16,146		317,590
2006	165,859	31,668	48,724	43,733	58,452	43,368	21,466	413,270
C. Exports per firm (USD million)								
2000	4.8							4.8
2001	6.5	0.9						4.8
2002	9.1	3.1	0.8					5.1
2003	12.6	7.4	3.7	1.1				5.9
2004	17.2	10.6	7.0	3.7	1.0			6.3
2005	22.2	12.4	9.7	5.3	3.5	1.0		6.6
2006	26.0	14.2	12.1	7.3	6.2	3.4	0.9	6.5

Note: a firm is classified as belonging to cohort x if the firm first reported exporting in year x. If a cohort x firm exits in a given year and re-enters in the future, it is still treated as belonging to cohort x. Altering this classification to allow firms to switch cohorts as they re-enter does not significantly change the results.

Table 5: Firms by initial export year cohorts. Apparel and textiles, Colombia.

Year	Cohort							Total
	2000	2001	2002	2003	2004	2005	2006	
A. Number of firms								
2000	2,079							2,079
2001	1,495	983						2,478
2002	1,271	449	869					2,589
2003	1,152	338	396	1,069				2,955
2004	1,128	298	321	390	1,523			3,660
2005	929	204	192	273	313	1,005		2,916
2006	861	179	169	215	227	585	616	2,852
B. Value of exports (USD million)								
2000	893							893
2001	901	47						948
2002	756	38	23					817
2003	852	42	28	31				953
2004	1,039	73	50	51	84			1,297
2005	1,142	69	55	57	39	41		1,403
2006	1,204	59	55	41	39	67	27	1,492
C. Exports per firm (USD million)								
2000	0.43							0.43
2001	0.60	0.05						0.38
2002	0.59	0.08	0.03					0.32
2003	0.74	0.12	0.07	0.03				0.32
2004	0.92	0.24	0.16	0.13	0.06			0.35
2005	1.23	0.34	0.29	0.21	0.12	0.04		0.48
2006	1.40	0.33	0.33	0.19	0.17	0.11	0.04	0.52

Note: a firm is classified as belonging to cohort x if the firm first reported exporting in year x. If a cohort x firm exits in a given year and re-enters in the future, it is still treated as belonging to cohort x. Altering this classification to allow firms to switch cohorts as they re-enter does not significantly change the results. Figures based on EEKT (2008).

Table 6: Age when entering foreign markets.

	Apparel and textiles		Electronics and machinery		Other sectors	
	Mean	Median	Mean	Median	Mean	Median
Bangladesh	1.8	0.0	-	-	2.1	0.2
China	6.8	5.0	6.5	4.3	7.3	4.7
Colombia	11.9	7.9	-	-	14.4	10.6
Taiwan	11.9	10.7	7.2	4.7	-	-

Note: figures are annual averages as follows: Bangladesh (2005-2009), China (2001-2006), Colombia (1983-1989) and Taiwan (2002-2004). Age at entry for an exporter is determined by the year it entered an export cohort and the date of tax registration (for Bangladesh) or firm start up (for Colombia, China and Taiwan).

Table 7: Product specialization (selected products), Bangladesh (2005).

Product	Export intensity	% of total exports	% of total domestic sales
Woollen jumpers	100.0	3.7	0.0
Plastic buttons	100.0	0.1	0.0
Garments, all types	99.4	62.8	0.4
Cotton yarn, up to 10 ccounts	43.5	0.4	0.6
Cloth and cotton fabrics	40.7	1.4	2.2
Knitted or crocheted fabrics	9.5	0.0	0.1
Lungi or tahband	0.0	0.0	0.8
Silk sarees	0.0	0.0	0.2
Dhoties and sarees	0.0	0.0	2.3
Men's leather boots and shoes	8.3	0.2	2.7
Iron and steel, rods and bars	0.0	0.0	9.1
Motorcycles	0.0	0.0	8.6
Ordinary brick	0.0	0.0	6.5
Parboiled rice, polished	0.0	0.0	6.5
Cigarettes	1.7	0.1	6.2

Note: based on survey data from the Bangladesh Bureau of Statistics, applying firms sample weights to construct aggregate figures. Export intensity is defined as the share of exports in total sales. Products are selected from the larger sample included in the survey and hence columns 2 and 3 do not add up to 100%.

Table 8: Exporters in export processing zones (EPZ), Bangladesh, 2004-2009.

	2004	2005	2006	2007	2008	2009
			Plants in EPZs			
Exports (US$ million)	775	1,551	1,099	1,277	1,422	1,594
Apparel and textiles	698	1,466	1,009	1,182	1,340	1,500
Number of plants	146	169	168	210	213	238
Apparel and textiles	94	110	122	151	153	163
Number of products	338	340	360	378	389	418
Number of destinations	88	82	93	87	98	96
Exports per plant (US$ million)	5.3	9.2	6.5	6.1	6.7	6.7
Apparel and textiles	7.4	13.3	8.3	7.8	8.8	9.2
			Plants outside EPZs			
Exports (US$ million)	6,865	8,329	9,839	11,832	13,360	14,035
Number of plants	4,542	4,960	5,034	5,827	6,257	6,469
Number of products	1,334	1,425	1,459	1,400	1,449	1,532
Number of destinations	172	171	178	186	182	185
Exports per plant (US$ million)	1.5	1.7	2.0	2.0	2.1	2.2
EPZ exports (% of total)	10.1	15.7	10.0	9.7	9.6	10.2
Data as % of BEPZA	50.0	84.5	53.3	52.6	55.1	56.5

Notes: source is Bangladesh customs and tax registration data. Location in an EPZ is determined by the address of the plant. Last row computes EPZ exports in our data (the one to last row) as a percentage of total EPZ exports as reported by BEPZA.

Table 9: Plant age by EPZ status, Bangladesh, 2009.

	Age		Age at entry	
	Mean	Median	Mean	Median
Non-textiles				
Non-EPZ	6.39	4.81	1.94	0
	(0.13)		(0.17)	
EPZ	7.29	6.50	2.00	1
	(0.47)		(0.75)	
Apparel and textiles				
Non-EPZ	6.74	5.09	2.00	1
	(0.08)		(0.13)	
EPZ	7.41	6.03	1.92	1
	(0.37)		(0.57)	

Notes: source is Bangladesh customs and tax registration data. Location in an EPZ is determined by the address of the firm. Apparel and textiles sector are HS 2-digit codes 42, 43 and 50-65.

Table 10: Born to export plants, by EPZ status, 2004-2009.

	2004	2005	2006	2007	2008	2009
Plants in EPZs						
No. of BTE plants	39	54	52	80	81	98
% of total	26.7	32.0	31.0	38.1	38.0	41.2
Exports (US$ million)	37.4	725.1	114.7	196.8	311.3	370.0
% of total	4.8	46.8	10.4	15.4	21.9	23.2
% apparel and textiles	55.2	97.8	90.2	88.7	92.7	94.4
Plants outside EPZs						
No. of BTE plants	1,093	1,601	1,907	2,542	2,922	3,179
% of total	24.1	32.3	37.9	43.6	46.7	49.1
Exports (US$ million)	601.5	1,295.1	2,078.8	2,895.5	3,684.6	4,311.2
% of total	8.8	15.5	21.1	24.5	27.6	30.7
% apparel and textiles	84.3	86.4	91.1	90.0	93.0	91.2

Notes: source is Bangladesh customs and tax registration data. Location in an EPZ is determined by the address of the firm. Born to export (BTE) plants are defined as plants that began to export within 1 year or less from start-up. Apparel and textiles sector are HS 2-digit codes 42, 43 and 50-65.

Table 11: Characteristics of EPZ districts, by survey year.

	1999	2001	2005
	Plants in EPZs districts		
Number of plants	1,247	1,583	2,367
Number of exporters	750	824	628
Exports (US$ million)	1,833.8	1,688.2	2,402.6
Total sales	3,021.3	2,843.0	4,790.0
Employment	514,345	470,185	600,917
Exports/Total sales (%)	60.7	59.4	50.2
Sales per plant (US$ million)	2.4	1.8	2.0
	Plants outside EPZs districts		
Number of plants	2,464	2,864	2,850
Number of exporters	90	128	154
Exports (US$ million)	298.5	461.9	1,688.3
Total sales (US$ million)	976.9	1,228.8	3,357.2
Employment	232,449	222,188	300,171
Exports/Total sales (%)	30.6	37.6	50.3
Sales per plant (US$ million)	0.4	0.4	1.2
EPZ exports (% of total)	91.0	86.0	73.9
EPZ employment (% of total)	68.9	67.9	66.7

Notes: EPZ districts are those districts in which there is an EPZ. It is not necessarily the case that all establishments in these districts are in fact located in an EPZ.

Table 12: Establishment characteristics among EPZ and non-EPZ districts.

	All districts			Dhaka & Chittagong excluded		
Plant characteristic	EPZ	Exporter and EPZ	Observations	EPZ	Exporter and EPZ	Observations
Variable cost	−0.011	0.033	8,906	0.019	−0.012	6,095
	(−0.023)	(−0.037)		(−0.034)	(−0.098)	
Labor productivity	−0.023	0.437*	8,904	−0.212*	0.696*	6,094
	(−0.035)	(−0.057)		(−0.049)	(−0.138)	
Employment	0.119*	0.660*	13,371	−0.012	0.641*	9,141
	(−0.024)	(−0.039)		(−0.034)	(−0.085)	
Total sales	0.163*	0.923*	12,650	−0.072	1.149*	8,659
	(−0.040)	(−0.066)		(−0.053)	(−0.133)	
Wage	0.081*	−0.002	13,330	0.024	0.045	9,101
	(−0.018)	(−0.028)		(−0.024)	(−0.060)	
Fixed assets	−0.136*	0.901*	13,356	−0.304*	1.221*	9,136
	(−0.042)	(−0.067)		(−0.056)	(−0.141)	

Notes: standard errors in parenthesis. Differences are obtained from a regression of the form $\ln Y_{ij} = \beta_0 + \beta_1 EPZ_{ij} + \beta_2 EX_{ij}^{EPZ} + I_j + \varepsilon_{ij}$, where i indexes plants, j indexes four-digit BSIC industries; EPZ are plants in EPZ districts, and EX^{EPZ} are exporters in EPZ districts; I are industry dummies and Y is the plant characteristic. *,** and + indicate significance at the 1%, 5% and 10% level, respectively.

Table 13: Export intensity (X/Y) for exporters in EPZ districts.

	Mean X/Y			% with $X/Y \geq 95\%$		
	1999	2001	2005	1999	2001	2005
Non-EPZ	82.3	75.9	87.1	66.7	58.6	75.3
EPZ	97.0	97.0	96.4	94.1	94.1	94.8

Note: Export intensity is defined as exports as a share of total sales.

Table 14: Age of establishments by EPZ and export status.

	Non-exporters		Exporters	
	Mean	Median	Mean	Median
	Non-apparel and textiles producers			
Non-EPZ	13.2	10	19.5	14.5
EPZ	13.1	9	12.5	6
	Apparel and textiles producers			
Non-EPZ	19.3	13	17.1	10.5
EPZ	18.9	18	9.1	8

Note: Age is computed using the year of start of operations.

Table 15: Establishment age differences between EPZ and non-EPZ districts.

	All districts	Dhaka & Chittagong excluded
Located in EPZ district	0.236	0.905
	(−0.670)	(−0.876)
Exporter	5.563*	5.794*
	(−1.765)	(−1.983)
Exporter in an EPZ district	−5.173**	−14.207*
	(−2.080)	(−4.368)
Constant	27.764**	27.095**
	(−12.99)	(−13.348)
Observations	3,086	2,592

Notes: standard errors in parenthesis. Age differences are obtained from a regression of the form $A_{ij} = \beta_0 + \beta_1 EPZ_{ij} + \beta_2 EX_{ij} + \beta_3 EX_{ij}^{EPZ} + I_j + \varepsilon_{ij}$, where i indexes plants, j indexes four-digit BSIC industries; EPZ are plants in EPZ districts, EX are exporters, and EX^{EPZ} are exporters in EPZ districts; I are industry dummies and A is establishment age. *,** and $^{+}$ indicate significance at the 1%, 5% and 10% level, respectively.

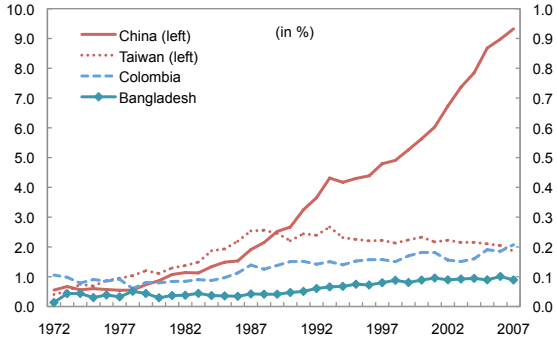
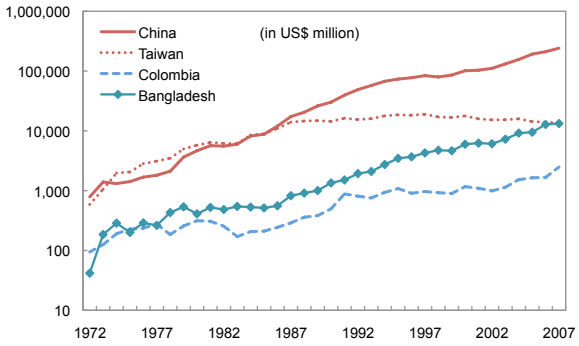
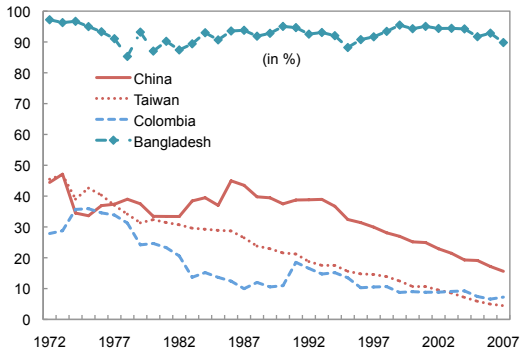


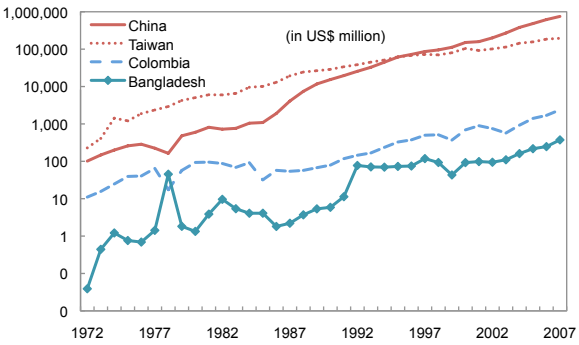
Figure 1. Share of world manufacturing exports, Bangladesh, China, Colombia and Taiwan, 1972-2007.



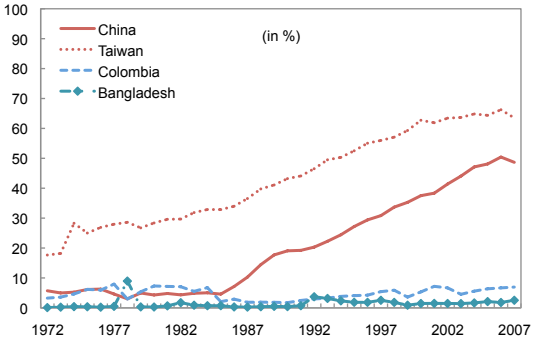
(a) Exports of apparel and textiles (logs).



(b) Apparel share in total exports.

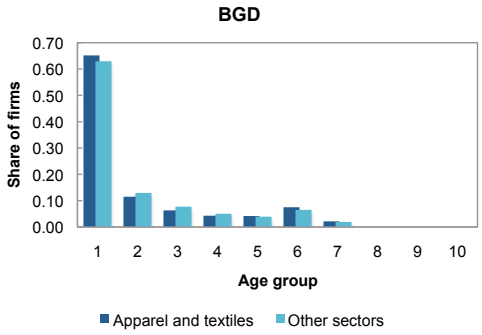


(c) Exports of machinery and equipment.

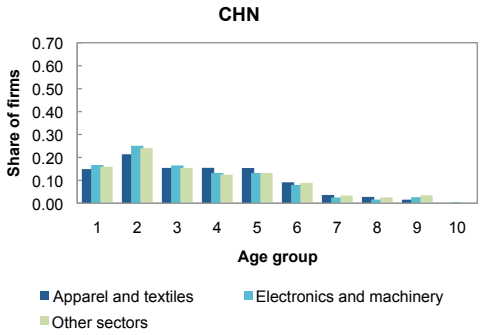


(d) Machinery share in total exports.

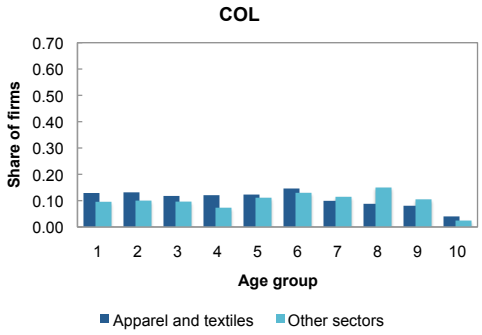
Figure 2. Export dynamics, Bangladesh, China, Colombia and Taiwan, 1972-2007.



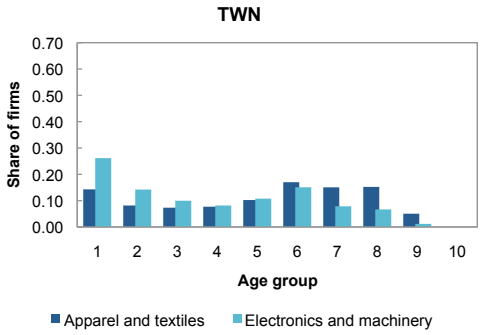
(a) Bangladesh, 2004-2009 average.



(b) China, 2000-2006 average.

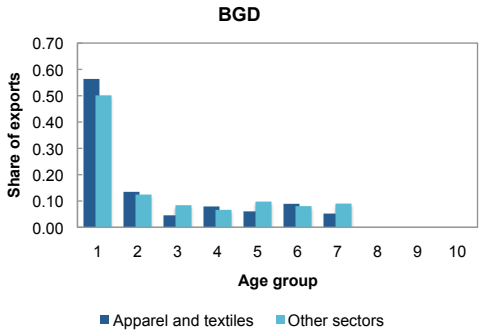


(c) Colombia, 1981-1989 average.

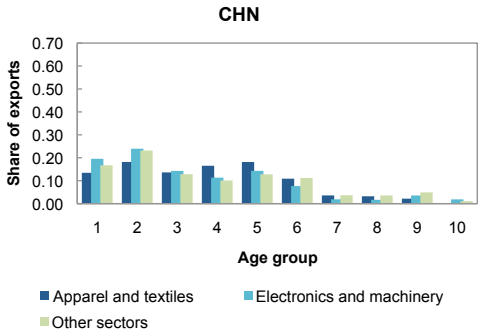


(d) Taiwan, 2000-2004 average.

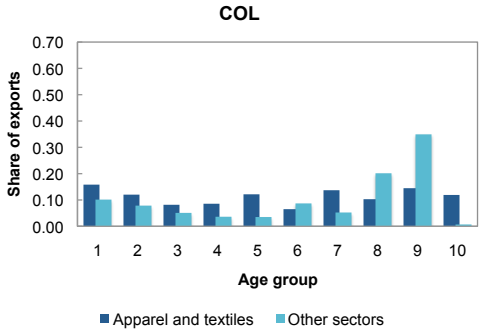
Figure 3. Share of firms in each age group in the first year of an export cohort.



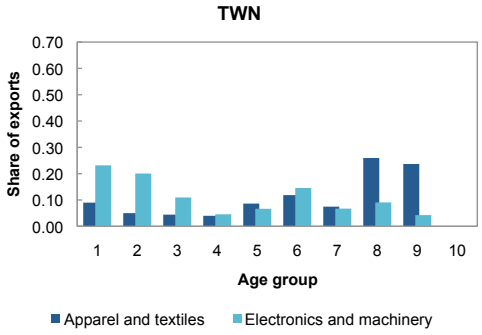
(a) Bangladesh, 2004-2009 average.



(b) China, 2000-2006 average.

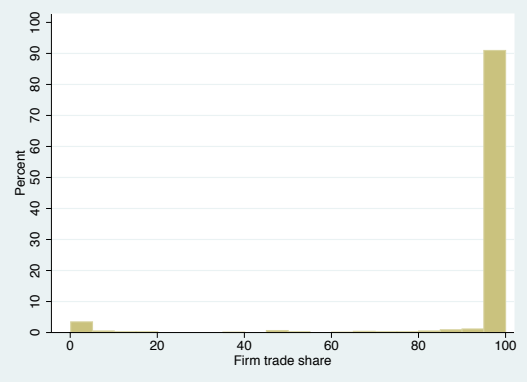


(c) Colombia, 1981-1989 average.

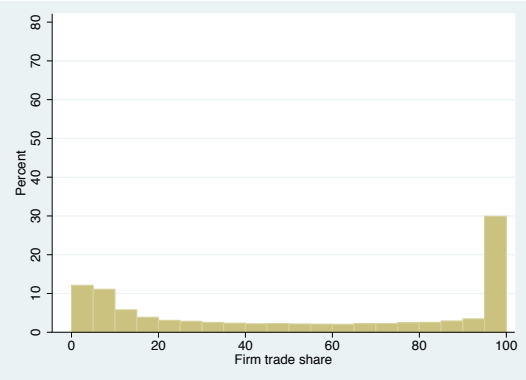


(d) Taiwan, 2000-2004 average.

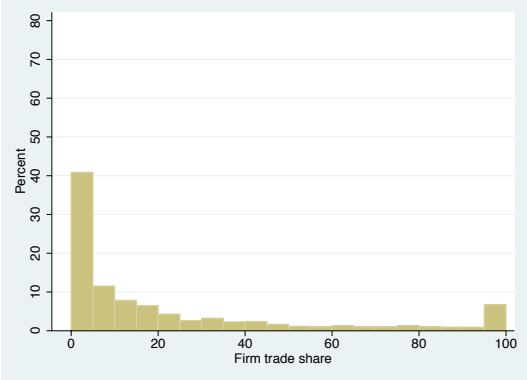
Figure 4. Share of total exports by age group in the first year of an export cohort.



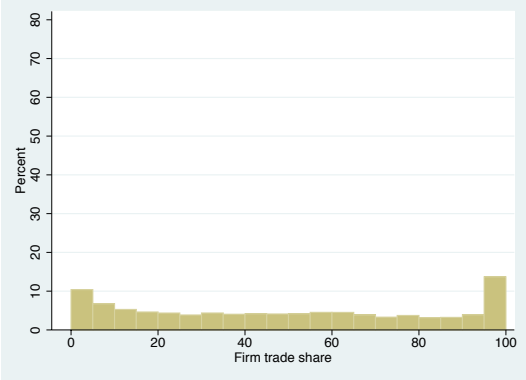
(a) Bangladesh (2005).



(b) China (2006).



(c) Colombia (1989).



(d) Taiwan (2004).

Figure 5. Composition of exporters by trade shares at the firm level.

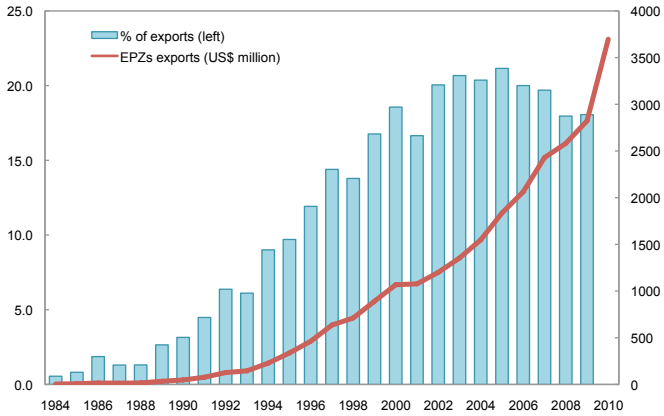


Figure 6. Exports from EPZs, Bangladesh, 1984-2009.

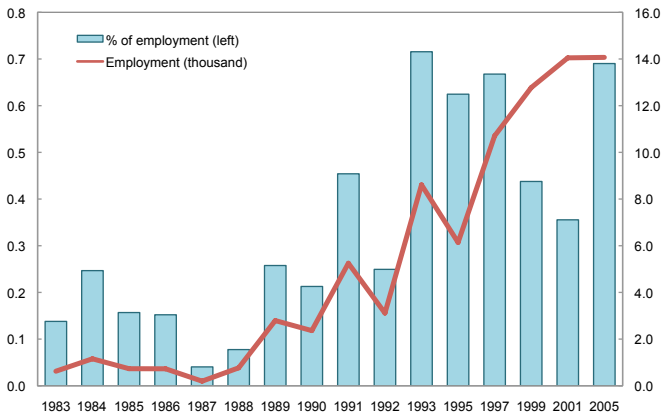
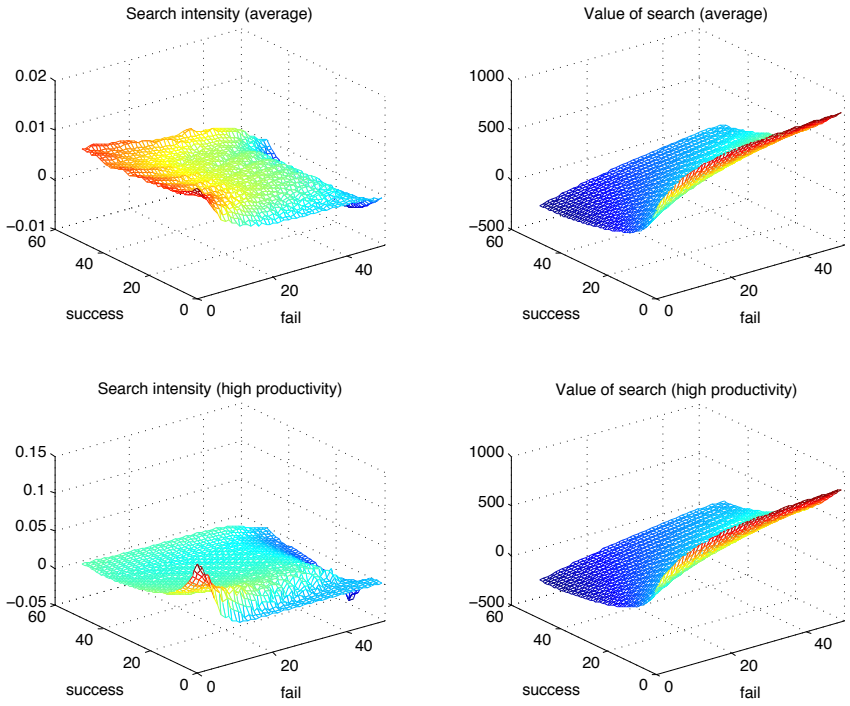
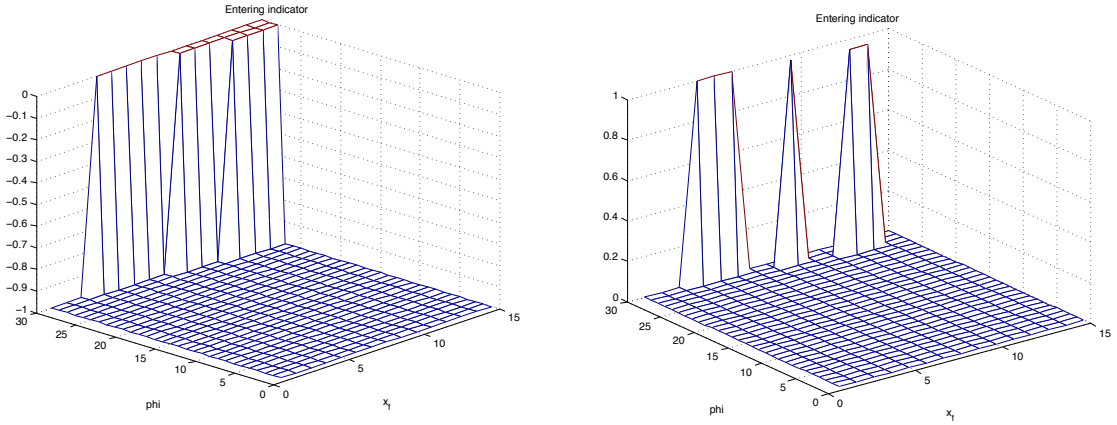


Figure 7. Employment in EPZs, Bangladesh, 1983-2005.



(a) Policy and value functions.

Figure 8. Differences in policy and value functions ($K = 3,000 - K = 0$).



(a) $K = 3,000 - K = 0$

(b) $K = 3,000$, $\phi = 0.3 - \phi = 0$

Figure 9. Entering indicator (difference).

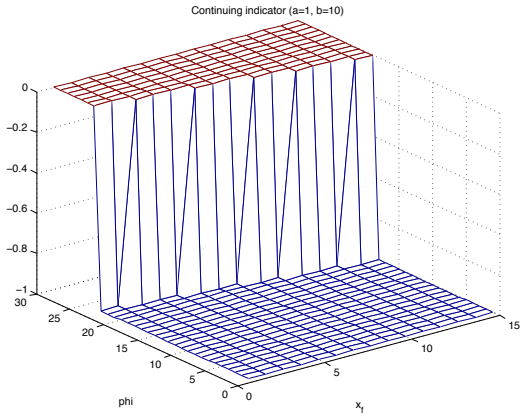


Figure 10. Continuing indicator (difference).

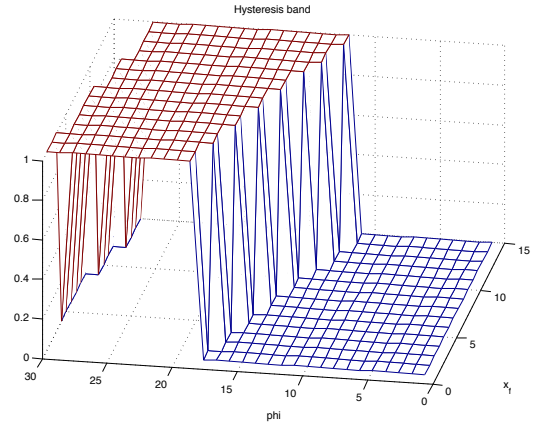
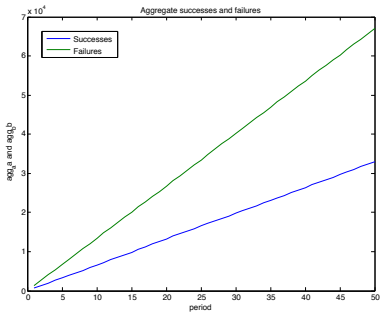
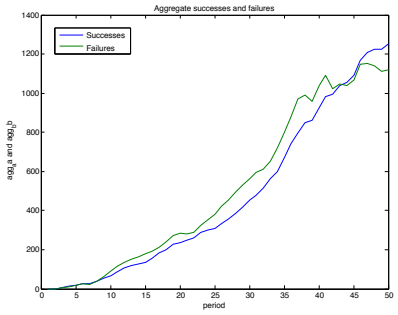


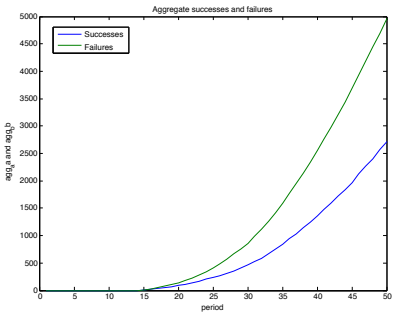
Figure 11. Hysteresis band, $K = 3,000, \phi = 0.3$.



(a) $\gamma = 0, K = 0$



(b) $\gamma = 0, K = 3000, \phi = 0.3$



(c) $\gamma = 0, K = 3000, \phi = 0$

Figure 12. Aggregate successes and failures.

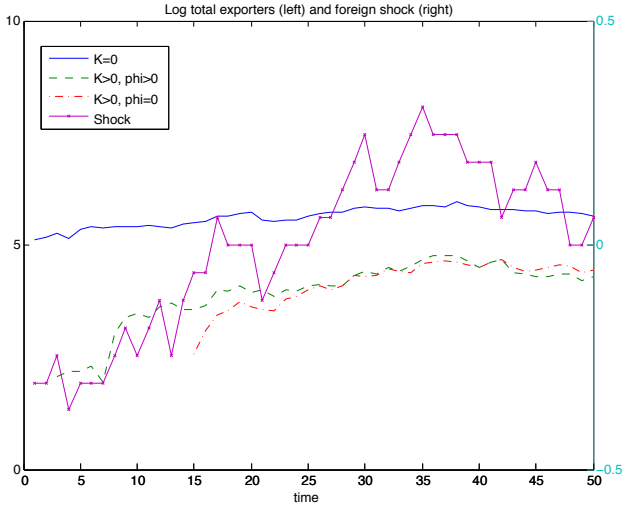


Figure 13. (Log of) Total exporters and foreign shock trajectories.

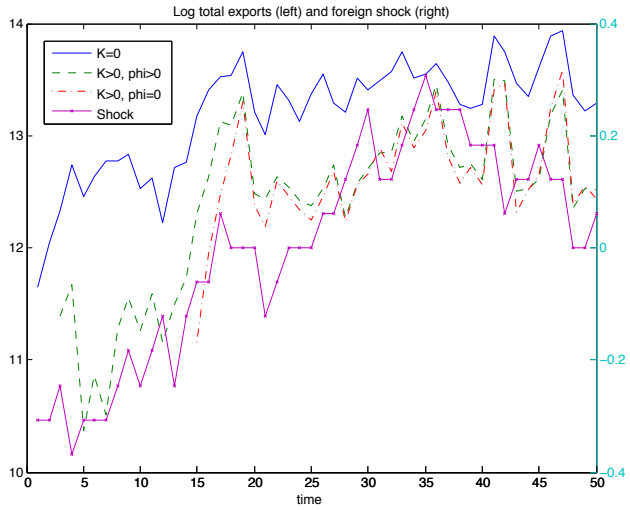


Figure 14. (Log of) Total exports and foreign shock trajectories.

References

Aggarwal, Aradhna (2005). "Performance of Export Processing Zones: A Comparative Analysis of India, Sri Lanka and Bangladesh", ICRIER Working Paper No. 155.

Albornoz, Facundo; Calvo-Pardo, Hector; Corcos, Gregory; and Emmanuel Ornelas (2010). "Sequential Exporting" forthcoming, *Journal of International Economics*.

Bai, Xue; Krishna, Kala and Hong Ma (2011a). "Self Inflicted Wounds? China's Restrictions on Direct Exporting" Mimeo.

Bai, Xue; Krishna, Kala and Hong Ma (2011b). "Export Modes and Productivity". Mimeo.

Baldwin, Richard. E. and Paul Krugman (1989). "Persistent Trade Effects of Large Exchange Rate Changes." *Quarterly Journal of Economics*, 104, 635-654.

Bangladesh Bureau of Statistics (2010). "Foreign Trade Statistics of Bangladesh 2008-9."

Bernard, Andrew and J. Bradford Jensen (1999). "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics,* 47 (1), pp. 1-25.

Cherkashin, Ivan, Svetlana Demidova, Hiau Looi Kee and Kala Krishna (2010). "Firm Heterogeneity and Costly Trade: A New Estimation Strategy and Policy Experiments," NBER Working Paper 16557.

Brambilla, Irene; Khandelwal, Amit and Peter Schott (2007). "China's Experience under the Multifibre Arrangement (MFA) and the Agreement on Textile and Clothing (ATC)."

Dayarathna-Banda, O.G. and John Whalley (2007). " After the MFA, the CCAs,". The Centre for International Governance Innovation Working paper No 24. www.cigionline.org

Dixit, Avinish (1989). "Hysteresis, Import Penetration, and Exchange Rate Pass-Through," *Quarterly Journal of Economics*, Vol. 104, No. 2 (May), pp. 205-228.

Eaton, Jonathan, Marcela Eslava, Maurice Kugler and James Tybout (2008). "The Margins of Entry into Export Markets: Evidence from Colombia," in Elhanan Helpman, Dalia Marin, and Thiery Verdier (eds.), *The Organization of Firms in a Global Economy*, Cambridge, MA: Harvard University Press.

Eaton, Jonathan, Samuel Kortum and Francis Kramarz (2011). "An Anatomy of International Trade: Evidence from French Firms," *Econometrica,* 79 (5), pp. 1453-1498.

Eaton, Jonathan, Marcela Eslava, David Jinkins, C. J. Krizan, Maurice Kugler and James Tybout (2012). "A Search and Learning Model of Export Dynamics," mimeo.

Feenstra, Robert C., Robret E. Lipsey, Haiyan Deng, Alyson C. Ma and Hengyong Mo (2005). "World Trade Flows: 1962-2000," NBER Working Paper 11040.

Gebreeyesus, Mulu and Michiko Iizuka (2010). "Discovery of the Flower Industry in Ethiopia: Experimentation and Coordination," UNU-MERIT Working Paper 2010-025.

Handley, Kyle and Nuno Limao (2010). "Trade and Investment under Policy Uncertainty: Theory and Firm Evidence". Mimeo. University of Maryland.

China Textile University and Harvard Center of Textile and Apparel Research (1999). *The Development of the China Apparel Industry.*

Iizuka, Michiko (2009). "Standards as a Platform for Innovation and Learning in the Global Economy; a Case Study of the Chilean Salmon Farming Industry," *International Journal of Technological learning, Innovation and Development*, 2(4): 274-293.

Impullitti, Giammario, Alfonso Irarrazabal, and Luca David Opromolla (2012). "A Theory of Entry into and Exit from Export Markets," mimeo, Cambridge University.

Katz, Jorge (2006). "Salmon Farming in Chile", in Chadra, V. (ed.): Technology, Adaptation and Exports: How Some Developing Countries Got It Right. Washington, DC: The World Bank.

Krishna, Kala and Yelena Sheveleva (2011). "Wheat or Strawberries? Intermediated Trade with Limited Contracting," mimeo.

Lederman, Daniel, Andrés Rodríguez-Clare and Daniel Yi Xu (2011). "Entrepreneurship and the Extensive Margin in Export Growth: A Microeconomic Accounting of Costa RicaÕs Export Growth during 1997-2007," mimeo.

Lu, Dan (2010). "Exceptional Exporter Performance? Evidence from Chinese Manufacturing Firms", Job Market Paper, University of Chicago.

Méndez, José A. (1991). "The Development of the Colombian Cut Flower Industry," World Bank Policy Research Working Paper Series, 660.

Mostafa, Romel and Steven Klepper (2009). "Industrial Development through Tacit Knowledge Seeding: Evidence from the Bangladesh Garment Industry," Working Paper, Department of Social and Decision Sciences, Carnegie Mellon University.

Nguyen, Daniel X. (2012). "Demand Uncertainty: Exporting Delays and Exporting Failures," *Journal of International Economics,* 86: 336-344.

Rhee, Yung Whee, and Therese Belot (1990). "Export Catalysts in Low-Income Countries: A Review of Eleven Success Stories," World Bank Discussion Paper 72.

Rodrik, Dani and Ricardo Hausmann (2003). "Economic Development as Self-Discovery," *Journal of Development Economics*, 72 (2), 603-633.

World Bank (2011). *Doing Business Rankings* Washington, D.C.: The World Bank.

The International Growth Centre (IGC) aims to promote sustainable growth in developing countries by providing demand-led policy advice based on frontier research.

Find out more about
our work on our website
www.theigc.org

For media or communications
enquiries, please contact
mail@theigc.org

Subscribe to our newsletter
and topic updates
www.theigc.org/newsletter

Follow us on Twitter
@the_igc

Contact us
International Growth Centre,
London School of Economic
and Political Science,
Houghton Street,
London WC2A 2AE

IGC
International
Growth Centre

DIRECTED BY
LSE
UNIVERSITY OF OXFORD

FUNDED BY
UKaid
from the British people

Designed by soapbox.co.uk