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Foreign Direct Investment and Industrial Restructuring
The Case of Taiwan's Textile Industry

Tain-Jy Chen and Ying-Hua Ku

11.1 Introduction

Whether or not foreign direct investment (FDI) causes domestic industry to "hollow out" (deindustrialize) is a question that has long been debated in the literature but that remains unanswered. The debate has focused on the relation between FDI on the one hand and employment and exports on the other. Some argue that FDI creates jobs at the headquarters, which provides technical and managerial services to overseas subsidiaries (Lipsey 1995). FDI may even protect unskilled jobs at home if skill-intensive work like R&D is conducted abroad (Blomström, Fors, and Lipsey 1997). FDI also enables investing companies to preserve export market shares that would otherwise be lost to local competition or competition from low-wage countries (Lipsey and Weiss 1984). Others argue that FDI is tantamount to industry dislocation and the export of jobs from home (Bluestone and Harrison 1982).

In this paper, we take a direct look at the relation between FDI and the domestic industrial structure. Following Mucchielli and Saucier (1997), we view FDI as a Schumpeterian innovation whereby industrial production is reorganized across borders in order to gain a competitive edge. Indeed, Schumpeter called "the conquest of a new source of supply of raw materials or half-manufactured goods" (1934, 66) an innovation. Since any innovation is a "constructive destruction" process, it inevitably has some impact on the domestic industry, benefiting some firms and factories while hurting others. Therefore, it should not be surprising if FDI brings about

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some redistribution in the economy. And like any successful innovation, successful FDI creates transitory profits for the innovators, tempting their competitors to follow suit until profits are completely dissipated.

If FDI is something innovative that brings competitive advantages to the investors, firms that choose not to follow suit must come up with some counterinnovations at home or risk losing their market shares and consequently their workforce. Therefore, FDI by an individual firm is likely to have an extensive impact on the whole industry through innovations and counterinnovations. The key to understanding how FDI may affect the domestic industry, therefore, lies in an exploration of the nature of the restructuring associated with FDI-induced innovations.

Industrial restructuring associated with FDI may occur on three different levels. First, some firms may introduce new product lines to replace old ones transplanted overseas. This is done in an effort to exploit the power of their firm-specific assets, which are often embodied in their employees, especially in the skilled ones. Laying off workers runs the risk of leaking special know-how to competitors. Therefore, arrangements will be made to deploy workers to new production units. Usually, such a placement plan is well thought out before a foreign investment project is undertaken. This is the case of intrafirm restructuring.

Second, relocated overseas production may be linked forward or backward to domestic industries (Rodríguez-Clare 1996). Through this linkage, overseas production may nourish downstream or upstream industries at home. This is intraindustry restructuring. The key to this type of restructuring is vertical integration between home and overseas production. Involved in intraindustry restructuring may be intrafirm transactions or interfirm linkages. Most multinational firms prefer to source from their home markets, particularly the headquarters, to reduce adjustment costs in overseas production. This provides the impetus for intraindustry restructuring.

Third, the resources released from the relocated industries may be channeled to new industries. This follows from the classical assertion that resources find their own way toward full employment. When one industry declines, other industries take its place automatically in accord with the country's comparative advantages. This is intersectoral, or economywide, restructuring.

In this paper, we study only intrafirm restructuring, using the case of Taiwan's textile industry as an example. The study shows that firms that undertook FDI gained market share and employment share at home relative to firms that did not. Loss of employment in Taiwan's textile industry was mainly attributable to the exit of failing firms rather than to FDI. All firms responded to rising labor costs in Taiwan by increasing specialization, but those engaged in FDI proceeded further. FDI firms also switched

their major product lines more frequently and changed overall product composition more extensively than their non-FDI firm counterparts. The evidence suggests that FDI accelerates the restructuring process, which is probably inevitable under prevailing macroeconomic conditions. Firms that choose to make overseas investments also choose a fast track for restructuring and take high jumps over technological hurdles, while those choosing not to engage in overseas production choose a "gradual" approach to restructuring and make only marginal changes in production technology.

11.2 Foreign Direct Investment and the Restructuring of Taiwan's Textile Industry

Before 1980, the textile industry was Taiwan's largest manufacturing industry and largest export sector. Starting in the mid-1980s, rising wages made labor-intensive operations in the textile industry uncompetitive, and many textile firms responded by undertaking FDI in lower wage countries. FDI set off a restructuring process that has completely reshaped the textile industry. Production shifted from garments to fabrics and textile fibers with the method of production becoming more capital intensive and the value added generally increasing. There has been extensive turnover among individual firms since FDI began, and the surviving firms have recomposed their product lines to cope with the new climate of competition. This experience makes the textile industry a perfect case for the study of the relation between FDI and industrial restructuring.

FDI in the textile industry started with garment firms that relocated to nearby Southeast Asian countries and China with the simple aim of salvaging their export markets. After a massive relocation of garment operations, fabric manufacturers found it difficult to service overseas markets from Taiwan. Some decided to make FDI in the clusters of garment operations in Southeast Asia and China in order to better serve their old customers or to explore new patrons in the same locations. FDI by fabric manufacturers brought with it the dyeing and finishing operators that create the textures and colors distinctive of the Taiwanese industry.

When the local fabric industry reached a certain level of output, spinning operators from Taiwan also started to appear. Spinning operations are more capital intensive than weaving and garment operations. Unlike FDI in weaving and garments, where a large number of small investors congregated in the same locations, FDI in spinning was undertaken by a small number of relatively large firms, scattered throughout different countries. Each was to serve a cluster of local weaving and garment firms.

Finally, fiber producers from Taiwan also joined these clusters to cap the agglomeration process. Because fiber production is even more capital

intensive and technologically demanding than spinning, FDI takes place only when the local market is large enough to guarantee economies of scale and competition is such that local production is more advantageous than export. By 1997, Taiwanese fiber producers had made three major investments: in Thailand, Malaysia, and the Philippines.

FDI has brought about a dramatic change in the textile industry in Taiwan. Table 11.1 lists the employment and output values of three subsectors of the textile industry, namely, synthetic fibers, spinning and weaving (knitting), and garments for 1986–96. It can be seen that total employment in the textile industry fell from 473,662 in 1986 to 287,065 in 1996, a drop of 186,597 jobs, equivalent to 40 percent of the 1986 employment level. Most jobs were lost in the garment sector. The output value of all textile products increased slightly over 1986–96, but its share in manufactured output decreased from 21.6 to 12.2 percent (data not shown). If "deindustrialization" is defined as "the dismantling of a country's manufacturing base" (Caslin 1987, 240) and if dismantling is taken to mean a rapid decline in output share, then Taiwan's textile industry is a classic case of deindustrialization. But a closer examination reveals that structural change seems to characterize the trend in the industry more vividly than absolute or relative decline. The composition of textile output shifted dramatically between 1986 and 1996, with the garment sector declining as synthetic fibers and spinning and weaving gained.

Overseas production was an apparent catalyst for domestic restructuring, as manifested in the pattern of exports. In 1986, garments accounted for 55.8 percent of Taiwan's textile exports, shrinking to only 19.8 percent in 1996. Taking the place of garments was exports of fabrics and yarn, whose share of total textile exports increased from 40.6 percent in 1986 to 73.9 percent in 1996. The destination of textile exports also shifted dramatically. In 1986, the U.S. market absorbed 36.8 percent of Taiwan's exports of textile products, of which garments took the lion's share. The U.S. market share had shrunk to only 15.9 percent by 1996, as Taiwan's exports were supplanted by those from Southeast Asia and China. In turn, the market share of Taiwan's exports of fabrics and yarn to this region rose from 23.4 percent in 1986 to 53.8 percent in 1996 (Chen et al. 1997, 201–8).[1]

In the following subsections, we will outline the restructuring process in each subsector of Taiwan's textile industry, focusing on how domestic restructuring was brought on by FDI. The outline is based mainly on interviews given by Taiwanese firms operating in Southeast Asia.

1. Southeast Asia includes Malaysia, Thailand, the Philippines, Vietnam, and Singapore. China includes Hong Kong. Direct trade between Taiwan and China during the sample period was prohibited, and indirect trade between them was usually transshipped through Hong Kong. Exports to Hong Kong were taken to be exports to China in our calculations.

Table 11.1 **Employment and Output Value of Taiwan's Textile Industry, 1986–96**

	Fibers		Spinning and Weaving		Garments		Total	
Year	Employment	Output	Employment	Output	Employment	Output	Employment	Output
1986	16,945	1,897	185,328	7,560	271,389	5,457	473,662	14,913
1987	27,217	2,545	186,277	9,802	247,175	7,138	460,669	19,485
1988	26,575	2,711	186,365	9,517	226,427	6,136	439,367	18,364
1989	24,839	3,222	174,234	6,842	196,000	6,693	395,073	16,757
1990	24,330	2,918	159,763	10,444	171,771	5,672	355,864	19,034
1991	23,916	3,700	155,292	12,633	160,067	6,299	339,275	22,633
1992	23,547	3,672	157,273	11,974	146,684	5,443	327,504	21,090
1993	22,560	3,092	153,241	10,253	139,142	4,777	314,943	18,088
1994	22,974	3,996	155,768	11,866	137,897	4,449	316,639	20,311
1995	23,654	5,206	149,832	12,002	126,901	3,946	300,387	21,154
1996	23,412	4,389	143,756	11,884	119,897	3,863	287,065	20,136

Sources: Employment from Directorate General of Budget, Accounting and Statistics, *Monthly Report on Wages and Salaries;* output value from Ministry of Economic Affairs, *Monthly Industry Report.*

Note: Employment reported in number of persons; output value reported in million U.S. dollars.

11.2.1 Garments

Garment firms were the frontrunners of Taiwanese FDI. After relocating production lines overseas, most garment firms reduced or removed their domestic production capacity. In general, larger firms and those possessing brand names in the domestic market were more capable than others of retaining domestic production after FDI. Taiwan continued to export some garments, partly because export quotas in the United States, Canada, and Europe served to protect Taiwan's market shares, partly because of Taiwan's unique production environment. A flexible production network cultivated over long years of experience in serving export markets gave Taiwan the unique capability to switch product lines swiftly and deliver products promptly. Even small garment firms maintained small-scale production capacity in Taiwan to produce for short orders after they had invested abroad. Production lead time was shorter in Taiwan because of a well-knit network comprising suppliers and subcontractors who could divide jobs in a very efficient and flexible manner.

If a garment firm was too small to maintain even small-scale production at home, it at least kept an office in Taiwan to provide logistical support to overseas production. Logistical support mainly consists of such marketing and procurement functions as accepting orders, making samples, participating in trade fairs, and procuring and collecting materials in preparation for overseas production. Making samples, for instance, is a very important part of soliciting orders. Normally, when a potential client indicates an intention to purchase a certain type of product, multiple samples need to be prepared quickly for the client to inspect and to choose from. Taiwan is known for its superior ability to supply small-volume, large-variety orders. For the small-volume market, the capacity to make samples fast and creatively is essential in the competition for orders. Making samples entails design capability in transforming the vague ideas of clients into a visualization of real products, and this capability needs to be maintained at the headquarters to ensure a nimble response to market demand.

Logistical support in the procurement of parts and materials in preparation for production is also essential to the flexibility of overseas production. When an order is accepted and planned to be carried out in an overseas subsidiary, parts and materials not available at the overseas location need to be procured and shipped there "just in time." Note that even in overseas production, quick delivery constitutes a competitive edge for Taiwanese subsidiaries over local firms, as both groups face the same wages. Any disruption in the supply of parts and materials will delay the delivery schedule and undermine the core competitiveness of Taiwanese subsidiaries. For example, most Southeast Asian subsidiaries of Taiwanese garment firms purchase fabrics from Taiwan, and procurement is conducted by parent firms. It is advantageous to import fabrics from Taiwan because

Taiwanese suppliers provide more variety, accept smaller orders, and promise shorter delivery time. Only such general purpose parts as buttons and zippers are procured locally. Logistical support from Taiwan's local networks provides linkages that allow Taiwanese suppliers to restructure themselves and survive despite a massive relocation of production.

The initial production of overseas subsidiaries of Taiwanese garment firms is furnished by orders transferred from parent companies. Gradually, overseas subsidiaries accumulate new assets and explore new sources of clients. To beat off local competitors, logistical support from the parent firm and the unique resources available from Taiwan's production networks become their weapons. New clients typically come from export markets, and original equipment manufacturer (OEM) contracts are the typical form of engagement. Diversification and enlargement of the customer base enable home and overseas operations to be horizontally integrated, whereby firm-specific know-how is shared.

Although most Taiwanese garment firms are export oriented, domestic-market-oriented firms do exist, and their FDI pattern is distinctive. When undertaking FDI, this type of firm exploits local markets or obtains low-cost products through direct production for resale to Taiwan. Such firms usually hold brand names. Together with overseas production, they strengthen their marketing capability and enlarge their marketing channels to enhance the value of their brands. Unlike export-oriented firms, which emphasize cost reduction, this type of firm emphasizes product value enhancement. Through FDI, they gain better access to local markets, lower their production costs, and expand their global production capacity, all of which serve to enhance the value of their brands.

Moreover, these firms often have an internationalization strategy in market development and labor sourcing. They are reminiscent of U.S. and European firms for which international subcontracting was a major strategy for reorganizing production in the 1970s and 1980s (Mytelka 1991). For this type of firm, the responsibilities of the headquarters are more demanding and more diverse than those associated with export-oriented investors. In addition to procurement, production allocation, design, R&D, and marketing coordination are all conducted at the headquarters.

In any event, relocated garment firms maintain close links with domestic industries. They purchase a large proportion of their fabrics from Taiwan, contributing to the expansion of fabric production in Taiwan. This linkage allows Taiwanese subsidiaries to hone a keener competitive edge than their local peers.

11.2.2 Fabrics

Weaving (knitting) firms relocated either by following in the footsteps of their main customers or by making independent moves in response to rising labor costs at home. The overseas products of Taiwanese weaving

firms were usually export oriented. A few firms that aimed at local markets often found their main competition came from imported Taiwanese fabrics. Local production gave them the advantage of market proximity, but imported fabrics from Taiwan had the edge in quality and product variety.

In Taiwan, the production of fabrics was normally accomplished by weaving and dyeing firms independently, with the latter acting as a subcontractor to the former. Only very large fabric firms had integrated weaving and dyeing operations. When weaving firms relocated abroad, they often had difficulty finding subcontractors to perform dyeing and finishing functions for them. Even if there was one, its technology was likely to be geared toward domestically consumed fabrics and unsuitable for exports. Local dyeing and finishing concerns were also unaccustomed to the speed and punctuality of delivery required by export orders. For example, in Southeast Asia, local fabric firms were usually established with in-house dyeing and finishing operations. Specialized and independent dyeing and finishing subcontractors were not as common as in Taiwan. Subcontracting dyeing and finishing jobs to an integrated fabric firm ran the risk of products being emulated. The response of Taiwanese weaving firms to this problem was to establish their own dyeing and finishing divisions, making overseas operations more integrated than home operations.

Unlike overseas subsidiaries of garment firms, which procured a majority of their fabrics from Taiwan, weaving firms bought most of their yarn from local suppliers, many of which were Taiwanese subsidiaries. Overseas production of fabrics was normally differentiated from Taiwanese production by quality, tilting toward low-end products. In general, locally produced yarn was good enough to meet low-end demand. Production of yarn was capital intensive, and the investment scale tended to be large. A few Taiwanese subsidiaries of yarn producers in Southeast Asia were able to take care of most of the demand from local Taiwanese weaving firms, with the rest supplemented from Taiwan. The close working relations between Taiwanese subsidiaries of spinning and weaving firms stood in sharp contrast to the largely segregated operations of weaving and garment investors.

Fabrics made by Taiwanese weaving firms were either directly exported or made into garments for export. Only a small fraction was locally consumed. Because the customer base was partly formed by local garment firms, Taiwanese weaving subsidiaries were much more adapted to local conditions than were garment firms, which more or less operated in export enclaves.

Unlike garment firms, most weaving firms retained their home operations after investing abroad. Relocation of some low-end product lines prompted Taiwanese operations to move upward to higher end products. Horizontal differentiation of domestic and overseas production was the norm. Overseas production complemented domestic production in terms of product variety and production capacity. In general, parent firms and

overseas subsidiaries accepted orders independently and swapped production capacity when needed. To increase the degree of product differentiation, many weaving firms in Taiwan also integrated fabric design, dyeing, and printing operations at home. More commonly, they invested in new weaving and knitting machines to improve productivity. This resulted in increased capital intensity and overall plant modernization in the fabric industry after the mid-1980s.

Improvements in design capability were also evident in Taiwan's fabric industry. In the old days, the possession of production capacity seemed to be enough to attract orders from international buyers. Nowadays, Taiwanese fabric producers have to keep abreast of world fashion, to design their own products, and to participate actively in international fairs in order to attract orders. In the past, trading firms collected fashion information and provided samples to fabric producers to ask for an allotment of production capacity. Nowadays, fabric producers present their own samples, albeit mimics of international fashion products, to trading firms in order to solicit business and sometimes bypass trading firms and appeal directly to international merchandisers.

11.2.3 Yarn

Yarn production was more capital intensive and the scale of investment larger than that of apparel and fabrics. Initial investment by Taiwanese yarn producers was often made by transplanting old-vintage machinery and equipment from Taiwan. New machinery and equipment made in Taiwan and other advanced countries would be purchased, however, when local production capacity was expanded after the initial investment. Relocation of existing production capacity from Taiwan was prompted by rising labor costs and land value in Taiwan, which rendered some yarn production inefficient. A shift from cotton-based spinning to manmade-fiber-based fabrics also made some cotton yarn production capacity obsolete in Taiwan.

The overseas subsidiaries of Taiwanese yarn producers were mostly local market oriented; only a small fraction of their products were exported. Customers in local markets included local firms and Taiwanese subsidiaries, but local firms usually outweighed Taiwanese subsidiaries in sales.

Product lines in overseas yarn production were diverse. Mixed yarns based on manmade fibers, such as T/C (polyester-cotton mix) and T/R (polyester-rayon mix), were most common. In initial operations overseas, manmade fibers were mostly imported from Taiwan, and cotton was imported from cotton-producing countries. Recently, some Southeast Asian countries have established or expanded their local production capacity of textile fibers by enticing direct investment or obtaining technology transfers from multinational firms. As a result, local Taiwanese yarn subsidiaries have also started procuring textile fibers from local or regional manufacturers. Countries with the capacity to produce textile fibers were

inclined to erect trade barriers to hinder imports and to induce the localization of procurement.

FDI certainly reduced yarn production in Taiwan. Total spindles fell from a peak of 4.8 million to 3.3 million in 1996. Capacity utilization also diminished for the remaining spindles. Some capacity was dismantled instead of being relocated overseas. For spinning firms that maintained bicountry or multicountry plants, domestic production was still comparable or even larger than overseas, however, because of active investment in new-vintage and superior equipment.

The restructuring of the domestic spinning industry led to a change in product composition. The share of cotton yarn decreased while the share of polyester-based yarn increased. The sharpest increase was observed in the production of draw textured yarn (DTY) of polyester, output of which increased from 335,923 metric tons in 1986 to 883,005 metric tons in 1996. In recent years, Taiwanese spinners have all but bought out the whole production capacity of the world's two major manufacturers of DTY machines, Barmag of Germany and Murata of Japan (Taiwan Textile Federation 1998, 116–17). The rapid increase in DTY production was made possible by the capacity expansion of its upstream material, preoriented yarn (POY). Capacity expansion of POY by fiber manufacturers was mainly geared toward rapidly expanding demand in China. This expansion led to a cost reduction in POY, which boosted the competitiveness of DTY and trickled down to the downstream products of polyester-based fabrics. The buoyant fabric industry maintained close links to the clusters of garment manufacturers in China and Southeast Asia, explaining the looming share of fabric exports in Taiwan's textile trade.

11.2.4 Fibers

Taiwan's FDI in manmade textile fibers took place in Thailand, Malaysia, and the Philippines, each by a single company. These three Taiwanese subsidiaries all specialized in polyester fibers. Indonesia had the largest textile market in Southeast Asia, but there was no Taiwanese direct investment in manmade fibers there. Some indigenous textile fiber firms had technology cooperation programs with Taiwanese manufacturers, and some employed Taiwanese technicians to improve productivity and quality. There were also joint-venture textile fiber producers using technology furnished by the joint venture partners, notably those from Japan. The significant presence of local firms and the Indonesian government's divestiture policy, which requires foreign investors to relinquish their ownership over time, discouraged direct investment from Taiwan.

The manmade fiber industry was considered strategic in most developing countries. Tariff protection and nontariff barriers, such as licensing controls on imports and domestic entry, were often employed to protect local industries, including those in which multinational firms had invested. Trade barriers made local presence necessary to compete in the local mar-

ket. Major competition for Taiwanese subsidiaries came from Japanese subsidiaries. Although the Japanese subsidiaries might have had a technological edge, in terms of product quality, Taiwanese subsidiaries resorted to a larger scale of production to gain cost advantage. For example, Taiwan's Tuntex in Thailand endured Japanese competition and obtained a market share of roughly 40 percent in polyester fibers in 1997, mainly through price competition. Taiwan's Hualon in Malaysia has monopolized the local market so far, although a majority of its products are exported to regional markets, China and Europe.

In spite of FDI, domestic investment in manmade fibers was vibrant. In 1986, Taiwan produced NT$44.2 billion worth of manmade fibers. In 1996, the product value increased to $85.8 billion. The quantity of manmade fibers produced was 1.24 million metric tons in 1986 and 2.60 million metric tons in 1996. Most expansion was accounted for by polyester fibers, of which Taiwan's production capacity was ranked first in the world in 1996. Expanding capacity to keep unit cost down was the main strategy of Taiwan's synthetic fiber producers, unlike their Japanese counterparts, who pursued product differentiation more earnestly than investment in capacity (Japan, Ministry of International Trade and Industry 1994).

11.3 Microdata Analysis

In this section, we analyze firm-level data to uncover the pattern of restructuring within Taiwan's textile industry. We draw data from the government's annual censuses of manufacturing plants. We take 1992 as the initial point of observation and 1995 as the end point. The choice of 1992 is dictated by the fact that this is the earliest survey year that provides data on FDI. The 1995 survey provides the most recent data available. The time span from 1992 to 1995, although short, is long enough to trace out the major restructuring path of the industry, as we will see later.

Table 11.2 lists the number of firms and plants in the sample. Only firms that own a textile plant are included in the sample, but textiles need not be the company's main business. By textiles, we mean the manufacturing of synthetic fibers, spinning and weaving (knitting), and garments. The census was conducted at the plant level. We consolidate plant-level data into firm-level statistics, on which our analysis is based. The quality of the 1992 census is relatively poor as it contains a large number of missing observations on employment and sales.[2] We delete observations where both employment and sales values are absent. In comparison, the quality of the 1995 census is relatively good, with only a few missing observations.

As can be seen from table 11.2, 6,054 textile firms were observed in

2. The census is meant to cover the population of all manufacturing plants, but inevitably, some plants refuse to answer census questions, provide incomplete information, or simply cannot be located. These missing observations are mainly for smaller plants.

Table 11.2 **Textile Firms and Plants in the Sample**

Category	1992			1995		
	Firm	Plants[a]	Textile Plants	Firm	Plants[a]	Textile Plants
FDI firms	213	279	267	173 (167)	239 (227)	228 (222)
Non-FDI firms	5,841	6,197	6,086	4,866 (4,735)	5,339 (5,072)	5,201 (5,041)
New entrants[b]				2,272 (2,409)	2,343 (2,622)	2,295 (2,461)
Total	6,054	6,476	6,353	7,311	7,921	7,724

[a]Plants include textile plants and other plants owned by textile firms.

[b]New entrants are firms entering the textile industry in 1992–95 by establishing new plants. If entry by acquiring or merging with existing textile plants in 1992 is included, the numbers are shown in parentheses. In this case, the acquired or merged plants are also deducted from the calculation of survivors, where the corresponding numbers of firms and plants are also shown in parentheses.

the 1992 census. Among them 213 firms indicated that they sometimes undertook FDI before 1992.[3] The proportion appears to be small, but those undertaking FDI are relatively large firms and are more likely to operate multiple plants compared to the rest of the industry. Among the 213 firms in the FDI group, 173 survived until 1995. Meanwhile, among the 5,841 firms in the non-FDI group, 4,866 survived.

Note that census data are plant-level data. Plants that changed affiliating companies are considered to have been acquired by or merged into new companies. In calculating the number of survivors in 1995, these plants are treated as being "survived" by the new companies, which in turn, are part of the survivor group. If the "new" companies were nontextile firms in 1992 that acquired or merged with textile plants to become part of the textile industry in 1995, we may wish to treat them as new entrants rather than surviving firms from 1992 (see Dunne, Roberts, and Samuelson 1988, for a similar treatment). In this case, the number of survivors decreases to 167 firms for the FDI group and 4,735 for the non-FDI group. This implies that out of 213 FDI firms in 1992, 46 exited the market, whereas 1,106 out of 5,841 non-FDI firms did the same, including those acquired by or merged into other firms. The exit rate is 21.6 percent for the FDI group and 18.9 percent for the non-FDI group.

Between 1992 and 1995, 2,272 new firms entered the textile industry

3. The census asked whether the company had engaged in any FDI before the time of survey. The exact time of investment was not identified. The 1993 census also provided similar data. We used the 1992 census as the basis by which to cut the sample into the FDI group and non-FDI group, according to which differences in performance in subsequent years were examined. The comparison is subject to the disturbance that some firms may have undertaken FDI between 1992 and 1995 but been classified in the non-FDI group. Statistics indicate that Taiwanese overseas investment peaked around 1991 and 1992 (Chen et al. 1997); hence the number of FDI cases occurring in 1992–95 tends to be small compared with the cumulative number in 1992.

Table 11.3 **Employment by Different Groups of Firms in the Textile Industry**

Category	Number of Firms	Employment (persons)	Share (%)	Employment per Firm
		1992		
FDI firms	213	41,228	12.6	193.6
Non-FDI firms	5,841	228,459	69.8	39.1
Unobserved or error	–	57,817	17.7	–
Total	–	327,504	100.0	–
		1995		
FDI firms	173	38,917	13.0	225.0
Non-FDI firms	4,886	193,953	64.6	39.7
New entrants	2,272	59,060	19.7	26.0
Unobserved or error	–	8,457	2.8	–
Total	–	300,387	100.0	–

Source: Employment from Directorate General of Budget, Accounting and Statistics, *Monthly Report on Wages and Salaries.*

by establishing new plants, while 137 firms entered through merger and acquisition. New entrants, including the latter group, accounted for 33.0 percent of the stock of firms in 1995. Rapid exit and entry is a characteristic of Taiwan's industry and is an important contributor to the industry's improvement in efficiency (Aw, Chen, and Roberts 1997).

Now let us look at employment in the textile industry, shown in table 11.3. In 1992, total employment was 327,504, of which 12.6 percent was provided by firms that engaged in FDI and 69.8 percent by firms that did not, and 17.7 percent was unaccounted for due to missing observations. In 1995, total employment decreased slightly to 300,389, of which 13.0 percent was contributed by FDI firms that had survived (including plants that survived through merger and acquisition), 64.6 percent by non-FDI firms that had survived, and 19.7 percent by new entrants through establishment of new plants, while unaccounted employment was a negligible 2.8 percent.[4] These statistics show that despite attrition through exit, the share of employment in the textile industry contributed by FDI firms did not diminish. The assertion that foreign investors export jobs can be easily refuted in our case. In fact, if we look at employment provided by each firm, average employment by FDI firms actually increased from 193.6 per-

4. A textile plant may be acquired by (or merged into) a textile or a nontextile firm. A textile firm that expands by acquiring existing textile plants is naturally included in the survivor group, and its corresponding employment in the newly acquired plants is counted as part of the contribution by the survivor group to overall employment. It is logical to also treat employment by existing plants that are merged into nontextile firms in the contribution by the same group. Sales of the survivor group, reported below, are treated in the same manner.

Table 11.4 **Sales by Different Groups of Firms in the Textile Industry**

Category	Number of Firms	Sales (million NT$)	Share (%)	Sales per Firm (million NT$)
		1992		
FDI firms	197	54,242	10.1	275.3
Non-FDI firms	5,124	340,255	63.5	66.4
Unobserved or error	–	141,188	26.3	–
Total	–	535,685	100.0	–
		1995		
FDI firms	173	86,728	15.7	501.3
Non-FDI firms	4,886	405,989	73.3	83.1
New entrants	2,272	76,353	13.8	33.6
Unobserved or error	–	−15,535	−2.8	–
Total	–	553,535	100.0	–

Source: Sales from Ministry of Economic Affairs, *Monthly Industry Report.*

sons in 1992 to 225.0 persons in 1995.[5] We do not know whether major employment shedding had taken place before 1992, but these results at least indicate that FDI firms are not more susceptible to downsizing than non-FDI firms. On the other hand, average employment of new entrants (through new plants) is smaller than for any existing group of firms.

Next, let us look at market share in terms of sales as listed in table 11.4. The 197 FDI firms that provided sales data had a combined market share in 1992 of 10.1 percent. In comparison, the non-FDI firms took 63.5 percent of the market. The market share of surviving FDI firms rose to 15.7 percent in 1995, while that of their non-FDI counterparts rose to 73.3 percent. Both gained at the expense of failing firms. The average sales of surviving firms increased during the period, particularly among FDI firms.[6] Yamawaki (1992) reported that similarly Japanese textile and clothing firms significantly increased in size in 1965–83 by way of restructuring in response to rising wages in Japan. Torre (1986, 117) also reported that size is an important factor contributing to successful adjustment to rising production costs by clothing firms in developed countries because it permits firms to centralize a number of production services, which then could be provided to various plants at significant savings. New entrants through new plant establishments, despite their large number, took only 13.8 per-

5. These numbers do not include employment in nontextile industries.

6. According to *Commodity Price Statistics Monthly in Taiwan Area of the Republic of China* (June 1998), the wholesale price index of textile products rose 14.9 percent in 1992–95 while that of apparel and accessories rose 10.7 percent. If we use the wholesale price index of textile products to deflate nominal sales value, average sales of FDI firms rose 58.7 percent in real terms during the period while that of non-FDI firms rose 8.9 percent.

Table 11.5 **Distribution of Product Lines**

	1992		1995	
Number of Lines	All Products	Textile Products	All Products	Textile Products
1	4,277	4,311	4,539	4,441
2	671	642	389	356
3	191	173	125	106
4	102	95	52	50
5	45	42	14	11
6	30	25	13	11
7	12	10	6	4
8	6	6	0	0
9	6	6	0	0
10	4	2	0	0
Greater than 10	9	7	6	4
Total lines	7,504	7,173	6,200	5,876
Number of firms	5,353	5,319	5,144	4,986
Lines per firm	1.4	1.35	1.21	1.18

cent of the market in 1995. The pattern that new entrants tend to contribute only marginally to employment and sales is also found in U.S. industry data. Diversification and expansion (including that through merger and acquisition) by existing firms are found to be the major driving force of industrial growth in the U.S. industry (Dunne et al. 1988).[7]

To understand the nature of restructuring, let us first look at the distribution of product lines in the industry. Product line is defined by the seven-digit commodity code in Taiwan's official commodity classification. It distinguishes, for example, woven fabrics from knit fabrics, ladies' wear from men's wear, and further distinguishes woven fabrics made of different materials. Table 11.5 lists the distribution of product lines in the sample. It can be seen that most firms operate a single product line; only about one-fifth of the firms operate multiple product lines. As a whole, the average firm operated 1.35 textile product lines in 1992. Even if nontextile products were included, the average number of product lines was merely 1.40. From 1992 to 1995, the average number of product lines decreased, indicating that the average firm became more specialized in this period.

Table 11.6 confirms this trend. In this table, we trace the product lines of firms that survived from 1992 to 1995. New entrants, either through new plant establishment or through merger and acquisition, are excluded. It can be seen that the number of product lines of the average FDI firm

7. Dunne et al. (1988) reported that by averaging across industries, new entering firms between two census years (five years) account for approximately 16 percent of industry output, but 40 percent of the number of firms of each census year. In their paper, new entering firms include new entrant firms and existing firms that diversify into the said industry. New entrants alone account for only about 8 percent of industry output.

Table 11.6 **Product Lines per Firm, 1992–95**

	All Products		Textile Products	
Category	1992	1995	1992	1995
FDI firms	2.01 (163)	1.89 (139)	1.82 (163)	1.69 (136)
Non-FDI firms	1.39 (4,334)	1.20 (3,721)	1.33 (4,314)	1.18 (3,636)
Total	1.41 (4,497)	1.23 (3,860)	1.35 (4,477)	1.20 (3,772)

Note: Only firms that operate in both 1992 and 1995 are included in the statistics. Numbers in parentheses are sample sizes.

decreased from 2.01 in 1992 to 1.89 in 1995. The average non-FDI firm had significantly fewer product lines, but the trend was the same: decreasing from 1.39 lines in 1992 to only 1.20 lines in 1995. Fewer lines among the non-FDI group were largely attributable to their smaller firm size. If we count the number of four-digit industries operated by each firm, the average number of industries operated by each firm also decreased from 1992 to 1995. Similar findings were reported by a study of the U.S. manufacturing industry over 1963–82 (Dunne et al. 1988).

In essence, Taiwanese textile firms chose to specialize in a few product lines and resorted to equipment modernization, process innovation, and product differentiation to create a new competitive edge under immense pressure from rising wages. Mytelka (1991) reported a similar pattern of restructuring by the Italian textile industry in an effort to weather competition coming from East Asian producers. Ghadar, Davidson, and Feigenoff (1987, 76) also reported that U.S. textile and clothing firms attempted to increase specialization in segments where they enjoyed leadership positions in order to combat import competition. When wages were low in Taiwan, textile firms took any OEM orders that could fill their idled capacity; when wages rose and labor-intensive operations were no longer profitable, concentration on a few niche products was desirable because in order to protect their threatened competitive margin, firms had to acquire new resources, and resources are always limited and costly. Specialization allowed firms to strengthen their core competitiveness with limited resources. Gollop (1997) also reported that increased plant specialization in narrow product lines was a major determinant of recent U.S. manufacturing productivity growth. Over the 1963–87 period, decreased product heterogeneity accounted for about 17 percent of productivity growth, second in importance only to technical change and equaling the contribution of scale economies. Studying large U.S. companies in the second half of the 1980s, Lichtenberg (1992) also found that de-diversification contributed to productivity growth of the companies studied.

We may use a more formal index of product line concentration (or diversification), the Herfindahl index, to further verify the trend of special-

ization. The Herfindahl index takes into account not only the number of product lines but also the distribution of sales among all production lines. The greater the Herfindahl index, the higher the degree of product concentration or the lower the degree of diversification. We calculate the Herfindahl index for each group of firms and list the results in table 11.7. Again, only surviving firms are included in the calculation. This principle applies to all indexes to be elucidated in the rest of the paper.

It can be seen that the Herfindahl index increases across the board between 1992 and 1995, suggesting that all firms had to become more specialized during this period. FDI firms are shown to be more diversified than non-FDI firms in general, and this pattern persisted over 1992–95. This may be largely attributable to the larger size of FDI firms because firm size has been shown to be positively correlated with degree of diversification (Amey 1964). In 1992, the Herfindahl index (for textile products alone) was 0.8367 for FDI firms and 0.9284 for non-FDI firms. The indexes increased to 0.8622 and 0.9552, respectively, in 1995.

Another "paper trail" of industrial restructuring is shifts in major product lines between 1992 and 1995. By major product line we mean the product line that accounts for the largest proportion of a company's total sales revenue. A shift in major product line indicates a major change in the company's business orientation.

Table 11.8 indicates the extent of major product line shift between 1992 and 1995. It can be seen from the table that among all textile firms, 41.1 percent shifted major product lines in 1992–95. This defuses our concern that we may be looking at a period in which industrial restructuring was rather dormant. Indeed, the restructuring taking place in the sample period was remarkable. Comparing firms engaged in FDI with those holding out, the FDI group underwent more extensive restructuring. Among the FDI group, 53.4 percent of firms switched major product lines in 1992–95, while among the non-FDI group, only 40.7 percent of firms did so. The evidence suggests that FDI is often accompanied by more thorough re-

Table 11.7 **Herfindahl Index of Product Line Concentration**

Category	1992	1995
FDI firms		
All products	0.8225 (163)	0.8495 (139)
Textile products	0.8367 (163)	0.8622 (136)
Non-FDI firms		
All products	0.9225 (4,334)	0.9512 (3,721)
Textile products	0.9284 (4,314)	0.9552 (3,636)
All firms		
All products	0.9184 (5,353)	0.9517 (5,144)
Textile products	0.9241 (5,319)	0.9558 (4,983)

Note: Numbers in parentheses are sample sizes.

Table 11.8 **Shifts of Main Product Line, Subsector, and Sector, 1992–95 (number of firms)**

Shift	All Firms	FDI Firms	Non-FDI Firms
Product line shift			
Shift	1,601 (41.1)	70 (53.4)	1,531 (40.7)
Do not shift	2,291 (58.9)	61 (46.6)	2,230 (59.3)
Total	3,892 (100)	131 (100)	3,761 (100)
Subsector shift			
Shift	752 (19.3)	31 (23.3)	721 (19.1)
Do not shift	3,152 (80.7)	102 (76.7)	3,050 (80.9)
Total	3,904 (100)	133 (100)	3,771 (100)
Sector shift			
Shift	297 (7.6)	15 (11.3)	282 (7.5)
Do not shift	3,607 (92.4)	118 (88.7)	3,489 (92.5)
Total	3,904 (100)	133 (100)	3,771 (100)

Note: Subsector shift indicates a shift between four-digit industry codes. Sector shift indicates a shift between fiber, weaving and spinning, and garment industries. Numbers in parentheses are percentages of firms in category.

structuring and that firms making overseas investment are less likely to avoid reorienting their businesses.

A similar pattern is observed if we define business orientation in a broader sense. For this, we look at the major subsector from which the sample firms derived their sales. By subsector, we refer to the four-digit industry classification in accord with Taiwan's official industrial code. Subsector refers to industries such as cotton textiles (spinning and weaving), polyester textiles, knit garments, and the like.

Table 11.8 also indicates that the textile industry underwent extensive restructuring, even at the subsector level. As a whole, 19.3 percent of textile firms switched subsector in the sample period. Again, FDI firms were more likely than their non-FDI counterparts to switch subsectors, such as from cotton textiles to polyester textiles. Nearly a quarter (23.3 percent) of FDI firms switched subsectors while only about one-fifth (19.1 percent) of non-FDI firms did so.

If we divide the textile industry into three main sectors, namely, fibers, spinning and weaving (yarn and fabrics), and garments, in accord with two-digit industry demarcation lines, to examine whether the shift in four-digit industry has crossed sectoral lines, the result remains robust. Switching between sectors is naturally less common but is, nevertheless, significant. Table 11.8 shows that 7.6 percent (297 cases) of textile firms in the sample switched sectors in 1992–95. Once again, firms that had invested abroad were more likely to switch sectors than those that had stayed home. Production sector switches occurred mostly from garments to spinning

and weaving, and from textile to nontextile industries. In other words, shifts within the textile industry were mostly vertical movements toward upstream production. Shifts of major business from textile to nontextile industries occur more often in the non-FDI group (65 out of 282 cases) than in the FDI group (2 out of 15 cases).

In studying the largest U.S. firms, Berry (1975, 74) concluded that four-digit interindustry activity was most conducive to corporate growth but that this activity is normally confined within the border of two-digit industry groups. Gorecki's study of British industry between 1958 and 1963 also found that "enterprises diversified to a large extent within a group of industries that could be considered homogeneous in a technical sense" (1975, 143). Our finding is in general conformity with these conclusions, but cases of firms jumping industry borders seem to be more pervasive in Taiwanese industry.

It is worth nothing that restructuring within the garment sector may be relatively difficult for Taiwanese firms. Torre (1986, 90), for example, reported that successful adjustments of the garment industries in developed countries in the 1970s and 1980s entailed either "moving up the market" by incorporating better product design, higher quality, more elaborate materials and accessories, and better distribution networks and consumer services or reducing costs through offshore subcontracting. Both cost reduction and product value enhancement options are formidable tasks for Taiwan's no-brand manufacturers, who themselves serve as international subcontractors. In contrast, restructuring is relatively easy in the weaving and spinning sector because there is some room for Taiwanese firms to make process innovations and expand capacity. Garment firms that have difficulties restructuring within the garment sector may wish to jump to weaving and spinning, taking advantage of knowledge relevant to the textile industry.

Switching main product lines is only a crude measure of product line shift. It provides a discrete number (zero or one) to indicate whether there is a switch. Firms shifting weights between product lines without changing major product always get a measure of zero. We therefore need a more sophisticated measure to capture shifts in product line composition. To this end, we calculate the share of each product line in total sales and measure changes in these shares between 1992 and 1995. Naturally, some product lines have their shares increased while others have them decreased. Since the shares of all product lines sum to one, the shares gained by the rising product lines always equal the shares lost by the declining product lines. We therefore take the combined shares gained by the rising product lines as a measure of product composition change and call it the "composition change index."

The index can be understood from figure 11.1. In figure 11.1, we spread product lines along the horizontal axis, assuming, for simplicity, that these

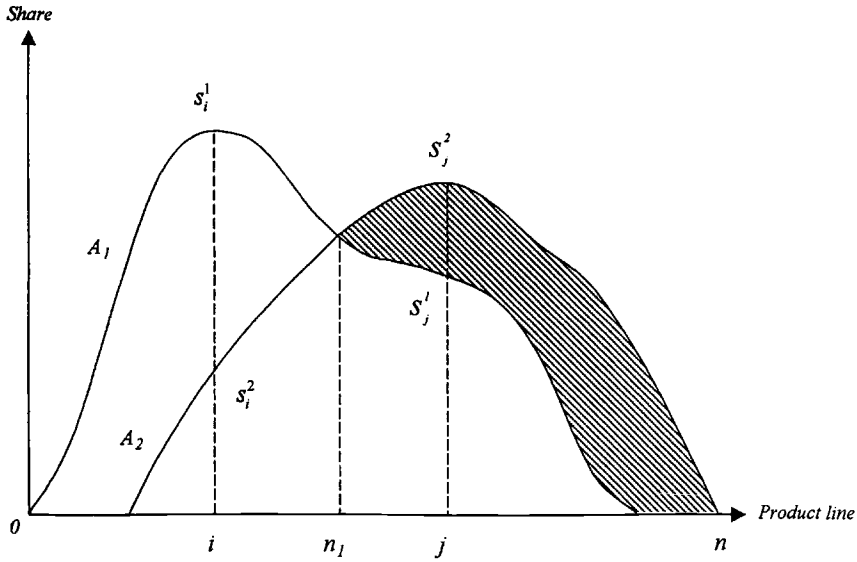

Fig. 11.1 Measuring changes in product composition

product lines are continuous. The product lines manufactured in period 1, together with their respective shares, are depicted by contour A_1. Since the shares of all products sum to one, the area under A_1 is unity. Similarly, product lines manufactured in period 2 are depicted by contour A_2. For the *i*th product line, its share decreases from period 1 (S_i^1) to period 2 (S_i^2). For the *j*th product line, its share increases from period 1 (S_j^1) to period 2 (S_j^2). Our index measures total shares gained by product lines such as the *j*th, or the area below the period 2 contour and above the period 1 contour, shaded in the figure.[8]

Note that the composition change index always lies between zero and one. If the composition of product lines does not change, the index is zero; if all product lines have been replaced, the index is one. The measure applies to single- as well as multiple-product firms. For single-product firms, the measure is identical to the "major product shift" index described in table 11.8.

As a side measure, we also calculate the number of product lines that increased their shares of sales between 1992 and 1995 as a proportion of the combined number of product lines in these two years. This measure is named the "product line change index." In figure 11.1, for instance, the total number of product lines in the two periods is *n*, and the number of

8. We are indebted to Chien-Fu Chou of National Taiwan University for suggesting such a measure.

Table 11.9 **Changes in Product Line Composition**

Category	Composition Change Index (%)	Product Line Change Index (%)	Sample Size
FDI firms			
Single plant	0.4857 (0.4654)	0.3020 (0.2512)	98
Multiple plants	0.5858 (0.3692)	0.4208 (0.2052)	31
Total	0.5082 (0.4503)	0.3306 (0.2455)	129
Non-FDI firms			
Single plants	0.3946 (0.4678)	0.2272 (0.2486)	3,093
Multiple plants	0.5423 (0.4280)	0.3658 (0.2217)	256
Total	0.4058 (0.4665)	0.2380 (0.2495)	3,349

Note: Numbers in parentheses are standard errors of the sample.

product lines that increased their shares is $n - n_1$; hence the product line change index is $(n - n_1)/n$. Both indexes are presented in table 11.9.

It can be seen from table 11.9 that both indexes suggest that product shifting is more pervasive among firms that undertook FDI. The composition change index is 0.5082 for FDI firms against 0.4058 for non-FDI firms. This indicates that over half of the sales revenue of FDI firms in 1995 came from new production or uneven expansion of old product lines. The statistics also indicate that firms with multiple plants underwent more sweeping changes in product composition than those with a single plant. This is not surprising because multiple plants provide more room for adjustment and restructuring.[9]

The product line change index shows a similar pattern, that is, more sweeping changes taking place among FDI firms. The index shows that among the FDI group, 33.06 percent of product lines were either newly introduced or gained production share between 1992 and 1995. In comparison, only 23.80 percent of the product lines of non-FDI firms fall into this category. From this index, we can also infer that 66.94 percent of the product lines of FDI firms were abandoned or lost production share in 1992–95, while 76.20 percent of the product lines of non-FDI firms received the same treatment. This suggests that more attrition and dismantling of product lines took place among non-FDI firms. As FDI is usually accompanied by product line relocation, investing firms are likely to introduce new product lines to replace outgoing ones or to expand remaining product lines to fill the vacuum left by relocation. In contrast, firms that

9. Changes in relative prices, in addition to changes in production costs, lead to restructuring in product composition. Part of change in product mix may be a natural response to change in relative prices without "reorganization" of the production structure or "retooling" of the production technology. Hence, our index needs to be interpreted as a broad measure of restructuring in response to both price signals and cost factors.

stayed away from FDI restructured themselves by selecting a few niche product lines for expansion and upgrading. Our data show that 95 new product lines were introduced by 129 FDI firms between 1992 and 1995, with each firm introducing an average of 0.736 lines, while only 1,468 new product lines were introduced by 3,349 non-FDI firms in the same period, with an average of 0.438 new lines per firm. In fact, non-FDI firms tend to resort to capacity expansion in a few emerging product lines, whether they be old or new. These product lines are conducive to process innovation or the realization of scale economies. This can be seen from table 11.10.

Table 11.10 lists the ten most rapidly growing product lines in 1992–95 and the contributions by various groups of firms to their growth. By "most rapidly growing" we refer to the largest increases in terms of the absolute value of sales. Six of these product lines are polyester-based products, whether fibers, yarn, or fabrics. Capacity expansion of non-FDI firms in these areas is apparent, as non-FDI firms contribute the lion's share to the growth in output. In comparison, FDI firms only contributed marginally to growth in these segments of the industry. Even new entrants (including those entering through merger and acquisition) contributed more than the FDI group. Meanwhile, exit from these emerging industry segments is negligible, except for cotton-polyester mix yarn.

Among the ten top emerging product lines, three lines were in the garment sector, where production was nonexistent in 1992. These were newly introduced products. FDI firms contributed significantly to growth in two of them. Antonelli (1995) argued that in response to rising factor costs, firms restructure themselves by considering the trade-off between switching costs and innovation costs. The former refer to costs of changing techniques within a given technology set, and the latter refer to costs of changing production technology. A firm's accumulated knowledge specific to existing production techniques is critical to this choice. Although our study focuses on restructuring of product lines and ignores technology changes, our results seem to suggest that FDI firms have endowment advantages in innovation costs over switching costs. The endowment advantages that reduce innovation costs for them may be firm-specific assets such as organizational strength and technological capability. With these advantages, FDI firms are more inclined to switch product lines by adopting new technologies than to switch production techniques within existing product lines. To the extent that firms with more endowment advantages are more inclined to make overseas investments (Caves 1971), the fact that FDI firms are more apt to restructure themselves may simply be a result of these advantages, rather than of FDI actions per se. Even if this is the case, FDI is still an important indication of the restructuring process, although it is not the root of restructuring. The evidence presented above at least illustrates the differences between domestic restructuring that is associated with FDI and restructuring that is not.

Table 11.10 **Top Ten Growth Product Lines, 1992–95 (million NT dollars)**

Commodity Code	Product Line	1995 Sales	1992 Sales	Increase 1992–95	Contribution by FDI Firms (%)	Contribution by Non-FDI Firms (%)	Contribution by New Entrants (%)	Contribution by Exits (%)
1360014	Textured filament yarn of polyesters	50,556	30,942	19,614	0.7	92.2	9.6	−2.6
1360201	Polyester woven fabrics	33,315	18,765	14,550	10.6	65.0	26.0	−1.5
2121020	Polyester staple fiber	31,050	16,890	14,160	−0.1	85.2	14.9	0
2121012	Polyester filament	21,262	9,321	11,941	−0.3	100.3	0	0
1360140	Cotton-polyester mix yarn	20,366	13,595	6,771	15.1	75.4	23.2	−13.8
2121013	Partially oriented filament yarn of polyesters	17,628	9,071	8,557	0	72.9	27.1	0
2121002	Nylon filament	16,733	4,765	11,968	74.5	14.8	18.0	−7.3
1419090	Outerwear made of other fabrics	9,078	0	9,078	25.2	39.6	35.2	0
1342320	Knit women's underwear	8,313	0	8,313	42.2	32.2	25.7	0
1342110	Knit sportswear	6,396	0	6,396	7.1	78.1	14.8	0

Note: The contribution of each group of firms is measured by the change in their sales as a percentage of the increase in total sales in respective product lines.

Since some indicators seem to suggest that more extensive and sweeping restructuring occurred in FDI firms, it would be desirable to put all the indicators together and formally test whether there was indeed a difference associated with FDI. To do this, we perform a principal component analysis on several indicators that we have presented above to obtain an aggregate measure of restructuring. We then conduct analysis of variance (ANOVA) to test whether there is a significant difference between FDI and non-FDI firms. The restructuring indicators included in the principal component analysis are (1) change in the number of product lines, (2) change in the Herfindahl index, (3) change in the main product line, (4) change of subsector, (5) change of sector, (6) composition change index, and (7) product line change index.

The standardized scoring coefficients resulting from the principal component analysis are listed in table 11.11. It can be seen that all coefficients are positive except for change in the number of product lines. This is be-

Table 11.11 Tests of Difference between FDI and Non-FDI Firms

Principal Components Analysis of Restructuring Indicators

Indicator	Scoring Coefficient (standardized)
Change in number of product lines	−0.02171
Change in Herfindahl index	0.02324
Change in main product line	0.27659
Change of subsector	0.22165
Change of sector	0.16227
Composition change index	0.27964
Product line shift index	0.25641

Analysis of Variance by FDI

Category	Mean Loading Score	Sample Size
FDI firms	0.3118	124
Non-FDI firms	−0.0119	3,261
F-statistic	12.56	

Analysis of Variance by Size and FDI (mean loading score)

Category	Large Firms[a]	Small Firms	Significant Difference?
FDI firms	0.2864 (90)	0.3791 (34)	No
Non-FDI firms	0.0691 (1,100)	−0.0531 (2,161)	Yes
Significant difference?	Yes	Yes	

Note: Numbers in parentheses are sample sizes.

[a]Large firms are firms employing thirty persons or more. The rest are small firms.

cause the number of product lines decreased over 1992–95 and a larger negative value actually indicates a higher degree of change. The rest of the indicators are consistently positive, where larger values suggest higher degrees of restructuring.

From the appropriation of scoring coefficients, each firm is given a loading score based on the principal components of these seven indicators. The loading score is standardized with zero mean and unit variance, and ANOVA can be performed to see whether there is a significant difference between FDI and non-FDI firms. We list the mean score for each group in table 11.11. It can be seen that the mean score is 0.3118 for FDI firms and −0.0119 for non-FDI firms. The *F*-statistic for the null hypothesis that the two groups come from the same population is 12.56, indicating that there is a significant difference at the 1 percent level between the two groups of firms. Since a greater loading score indicates a higher degree of restructuring, the result suggests that firms that invested abroad before 1992 underwent deeper and more extensive restructuring in 1992–95 compared to those that had not taken a similar course.

Since FDI firms are generally larger than non-FDI firms, this difference in restructuring may be attributable to size rather than FDI activity. We therefore introduce another dimension into the ANOVA by separating the sample by size, in addition to FDI. Firms that employ fewer than thirty employees are called small firms, and the rest are called large firms. A four-way classification of ANOVA is also presented in table 11.11. It can be seen that there is a significant difference in terms of mean loading score between the FDI and non-FDI classes whether they be large or small firms. Meanwhile, size makes no difference to mean leading score among the FDI firms. Size only matters for the non-FDI group, where large firms are shown to have a significantly higher loading score. This suggests that it is FDI, rather than firm size, that accounts for the difference in the degree and extent of restructuring.

11.4 Concluding Remarks

We view FDI as a Schumpeterian innovation whereby an old production structure is dismantled in favor of a new one. Therefore, FDI is always accompanied by restructuring. Restructuring may take place at the firm, industry, or economy-wide level. In this paper, we examine the firm-level restructuring of Taiwan's textile industry between 1992 and 1995 and find that restructuring was indeed extensive and sweeping. We find that the average textile firm reduced its number of product lines and increased its concentration of product line distribution as measured by the Herfindahl index. About half of the textile firms under our observation switched their main product lines in the short time span of three years. More than one-fifth of the textile firms switched between four-digit industry categories.

Some even moved from downstream operations to upstream operations, such as from garments to weaving, to take advantage of new schemes in the international division of labor. In fact, the product mix of the whole textile industry has been reshuffled to an amazing degree. For an average textile firm, nearly half of sales revenue comes from newly introduced product lines or from disproportional expansion of existing product lines. When compared with textile firms that did not undertake FDI, those investing abroad show a significantly higher degree of restructuring by all indexes.

There is no evidence that overseas investment led investing firms to shed jobs from domestic operations. In fact, there is even some indication that FDI enables firms to increase employment at their headquarters. Most job losses in Taiwan's textile industry during the sample period were attributable to the exit of firms, and there is no evidence that FDI contributed to exit either. Firms that undertook FDI were also likely to expand sales in domestic markets, casting doubt on the assertion that "FDI hollows out domestic industry."

However, this paper falls short of uncovering intrinsic differences in terms of the nature of restructuring, except for product line shift. Scanty evidence suggests that non-FDI firms resort more often to capacity expansion and process innovation whereas FDI firms are more keen on new product introduction and technology change. More research in this area is desirable.

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Comment

Yum K. Kwan

This paper has to do with outward FDI of Taiwan's textile industry. Adopting the view that FDI is a Schumpeterian innovation, Chen and Ku emphasize the impact of outward FDI on the domestic industrial structure, using the textile industry as a case study. The data consist of two

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surveys of firms, one conducted in 1992 and the other in 1995. Firms are classified into two groups, FDI firms and non-FDI firms, according to whether they have invested abroad or not. The two groups are then compared by a number of characteristics, including employment and sales; distribution, number, and concentration of product lines; and indicators of restructuring such as shifts of main product line, subsector, and sector, among others. The comparison shows that FDI firms undertake more rapid restructuring than non-FDI firms. The authors interpret this as evidence that FDI leads to restructuring and even accelerates the restructuring process.

At first glance, what could be more natural than doing a pairwise comparison of the kind so skillfully exploited by the authors in tables 11.2 through 11.11, since the objective is to ascertain the effects of FDI on industrial structure? In the jargon of experimental design, the exercise is to measure the "treatment effect" of FDI on industrial structure, where the FDI firms constitute the "treatment group" and the non-FDI firms the "control group." If the firms were randomly assigned into the two groups (i.e., making outward FDI or not) by some superior authority—as in a textbook experimental design setting—the authors' approach would be the right way to go. But presumably, firms do make FDI decisions purposefully so that they are in fact *self-selecting* themselves into the two groups. In other words, being an FDI firm or not is an endogenous variable—and it should be taken into account as such in the analysis—rather than exogenous as is implicitly assumed by the authors. Ignoring data self-selectivity, as the authors do in this paper, unfortunately, leads to biased samples and usually exaggerated treatment effects. Econometric issues related to the problem of self-selectivity have been extensively studied in the literature (especially in labor economics); see Maddala (1983, chap. 9) for a survey.

Similarly, the issue of survival bias (another kind of sample selectivity) also applies here. For an existing firm, it is unlikely that the decision to quit or stay is independent of the decision to invest abroad. Ignoring the simultaneity by comparing only surviving firms, as in the paper, will again lead to sample selection bias.

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Comment Munehisa Kasuya

An Overview

This paper tries to analyze the effect of FDI on employment, sales, and restructuring of the home country industry by using firm-level data. It obtains a lot of findings that are very interesting, stimulating, and useful. I would like to summarize these before making a few comments.

First, Chen and Ku criticize the hypothesis that "FDI is tantamount to industry dislocation and the export of jobs from home" by examining the relation between FDI firms and shares of employment and sales. That is, the data on employment in table 11.3 show that "there is no evidence that overseas investment led investing firms to shed jobs from domestic operations." Those data refute the assertion that foreign investments export jobs. The data on sales in table 11.4 show that FDI firms "were also likely to expand sales in domestic markets." Those data cast doubt on the proposition that "FDI hollows out domestic industry."

After the analysis of employment and sales, the paper moves to the topic of restructuring. The data on restructuring in tables 11.5 through 11.11 indicate that "FDI firms show a significantly higher degree of restructuring." Based on these statistical correlation analyses, the authors conclude that FDI induces restructuring.

Comments

Chen and Ku are trying to support the hypothesis that "FDI induces a higher degree of restructuring." I think the hypothesis is theoretically plausible because firms with more choices of production factors are supposed to be able to reach more efficient production levels by rearranging production factors. What I want to comment on first is not the hypothesis but the methodology of the empirical analysis.

If we want to support the hypothesis, we should use firms that have the same attributes with the exception of FDI. If firms have different attributes, we should control for those different attributes. Without such control, we might mistake the effects of those different attributes on restructuring for the effect of FDI on restructuring. This kind of control has already been done in the paper. The authors control firm size effects in the ANOVA because "FDI firms are generally larger than non-FDI firms" and "the difference may be attributable to size rather than FDI activity."

Meanwhile, the authors suggest that FDI firms may have "endowment advantages." I am confused by this statement. That is, I am afraid that the endowment advantages could be a variable to be controlled like firm size. Differences in restructuring may be attributable to endowment advantages

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rather than FDI activity, like firm size. Of course, there are several possibilities. We could assume that FDI causes endowment advantages. Under this assumption, we could conclude that FDI induces restructuring without controlling endowment advantages. However, we could also assume that there is no causality or even assume that endowment advantages cause FDI. Under these assumptions, we should control endowment advantages. Even if we cannot tell which possibility is correct, I do not think this kind of reservation would require us to reject the conclusions of the paper. However, it might be better for us to be more careful in deriving implications.

My second comment is on the data indicated in table 11.2. Based on these data, the paper analyzes several characteristics of FDI firms. I am afraid that we could not get information of FDI except the data for 1992. However, I am also afraid that we could not reject the possibility that new FDI firms entered between 1992 and 1995 from among the non-FDI firms of 1992. If there were new FDI firms after 1992, the comparison between 1992 and 1995 could include a kind of bias.

My third comment is on the "unaccounted data" in table 11.3. The author suggests "the share of employment contributed by FDI firms did not diminish" after comparing 13.0 percent for 1995 with 12.6 percent for 1992. However, the unaccounted data amount to 17.7 percent. I am afraid that the difference in shares of employment could be smaller than those unaccounted data.

My next comment is on the composition change index in table 11.9. By using the composition change index, the authors suggest FDI firms show a higher degree of restructuring. I think the share data used in making the index include the information of price changes. However, I do not think price changes mean restructuring in general, although price changes can lead to restructuring. It would be more comfortable for us to interpret the index as a broad measure of restructuring.

Last but not least, I would like to confirm again the contributions of this paper. Even if there are some limits in data availability, by using firm-level data very efficiently and intensively, this paper makes important contributions to the field of empirical analysis of restructuring induced by FDI.