

TECHNOLOGY TRANSFER TO CHINA BY HONG KONG'S CROSS-BORDER GARMENT FIRMS

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Hong Kong manufacturers have historically been one of the main sources of foreign direct investment to China, but their contribution to the transfer of technology to the mainland has been questioned due to the generally labor- rather than capital-intensive, low-value-adding activities they perform there. Using data from eighty-four Hong Kong-based garment manufacturers that have invested directly in mainland China, this paper examines the role of Hong Kong FDI in the transfer of technology to China. Analyses show that Hong Kong garment firms are in fact human-capital-intensive and are endowed with valuable managerial technology and, moreover, act as effective channels for the transfer of such technology to mainland China.

I. INTRODUCTION

SINCE the implementation of its “open door policy” in 1979, China has become increasingly enthusiastic about inward foreign direct investment (FDI) generally and, in particular, the technology transfer benefits it can bring (Ball, Zhang, and Pearson 1993; Chen, Chang, and Zhang 1995; Fischer 1991). FDI to China gradually increased during the 1980s and escalated at the beginning of the 1990s as a greater proportion of global FDI flows were directed to the mainland (Wei 1995). Such FDI has originated notably from U.S. and Japanese firms, but mainly from Hong Kong businesses, which alone accounted for nearly 60 per cent of total investments (by value) between 1979 and 1992 (Leung 1996; Zhan 1993). Having found that foreign firms were keen to invest in China, official government policy has for some time aimed to “speed up technology transfer and dissemination” in order to shift the mainland to a knowledge- and intelligence- rather than a labor- and resource-intensive economy (Xuan 1995).

Whether and how FDI is capable of promoting this policy has not been extensively studied (Lan and Young 1996). Considerable academic attention has been

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paid to the practicalities, nature, and location of FDI in the mainland (Broadman and Sun 1997). However, as scholars have pointed out, “less critical attention . . . has been directed towards the efficacy of FDI as a source of know-how in the modernization of the Chinese economy” (Hayter and Sun 1998, p. 2). This is especially the case for FDI from Hong Kong, much of which had consisted of the transplantation of supposedly low technology, labor- rather than capital-intensive manufacturing activities. In this paper, attempts are made to rectify this situation by examining the extent to which Hong Kong’s garment industry is, or is not, transferring technology to the mainland.

The Hong Kong garment industry makes a compelling case for analysis for various reasons. The industry has long been the largest manufacturing sector within the Hong Kong economy, but its geographical scope has now become transnational through extensive vertical integration via FDI into China (Thompson 2000). Survey data suggest that the industry accounts for the largest proportion, some 20 per cent, of Hong Kong-derived FDI to China based on the number of investing firms (Wei 1995). Consequently, the sector should potentially constitute a major engine of technology transfer to China generally and to China’s garment industry in particular (Yang and Zhong 1998). However, it remains to be determined whether Hong Kong garment firms have been useful agents of technology transfer because they have been characterized as being relatively backward due to their labor intensiveness (Lui and Chiu 1994). Hence, the question of whether or not Hong Kong garment firms have worthwhile and appropriate technology to pass on to China needs to be raised. Should the answer to that question be affirmative, then the issue of whether or not any such technology is in fact transferred to the mainland China economy needs to be addressed.

The following section reviews the role of transnational firms in technology transfer as a basis for determining whether Hong Kong garment firms transfer or do not transfer useful technology to mainland China. The research methodology and results are then reported and discussed in the subsequent sections.

II. TECHNOLOGY TRANSFER THROUGH MULTINATIONAL FIRMS

A. *Types of Technology*

Any discussion of what, if any, technology Hong Kong garment firms might usefully transfer to China, and the ways they might do so, rests on how broadly both “technology” and “transfer” are defined. In the narrowest definition, technology includes patentable blueprints, plans, mechanisms, formulae, and the like (Enos 1989), and transfer can be limited to the new use of such technology either within a particular multinational or by a host country firm after contractual exchange with a foreign firm or organization (Smith 1980). However, a broader and more sophisti-

cated concept of technology transfer is more useful and common when considering multinational firms as its agent (Wu 1999), although it would be more difficult to quantify it.

Technology can perhaps be better defined as the knowledge whereby economic efficiency can be improved. Hence, it includes not only the “hard,” possibly patentable, aspects of production, like the specifications of goods and the mechanistic details of their manufacture, but also the “soft” aspects of business processes, such as organization, marketing, and other types of managerial knowledge and skills (Stewart 1977). Certainly these are the “technologies” on which the world’s wealthier economies increasingly rely—especially the now overwhelmingly service-oriented economy of Hong Kong—and which ensure that hard technology is optimally used. Consequently, the transfer of such broadly defined technology need not be formal and contractual alone, but can include all the channels by which managerial know-how and techniques can be passed on, such as on-the-job learning, informal discussions, and so on (Ahiakpor 1990). Moreover, the transfer of technology need not be considered as a static process whereby a particular element of business knowledge is passed on in a one-off fashion. Rather it can be seen as a positive externality of the presence of one or more multinationals, a dynamic process in which knowledge becomes more widely diffused, adopted, and adapted throughout an economy over time (Das 1987). Thus, the question of whether or not Hong Kong garment firms in mainland China transfer technology implies a prior assessment of the kinds of technology they incorporate and use, which goes beyond the kind of easily measurable, “technological” forms of technology that can be formally exchanged. Such an assessment must also include less tangible, “soft” technologies that are generally transferred more informally.

B. *Mechanisms of Transfer*

By considering technology in its most sophisticated and broader concept, multinational firms can act as sources not only of “hard” technology, but also of relatively advanced “soft” managerial practices that spill over generally into their hosts’ business environment with a multiplier effect. Such spillover can be either intra- or inter-industry, and occur through both direct and indirect horizontal or vertical linkages between firms (Chen 1996). It has been suggested that “horizontal, *intra*-industry spillovers” occur through a number of mechanisms (Blomström and Persson 1983): directly through straightforward emulation by firms within the same industry; via human capital, shifting employment from the multinational firm to local firms in the same industry; by informal exchange between managers meeting in trade associations and other industry fora, such as trade fairs (Bennett 1998), and even social functions (Coleman 1988); and indirectly by the stimulation of intensified competition within the same industry (Hirschman 1958). “Vertical, *inter*-industry spillovers” may occur through some of these channels, in addition to direct

vertical linkages with suppliers and buyers in other industries (Asanuma 1989; Egan and Mody 1992). Inter-industry spillovers can also take place indirectly through the stimulus that multinationals provide to new entrants in supplier industries, which thereby increases competition and enhances performance in those industries (Lall 1980; Lim and Pang 1982).

C. *Appropriate Technology*

For particular host country firms, and for rival firms in competing industries, sometimes, FDI may, of course, be disadvantageous, especially when associated with some contractually restrictive forms of technology transfers (Teece 1977). But past concerns about broader dependency disadvantages (Cavusgil 1985, p. 218), relating sometimes as much to political sovereignty as to economic growth, have largely subsided due to the general recognition that FDI and associated technology transfers exert a diffusely beneficial effect on host countries' economies as a whole (Quinn 1969). For developing countries generally, foreign multinationals are now widely considered as a key component in economic growth (Ostry and Gestrin 1993).

However, it has been argued that the degree of economic benefits conferred by FDI may vary (Reuber 1973), and in some cases, FDI is considered to be inappropriate for an economy at a particular stage of economic or political development (White 1978). Of course, some types of FDI appear to have less than optimal multiplier effects mainly because of systemic distortions caused by the incompetence, venality, and corruption of host country public servants (Winston 1979). Nevertheless, some scholars have suggested that FDI from firms in different home countries does not necessarily provide more advanced, but provides more appropriate forms of technology which are more readily adaptable and adoptable (Kojima 1977).

Typically, Japanese FDI, for instance, has been considered to contribute more to the host country growth than American FDI. American FDI has been generally motivated by oligopolistic firms seeking, through horizontal integration, to exploit host country markets (Hymer 1976). They do so by using company-specific competitive advantages, which are, in order to maintain competitiveness, protected via internalization from appropriation by other multinationals and local firms (Caves 1971). Successfully protecting firm-specific competitive advantages through internalization can involve strict maintenance of confidentiality concerning processing and management techniques and the importation of key inputs made by the firms elsewhere. Hence, such oligopolistic firms deliberately attempt *not* to transfer technology through vertical and horizontal linkages. On the other hand, Japanese FDI has, in the past at least, generally been characterized by transnational vertical integration prompted by a search for comparative advantages as domestic factor costs rose. As such, Japanese firms have often been investing to set up export platforms and, since their markets are external to the host country, they have not been particu-

larly interested in keeping confidential in the emerging countries where the FDI has been directed those business processes on which their market competitive advantages depend. Hence, they have not especially sought to prevent their technology from being transferred by informal mechanisms to host country economies. Moreover, because they deliberately seek to utilize cheap local factor inputs, they actively create many of the horizontal and vertical linkage mechanisms by which technology is informally transferred.

However, while it can be argued that such vertical integration-driven FDI comprises more appropriate and more easily transferable technology for emerging economies like China, it has also been suggested that such FDI simply transfers outdated, labor-intensive machinery and management techniques to host countries (Kagami 1998). Research does not find convincing evidence to suggest generally that comparative advantage-, as opposed to competitive advantage-driven FDI, or Japanese- versus U.S.-type FDI, consistently brings about higher economic growth in a developing country through the promotion of technology transfer (Poon and Thompson 1998). Neither is there clear-cut evidence, one way or the other, about the respective “appropriateness” specifically for China of “Japanese” and “U.S.” forms of FDI (Grow 1991). Moreover, the often observed charges that “MNCs transfer obsolete textile machines . . . to developing countries for apparel manufacturing” (Kagami 1998, p. 8) do not correspond to reports by other scholars of the beneficial host-country effects of garment sector FDI (Lall and Wignaraja 1994).

D. *Hong Kong’s Cross-Border Garment Industry*

Whether or not Hong Kong garment sector FDI in China provides any worthwhile, still less an optimum, degree of spillover is open to question. The geographical scope of Hong Kong garment manufacturers has become effectively “transnational” as they have vertically integrated across the mainland China border at a rapid pace in the past decade or so. By 1997, around 80 per cent of surveyed garment firms had manufacturing investments in China so as to take advantage of lower factor costs (Thompson 2000). Higher-value-adding activities, including order processing, distribution, product and process development, finance, strategy, and information technology remain, however, located almost exclusively in Hong Kong. Such comparative advantage-driven, vertical integration across the mainland China border indicates a possibly beneficial, Japanese-style of FDI likely to transfer technology. But this shift of labor-intensive activities to China can also be considered as the latest in a series of circumstances, which it has been argued, ensured that Hong Kong’s garment industry would have never in fact been anything like technologically advanced. Indeed, since Hong Kong garment industry has been characterized as being particularly backward, it is most unlikely that it would have been a worthwhile agent of useful technology transfer.

Actually, most of the manufacturing industries in Hong Kong had been built by

TABLE I
RELATIVELY LOW VALUE ADDED PER PERSON IN HONG KONG GARMENT SECTOR

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Garment sector	47	47	54	67	74	84	91	102	122	127	134
All manufacturing sectors	55	55	67	80	94	108	121	142	165	181	200

Source: Hong Kong Government, Hong Kong Industry Department (1996).

Note: Value added per person engaged in HK\$1,000.

the use of cheap labor, and in the garment industry, at first glance, this has remained the case. Poorly capitalized, self-reliant immigrants from mainland China initiated garment production using abundant, low-priced labor in the form of their fellow immigrants (Skeldon 1986). Whenever garment industry competitiveness had in the past been threatened by rising labor costs, successive incoming waves of immigrants from China had generally been used to alleviate upward pressure on labor prices (Greenwood 1990). As a result, the garment sector has never had a strong wage-cost incentive to switch from labor- to capital-intensive production, and labor productivity in the sector has remained low relative to that of other sectors (Table I).

It has been argued that what began as an initial reliance on labor-intensive production brought about by an abundance of low-cost manpower and a shortage of financial capital, became self-reinforcing for various reasons. First, manufacturers have emphasized labor-intensive production by catering to markets requiring relatively small runs of garments in short turnaround times. Producing for such fickle, mostly fashion-oriented markets puts a high risk on capital investment that simply need not be taken if highly adjustable, labor-intensive production methods can be used. Low trade unionization among newly arrived immigrants has also been considered to have ensured that potential rigidity of employed labor would remain low, making it simpler for manufacturers to develop and perpetuate highly flexible labor-input systems of production (Henderson 1991). Labor-intensive production has also become self-perpetuating as low capital requirements have resulted in low entry barriers to the sector, thereby ensuring constant pressure on margins and high risk to capital investment, which has itself consequently been prevented.¹ Moreover, ease of entry has produced a host of labor-intensive subcontractors competing

¹ Labor-intensive production has become entrenched in the Hong Kong garment sector also because of the need to avoid nonmarket risks to capital investment, such as international trade policy. For example, output from the garment sector has since the late 1950s been exposed to the vagaries of protectionist trade policies, such as the GATT's multi-fibre agreement. Between 1959 and 1987 alone, fifteen different policies and agreements affecting the garment sector, together with subsequent alterations, were imposed on Hong Kong, leading to a particularly uncertain trading environment (Li 1991). In addition, the sector has avoided long-term capital investment due to the perceived risks associated with the assumption of sovereignty from Britain by China in 1997.

TABLE II
RESEARCH AND DEVELOPMENT AMONG HONG KONG MANUFACTURING SECTORS

	Electronics	Moulds/dies	Plastics	Toys	Garments	Watches
Firms investing in R&D in Hong Kong (%)	71	78	25	48	16	59
Firms investing in R&D in China (%)	24	26	18	13	9	22
Motivations for R&D (%):						
Product innovation	67	30	92	52	73	90
Lower manpower demands	0	70	25	15	20	33

Source: Federation of Hong Kong Industries (1995).

for price that enables to obviate the need for capital investment. These subcontractors not only absorb much of the impact of demand fluctuations, but they also further facilitate the continued supply to volatile, small production-run, fashion markets, hence locking in labor- rather than capital-intensive methods (Glasmeier 1994).

As a result, scholars, referring especially to garment manufacturing, have suggested that “the case of Hong Kong is not one of success in terms of the upgrading of industries. Not only have the industries been unsuccessful in trading up to high-technology production and to producing high-value-added products, but . . . they have remained where they were—in labour-intensive production” (Lui and Chiu 1994, p. 54). Such views are reinforced by Hong Kong government research reports on the garment sector which recommend that it should implement longer-term, more strategic and investment-intensive management policies, although little convincing business logic is offered to support such suggestions (Hong Kong Government, Hong Kong Industry Department 1996). The sector has certainly lagged far behind other Hong Kong manufacturing sectors in terms of research and development. Only 16 per cent of the garment firms undertake any R&D, compared with between around 60 and 75 per cent of Hong Kong manufacturers in such sectors as electronics, moulds and dies, and watches (Table II). Moreover, only a low proportion of this R&D expenditure is used for reducing labor-intensive production compared with some other sectors. Consequently, it could reasonably be argued that those garment firms that have shifted manufacturing to mainland China are unlikely to transfer much technology that will significantly improve its economy and growth (Lardy 1999). This is especially the case now that China is seeking deliberately to enhance technologies specifically “to restructure [its] industries from the largely labor and resource intensive to the technology and intelligence intensive [ones]” (Xuan 1995, p. 156). Therefore, the Hong Kong garment sector is simply not appropriate for this policy ambition.

However, it can be argued that the sector’s low level of “hard” technology may have forced it to adopt ever higher degrees of “soft” managerial technology which

is as strongly needed in China as any other forms of technology. Hong Kong garment firms are still highly successful at selling to buyers in the demanding, fashion-oriented markets of advanced industrial economies. Satisfying these markets profitably requires a very high level of soft, managerial technology in terms of management of human resources, operations, and suppliers (Thompson 2000). Such managerial technology, if it does in fact spill over through vertical and horizontal inter- and intra-industry linkages, should prove beneficial to mainland China's economy. However, verifying this assumption is not simple. First, spillovers can be so diffuse and multiple, and stem from so many sources, that it is often impossible to isolate and identify specific FDI as a cause and relate it to any particular technology transfer effect. Second, for similar reasons, it is also notoriously difficult objectively to quantify the cumulative benefits, or costs, of such technology transfer (López-Eguilaz and Pérez 1997). However, it is possible quantitatively to attempt to answer empirically the following two questions: (1) Do Hong Kong garment firms actually have beneficial technology to transfer in the first place? And, if so, (2) does that technology in fact spill over via the vertical, inter-industry and horizontal, intra-industry mechanisms mentioned above?

III. METHOD

A. *Sample*

The initial sample comprised all the firms listed as members of the Federation of Hong Kong Industries that were categorized under woven and knitted garment sectors in its 1998 directory. This directory was selected because it had in previous years been used by the federation itself as the basis for its own postal surveys on investment in China (Federation of Hong Kong Industries 1992, 1995). These two surveys which are some of the only empirical studies covering FDI by Hong Kong garment firms have been widely analyzed and cited (Berger and Lester 1997). Inquiry with the federation suggested that their membership was broadly representative of Hong Kong garment firms, with perhaps a slight bias toward larger companies. Data gathered from the same population in a recent, separate survey (Thompson 2000), indicated that the FDI in China covers predominantly self-manufacture of garments (rather than outsourced assembly), packaging of finished garments, warehousing, and sample making. Hence, the processes of technology transfer examined do not relate primarily to those associated with outsourced piece-work (Deardorff and Djankov 2000). Based on discussions with industry participants, all of these activities are associated with a high degree of quality control through intensive on-the-spot management of all the processes that have been vertically internalized, in addition to close managerial relationships with textile and other suppliers.

B. *Procedure*

Based on discussions with senior industry managers, a questionnaire was devised and pilot-tested by telephone. A letter was then sent in 1999 to the whole sample announcing the aim of the research and stating that the recipients would receive a survey questionnaire shortly. Recipients were generally managing directors, chief executives, or general managers. The introductory letter was sent to a total of 307 firms. Then, between one and two weeks later, the questionnaires were sent. Three weeks after, a reminder and duplicate questionnaire were sent to nonrespondents. Second and third reminder letters, together with duplicate questionnaires, were then sent to remaining nonrespondents at two weekly intervals thereafter.

C. *Response*

Of the original 307 recipients, six replied that they were not in fact garment manufacturers and could thus not complete the questionnaire. Questionnaires could not be delivered to another 24 firms. It is likely that more were not received by prospective recipients, but it is not possible to quantify how many failed attempted deliveries went unnoticed. However, from an assumed final sample of 277 recipient firms, 107 completed and useable questionnaires in total were returned, 39 from the first dispatching, 42 from the second, 11 from the third, and 15 from the final dispatching. Hence, a final real response rate of over 38 per cent was obtained. After four waves of questionnaire dispatching, as it was eventually decided that checking for nonresponse bias would be useless, the profile and responses of returns from the first, second, and combined third and fourth questionnaire deliveries were compared. No significant differences were found. Of the 107 responses, 84 originated from Hong Kong firms with manufacturing plants in mainland China (just under 80 per cent). The mean number of employees within mainland China of the respondent firms was 657.4 (*S.D.* 767.7). Thirty-two per cent of the firms had an annual turnover below U.S.\$7 million, 59 per cent had turnovers in the range of U.S.\$7–14 million, the remaining 9 per cent having turnovers of U.S.\$15 million and above. Some 21 per cent of the respondent firms had made their investments in mainland China within the previous four years (1995–99), 64 per cent during the period 1986–94, and 15 per cent in 1985 or earlier. Of the respondents clearly stating the location of their investments, 51 had made investments in the area around Guangzhou, most particularly Dongguan and Shenzhen. For the remaining 49 per cent, the investments were dispersed throughout China.

D. *Measures*

Objective measurement of technology transfer, particularly the “softer” forms of technology, is very difficult. As researchers in the field of technology transfer to

China have generally observed, lack of reliable secondary data in mainland China exacerbates such difficulties (Andreosso-O'Callaghan and Qian 1999). Accordingly, the methods of measurement previously used by two of the only empirically based studies of technology transfer to China, one by Ball, Zhang, and Pearson (1993), the other by Lan and Young (1996), were adopted to obtain primary, quantitative data. In both studies, interval measures to evaluate, across a range of technology transfer-related items, the perceptions of executives from foreign firms investing and doing business in China were used. For the current study, along with appropriate categorical parameters, the questionnaires included statements to which respondents were asked to indicate their degree of agreement or disagreement on a five-point interval measure as follows: 1, strong disagreement; 2, disagreement; 3, neutral; 4, agreement; and 5, strong agreement.

Technology Level: To evaluate perceived levels of hard and soft technology, based on the methodology used by prior researchers (Chen 1998; Lan and Young 1996; Ball, Zhang, and Pearson 1993), the respondents were asked to rate their own firms relative to those of mainland China competitors. For hard technology, direct assessments of comparative technological advancement were sought. Soft technology, including essentially management know-how, was measured through a series of comparative items indicating relatively high degrees of advanced managerial input.

Transfer Mechanisms: Backward vertical, inter-industry linkage spillovers were assessed using a series of items relating to the impact of investing firms on the suppliers. The effect of forward inter-industry linkages was deduced from data collected about buyers, notably location. Spillovers via horizontal linkages were assessed by the perceived impact on mainland competitors, effect on human capital, and extent of formal associability in terms of membership of mainland China trade associations.

This approach had the advantage of having already been used by the above researchers, specifically regarding technology transfer to China. Moreover, the use of interval measures of perceptions also has been widely accepted in a range of recent development and business-related studies in which statistical soundness had been demonstrated (Schmitz 1999; Nadvi 1999). The approach might be criticized because it quantifies perceptions that, sometimes, can be subjective, although not, possibly in this case, so much for socio-cultural reasons as perhaps simply for hubris. The effect should not, however, be exaggerated as business managers generally know their firms' relative strengths compared with those of competitors and there is little benefit for them not to be objective. The fact that questionnaire recipients were informed that their responses would be used only anonymously and in aggregated data might also have mitigated any incentive to answer questions in such a way as to cast respondents in a favorable light.

Nevertheless, it was eventually decided to test the objectivity and accuracy of the responses as much as possible, by asking business managers to provide information

about the most sensitive and hubris-prone subject, namely, levels of profitability. In the initial survey questionnaire, respondents were asked to indicate the profitability of their firm relative to that of competitors on a five-point interval measure ranging from significantly lower to significantly higher. At the start of 2000, roughly two months after initial responses had been received, a supplementary questionnaire was sent to all the identifiable respondents, asking them to state what they estimated or assumed to be the average gross margin on sales in the garment sector generally and what their own firms' gross margin actually was. If the sample respondents had a reasonable and objective knowledge of competitors' firms and were also accurate in statements about their own firms, one would expect that the mean of assumed sector gross margins would be very similar to the mean of stated individual firm gross margins. On the other hand, if the sample managers were prone to hubris- or ignorance-driven exaggerations of their particular firms' relative profitability, one might expect that the mean of assumed general sector gross margins would somewhat be lower than the mean of stated individual firm gross margins.

Fifty-nine of the original respondents replied. The mean of assumed sector average gross margin on sales was 15.612 per cent, which corresponded very closely to the mean of stated individual firm gross margin on sales of 15.864 per cent. This result strongly indicates that the respondents appeared to be both accurately knowledgeable about competitors' firms and not prone to exaggerate their own firms' attributes relative to those of competitors.

To determine whether the respondent managers were also consistent, responses to the original questionnaire item about relative profitability were compared with the responses to the supplementary questionnaire item about gross margin on sales for individual firms. While profitability and gross margin are not necessarily synonymous, one would expect that they would be correlated if the survey respondents were reasonably consistent. A significant correlation was found ($r = 0.23$, $p < 0.10$), suggesting that the respondents were reasonably objective and also consistent in evaluating their own firms against those of competitors. The implication of these tests is that, while caution is still needed, the overall survey results can certainly be considered to be relatively accurate and objective.²

IV. RESULTS

A. *Hard Technology Level*

Items in Table III indicate that the manufacturing investments made by Hong Kong garment firms were considered to involve technology that was more advanced

² Notwithstanding the objectivity of the present study method, the findings would be considerably corroborated and enhanced if comparative studies with an appropriate population of mainland China firms could be conducted. Certainly future studies might usefully incorporate such a comparative approach.

TABLE III
MEANS, STANDARD DEVIATIONS, AND CORRELATIONS BETWEEN INDICATORS OF THE LEVEL OF HARD AND SOFT TECHNOLOGY

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>t</i> -statistic	1	2	3	4	5	6	7	8
Your mainland China manufacturing investment(s) are generally more technologically advanced than:												
1. Those of the plant in Hong Kong they replaced when you set them up	78	3.12	.90	1.18								
2. Those of your plants remaining in Hong Kong, if any	68	2.96	.97	-0.34	.31**							
3. Those of preexisting, local mainland China competitors' plants	71	3.69	.82	7.09**	.35**	.12						
4. Those of new mainland China competitors' plants	72	3.35	.72	4.12**	.30**	.14	.47**					
Generally, your mainland China manufacturing investment(s):												
5. Are more efficient than those of your mainland China competitors' plants	77	3.51	.75	5.97**	.12	-.12	.39**	.24*				
6. Are more capital-intensive than those of your mainland competitors' plants	76	3.58	.74	6.83**	.23*	-.11	.27*	.28*	.56**			
7. Require higher-skilled managers than those of your mainland competitors' plants	79	3.78	.65	10.67**	.14	.12	.31**	.42**	.27**	.39**		
8. Can produce higher quality products than those of mainland competitors' plants	80	3.89	.64	12.44**	.05	.15	.42**	.19	.42**	.31**	.31**	
9. Are capable of more flexible production than those of mainland competitors' plants	79	3.85	.62	12.19**	.16	.02	.08	.09	.37**	.25*	.20*	.47**

Source: Author's survey.

Note: Single sample *t*-statistics are against the neutral mid-point of 3.00. Pearson product-moment correlation, one-tail test: ** = $p \leq 0.01$, * = $p \leq 0.05$.

than that used by their mainland China competitors. However, the technological level of such investments was only very slightly more advanced than that of the Hong Kong-based plants they replaced, and the level was certainly not more advanced than that of the respondent plants remaining in Hong Kong (items 1 and 2, Table III). Nevertheless, the respondents agreed quite strongly and significantly that the technological level of their manufacturing investments was generally more advanced than the level of preexisting mainland China competitors' plants ($mean = 3.69$, $t = 7.09$, $p \leq 0.01$). They also significantly agree, although less strongly, that the technological level of their own manufacturing investments was more advanced than that of new local mainland China competitors' plants ($mean = 3.35$, $t = 4.12$, $p \leq 0.01$). They indicated that this was due to the fact that their investments were significantly more capital-intensive than those of their mainland competitors ($mean = 3.58$, $t = 6.83$, $p \leq 0.01$).

B. *Soft Technology Level*

Other items in Table III suggested that the level of managerial technology extended by the Hong Kong firms to mainland China manufacturing plants was also substantially higher than that of their mainland competitors. Survey respondents agreed significantly and strongly that their plants required higher-skilled managers than those of the local competitors ($mean = 3.78$, $t = 10.67$, $p \leq 0.01$). They also significantly agreed strongly that their own plants were more efficient ($mean = 3.51$, $t = 5.97$, $p \leq 0.01$), could produce superior quality products ($mean = 3.89$, $t = 12.44$, $p \leq 0.01$), and were capable of more flexible production than the plants of their mainland competitors ($mean = 3.85$, $t = 12.19$, $p \leq 0.01$). These three items, obviously, partially reflected the higher level of hard technology that Hong Kong firms' investments incorporate. This was indicated by the significant positive correlations between capital intensity and each of the three items (respective r s of 0.56 [$p < 0.01$], 0.31 [$p < 0.01$], and 0.25 [$p < 0.05$]). However, efficient production of superior products through highly flexible production methods also partially depends on advanced managerial techniques. This was suggested by the significant positive correlations between the item for higher-skilled management and the items for higher efficiency ($r = 0.27$, $p < 0.01$), superior products ($r = 0.31$, $p < 0.01$), and flexible production ($r = 0.20$, $p < 0.05$).

In all, these results showed that the level of both hard and soft technology of the Hong Kong garment firms was somewhat more advanced than that of their mainland competitors. Although the technological edge over local Chinese firms of the Hong Kong firms may appear to be declining, it is reasonable to conclude that the technology has been and still remains useful, if it is in fact transferred. Indeed, provided that the level of hard and soft technology of the Hong Kong firms is merely different from that of mainland competitors, it can be considered to be useful. Useful technology need not necessarily be superior in any objective sense as long as it

has the potential to improve economic efficiency and be transferred. This leads us, of course, to the question of whether or not the level of technology of the Hong Kong firms does in fact spill over via vertical and horizontal linkages to mainland competitor firms and the wider Chinese economy.

C. Vertical, Inter-industry Spillovers

The presence of more Hong Kong garment firms should attract new entrants in supplier industries, which should, in turn, stimulate competition between them to improve their goods and services. According to the respondents, there are certainly more mainland suppliers to their plants than there used to be, and such suppliers are also competing more strongly for their business (Table IV). They agreed significantly and quite strongly that there were more suppliers ($mean = 3.54, t = 5.86, p \leq 0.01$), and agreed slightly more strongly that these suppliers were competing harder for their custom ($mean = 3.61, t = 7.39, p \leq 0.01$). While it is not possible to ascribe the increased number of suppliers directly to the presence of more Hong Kong firms, it seems logical to assume that there should be an association. That this logic prevails seems reasonable because there was a positive correlation, significant at the 1 per cent level, between the reporting of more suppliers and higher competition between suppliers for Hong Kong firms' business ($r = 0.37$). There was also a positive correlation, significant at the 1 per cent level, between the reporting of more suppliers and agreement that better value for money was provided by the suppliers ($r = 0.34$).

Along with the above indirect positive externality, the findings indicated that Hong Kong firms indeed encouraged their mainland suppliers to produce better

TABLE IV
MEANS, STANDARD DEVIATIONS, AND CORRELATIONS: BACKWARD VERTICAL INTER-INDUSTRY TECHNOLOGY TRANSFER INDICATORS (SUPPLIER RESPONSES AND LINKAGES)

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>t</i> -statistic	1	2	3	4
Mainland suppliers to your plant(s) in China are:								
1. More numerous than they used to be	68	3.54	.76	5.86**				
2. Upgrading their products/services as a result of your demands	77	3.60	.69	7.63**	.40**			
3. Working closely with your firm to improve their productivity/services	77	3.57	.70	7.15**	.31**	.62**		
4. Providing better value for money than they used to	73	3.51	.75	5.81**	.34**	.45**	.69**	
5. Competing harder with each other for your business	72	3.61	.70	7.39**	.37**	.43**	.66**	.52**

Source: Author's survey.

Note: Single sample *t*-statistics are against the neutral mid-point of 3.00. Pearson product-moment correlation, one-tail test: ** = $p \leq 0.01$, * = $p \leq 0.05$.

inputs. Respondents agreed quite strongly that their mainland suppliers were upgrading products and services as a result of their demands ($mean = 3.60, t = 7.63, p \leq 0.01$). This item showed a fairly strong and significant correlation with higher levels of competition between suppliers ($r = 0.43, p < 0.01$) and the provision of better value for money ($r = 0.45, p < 0.01$), suggesting that a combination of more competition between suppliers and more demanding Hong Kong firm buyers acted indirectly to enhance the supplier quality. While it could be suggested that Hong Kong firms played essentially a passive role, the findings also indicated that the respondents in fact directly cooperated with their mainland suppliers to assist them in the improvement of their products and services to meet specified requirements. Hong Kong firms agreed quite strongly that they were generally working closely with mainland suppliers to improve supplier inputs ($mean = 3.57, t = 7.15, p < 0.01$). This item showed a very strong and significant correlation with higher inter-supplier competition ($r = 0.66, p < 0.01$) and provision of better value for money ($r = 0.69, p < 0.01$), suggesting that the direct action of Hong Kong firms in working closely with mainland supplier firms resulted in technology transfer that enhanced the competitiveness of the supplier firm.

In addition to indicating backward vertical, inter-industry linkages as a mechanism of technology transfer from Hong Kong garment firms to mainland China, the findings suggested that the impact of buyers, a forward vertical linkage, could reasonably be considered to provide a positive externality for mainland China. However, this externality from FDI by Hong Kong garment firms was essentially vicarious. The domestic mainland market may be vast, but it is by no means rich or sophisticated compared with other markets around the world. Certainly it could not be expected to catapult local manufacturers out of relatively commoditized production for domestic consumers served through relatively underdeveloped wholesale and retail channels. Consequently, anything which might make buyers more particular and demanding of manufacturers (and, by extension, manufacturers' suppliers) should contribute to vertical technology transfers. The quality of customer demand for the upgrading of firm performance has been particularly stressed by management scholars (von Hippel 1986). Obliquely, Hong Kong's garment firms in China massively upgraded the demand conditions of the garment sector. The surveyed firms only sold on average less than 5 per cent of their turnover in China. However, the important market was not necessarily the China "home" market in this case, but the main foreign markets, of North America, Europe, and Japan, which are highly sophisticated as well as demanding fashion-oriented and quality-conscious markets (Table V). Supplying these highly advanced markets imposes a constant discipline upon Hong Kong firms to upgrade their products and services. In doing so they are forced to use ever more refined manufacturing and managerial techniques throughout their vertically integrated operations (Moon et al. 1995). Hence, FDI by Hong Kong garment firms brings to China the product and produc-

TABLE V
PERCENTAGE OF SALES TO RESPECTIVE MARKETS

	Percentage
China	5
Europe	32
Hong Kong	11
Japan	13
North America	32
Elsewhere	7

Source: Author's survey.

tion demands of markets with which its own domestic manufacturers do not yet deal to a large extent.

D. *Horizontal, Intra-industry Spillovers*

If Hong Kong garment firms with investments in mainland China bring with them both hard and soft technologies that are relatively more advanced than those of the local competitors, such competitors might attempt to emulate and acquire such technologies. The respondents suggested that this was indeed the case (Table VI). They significantly agreed that wholly owned mainland China garment firms tried to copy their production processes and techniques ($mean = 3.42, t = 4.13, p \leq 0.01$). Respondents significantly agreed slightly more strongly still that mainland firms attempted to learn their managerial practices ($mean = 3.45, t = 4.84, p \leq 0.01$).

One mechanism through which rival firms can learn from each other is through trade and industry associations. Hence, the survey respondents were asked about their membership of both general and specialist business associations in mainland China. Just over a quarter ($n = 22$) indicated that their firms held memberships in such associations. Some 23 per cent ($n = 19$) of the respondents reported membership of one or more general, mainland-based business or industry association. Around 12 per cent ($n = 10$) reported membership of a mainland-based specialist trade association related to the garment sector. These rates of membership were not particularly high and further research would be required to investigate the extent to which any forms of technology might be transferred via associability. However, it is likely that some informal technology transfer from Hong Kong- to mainland-based firms may indeed occur through this mechanism.

A horizontal mechanism of technology transfer suitable for better quantification is the role of mobile labor. Survey respondents certainly indicated that mainland rival firms like particularly to hire their employees (Table VI). The degree to which this is the case depends on the level of employee. Respondents significantly agreed, but not very strongly ($mean = 3.28, t = 3.06, p \leq 0.01$), that mainland rivals liked particularly to hire their factory managers. Employees at the supervisor level were

TABLE VI
 MEANS, STANDARD DEVIATIONS, AND CORRELATIONS: HORIZONTAL INTRA-INDUSTRY TECHNOLOGY
 TRANSFER INDICATORS (COMPETITOR RESPONSES)

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>t</i> -statistic	1	2	3	4
Wholly mainland-owned firms in your sector:								
1. Try to copy your production processes/techniques	62	3.42	.80	4.13**				
2. Attempt to learn your managerial practices/style	65	3.45	.75	4.84**	.49**			
3. Like particularly to hire your factory managers	67	3.28	.75	3.06**	.33**	.54**		
4. Like particularly to hire your factory supervisors	69	3.42	.77	4.53**	.30*	.57**	.87**	
5. Like particularly to hire your factory workers	69	3.54	.68	6.60**	.23*	.44**	.77**	.84**

Source: Author's survey.

Note: Single sample *t*-statistics are against the neutral mid-point of 3.00. Pearson product-moment correlation, one-tail test: ** = $p \leq 0.01$, * = $p \leq 0.05$.

slightly more sought after ($mean = 3.42$, $t = 4.53$, $p \leq 0.01$), and factory workers were sought by mainland competitors even more ($mean = 3.54$, $t = 6.60$, $p \leq 0.01$). Based on the significance and strength of the correlations between the items in Table VI, it is possible, as would be expected, that the hiring of Hong Kong firm employees by mainland rivals was mainly geared to learning management practices than to copying production processes. The item relating to the hiring of supervisors was positively correlated quite strongly and significantly with that related to the learning of management practices ($r = 0.57$, $p < 0.01$), but was less strongly and less significantly correlated with the item relating to production processes ($r = 0.30$, $p < 0.05$).

The desire by mainland firms particularly to hire employees from Hong Kong firms may imply that they are more valuable units of labor for having been employed by Hong Kong firms, which was substantiated by the survey respondents (Table VII). They agreed very strongly that their factory workers were being trained by their firms ($mean = 3.99$, $t = 13.54$, $p \leq 0.01$), and agreed strongly that they provided more training than their mainland competitors ($mean = 3.63$, $t = 6.62$, $p \leq 0.01$). The respondents also significantly agreed strongly that they paid their factory workers more than mainland companies ($mean = 3.88$, $t = 11.31$, $p \leq 0.01$). This suggests that the Hong Kong firms realized the value they added to their employees by training them and that they considered that the resulting higher productivity justified the higher wages which enabled to retain such workers. The positive and significant correlations between the two training-related items and payment of higher wages appeared to support this assumption ($r = 0.23$ [$p < 0.05$] and $r = 0.31$

TABLE VII
 MEANS, STANDARD DEVIATIONS, AND CORRELATIONS: HORIZONTAL INTRA-INDUSTRY TECHNOLOGY
 TRANSFER INDICATORS (MAINLAND FACTORY WORKERS)

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>t</i> -statistic	1	2	3
Factory workers in your mainland plant(s) generally:							
1. Are trained by your firm	84	3.99	.67	13.54**			
2. Receive more training than they would in mainland-owned plants	78	3.63	.84	6.62**	.25*		
3. Are paid slightly more than the workers in mainland-owned plants	81	3.88	.70	11.31**	.23*	.31**	
4. Take up higher paid employment when they leave for another job	68	3.31	.80	3.20**	.06	.21*	.35**

Source: Author's survey.

Note: Single sample *t*-statistics are against the neutral mid-point of 3.00. Pearson product-moment correlation, one-tail test: ** = $p \leq 0.01$, * = $p \leq 0.05$.

[$p < 0.01$], respectively). It seems that rival employers also recognized the higher productivity of Hong Kong firms' factory workers as the respondents agreed that such workers take up higher paid employment when they leave for another job ($mean = 3.31$, $t = 3.20$, $p \leq 0.01$).

Based on the reported staff turnover levels, the training and on-the-job learning that Hong Kong firms provide to their factory workers would seem to spill over relatively quickly into other firms within China. Around one-third of the respondents reported an annual staff turnover among their factory workers of between 11 and 20 per cent, with over one-tenth reporting turnovers of more than 21 per cent a year. Only 16 per cent of the firms stated a staff turnover of less than one in twenty workers per annum. In absolute terms, since the respondent firms each employed on the average 1,029 full-time factory workers in their mainland plants, and assuming an average staff turnover of 15 per cent, it could be estimated that the respondent firms collectively lose around 13,000 workers per annum. Some of the staff may be hired by other Hong Kong garment firms, and other workers will exit the workforce altogether, but many may be assumed to find work in, and transfer their acquired know-how to, the broader Chinese economy.

Table VIII shows that the Hong Kong firms also agreed strongly that they trained their mainland China managers ($mean = 3.96$, $t = 12.68$, $p \leq 0.01$), and trained them to a higher degree than their mainland competitors ($mean = 3.86$, $t = 9.49$, $p \leq 0.01$). As in the case of the factory workers, the resulting higher productivity was being rewarded by higher remuneration, with the respondents agreeing very strongly that their mainland managers were paid more than those in rival mainland companies ($mean = 4.05$, $t = 13.27$, $p \leq 0.01$). The moderately strong, significant, positive correlation between training and higher pay reflected this fact ($r = 0.48$, $p < 0.01$).

TABLE VIII
 MEANS, STANDARD DEVIATIONS, AND CORRELATIONS: HORIZONTAL INTRA-INDUSTRY TECHNOLOGY
 TRANSFER INDICATORS (MAINLAND MANAGERS)

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>t</i> -statistic	1	2	3	4	5
Mainland managers in your mainland plant(s) generally:									
1. Are trained by your firm	83	3.96	.69	12.68**					
2. Receive more training than they would in mainland-owned plants	78	3.86	.80	9.49**	.39**				
3. Are paid slightly more than the managers in mainland-owned plants	76	4.05	.69	13.27**	.48**	.43**			
4. Take up higher paid employment when they leave for another job	68	3.43	.87	4.08**	.22*	.35**	.41**		
5. Sometimes leave to set up their own garment sector-related firms	65	3.02	.76	0.21	.06	.05	.12	.33**	
6. Often leave to work in mainland-owned plants/businesses	67	2.69	.76	-3.34**	-.09	-.14	.13	.05	.40**

Source: Author's survey.

Note: Single sample *t*-statistics are against the neutral mid-point of 3.00. Pearson product-moment correlation, one-tail test: ** = $p \leq 0.01$, * = $p \leq 0.05$.

A policy of paying higher wages to retain trained managers would seem to be effective as the respondents significantly did not agree that their managers often leave to work for mainland competitors ($mean = 2.69$, $t = -3.34$, $p \leq 0.01$). This suggests that managerial employees are not particularly good channels of technology transfer, but it should perhaps be remembered that in all the firms in all the countries managerial level staff turnover is low compared with that among factory workers. Moreover, while the respondents were neutral about the item concerning managerial departures for the purpose of setting up garment-related firms ($mean = 3.02$, $t = 0.21$, $p \geq 0.10$), one quarter of the respondents indicated that sometimes their managers left to start their own garment-related businesses, leading to an important channel of managerial/entrepreneurial technology transfer. Still others may leave to set up businesses not related to the garment sector. It is possible that a similar proportion of managers from local mainland producers also leave to venture into business on their own accounts, but, in that case, they would appear to have less training before leaving.

V. CONCLUSIONS

Hong Kong garment firms may rightly have been described as labor- rather than capital-intensive, but this by no means results in them being poor sources of transferable, useful technology that might contribute to the enhancement of the economic development of mainland China. Quite to the contrary, Hong Kong garment

firms are characterized by high levels of soft, managerial technology and relatively high levels of hard technology. The historical labor-dependence of the Hong Kong garment sector has resulted in the establishment of firms specialized in satisfying the demand of the highly sophisticated, wealthy, fashion-dominated markets of North America, Europe, and Japan. Focusing on these markets obviates many of the benefits of capital-intensive production because of the relatively small batch sizes required and the very short turnaround times imposed by rapidly shifting consumer sentiment. To successfully deal with such markets requires a high flexibility and very skilful value chain management and coordination—in short, managerial-intensive production. Hence, Hong Kong garment firm FDI in mainland China brings with it a high degree of cutting-edge, world-class, soft business know-how that is as much required in China as any hard technology. Nevertheless, the findings also suggested that the capital investments by Hong Kong firms were more technologically advanced in a hard sense than those of existing and new local mainland competitors' plants. As a result, Hong Kong garment sector FDI certainly cannot be characterized as the exportation of obsolescent hard or soft technology.

It is important to recognize that the technology of the Hong Kong garment firms was actually being transferred. Transfer via backward, inter-industry, vertical linkages would seem to be a particularly effective mechanism. The findings strongly suggested that the Hong Kong firms indirectly generated a higher competition between an increased number of suppliers, and that they also directly cooperated with suppliers in order to enhance mutual competitiveness. In terms of forward vertical linkages, the mainland is vicariously able to benefit from some of the most exacting demand conditions in the world through Hong Kong garment sector FDI geared to export production. While quantifying the overall technology transfer benefits associated with such forward linkages is extremely difficult, it is certain that China is benefiting from them sooner than might be the case without Hong Kong garment firm investments. Moreover, grafting this world-class demand onto China's economy through vertically integrated Hong Kong FDI implies that the deliberate obstruction of spillover mechanisms sometimes associated with the internalization motive of horizontal FDI can be avoided. Consequently, the export-oriented FDI of Hong Kong garment firms can be readily felt in terms of technology transfers through horizontal spillover channels.

Horizontal, intra-industry linkages were found to operate, although it is very difficult to evaluate them objectively. It appears that the mainland firms were stimulated by the Hong Kong firms to be more efficient. The mainland firms appeared to seek to emulate the Hong Kong firms, by attempting both to copy their production processes and to learn their managerial practices. It was not found that trade association memberships were likely to play a major mechanistic role in this aspect due to the low levels of reported memberships. However, the fact that reportedly well-trained and experienced personnel shifted employers, and sometimes even set up

their own firms, could possibly be a powerful mechanism of horizontal technology transfer.

In conclusion, the current studies showed that FDI by Hong Kong garment firms involved worthwhile technology and that this technology was in fact transferred to mainland China. Such a technology may not constitute the type of "rocket-science-high-technology" highly appreciated by politicians worldwide, but it involves advanced, market-focused managerial practices on which many of the world's most successful economies increasingly depend. If policy implications can be drawn from the findings, it appears that the mainland China authorities should shift their emphasis away from concerns about attracting FDI that ostensibly brings hard, high-technology and rather reorient their focus on facilitating and promoting the kinds of vertical and horizontal intra- and inter-industry linkages through which both hard and soft technology readily spills over.

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