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THE EFFECT OF OVERSEAS INVESTMENT ON DOMESTIC EMPLOYMENT

Tain-Jy Chen
Ying-Hua Ku

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ABSTRACT

In this paper, we study the effects of FDI on domestic employment by examining the data of Taiwan's manufacturing industry. Treating domestic production and overseas production as two distinctive outputs from a joint production function, we may estimate the effect of overseas production on the demand for domestic labor. We found that overseas production generally reduces the demand for domestic labor as overseas products serve as a substitute for primary inputs in domestic production (substitution effect). But overseas production also allows the investor to expand its domestic output through enhanced competitiveness. The expanded domestic output leads to more employment at home (output effect).

The net effect of FDI on domestic employment is a combination of substitution and output effects. For Taiwan, the net effect is positive in most cases but it differs across the labor group. Technical workers tend to benefit most from FDI, followed by managerial workers, and blue-collar workers benefit the least; indeed they may even be adversely affected. This suggests that after FDI, a reconfiguration of division of labor within a firm tend to shift the domestic production toward technology and management intensive operations.

Tain-Jy Chen
Chung-Hua Institution for Economic Research
tainjy@mail.cier.edu.tw

Ying-Hua Ku
Chung-Hua Institution for Economic Research

INTRODUCTION

It has long been a concern of policymakers that foreign direct investment (FDI) may cause job losses at home; indeed, labor unions generally consider FDI to be the equivalent of job exporting. The logic is simple; as production lines are relocated overseas, gone with them are the workers that served the domestic lines. This reasoning is of course over-simplistic, because there could never be any guarantees that the production lines that were relocated overseas would have been able to survive the competition had they remained at home. If these production lines were to be eliminated anyway, then their relocation does not result in any job losses.

Conversely, there is always the possibility that overseas investment might well enhance the overall competitiveness of the investing company and therefore boost job opportunities at home which would otherwise have been swept away by competition. Ku (1998), for example, found that FDI enabled Taiwanese enterprises to restructure themselves, and therefore increase their tenacity. They showed that firms engaging in overseas production had a better chance of survival than those that were not.

Those who are concerned about the adverse effects of overseas investment on domestic employment basically assume that overseas production is a substitute for exports; hence, as exports fall, so does employment. This is a conventional argument along the lines of Mundell (1957) who showed very elegantly, in a 2×2 model, that capital movement is equivalent to trade. Products produced in overseas locations not only replace exports, they may also in fact be re-imported back home to substitute the product lines that were previously imported to serve the home market (Liu and Lin 2001). There are, however, counter-arguments to Mundell's 'perfect substitution' theory. Markusen (1983), for example, demonstrated the theoretical possibility that FDI and trade are complementary rather than substitutes; therefore, the relationship between FDI and job opportunities at home is indeed an empirical question.

Brainard and Riker (1997a, 1997b) directly estimated the substitution elasticities between employment in parent companies and their foreign affiliates, as well as those between different affiliates, and found a very low degree of substitution between parent and affiliate employment, although there was a high degree of substitution between affiliates in developing counties. They also found that the relationship between employment in industrialized country affiliates and in developing countries was complementary rather than substituting.

Slaughter (1995) had earlier found a similar low degree of substitution between parent and affiliate employment when only production workers were considered. He noted that the employment of production workers did not seem to be systematically related to relative wages between the parent and the affiliate. This suggests that overseas employment corresponds only weakly to the wage gap between home and host countries, although it may correspond strongly to the wage gap between different overseas locations. Hatzius (1997) and Döhrn (1997) found similar results for Sweden with overseas employment of Swedish multinational firms corresponding to wages in actual and potential host countries, but not to wages in Sweden. Blomstrom and Kokko (2000) also discovered that Swedish multinationals relate to domestic policies rather than wages in determining whether to keep production at home.

This evidence suggests that overseas production and domestic production is closely related, but not necessary substitutable. In fact, there must be a division of labor between the parent and affiliates since FDI is an action taken to enhance the competitiveness of a company. To the extent that FDI reduces the costs of the parent's operations, it also helps the parent to expand its level of output, which in turn, increases employment at home. Blomstrom, et. al. (1997), for example, found that overseas investment in developing countries by US firms did have the effect of replacing domestic employment, but the same investment in developed countries did

not; the replacement effect was, however, limited to production workers.

Findings that the employment effect from FDI may differ across labor groups are important, for this implies that FDI has important consequences for income distribution. For example, the examination of Swedish firms by Blomstrom, et. al. (1997) found that FDI contributes to growth in employment of unskilled labor at home because Swedish multinationals were investing abroad to acquire skilled workers to engage in R&D and other skills-intensive activities. Lipsey's (1994) study of US multinationals also found that overseas affiliates allow the parent to employ more managerial and technical staff at the same level as in their domestic production. Feenstra (1996) showed that FDI in Mexico by US firms increased the demand at home for skilled workers vis-à-vis unskilled workers, thus raising the relative wage of skilled workers, and worsening income distribution for the investing country; whereas the reverse occurred in Mexico.

There is an indirect, but nevertheless very important, linkage between FDI and domestic employment; that is, the effect of FDI on domestic investment. If FDI outflows are accompanied by an equal reduction in the amount of domestic investment, then FDI may still reduce job opportunities at home even if overseas production is complementary to domestic production; Feldstein (1994) also seems to suggest such a one-to-one substitution effect. Stevens and Lipsey (1992) also found a negative relationship between FDI and domestic investment; although not as clear as one-to-one replacement; however, Bayoumi and Lipworth's (1997) study of the case in Japan found no displacement effect on domestic investment from FDI. Again, the actual relationship is therefore an empirical question.

The purpose of this paper is therefore to examine the relationship between FDI and domestic employment at firm level, using Taiwan's manufacturing industry as an example. We find that overseas production leads to an increase in the domestic employment of managerial and technical workers, but may also reduce the employment available to

unskilled workers. Overseas production partially replaces inputs to domestic production, resulting in a decline in labor demand at a given output level; however, at the same time overseas production reduces the costs of domestic production, leading to an expansion in output. These input-replacement and output-expansion effects combine to a produce a net effect which is positive in most cases, although the net effect differs with different labor groups and the geographical location of overseas investment.

AN OVERVIEW OF TAIWAN'S FDI AND MANUFACTURING EMPLOYMENT

Taiwanese firms made only sporadic outward investment before 1980. Beginning in the mid-1980s, Taiwanese firms started making more substantial foreign investment, driven by rising wages and rising value of Taiwanese currency, NT. Between 1987-1990, Southeast Asia and USA were the major destinations of Taiwan's foreign investment. In the early 1990s, China emerged in the FDI map and eventually became the most popular destination for Taiwanese investors. In the second half of the 1990s, China took up almost a half of Taiwan's total amount of outward investment (see Table 1). The manufacturing sector accounted for the majority of overseas investment, dominating the service and agriculture sectors. In the manufacturing sector, FDI is most active in the electronics, chemical, and textile industries. FDI appears to have important consequences on domestic employment.

Table 1 Taiwan's Outward Investment by Location

Unit: 1,000 US dollars

	Asia (excluding China)	America	Europe	China	Others	**Total**
1952~90	1,077,710	1,844,332	115,171	0	39,298	**3,076,511**
1991	929,819	658,958	60,289	174,158	6,964	**1,830,188**
1992	369,929	449,096	45,933	246,992	22,301	**1,134,251**
1993	663,514	740,110	255,913	3,168,411	1,398	**4,829,346**
1994	559,471	988,336	22,209	962,209	46,748	**2,578,973**
1995	467,743	787,105	59,868	1,092,713	42,162	**2,449,591**
1996	661,717	1,442,953	11,875	1,229,241	48,859	**3,394,645**
1997	818,743	1,915,948	58,508	4,334,313	100,627	**7,228,139**
1998	580,819	2,637,021	33,828	2,034,621	44,634	**5,330,923**

1999	836,378	2,267,710	60,982	1,252,780	103,943	**4,521,793**
2000	851,065	3,946,021	62,225	2,607,142	217,751	**7,684,204**
2001	814,981	3,460,902	45,594	2,784,147	70,177	**7,175,801**
2002	528,054	2,475,575	123,416	6,723,058	243,001	**10,093,104**
Total	**9,159,943**	**23,614,067**	**955,811**	**26,609,785**	**987,863**	**61,327,469**

Source: *Statistics on Overseas Chinese & Foreign Investment, Outward Investment, and Indirect Mainland Investment*. Investment Commission, Ministry of Economic Affairs.

Manufacturing employment in Taiwan reached a peak in 1987 when 2.821 million people were working in the manufacturing sector; thereafter, there was a general decline in manufacturing employment until it hit a trough in 1994, when 2.422 million people were working in the sector. It then started to recover through the mid- to late-1990s, with 2.655 million people being employed in the manufacturing sector by 2000 (see Figure 1).

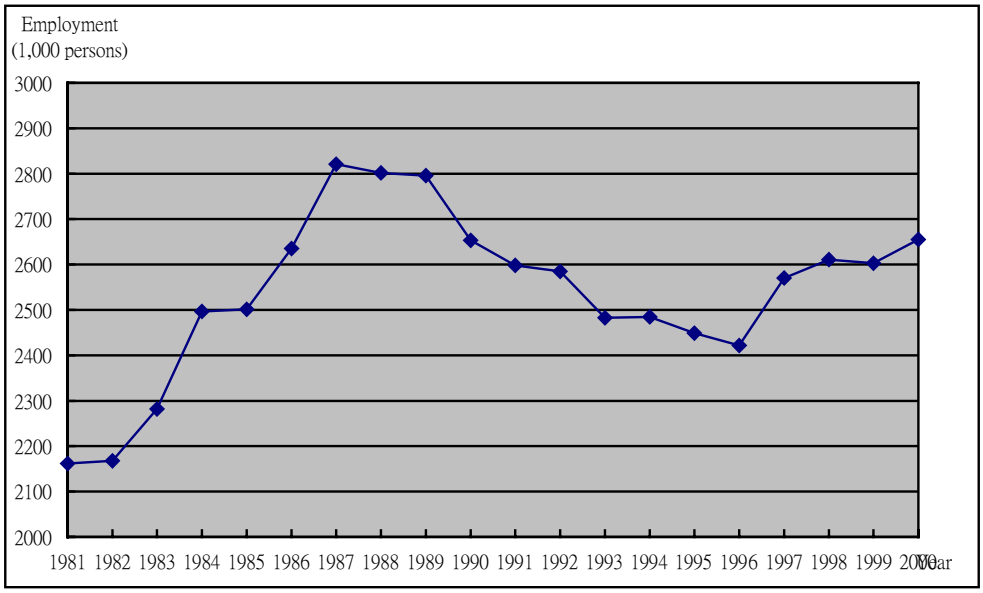

Figure 1 Manufacturing employment, 1981-2000

The available employment data suggests that the period 1987-1994 was a time when Taiwan's industry underwent dramatic restructuring. Whilst there were losses of 399,000 manufacturing jobs throughout that period, there was nevertheless an increase in employment in the service sector of around 1.385 million, more than enough to offset these losses. Thus, unemployment rates remained at low levels throughout the 1990s.

It is also worth noting that 1987 was around the time when Taiwanese firms began to embark on the course of FDI, with more than US$43 billion being invested overseas from 1987 to 2000. Between 1987 and 1992, FDI was concentrated in Southeast Asia where Malaysia, Thailand and Indonesia took the lion's share of Taiwan's overseas investment; however, from 1992 onwards, the focus for FDI shifted to China. After the 1997 Asian financial crisis, FDI in Southeast Asia came to a virtual standstill whereas FDI in China continued to surge. In 2001, the global recession saw Taiwan's unemployment rate reaching an unprecedented 4 per cent; thus there were heightened fears that FDI may have led to rising unemployment at home.

Beneath the surface of a relatively stable employment situation in the 1990s, there was a rather dramatic transformation taking place in the industrial structure. Amongst 22 two-digit industries in the manufacturing sector, 12 had increased their employment levels whereas the remaining 10 had seen their employment levels falling. The most rapid increase in employment occurred in the electronics industry in which 145,748 new jobs had been generated between 1991 and 2000, representing a 24.3 per cent increase on the 1990 level. It was probably no coincidence that the electronics industry was also the industry that was most active in undertaking outward investment. In contrast, employment in the apparel industry recorded the largest number of job losses, at 54,104, representing a loss of more than one-third of its initial 1991 employment level. However, FDI from the apparel industry was also substantial; thus, the relationship between FDI and domestic employment is unclear, to say the least. In the following section, we will examine this relationship in more detail.

THE STATISTICS ON FDI AND EMPLOYMENT

In this section, we present the employment data revealed by Taiwan's Manufacturing Census, and relate this to FDI. The census data are collected at plant level, but are

then aggregated into firm-level data; all of the following statistics are reported at firm level since it is considered that FDI is decided at firm level rather than plant level. Changes in employment between 1993 and 200 are studied, with 1993 having been chosen as the starting year because this was the first time that a comprehensive set of FDI statistics was collected in the census; 2000 is chosen as the terminal year because this was the most recent census year. A total of 75,101 firms are included in the 1993 census, of which 49,260 had survived until 2000, whilst the remaining 25,841 had exited the market during the period under study. 27,585 new firms had entered the market between 1993 and 2000, with these new entries during this eight-year period representing 36.7 per cent of the stock of firms in the initial year, and the exiting firms representing 34.4 per cent of the stock, a characteristically high turnover rate for Taiwan's industry (Aw, et. al., 2001). All firms that have shown up in either the 1993 census or the 2000 census come to a total of 102,686, which forms our sample for comparison.

We classify all sample firms into two categories, the FDI group and the non-FDI group. The FDI group includes all firms that have undertaken overseas investment, and the non-FDI group includes those that have not undertaken any such investment. Although there are some missing data, the census does cover the majority of manufacturing firms. The total employment figures in the sample were 2,155,672 persons for 1993, and 2,291,396 for 2000, representing 89.8 per cent and 92.9 per cent respectively of the total employment estimated by the statistics authorities during the two census years.

We tabulate the turnover of sample firms in Table 2, which shows that there were 4,283 firms in the FDI group, and 98,403 firms in the non-FDI group. Although, in terms of the number of firms, the FDI group accounted for just 4.3 per cent of the manufacturing sector (ignoring the missing data), it nevertheless accounted for 28.23

per cent of total employment within the sector, which suggests that firms engaging in overseas investment are relatively large in size.

Table 2 FDI and domestic employment, 1993-2000

Unit: persons, %

Firm Group	No. of Firms	1993		2000	
		Employment	%	Employment	%
FDI-Firms	4,283	608,501	28.23	689,769	30.10
Survivors	2,843	558,243	25.90	625,013	27.28
Exited	900	50,258	2.33	-	-
New entrants	540	-	-	64,756	2.83
Non-FDI firms	98,403	1,547,171	71.77	1,601,627	69.90
Survivors	46,417	1,119,060	51.91	1,055,421	46.06
Exited	24,941	428,111	19.86	-	-
New entrants	27,045	-	-	546,206	23.84
Total	102,686	2,155,672	100.00	2,291,396	100.00

Out of the 4,283 firms in the FDI group, 3,743 firms were already in existence in 1993; the remainder was made up of new firms that entered during the period under study. From the initial 1993 cohort, 2,843 had survived the competition and remained active within the industry in 2000, representing a 76.0 per cent survival rate.

Meanwhile, out of the 98,403 firms in the non-FDI group, 71,358 firms were already in existence in 1993, and 46,417 firms had survived up until 2000, representing a 65.0 per cent survival rate. Simple statistics suggest that those firms that were engaged in overseas investment had a higher survival rate, supporting the findings of Ku (1998) which, in a study of Taiwan's electronics industry, showed that FDI did indeed increase the probability of survival.

Within our sample, the FDI group accounted for 28.23 per cent of all manufacturing sector employment in 1993, but by 2000, this figure had risen to 30.10 per cent. If we count only those firms that were in existence in 1993, the employment share in 2000 was 27.28 per cent, representing only a slight fall on the 1993 proportion despite the fact that a quarter of them had been eliminated in the interim period. In contrast, the non-FDI group accounted for 71.77 per cent of all manufacturing sector employment in 1993, and 69.90 per cent in 2000. However, if

new entrants are excluded, the surviving firms in the non-FDI group account for only 46.06 per cent of employment in 2000. Simple statistics again suggest that FDI enabled investing firms to maintain more jobs at home.

It is worth noting that firms that exited the manufacturing industry during the period under study eliminated 478,369 jobs, or 22.2 per cent of the total employment in 1993. These losses were more than offset by the 610,962 jobs created by new entrants coming into the industry during the eight-year period. Total employment provided by those firms that survived the period is virtually unchanged; however, employment per firm increased by 12.0 per cent in the FDI group, in contrast to the 5.7 per cent decline in the non-FDI group.

THE EFFECT OF INVESTMENT LOCATION

As demonstrated by Lipsey (1994) and Blomstrom, et. al. (1997), the employment effect of FDI may differ by investment location; thus, we should also examine the data on Taiwan to see whether geographical location matters. Taiwanese FDI has been concentrated in China since the early 1990s; however, there is one perspective which argues that investment in China is potentially more harmful to domestic employment than FDI in other regions. The reason for this, so the argument goes, is because of the cultural proximity and similarity in labor skills, with production in China being likely to duplicate what had previously been done in Taiwan and therefore exerting a strong substitution effect on domestic employment.

In order to examine the location effect, we classify those firms undertaking overseas investment into four subgroups according to the location of their investment. The first subgroup contains firms undertaking investment in China only; the second subgroup contains firms investing in China plus other regions; the third subgroup

contains firms investing in regions other than China; and the fourth subgroup contains firms with unknown FDI locations. Table 3 provides details of the level of employment for the four respective subgroups in 1993 and 2000.

Table 3 Employment effect, by FDI location

Investment Location	No. of Firms	1993	Average Employment	2000	Average Employment	1993-2000 Change (%)
China	1,048	122,179	116.58	112,710	107.55	-7.75
China and others	630	284,876	452.18	333,269	529.00	16.99
Other than China	692	101,698	146.96	135,752	196.17	33.49
Unknown	473	49,490	104.63	43,282	91.51	-12.54
Total	2,843	558,243	196.36	625,013	219.84	11.96

Source: Ministry of Economic Affairs, *Census of Manufacturers*, 1993 & 2000.

As the table shows, of the 2,843 firms that undertook overseas investment and survived the 1993-2000 period, 1,048 had invested only in China, 630 had invested in China and somewhere else, 692 had invested only outside of China and the remainder had invested in unknown regions. Those investing only in China were apparently smaller in size as their average employment was only 116.58 in 1993, substantially lower than the average employment level for the entire FDI group; furthermore, the average employment of this subgroup declined again, to 107.55 employees, in 2000. In contrast, the subgroup investing only outside of China registered the highest growth rate in employment of all the subgroups, at 33.49 per cent, whilst firms that invested in China and other regions saw their employment rise by 16.99 per cent.

This seems to suggest that investing only in China undermines the investor's capacity to maintain jobs at home; however, this conclusion is somewhat premature as there are other factors that may affect domestic employment after an enterprise invests abroad. Two obvious factors are firm size and industry. It is well established within the literature that firm size is positively correlated to the ability to invest abroad (Caves 1971; 1996). Large firms may therefore be more capable of undergoing internal restructuring after they have invested abroad and therefore more capable of

maintaining jobs at home (Chen and Ku, 2000).

Industry is also an important factor because a high-growth industry provides more opportunities for firms to diversify after they have invested abroad. In order to test the size and industry effects, we make a two-way classification of firms according to their size and industry affiliations; firms that employ more than 300 persons are classified as large firms, the rest are small firms. Industries that have grown by more than 30 per cent in output between 1993 and 2000 are considered to be 'high-growth' industries, otherwise they are 'low-growth' industries; the demarcation line of 30 per cent is the average growth rate in entire manufacturing output for the period under study.

We apply analysis of variance (ANOVA) to determine how much FDI location matters when controlling for industry and size, and vice versa; the results are shown in Table 4 which indicates that when controlling for investment location, employment growth is significantly affected by both industry and size. Firms in the high-growth industries show a significantly higher employment growth rate than those in the low-growth industries, whilst large firms show a significantly higher employment growth rate than small firms.

Table 4 Change in employment, 1993-2000 (ANOVA)

Investment Location	Industry			Size			Sample
	Low growth	High growth	F Statistics	Small	Large	F Statistics	
China	0.017	0.812	3.27 *	0.044	4.238	27.43**	1,048
China and others	0.235	1.524	8.52 **	0.628	1.669	27.15**	692
Other than China	0.183	0.532	4.59 **	0.241	1.239	2.92*	630
Unknown	0.226	0.716	1.3	0.458	0.525	-	473
F-Statistics	1.36	1.01	-	2.61**	1.19	-	2,843

When both industry and firm size are controlled for, investment location becomes inconsequential, except for the small-firm group where those investing in China only registered the lowest employment growth rate, as compared to those investing outside of China. This seems to suggest that job displacement, if there is any, may affect small

firms that choose to invest solely in China.

ESTIMATING THE EFFECTS OF FDI ON EMPLOYMENT

In this section, we estimate the statistical effects of FDI on employment, using a production function to portray the relationship between domestic and overseas operations. We basically treat overseas operation and domestic operation as joint production which can be portrayed by an appropriate production function. The output from overseas production may serve as an intermediate input to domestic production, thereby reducing the cost of domestic production; by so doing, this reduces the demand for domestic primary inputs, including labor. The output from overseas production may also add to the burden of domestic operations if it requires managerial and technical support from the headquarters. Here, we treat the output from both overseas and domestic operations as two joint outputs from centrally-managed production aimed at minimizing overall costs.

We employ the generalized Leontief production function developed by Diewert (1971) and Hall (1973) to portray a cross-border operation yielding two distinctive outputs Y_1 and Y_2; where Y_1 is the output from domestic operations and Y_2 is that from foreign operations. There are three kinds of labor inputs to production, namely managerial workers, technical workers and blue-collar workers. Labor is finely classified because we are concerned about the effects of FDI on different kinds of labor, given the complexity of the international division of labor. Three kinds of workers constitute a composite labor input underlying which is a sub-production function. The relationship between this composite labor input and capital is a Leontief relationship; therefore the demand for labor can be solely determined by output levels and wages, irrespective of capital input. We can therefore depict the cost function of the composite labor as follows:

$$
\begin{aligned}
C(Y_1, Y_2, W_1, W_2, W_3) = {} & \beta_1 Y_1 W_1 + \beta_2 Y_1 W_2 + \beta_3 Y_1 W_3 + \beta_4 Y_2 W_1 + \beta_5 Y_2 W_2 + \beta_6 Y_2 W_3 \\
& + 2\beta_7 W_1 \sqrt{Y_1 Y_2} + 2\beta_8 W_2 \sqrt{Y_1 Y_2} + 2\beta_9 W_3 \sqrt{Y_1 Y_2} + 2\beta_{10} Y_1 \sqrt{W_1 W_2} \\
& + 2\beta_{11} Y_1 \sqrt{W_1 W_3} + 2\beta_{12} Y_1 \sqrt{W_2 W_3} + 2\beta_{13} Y_2 \sqrt{W_1 W_2} \\
& + 2\beta_{14} Y_2 \sqrt{W_2 W_3} + 2\beta_{15} Y_2 \sqrt{W_1 W_3} + 4\beta_{16} \sqrt{Y_1 Y_2 W_1 W_2} \\
& + 4\beta_{17} \sqrt{Y_1 Y_2 W_2 W_3} + 4\beta_{18} \sqrt{Y_1 Y_2 W_1 W_3}
\end{aligned}
$$

where C is the total cost of labor; and W_1, W_2 and W_3 are the respective unit costs of managerial workers, technical workers and blue-collar workers. Note that outputs Y_1, Y_2 are measured by value-added in NT dollar terms. The sample covers firms from various industries and value-added is the only meaningful measuring unit common to all industries.

Although generalized Leontief production function restricts the production technology to be constant returns to scale, it does allow the elasticity of substitution (or complementarity) between three kinds of labor to be flexible. The inter-relationship between different kinds of labor in production is the focus of our study.

Using Shepherd's lemma, we may derive the labor demand equation for each kind of worker:

$$
\begin{aligned}
L_1 = \frac{\partial C}{\partial W_1} = {} & \beta_1 Y_1 + \beta_4 Y_2 + 2\beta_7 \sqrt{Y_1 Y_2} + \beta_{10} Y_1 \sqrt{W_2/W_1} + \beta_{11} Y_1 \sqrt{W_3/W_1} + \beta_{13} Y_2 \sqrt{W_2/W_1} \\
& + \beta_{15} Y_2 \sqrt{W_3/W_1} + 2\beta_{16} \sqrt{Y_1 Y_2 W_2/W_1} + 2\beta_{18} \sqrt{Y_1 Y_2 W_3/W_1}
\end{aligned}
$$

$$
\begin{aligned}
L_2 = \frac{\partial C}{\partial W_2} = {} & \beta_2 Y_1 + \beta_5 Y_2 + 2\beta_8 \sqrt{Y_1 Y_2} + \beta_{10} Y_1 \sqrt{W_1/W_2} + \beta_{12} Y_1 \sqrt{W_3/W_2} + \beta_{13} Y_2 \sqrt{W_1/W_2} \\
& + \beta_{14} Y_2 \sqrt{W_3/W_2} + 2\beta_{16} \sqrt{Y_1 Y_2 W_1/W_2} + 2\beta_{17} \sqrt{Y_1 Y_2 W_3/W_2}
\end{aligned}
$$

$$
\begin{aligned}
L_3 = \frac{\partial C}{\partial W_3} = {} & \beta_3 Y_1 + \beta_6 Y_2 + 2\beta_9 \sqrt{Y_1 Y_2} + \beta_{11} Y_1 \sqrt{W_1/W_3} + \beta_{12} Y_1 \sqrt{W_2/W_3} + \beta_{14} Y_2 \sqrt{W_2/W_3} \\
& + \beta_{15} Y_2 \sqrt{W_1/W_3} + 2\beta_{17} \sqrt{Y_1 Y_2 W_2/W_3} + 2\beta_{18} \sqrt{Y_1 Y_2 W_1/W_3}
\end{aligned}
$$

…….. (1)

where L_1, L_2 and L_3 denote managerial, technical and blue-collar workers,

respectively.

We may use seemingly unrelated regressions to estimate Equation (1), taking into consideration the fact that disturbance terms in the three single equations may be somehow correlated. In undertaking the regression, we should impose cross-equation restrictions on parameters to ensure that the same estimate is produced for any parameter that appears in more than one equation. From the parameter estimates, we can easily measure the effects of Y_1 and Y_2 on each kind of labor demand, as shown in Equation (1).

In order to measure the quantity of labor, data was drawn from the latest survey on employment undertaken by Taiwan's Bureau of Labor Affairs (BOLA) in 1999. The survey classifies labor into nine categories, but these nine categories are far too many to handle and also contain many zeros; therefore, they are combined into three categories to suit our purposes: (i) supervisors (managers), administrative and professional staff are classified as managerial workers; (ii) engineers, technicians and specialists are classified as technical workers; and (iii) operators, laborers and service workers are classified as blue-collar workers. The raw data drawn from the three small labor categories are converted into a large category, using the Divisia index, with each sample mean being normalized to unity. We thus obtained the measures for L_1 (managerial workers), L_2 (technical workers), and L_3 (blue-collar workers).

Wage rates W_1, W_2, W_3 are obtained by dividing the respective total wage bills by the measures of L_1, L_2 and L_3. The data for domestic output (Y_1) and overseas output (Y_2) are obtained from the 1999 *Survey on Overseas Investment by Manufacturing Firms* undertaken by the Ministry of Economic Affairs (MOEA). This survey also provides information on investment locations, but it only covers manufacturing firms that possess overseas affiliates. The BOLA and MOEA surveys are combined to yield 394 observations, all of which are firms engaged in FDI. We then randomly drew 140 non-FDI firms from the BOLA survey in order to supplement the observations using

firms without overseas affiliates. The total of 140 was taken so as to make the ratio of FDI to non-FDI firms roughly 3:1. The combined sample of 534 firms form the basis of our regression analysis, but only 451 of them contain complete data for entry into the regression estimation. Both MOEA and BOLA surveys covered firms of all sizes, so there is no selection bias problem associated with size. The regression results are shown in Table 5.

Table 5 Regression estimates of generalized Leontief production function

Independent Valuables	Parameter Estimates	t-Statistic
Dependent variable: Managerial workers (L_1)		
Y_1	-1.639×10^{-2}	0.299
Y_2	0.391	3.110**
YY	-0.232	2.430**
Y_1W_{12}	9.552×10^{-2}	1.348
Y_1W_{13}	0.103	3.152**
Y_2W_{12}	-0.449	3.068**
Y_2W_{13}	-3.610×10^{-2}	0.992
YYW_{12}	0.363	3.016**
YYW_{13}	-5.645×10^{-2}	1.187
Dependent variable: Technical workers (L_2)		
Y_1	0.389	3.014**
Y_2	0.739	3.985**
YY	-0.748	3.997**
Y_1W_{21}	9.552×10^{-2}	1.348
Y_1W_{23}	-0.131	2.230**
Y_2W_{21}	-0.449	3.068**
Y_2W_{23}	-0.125	2.101**
YYW_{21}	0.363	3.016**
YYW_{23}	0.177	2.254**
Dependent variable: Blue-collar workers (L_3)		
Y_1	0.205	4.116**
Y_2	0.195	3.514**
YY	-0.160	-2.541**
Y_1W_{31}	0.103	3.408**
Y_1W_{32}	-0.131	-2.380**
Y_2W_{31}	-3.610×10^{-2}	0.992
Y_2W_{32}	-0.125	2.101**
YYW_{31}	-5.645×10^{-2}	1.187
YYW_{32}	0.177	2.254**

Notes:

[1] System weighted $R^2 = 0.5649$

[2] Degree of freedom: 1335

[3] $YY = (Y_1Y_2)^{1/2}$; $Y_1W_{12} = Y_1W_1^{-1/2}W_2^{1/2}$; $Y_1W_{13} = Y_1W_1^{-1/2}W_3^{1/2}$; $Y_2W_{12} = Y_2W_1^{-1/2}W_2^{1/2}$; $Y_2W_{13} = Y_2W_1^{-1/2}W_3^{1/2}$; $YYW_{12} = (Y_1Y_2)^{1/2}W_1^{-1/2}W_2^{1/2}$; $YYW_{13} = (Y_1Y_2)^{1/2}W_1^{-1/2}W_3^{1/2}$

From Equation (1), we can derive the effects of domestic output (Y_1) and overseas output (Y_2) on labor demand. They are respectively,

$$\frac{\partial L_1}{\partial Y_1} = \beta_1 + \beta_7\sqrt{Y_2/Y_1} + \beta_{10}\sqrt{W_2/W_1} + \beta_{11}\sqrt{W_3/W_1} + \beta_{16}\sqrt{Y_2W_2/Y_1W_1} + \beta_{18}\sqrt{Y_2W_3/Y_1W_1}$$

$$\frac{\partial L_2}{\partial Y_1} = \beta_2 + \beta_8\sqrt{Y_2/Y_1} + \beta_{10}\sqrt{W_1/W_2} + \beta_{12}\sqrt{W_3/W_2} + \beta_{16}\sqrt{Y_2W_1/Y_1W_2} + \beta_{17}\sqrt{Y_2W_3/Y_1W_2}$$

$$\frac{\partial L_3}{\partial Y_1} = \beta_3 + \beta_9\sqrt{Y_2/Y_1} + \beta_{11}\sqrt{W_1/W_3} + \beta_{12}\sqrt{W_2/W_3} + \beta_{17}\sqrt{Y_2W_2/Y_1W_3} + \beta_{18}\sqrt{Y_2W_1/Y_1W_3}$$

…….. (2)

and

$$\frac{\partial L_1}{\partial Y_2} = \beta_4 + \beta_7\sqrt{Y_1/Y_2} + \beta_{13}\sqrt{W_2/W_1} + \beta_{15}\sqrt{W_3/W_1} + \beta_{16}\sqrt{Y_1W_2/Y_2W_1} + \beta_{18}\sqrt{Y_1W_3/Y_2W_1}$$

$$\frac{\partial L_2}{\partial Y_2} = \beta_5 + \beta_8\sqrt{Y_1/Y_2} + \beta_{13}\sqrt{W_1/W_2} + \beta_{14}\sqrt{W_3/W_2} + \beta_{16}\sqrt{Y_1W_1/Y_2W_2} + \beta_{17}\sqrt{Y_1W_3/Y_2W_2}$$

$$\frac{\partial L_3}{\partial Y_2} = \beta_6 + \beta_9\sqrt{Y_1/Y_2} + \beta_{14}\sqrt{W_2/W_3} + \beta_{15}\sqrt{W_1/W_3} + \beta_{17}\sqrt{Y_1W_2/Y_2W_3} + \beta_{18}\sqrt{Y_1W_1/Y_2W_3}$$

…… (3)

If we fit the parameter estimates into Equations (2) and (3), we obtain the estimated effects of Y_1 and Y_2 on labor demand. The values of Y_1 and Y_2, and W_1, W_2 and W_3, are taken to be the sample means. We estimate these effects for firms investing in different locations as we did in the previous section. The results are shown in Table 6.

Table 6 Effects of domestic and overseas production on employment

	Managerial		Technical		Blue-collar	
	Domestic Production	Overseas Production	Domestic Production	Overseas Production	Domestic Production	Overseas Production
Investing in China only (136)	0.1760	-0.0291	0.2988	-0.0413	0.1412	-0.0481
Investing in China and others (126)	0.1847	-0.0286	0.2831	-0.0387	0.1264	-0.0220
Investing outside China (113)	0.1762	-0.0307	0.3018	-0.0533	0.1559	-0.0845

Note: Domestic and overseas production is estimated in NT$ billions.

It can be seen from Table 6 that the demand for all kinds of labor increases with an increase in domestic output. For example, for those firms investing in China only, the demand for managerial workers increases by 0.1760 for each NT$ billion (Taiwanese currency) increase in domestic output (as Y_1 is measured in NT$ billions). Since the Divisia index for labor has been normalized, this figure implies that in comparison with

the sample mean, there is an increase of 17.60 per cent in managerial workers. Similarly for each NT$ billion increase in domestic output, the demand for technical workers increases by 29.88 per cent, and the demand for blue-collar workers increases by 14.12 per cent. The results indicate that by 1999, the expansion in domestic production had led to an expansion in all three kinds of labor, although technical personnel tended to benefit the most, followed by managerial staff, and then blue-collar workers the least. This pattern prevails across all investment locations, despite the fact that firm size differs significantly across different subgroups. This implies that the output effect on employment is mainly driven by the nature of technology which, as Taiwanese industry intensifies its technology content, tends to favor technical workers.

Table 7 lists the mean values of Y_1 and Y_2 for the different FDI subgroups. It can be seen that the subgroup of firms investing in China only is the smallest of the three groups in terms of domestic output, followed by the subgroup investing in China plus other regions, with the subgroup investing only outside of China being the largest. However, the subgroup investing in China and other regions also has the highest overseas production ratio, at 0.702, followed by the 'China only' subgroup at 0.475, and then the 'outside China' subgroup at 0.292.

Table 7 Sample means, by FDI group

Unit: NT$ Million

FDI Location	Domestic Output	Overseas Output	Overseas/ Domestic Ratio	No. of Samples
China only	1,795.3	851.9	0.475	136
China and others	3,995.0	2,805.8	0.702	126
Other than China	5,591.1	1,633.8	0.292	113

Referring back to Table 6 also shows that overseas production has exerted a uniformly negative effect on each kind of labor, which suggests that when holding domestic output constant, domestic employment for a firm engaging in overseas production will decline by between 2 per cent and 8 per cent. This implies that overseas production complements domestic production and therefore reduces the need

for labor inputs at any given output level. However, we should not jump to the conclusion that overseas production reduces domestic employment, because such a complementary relationship also cuts down the cost of domestic production, thus enhancing the competitiveness of the company as a whole, which in turn, may lead to an expansion in domestic output. In other words, overseas production exerts a substitution effect which reduces the demand for labor at any given domestic output, as well as an output effect which expands domestic production. The net result has to take both effects into account, thus, it is the output effect to which we now turn.

We take the Manufacturers Census data, and choose the firms that have survived throughout the period under study, to explore the effects of FDI on domestic output. A simple regression is employed to estimate this effect:

$$LY99 = \alpha_0 + \alpha_1 LY93 + \alpha_2 DFI_1 + \alpha_3 DFI_2 + \alpha_4 DFI_3 + \alpha_5 DFI_4 + \alpha_6 IND \quad (4)$$

where the variables are as follows:

$LY99$: logarithm of domestic output in 1999;

$LY93$: logarithm of domestic output in 1993;

DFI_1: dummy variable for firms investing in China only;

DFI_2: dummy variable for firms investing in China and other regions;

DFI_3: dummy variable for firms investing only outside China;

DFI_4: dummy variable for firms investing in unknown regions;

IND: dummy variable for high-growth industries.

In Equation (4), we use the output in the base year (i.e. 1993), to project the output in the future year, 1999. Thus the coefficient α_1 reflects the average growth rate between 1993 and 1999. The dummy variables, DFI_1 - DFI_4, capture the extra growth attributable to overseas investments and the dummy variable, *IND*, captures

the extra growth attributable to industry affiliation. Included in the regression analysis were a total of 50,164 firms that survived the 1993-1999 period. The results are reported in Table 8, which shows that the coefficients for dummy variables, DFI_1 - DFI_4, were all positive and statistically significant. This suggests that foreign investment does indeed contribute to extra growth in output after controlling for the industry effect.

Table 8 Effect of FDI on domestic output

Dependent Variable: *LY*99	Parameter Estimates	t-Statistic
Intercept	1.217	44.562**
*LY*93	0.869	303.763**
Investing in China only (DFI_1)	0.180	5.573**
Investing in China and others (DFI_2)	0.517	9.288**
Investing outside China (DFI_3)	0.464	13.071**
Unknown FDI regions (DFI_4)	0.424	10.530**
High-growth industry (*IND*)	0.198	21.388**

Notes:
1 R^2=0.6818
2 F-Statistic=17915.45
3 Degrees of freedom: 50,158

Compared to non-FDI firms, firms investing only in China recorded extra growth of 18 per cent over the 1993-1999 period; those firms that invested in China and other regions gained an extra 51.7 per cent; and those whose investment was only outside of China achieved 46.4 per cent growth. The gains may be different, but other things being equal, FDI has indeed expanded their domestic output.

We can therefore estimate the output effect of FDI on domestic production, using these estimates; that is, our aim is to estimate the additional domestic output which is attributable to FDI.

Taking the estimate of α in equation (4), this would be $\Delta Y_1 = Y_1 \bullet \left(\alpha / 1+\alpha \right)$

where α corresponds to the location of investment. This output effect is to be added to the substitution effect to come up with the net effect of overseas production on domestic labor demand; thus, the total effect of FDI on domestic labor *Li* is:

$$\Delta Li = \frac{\partial Li}{\partial Y_1}\Delta Y_1 + \frac{\partial Li}{\partial Y_2}\Delta Y_2 \quad (5)$$

where the first term reflects the output effect and the second term reflects the substitution effect.

Inserting the relevant parameter estimates into Equation (5), using the relations established in Equation (4), we obtain the estimates for total employment effect arising from FDI. These are shown in Table 9.

Table 9 Overall effect of FDI on domestic employment

	Managerial workers	Technical workers	Blue-collar workers
Investing in China only	0.0402	0.0717	0.0277
Investing in China and others	0.1185	0.1933	0.0755
Investing outside of China	0.0833	0.1415	-0.0237

It can be seen from Table 9 that the total employment effects on FDI are positive for all kinds of labor and for all investment locations, with the exception of those investments undertaken outside of China. For the sub-group investing only outside of China, domestic employment of blue-collar workers is adversely affected by FDI (a decline of 2.37 per cent). The table also shows that technical workers are the biggest winners from FDI; regardless of the investment locations, the greatest increase is in the domestic employment of technical workers. We interpret this outcome as reflecting the fact that domestic production in recent years has been restructured towards more technology-intensive methods. Managerial workers also gain substantially from FDI, but not as much as their technical counterparts. Blue-collar workers gain the least and they may occasionally even lose. Capital outflow favoring technical workers was also found in Feenstra (1996), whilst Blomstrom, et. al. (1997) found that it favored managerial staff. In short, FDI may well affect different labor groups in different ways, but the overall effect is more likely to be positive than negative. The group which is most likely to feel any negative effects is the blue-collar group of workers.

It is noticeable that firms simultaneously investing in China and other regions

create the greatest proportion of new jobs at home. We take this subgroup of firms to be truly in pursuit of globalization, since globalization leads to an expansion of domestic production. This also manifests itself in the largest parameter estimate for DFI_2 amongst all *DFIs*. Those investing only in China do not create as much demand for technical and managerial workers at home because production in China is characterized by a low technology requirement and simple production arrangements.

Going back to Table 3 in which domestic employment is shown to decline for firms investing only in China, we may conclude that FDI, *per se*, is not to blame for the plight of labor; it is instead the fact that these investors belong to low-growth (or even declining) industries, as well as being small in size, that account for their inability to maintain their employment levels at home. In addition to the industry effect, the fact that the 'China-only' group did not generate as much output expansion effect as the other investment groups also contributes to their below-par performance. Although China production enhances the competitiveness of domestic production, just like other overseas production, it also takes market opportunities away from Taiwan because Chinese and Taiwanese suppliers are often viewed by foreign buyers (particularly in the Western markets) as close substitutes.

CONCLUSIONS

In this paper we study the effects of FDI on domestic employment by examining the data of Taiwan's manufacturing industry. In terms of growth in their number of employees, those firms investing abroad have outperformed those firms that have not undertaken such investment. Moreover, firms that have invested abroad have a higher probability of survival than the 'have-nots'; survival relies upon maintaining jobs at home.

Treating domestic production and overseas production as two distinctive but interrelated outputs from a joint production function, we may estimate the effects of

overseas production on domestic production, and thereafter, the consequences for domestic employment. Our study of Taiwanese manufacturing data indicates that overseas production reduces the demand for labor in domestic operations at any given domestic output. This implies that through 'joint production', overseas production reduces the input requirements at home to yield a given domestic output. In other words, overseas production substitutes for primary inputs in the domestic production process.

From a presumption of cost-minimization, this implies that overseas production complements domestic production to reduce the overall costs of cross-border operations, thereby enhancing the competitiveness of a company; this is to be achieved through a division of labor between the headquarters and the affiliates. Such enhanced competitiveness, in turn, helps firms to expand their domestic output, which leads to an increase in the demand for labor. Therefore, the total effect of FDI on domestic employment is a combination of output expansion effect and input substitution effect. Our estimates show that, in most cases, the output expansion effect more than offsets the input substitution effect to yield a net positive effect on domestic employment; however, the magnitude of employment effect arising from FDI differs across different labor groups.

In the case of Taiwan, technical workers tend to benefit most from FDI, followed by managerial workers, with blue-collar workers benefiting the least; indeed they may even be adversely affected. This implies that after overseas investment has taken place, a reconfiguration of the division of labor within a firm will tend to shift domestic production toward technology- and management-intensive operations.

Different investment locations exert slightly different impacts on domestic employment mainly because of the differences in output expansion effect. Those firms that invest only in China contribute the least to the expansion of domestic output, followed by firms that invest only outside of China, whilst FDI covering both China

and other regions is most conducive to domestic output expansion.

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