The Effect of Overseas Investment on Domestic Employment

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August 2003

Paper prepared for

14th East Asian Seminar

on Economics

September 5-7, 2003

Taipei, Taiwan

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I. Introduction

That foreign direct investment (FDI) may cause job losses at home has long been a concern of policy makers. Labor unions usually consider FDI as equivalent to job export. The logic is simple: as production lines are relocated to overseas, gone with them are workers that serve the lines. This reasoning, of course, is over-simplistic, because there is no guarantee that the production lines that have been relocated to overseas will survive the competition had they been kept at home. If they are to be eliminated anyway, then relocation results in no job loss. There is even a possibility that overseas investment enhances the competitiveness of the investing company as a whole and therefore maintains certain job opportunities at home which would otherwise have been swept away by competition. For example, Ku (1998) found that FDI enabled Taiwanese enterprises to restructure themselves and therefore increased their tenacity. Firms engaged in overseas production are shown to have a better chance of survival than those that did 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. As exports fall, so does the employment. This is a conventional argument along the line of Mundell (1957) who showed elegantly in a 2×2 model that capital movement is equivalent to trade. In fact, products made in overseas locations not only replace exports, they may also be re-imported back home to substitute the product lines that are designed to serve the home market (Liu & Lin 2001).

There are counter-arguments to Mundell's "perfect substitution" theory, however. Markusen (1983), for example, has demonstrated the theoretical possibility that FDI and trade are complements rather than substitutes. Therefore, the relationship between

FDI and job opportunity 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. They found a very low degree of substitution between parent and affiliate employment, and a high degree of substitution between affiliates in developing counties. They also found the relationship between the employment in industrial-country affiliates and that in developing countries is complementary rather than substituting. Slaughter (1995) also found a low degree of substitution between parent and affiliate employment when only production workers are considered. He noted that affiliate employment of production workers does not seem to be systematically related to relative wage of the parent to the affiliate. This suggests that overseas employment only weakly responds to the wage gap between home and host countries, although it may respond strongly to the wage gap between different overseas locations. Hatzius (1997b) and Döhrn (1997) found similar results for Sweden. They found that overseas employment of Swedish multinational firms respond to wages in actual and potential host countries but not to wages in Sweden. Blomstrom and Kokko (2000) also discovered that Swedish multinationals respond 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 a substitute to each other. In fact, there must be a division of labor between the parent and affiliates as FDI is an action to enhance competitiveness of the company. To the extent that FDI reduces the cost of the parent operation, it also helps the parent to expand the level of output, which in turn, increases employment at home. Blomstrom, Fors, and Lipsey (1997), for example, found that overseas investment by US firms in developing countries did replace

domestic employment, but the same investment in developed countries did not. Moreover, the replacement effect is limited to production workers.

The employment effect of FDI may differ across labor groups is an important finding, for this implies important consequences of FDI on income distribution. Blomstrom, Fors and Lipsey's (1997) study of Swede firms, for example, found that FDI contributes to growth of employment of unskilled labor at home as Swede multinationals invest abroad to acquire skilled workers to engage in R&D and other skill-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 of domestic production. Feenstra (1996) showed that FDI by US firms into Mexico increased the relative demand of skilled to unskilled workers at home, and hence raised the relative wage of skilled workers, which worsens the income distribution for the investing country. The reverse occurs 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 outflow is accompanied by an equal amount of reduction in domestic investment, then FDI may still reduce job opportunities at home even if overseas production is a complement for domestic production. Feldstein (1994) 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 much as one-to-one replacement. However, Bayoumi and Lipworth's (1997) study of Japanese case found no displacement effect of FDI on domestic investment. Again, the actual relationship is an empirical question.

The purpose of this paper is to examine the relationship between FDI and domestic employment at the firm level, using Taiwan's manufacturing industry as an example. We found overseas production to lead to an increase in domestic

employment of managerial and technical workers, but may reduce the employment of unskilled workers. Overseas production partially replaces the inputs to domestic production, resulting in a decline in labor demand at a given output level. But at the same time, overseas production reduces the cost of domestic production, leading to an expansion of output. The input-replacement effect and output-expansion effect combine to a produce a net effect which is positive in most cases. The net effect differs with the groups of labor and the geography of overseas investment.

II. An Overview of Manufacturing Employment in Taiwan

Manufacturing employment in Taiwan reached a peak in 1987 when 2.821 million persons worked in the manufacturing sector. Since then manufacturing employment has been on the decline until it hit a trough in 1994 when 2.422 million persons were working in the sector. It then recovered somewhat in the rest of 1990s. In 2000, 2.655 million persons were employed in the manufacturing sector (see Figure 1). The employment data suggests that the period 1987-1994 was the time span that Taiwan's industry underwent a dramatic restructuring. Along with the losses of 399,000 manufacturing jobs, the employment in the service sector increased by 1.385 million, more than enough to offset the former losses. Unemployment rates remained at low levels throughout the 1990s.

Incidentally, 1987 was also approximately the year when Taiwanese firms began to embark on the course of FDI. From 1987 to 2000, more than 43 billion US dollars have been invested overseas. 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. From 1992 onward, the focus of FDI has shifted to China. After the 1997 Asian financial crisis, FDI in Southeast Asia almost came to a halt while FDI in China continued to surge. Starting from 2001, the world recession

sent the unemployment rate in Taiwan to break the 4% mark, an unprecedented high level in Taiwan. The concern that FDI may cause unemployment at home was heightened.

Beneath the surface of a relatively stable employment situation in the 1990s was a rather dramatic transformation of the industrial structure. Among 22 two-digit industries in the manufacturing sector, 12 has increased their employment levels whereas the remaining 10 saw their employment levels lowered. The most rapid increase of employment occurred in the electronics industry in which 145,748 new jobs have been generated in 1991-2000, representing a 24.3% increase over the 1990 level. Coincidentally, the electronics industry is also the industry that was most active in making outward investments. In contrast, employment in the apparel industry recorded the largest number of job losses at 54,104, representing more than one-third of the initial employment in 1991. Foreign direct investment from the apparel industry was also substantial. The relationship between FDI and domestic employment is unclear, to say the least. We will look at this relationship in more details in the following section.

III. The Statistics of FDI and Employment

In this section, we present the employment data revealed by Taiwan's Manufacturing Census, and relate them to FDI. The census data are collected at the plant level, but we aggregate the plant-level data into firm-level data. All statistics in the following are reported at the firm level as FDI is decided at the firm rather than the plant level. Changes of employment between 1993 and 200 are studied. 1993 is chosen as the starting year because this is the first time a set of comprehensive FDI statistics was collected in the census; 2000 is chosen as the terminal year because this is the most recent census. A total of 75,101 firms are included in the 1993 census, of

which 49,260 firms survived until 2000, and the remaining 25,841 exited the market during the period. Between 1993 and 2000, 27,585 new firms entered the market. New entries in the eight-year period represented 36.7% of the stock of firms in the initial year, while the exits represented 34.4% of the stock, a characteristic of high turnover rate in Taiwan's industry (Aw, Chen & Roberts 2001). Firms that have shown up in either 1993 or 2000 census came to a total of 102,686, which form our sample for comparison.

We classify all sample firms into two categories; FDI group and non-FDI group. FDI group include firms that have made overseas investment, and FDI group include those that have not. Although there are some missing data, the census covered the majority of manufacturing firms. Total employment in our sample were 2,155,672 persons in 1993, and 2,291,396 in 2000, representing 89.8% and 92.9% respectively of the total employment estimated by the statistics authority in the two years.

We tabulate the turn-over of sample firms in Table 1. As can be seen from the table, there were 4,283 firms in the FDI group and 98,403 firms in the non-FDI group. FDI group accounted for 4.3% of the manufacturing sector (ignoring the missing data) in terms of the number of firms, but accounted for 28.23% of total manufacturing employment. This suggests that firms engaged in overseas investment are relatively large in size.

Out of 4,283 firms in the FDI group, 3,743 firms already existed in 1993, the rest are new entrants in the 1993-2000 period. Among the 1993 cohort, 2,843 of them survived the competition and remained active in the industry in 2000, representing a 76.0% of surviving rate. Meanwhile, out of 98,403 firms in the non-FDI group, 71,358 firms already existed in 1993. Among this group, 46,417 firms survived up until 2000, representing a 65.0% of surviving rate. Simple statistics suggest that firms that engaged in overseas investment have a higher survival rate. Ku (1998) has

studied Taiwan's electronics industry and shown that FDI indeed increases the probability of survival.

Within our sample, the FDI group accounted for 28.23% of total manufacturing employment in 1993, but for 30.10% in 2000. If only firms that had existed in 1993 are counted, their employment share in 2000 was 27.28%, only a slight decline from the 1993 proportion despite the fact that a-quarter of them have been eliminated in the interim years. In contrast, the non-FDI group accounted for 71.77% of the manufacturing employment in 1993, and 69.90% in 2000. However, if new entrants are excluded, the surviving firms in the non-FDI group accounted for only 46.06% of employment in 2000. Simple statistics again suggest that FDI enabled investing firms to maintain more jobs at home.

It is noticeable that firms that exited the manufacturing industry during 1993-2000 eliminated 478,369 jobs, or 22.2% of the total employment in 1993. The losses were more than offset by 610,962 jobs created by new entrants coming to the industry during the period. Total employment provided by the firms that survived the 1993-2000 period is virtually unchanged. However, per-firm employment increased by 12.0% in the FDI group and decreased by 5.7% in the non-FDI group.

IV. The Effect of Investment Location

As shown by Lipsey (1994) and Blomstrom et al. (1997), the employment effect of FDI may differ by investment location. We may also examine the Taiwanese data to see whether geography matters. Taiwanese FDI has been concentrating in China since the early 1990s and there is an argument that investment in China is potentially more harmful to the domestic employment than FDI in the other regions. This is so, as the argument goes, because of the cultural proximity and similarity in labor skills, production in China is likely to duplicate what was done in Taiwan and therefore

exerts a strong substitution effect on domestic employment.

To examine the location effect, we classify the firms that have made overseas investments into four subgroups according to the locations of investment. The first subgroup contains firms making investments 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. In Table 2, we show the employment in 1993 and 2000 for four respective subgroups.

It can be seen from the table that among 2,843 firms that have made overseas investments and survived the 1993-2000 period, 1,048 have invested only in China, 630 have invested in China and somewhere else, 692 have invested only outside China, and the rest invested in unknown regions. Those investing only in China are apparently smaller in size as their average employment was only 116.58 in 1993, substantially below the average employment of the entire FDI group. The average employment of this subgroup decreased further to 107.55 persons in 2000. In contrast, the subgroup that have invested outside China saw their employment grow between 1993 and 2000. Firms that have invested only outside China registered the highest growth rate of employment at 33.49%, while firms that have invested in China and other regions increased employment by 16.99%. This seems to suggest that investing in China undermines the investor's capacity to maintain jobs at home.

However, this conclusion is 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 has been well established in the literature that firm size is positively correlated with the ability to invest abroad (Caves 1971; 1996). Large firms may therefore be more capable of making internal restructuring after they have invested abroad and therefore maintaining jobs at home (Chen and Ku 2000).

Industry is also an important factor because a high-growing industry provides more opportunities for firms to diversify after they have invested abroad. To test the size and industry effects, we make a two-way classification of firms according to their size and industry affiliation. 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% in output in 1993-2000 are considered "high-growth" industries, otherwise they are "low-growth" industries. The demarcation line of 30% is the average growth rate of the entire manufacturing output in 1993-2000.

We apply an analysis of variance (ANOVA) to see how much FDI location matters when industry and size are controlled for, and vice versa. The results are shown in Table 3. It can be seen that both industry and size affect the employment growth significantly when investment location is controlled for. Firms in the high-growth industries showed a significantly higher growth rate in employment than those in the low-growth industries. Meanwhile, large firms showed a significantly higher growth rate in employment than small firms. When both industry and firm size are controlled for, investment location becomes inconsequential, except for the small-firm group. Within the small firm group, those investing in China only registered the lowest growth rate in employment, compared to those that have invested outside China. This seems to suggest that job displacement, if there is any, may occur to small firms that choose to invest solely in China.

V. Estimating the Effects of FDI on Employment

In this section, we statistically estimate the effects of FDI on employment, using a production function to portray the relationship between domestic and overseas operations. Basically we treat overseas operation and domestic operation as a joint production and can be portrayed by an appropriate production function. The output in

overseas production may serve as an intermediate input to domestic production and therefore reduces the cost of domestic production. By doing so, it reduces the demand for primary inputs at home, including labor. Output in overseas production may also increase the burden of domestic operation if it requires managerial and technical support from the headquarters. We treat the output in overseas operation and that from domestic operation as two joint outputs from a centrally managed production aiming at minimizing the overall cost.

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 operation and Y_2 is that from foreign operation. 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 effect of FDI on different kinds of labor, given the complexity of 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 one and 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 the following:

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

where C is the total cost of labor; W_1, W_2, W_3 are unit costs of managerial workers, technical workers, and blue-collar workers; respectively.

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

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

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

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

--- (1)

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

We may use seemingly unrelated regression to estimate equation (1), taking into consideration that disturbance terms in three single equations may be somehow correlated. In making the regression, we should impose cross-equation restrictions on parameters to make sure the same estimate will be produced for the 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, we drew data from Taiwan's Bureau of Labor Affairs (BOLA) which made an annual survey on employment. The latest survey available was conducted in 1999, so we drew data from it. The survey classifies labor into nine categories, which are combined into three to fit our purpose. Nine categories are too many to handle and they also contain many zero's. Supervisors (managers), administrative and professional staff are classified as

managerial workers; engineers, technicians, and specialists are classified as technical workers; and operators, laborers, and service workers are classified as blue-collar workers. Raw data drawn from three small labor categories are converted into a large category, using Divisia index, with each sample mean 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 "Survey on Overseas Investment by Manufacturing Firms (1999)" undertaken by Ministry of Economic Affairs (MOEA). The latter survey also provides information on investment locations, but it only covers manufacturing firms that own some overseas affiliates. The BOLA and MOEA surveys are combined to yield 394 observations, all of which are firms engaged in FDI. To supplement them with firms without overseas affiliates, we randomly drew 140 non-FDI firms from the BOLA survey. The number of 140 is set 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 to enter the regression estimation. The regression results are shown in Table 4.

From equation (1), we may 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, Y_2 and W_1, W_2, W_3 are taken to be the sample means. We estimate these effects for firms investing in different locations as we have done in the previous section. The results are listed in Table 5.

It can be seen from Table 5 that demand for all kinds of labor increases as domestic output increases. For example, for firms that invested in China only, demand for managerial workers increase by 0.1760 for each billion NT (Taiwanese currency) increase in domestic output (as Y_1 is measured in billions of NT). Because Divisia index for labor has been normalized, this figure implies that managerial workers increase by 17.60% as compared to the sample mean. Similarly for each billion NT increase in domestic output, demand for technical workers increases by 29.88%, and demand for blue-collar workers increases by 14.12%. The results indicate that as of 1999, the expansion of domestic production will lead to an expansion of all three kinds of labor, but technical personnel tends to benefit most, followed by managerial staff, and 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 favors technical workers as the Taiwan industry is intensifying its technology content.

Table 6 lists the mean values of Y_1 and Y_2 for different FDI subgroups. It can be seen that the subgroup of firms that have invested in China only is the smallest among the three groups in terms of domestic output, followed by the subgroup that have invested in China plus other regions, and the subgroup that have invested only outside China are the largest. The subgroup that have invested in China and other regions, however, also have 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 5 also shows that overseas production has exerted a uniformly negative effect on each kind of labor. The suggests that when holding the domestic output constant, if a firm engaged in overseas production, its domestic employment will decrease by 2 to 8%. 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, for such complementary relationship also cuts down the cost of domestic production to enhance competitiveness of the company as a whole, which in turn, may lead to an expansion of domestic output. In other words, overseas production exerts a substitution effect to reduce labor demand at any given domestic output, as well as an output effect to expand domestic production. The net result has to take both effects into account. It is to the output effect we will now turn.

We take the Manufacturers Census data and choose the firms that have survived throughout 1993-1999 to explore the effect of FDI on domestic output. A simple regression is employed to estimate this effect:

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

where the variables are as follows:

$LY99$: logarithan of domestic output in 1999;

$LY93$: logarithan 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, that is 1993, to project the output in the future year, 1999. Thus the coefficient α_1 reflects the average growth rate between 1993 and 1999. Dummy variables *DFIs* capture extra growth attributable to overseas investments; dummy variable *IND* captures extra growth attributable to industry affiliation. A total of 50,164 firms that survived the 1993-1999 period were included in the regression analysis. The results are reported in Table 7.

It can be seen from Table 7 that the coefficients for dummy variables *DFIs* are all positive and statistically significant. This suggests that foreign investment indeed contributes to extra growth in output, after the industry effect is controlled for. Compared to non-FDI firms, firms investing in China only recorded an extra growth rate of 18% in the 1993-1999 period, firms that invest in China and other regions gained an extra 51.7%, and those that investment only outside China, 46.4%. The gains may be different, but FDI indeed expands the domestic output, other things being equal.

We can therefore estimate the output effect of FDI on domestic production, using these estimates. That is, we want to estimate extra domestic output 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. That is, the total effect of FDI on domestic labor Li is

$$\Delta Li = \frac{\partial Li}{\partial Y_1} \Delta Y_1 + \frac{\partial Li}{\partial Y_2} \Delta Y_2 \qquad \text{--- (5)}$$

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

Inserting relevant parameter estimates into equation (5), using the relations shown in equation (4), we obtained the estimates for total employment effect arising from FDI. These are shown in Table 8.

It can be seen from Table 8 that the total employment effects on FDI are positive for all kinds of labor, for all investment locations, except the investments outside China. For the subgroup that invest only outside China, their domestic employment of blue-collar workers is adversely affected by FDI (declining by 2.37%). The table also shows that technical workers are the biggest winners from FDI. Regardless of the investment locations, domestic employment of technical workers increases most. We interpret this outcome as reflecting the fact that domestic production in recent years has been restructured toward 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 even lose occasionally. Capital outflow favors technical workers is also found in Feenstra (1996), and that it favors managerial staff is found in Blomstrom et al (1997). In short, FDI may affect different labor groups differently but the overall effect is more likely to be positive than

negative. The group that is most likely to be hurt are blue-collar workers.

It is noticeable that firms simultaneously investing in China and other regions create the greatest percentage of new jobs at home. We take this subgroup of firms to be truly in pursuit of globalization. Globalization leads to an expansion of domestic production. This also manifests in the largest parameter estimate for DFI_2 among 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 low technology requirement and simple production arrangement.

Going back to Table 2 in which domestic employment is shown to decrease for firms investing only in China, we may conclude that FDI per se is not to blame for the labor's plight. It is rather the fact that these investors belong to low-growth (or even declining) industries and being small in size that account for their inability to maintain employment at home. Besides the industry effect, the fact that "China-only" group did not generate as much output expansion effect as the other investment groups also contributes to the below-par performance. Although China production enhances the competitiveness of domestic production just like other overseas productions, it also takes away market opportunity from Taiwan as Chinese and Taiwanese suppliers are often viewed by foreign buyers (especially in the Western markets) as close substitutes.

VI. Conclusions

In this paper we study the effect of FDI on domestic employment by examining the data of Taiwan's manufacturing industry. In terms of the number of employees, firms that have invested abroad outperform firms that have not in employment growth. Moreover, firms that have invested abroad have a higher probability of survival than the have-not. Survival means 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 effect of overseas production on domestic production and henceforth the consequence of domestic employment. Our study of Taiwanese manufacturing data indicates that overseas production reduces the demand for labor in home operations at any given domestic output. It implies that via "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 to domestic production. From the cost-minimization presumption, this implies that overseas production complements domestic production to reduce the overall cost of the cross-border operation and therefore enhance the competitiveness of the company. This is to be achieved through a division of labor between the headquarters and the affiliates. Enhanced competitiveness, in turn, helps firms to expand domestic output, which leads to an increase in labor demand. Therefore, the total effect on domestic employment of FDI is a combination of output expansion effect and input substitution effect. Our estimation shows that, in most cases, 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 the labor groups. In Taiwan's case, technical workers tend to benefit most from FDI, followed by managerial workers, and blue-collar workers benefit the least from FDI and may even be affected adversely. This implies that a reconfiguration of the division of labor within the firm after overseas investment is made tends 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. Firms that invest only in China contribute the least to the expansion of domestic output, followed

by firms that invest only outside of China, and FDI covering both China and other regions is most conducive to output expansion at home.

Figure 1

Manufacturing Employment, 1981-2000

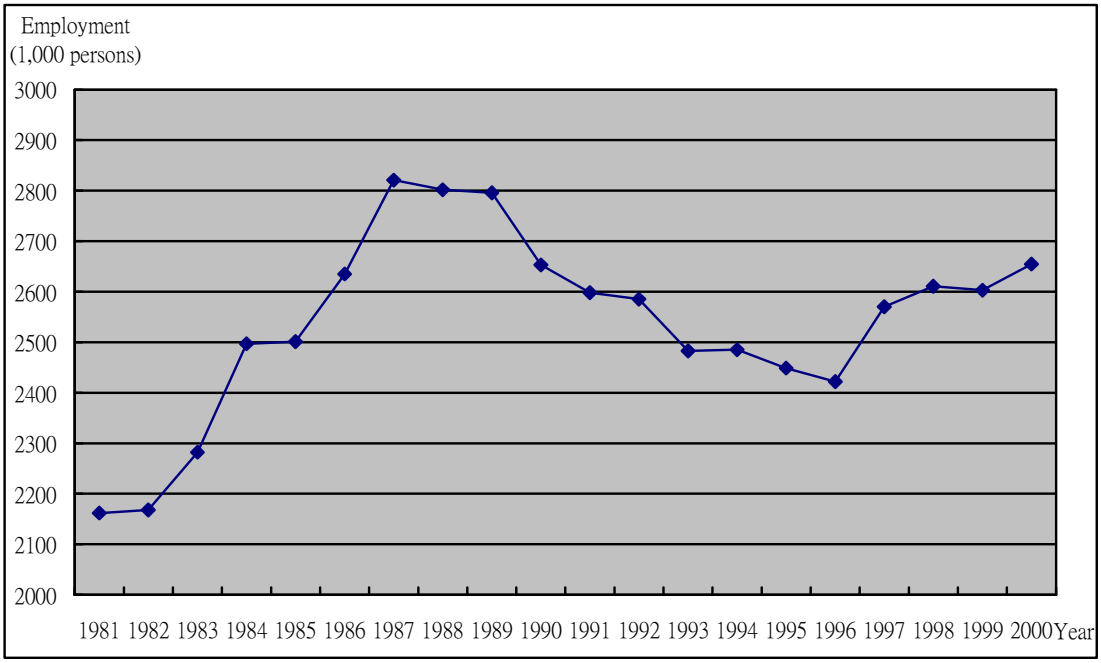

Table 1

FDI and domestic employment, 1993-2000

Unit: persons, %

Firm Group	No. of Firms	1993		1999	
		Employment	%	Employment	%
FDI-Firms	**4,283**	**608,501**	**28.23**	**689,769**	**30.10**
Survive	2,843	558,243	25.90	625,013	27.28
Exit	900	50,258	2.33	0	0
New entry	540	0	0	64,756	2.83
Non-FDI firms	**98,403**	**1,547,171**	**71.77**	**1,601,627**	**69.90**
Survive	46,417	1,119,060	51.91	1,055,421	46.06
Exit	24,941	428,111	19.86	0	0
New entry	27,045	0	0	546,206	23.84
Total	**102,686**	**2,155,672**	**100.00**	**2,291,396**	**100.00**

Table 2

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 & 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.

Table 3

Employment Changes, 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 & 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	0	473
F-Statistics	1.36	1.01	-	2.61**	1.19		2,843

Table 4

Regression Estimates of Generalized Leontief Production Function

Dependent variable: Managerial workers (L_1)		
Independent Valuables	Parameter Estimates	t-Statistic
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)		
Independent Valuables	Parameter Estimates	t-Statistic
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)		
Independent Valuables	Parameter Estimates	t-Statistic
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**

System weighted R^2=0.5649

Degree of freedom：1335

$YY = (Y_1 Y_2)^{1/2}$

$Y_1 W_{12} = Y_1 W_1^{-1/2} W_2^{1/2}$

$Y_1 W_{13} = Y_1 W_1^{-1/2} W_3^{1/2}$

$Y_2 W_{12} = Y_2 W_1^{-1/2} W_2^{1/2}$

$Y_2 W_{13} = Y_2 W_1^{-1/2} W_3^{1/2}$

$YYW_{12} = (Y_1 Y_2)^{1/2} W_1^{-1/2} W_2^{1/2}$

$YYW_{13} = (Y_1 Y_2)^{1/2} W_1^{-1/2} W_3^{1/2}$

Table 5

The Effects of Domestic & Overseas Production on Employment

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

Note: Domestic & overseas production is estimated in billion NT.

Table 6

Sample Means by FDI Group

Unit: Million NT

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

Table 7

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 & 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**

R^2=0.6818

F-Statistic=17915.45

Degrees of freedom: 50,158

Table 8

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 & others	0.1185	0.1933	0.0755
Investing outside China	0.0833	0.1415	-0.0237

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