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Abstract

This paper explores the effects of overseas activity on parent firm employment in a panel of Taiwan's large, listed firms during 2000-2005. Propensity score matching estimates of discrete effects suggest that employment growth did not differ significantly between new parents and firms with no overseas operations. Generalized method of moments' estimates of marginal effects for all firms indicate that, on average, there was a statistically significant and positive correlation between the size of overseas investment and parent employment after accounting for other factors thought to influence firm employment (wages, capital stocks, size, technology intensity, export propensity, and productivity). However, this positive correlation was limited to electronics parents and investment in China. Correlations were negative and significant for electronics parents investing in advanced economies and other manufacturers investing in China, and insignificant for other manufacturers investing in advanced economies. These findings contrast with common perceptions that overseas activity, especially in China, has reduced parent employment, especially in Taiwan's electronics firms.

Key words: Multinational enterprise, parent, employment, propensity score matching
JEL classification: C21, F21, F23.

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1. Introduction

Over the last two decades or more, there has been a large increase in foreign direct investment (FDI) by multinational enterprises (MNEs) from recently advanced economies such as Taiwan, Korea, Hong Kong, and Singapore. Many, if not most, of the major corporations in these economies now have operations overseas, some of which are very extensive. The advent and expansion of large-scale overseas operations has raised old concerns that MNE parents may be exporting jobs abroad when they shut down production lines in the home economy and move them overseas. Reactions are often strongest among labor unions and related activists, who purport to fight for the rights of workers and often view the MNE as a nemesis. The reality is more complex, however, even in the parent company itself. Expansion of overseas activities often facilitates reduction of parent employment engaged in relatively inefficient production and expansion of parent employment in more efficient production. The net effect of these changes is not clear *a priori* and has been the subject of several studies of MNE parents in the United States, Europe, and Japan, for example. However, the study of Korean parents by Debaere *et al*. (2010) is the only known one of parents from newly advanced economies, while Chen and Ku (2005) provide related industry-level estimates for Taiwan.[1] This paper's first contribution is thus to investigate how overseas activity affected parent employment in a large sample of Taiwan's listed firms during a key period, 2000-2005.

In Taiwan, the impact of foreign production on domestic employment has attracted increased attention since the mid-1990s and the concern is related to several important macroeconomic trends. First, the unemployment rate increased to 2.6-3.0 percent in 1996-2000 and then 4.1-5.1 percent in 2001-2005, after staying at 2.0 percent or less in 1987-1995 (Directorate-General of Budget, Accounting and Statistics, 2010). Second, manufacturing's share of total employment fell from a peak of 34-35 percent in 1983-1989 to

[1] Chen and Ku (2005) investigate the effect of outward FDI on Taiwan's manufacturing employment, suggesting that the net effect of FDI on domestic employment was positive in most cases. Technical workers experience the largest job gains from FDI, in China and/or other regions, followed by managerial workers, and finally by blue-collar workers, who were estimated to lose jobs from FDI outside of China.

27-28 percent in 1993-2006. Third, the accumulated value of actual outward FDI from 1981 forward (as recorded in the balance of payments) jumped from US$17 billion at yearend 1990 to US$54 billion in 2000, and US$83 billion in 2005. Although Taiwan does not publish data on actual FDI by country or industry, alternative data indicate that approvals of outward FDI have been increasingly concentrated in Mainland China, and that most of these investments were in manufacturing.[2]

Because the relationship with Mainland China (hereafter China) is politically sensitive and economically important, FDI in China receives close scrutiny in Taiwan. Before Taiwan joined the World Trade Organization (WTO) in 2001, Taiwanese authorities severely restricted FDI in China, especially in electronics-related industries, which are large and considered strategic. Although restrictions were substantially relaxed in order to comply with WTO rules, and FDI in many electronics activities reclassified accordingly, FDI in China, especially electronics FDI, remains a controversial issue.[3] Distinguishing FDI in China, and especially in Chinese electronics, is also of potential interest economically because related MNE affiliates are often thought to be involved in vertical production chains (different stages of producing a final product). On the other hand, MNE operations elsewhere (especially in advanced economies like Europe, Japan, and the United States) and in other industries are usually thought to be more frequently involved in horizontal production networks that replicate similar activities in multiple locations. Although "it is difficult to classify actual foreign operations into these theoretically neat [vertical and horizontal] categories" (Lipsey 2004, 349), it is still of interest to ask whether FDI in China and elsewhere, and well as FDI in electronics and other manufacturing industries, affect employment in Taiwanese parents

[2] For example, China's share of cumulative, approved, outward FDI from 1981 forward rose from 0 percent in 1990 to 26 percent in 1995, 31 percent in 2000, and 45 percent in 2005. However, data on FDI approvals must be used with extreme caution because a lot of actual FDI was never approved (e.g., the ratio of cumulative approved-to-actual outward FDI was only 17 percent in 1990, 47 percent in 1995, 72 percent in 2000, and 97 percent in 2005; Directorate-General of Budget accounting and Statistics 2010; Investment Commission, various years). According to a survey of outward investors in 2005 (Ministry of Economic Affairs 2007), manufacturing parents in Taiwan employed 626,792 production workers domestically (50 percent in electronics) and parents with FDI in China had 519,684 production workers (52 percent in electronics).

[3] In 2001, Taiwan's regulators of outward FDI adopted a new principle of "active openness and effective management". Thereafter, only outward FDI using technologies classified as state secrets was forbidden. Other FDI, including substantial FDI in electronics and in China was reclassified and permitted (Yang *et al.* 2010).

differently. This is the second major contribution of this study.

The paper proceeds to briefly review the related literature (Section 2) before describing the two analytical methodologies and the data (Section 3). It then analyzes results of propensity score matching (PSM) estimates of the how FDI affected subsequent employment in parents compared to similar non-parents, as well as generalized method of moments (GMM) estimates of the marginal effects of FDI on employment in parents (Section 4). Section 5 summarizes major findings.

2. Related Literature

Is there a positive or negative association between outward FDI and parent employment? MNEs clearly close down lines of production in the home economy and transfer them to foreign countries in many cases. The transfer of labor-intensive activities from high wage home countries to low-wage hosts is often conspicuous. Moreover, if the parent chooses to eliminate employees in transferred activities, it would have fewer employees after undertaking or expanding FDI. These are perhaps the simplest cases, which are often focused on by labor unions and others opposing overseas expansion by MNEs.

However, even when the MNE parent transfers entire production lines abroad, previous literature reviews (Kokko 2006, Lipsey 2004) emphasize how employment effects in the parent or the home economy are rarely clear cut. This is because FDI can allow the parent to reallocate its resources, including its workers, to activities which are more cost effective in the home economy. For example, FDI may allow a parent to expand activities such as supply of capital or intermediate goods used by the transferred production line, and/or related research and development (R&D) and marketing. FDI may also facilitate the initiation of new product lines and related activities in the parent. Thus, the net effect of overseas expansion on parent employment usually depends on whether the employment losses caused by transferring some activities abroad are greater or less than the employment gains in other parent activities that are facilitated by reorganization of activities in the parent and related affiliates.

The theoretical literature often emphasizes how FDI's negative effect on employment can

be particularly large when overseas production substitutes for parent exports (Kokko 2006). However, even when foreign production directly substitutes for parent production, related FDI might also make it easier for the parent to expand markets for products not substituted for. Here again, FDI's net effect on parent exports is ambiguous *a priori* and depends on the relative size of these substitution and expansion effects. Lipsey's (2004, 336-341) review of the related empirical literature suggests that net export substitution has been rare in U.S., European or Japanese MNE parents and industries, while export complimentarity and/or neutral (statistically insignificant) net export effects have been more common.

2.1 Employment in Existing Parents and the Scope of Foreign Operations

Lipsey (2004, 341) goes on to say "even if direct investment did not affect the location of total production and had no effect on a home country's exports, it could influence home-country factor demand and factor prices through changes in the allocation of types of production within the firm." Much of the literature he reviews asks the question: given the level of parent production, does greater overseas production increase or reduce parent employment? Initial, cross sectional evidence for the United States in 1982 (Kravis and Lipsey 1988) and 1989 (Lipsey 1995) suggests that there was a negative correlation between affiliate net sales and parent employment in both years. That is, larger overseas activity appears to have resulted in some substitution for U.S. parent employment. Kravis and Lipsey (1988, abstract) also find that U.S. parents tend to pay "slightly higher average wages and salaries" and interpret these findings as indications that "the larger a firm's foreign production, the greater its ability to allocate the more labor-intensive and less skill-intensive portions of its activity to locations outside the United States".[4]

Further analysis of the 1989 data (Blomström *et al.* 1997; Lipsey 2002) also asked this paper's second question: does the effect of affiliate activities on parent employment depend on FDI's location or industry? Both studies provide evidence that negative correlations were

[4] There is a substantial literature focusing on how overseas activities affect the composition of the parent workforce and parent wages, but that literature is not directly relevant to this study and omitted from this review.

related to affiliate activity in developing economies but not to those in developed economies. When Lipsey (2002) distinguished six industry groups, differences among FDI locations were only significant in foods, with FDI in developed economies and inward-oriented developing economies being negatively correlated to parent employment and FDI in outward-looking developed economies positively correlated. The net effect was significantly positive in non-electric machinery and in electric and electronic machinery, significantly negative in transportation equipment, and insignificant in foods, chemicals, and metals.

Similar analyses of Swedish parents in six years spanning 1970-1994 (Blomström *et al*. 1997) and for Japan in 1986, 1989, and 1992 (Lipsey *et al*., 2000) yield contrasting results. Employment in Swedish parents was usually positively correlated with the extent of overseas activities. Positive employment effects were larger for blue collar workers than for white collar workers and larger for both types of labor when related to overseas activities in developing economies than in developed economies. The authors interpreted this finding as a possible indication Swedish MNEs were inclined to upgrade their workforces abroad but keep and expand unskilled-intensive activities at home. The results for Japan varied among years and the 12 industry groups for which the equations were estimated. Most of the correlations (85 of 136) between parent employment and overseas activity were insignificant, but significantly positive correlations outnumbered significant negative ones 39 to 12, and the number of significantly negative correlations dwindled to two in 1992 from six in 1986. Correlations to overseas activity in developed regions were more frequently significant than those to activity in developing regions.

A recent study of large Japanese firms in 1992-2001 used a similar approach to examine the effect of overseas operations (measured as weighted shares of worldwide employment or sales in the MNE) on parent employment, but controlled for several additional firm and industry characteristics (wage levels, capital prices, R&D intensities, import propensities), used a larger sample of firms including non-MNEs, and used four alternative panel estimation techniques. The authors conclude by saying "the evidence suggests that expanded overseas operations by MNEs not only help firms to enhance their competitiveness and

profitability but may also have a positive impact on home MNE employment by generating higher demand for more technology and skill intensive activities" (Yamashita and Fukao 2010, 95). Their results also indicate that FDI in different regions had different effects on parent employment, and that the size, significance levels, and sometimes the signs of estimated coefficients were sensitive to estimation technique.

Several other studies estimate elasticities of parent labor demand with respect to labor prices in alternative affiliate locations in the MNE.[5] Brainard and Riken (1997) examined labor demand in U.S. parents and for 1983-1992, finding that overseas activity tended to negatively affect parent labor demand in the parent. The degree of substitution between overseas activity and parent employment was generally low but the degree of substitution among foreign affiliate employment, especially among affiliates in developing economies, was much larger. Cuyvers, et. al (2005) estimated elasticities of labor demand for EU parents investing in Central and Eastern European hosts during 1994-1998. They found overseas activity tended to reduce parent labor demand and that elasticity signs did not vary much across the six manufacturing sectors examined. However, they also noted considerable inter-sectoral heterogeneity. Konings and Murphy (2006) estimate elasticities of labor demand for EU parents, but distinguish the effects of investment in the high-wage North EU (which is home to most of the parents in the sample), the low-wage South EU, and the very low wage Central Europe. They conclude "contrary to the popular belief we find that employment relocation mainly takes place between (mainly North EU based) parent companies and their affiliates located also in the North EU" (p. 281).

2.2 Accounting for the Initial Overseas Investment Decision and Parent Employment

The studies summarized above analyze MNEs that have already invested abroad. In other words, these analyses measure the marginal impact of larger foreign operations on existing MNEs, but do not analyze the discrete effects of initial FDI on parent employment. To

[5] As Lipsey (2004, 338) points out, the focus on labor demand elasticities "excludes home-country responses to variables other than the price of labor" such as "income growth, trade restrictions, policies toward direct investment or changes in nonlabor costs of producing outside the home country".

estimate such discrete effects, a growing literature uses the PSM estimator to compare employment levels in new parents and non-parents with similar characteristics in a home economy. In addition to facilitating analysis of how initial FDI affects parent employment, some of these studies also claim this methodology corrects for sample-selection bias that might result from focusing exclusively on the employment effects of overseas operations in existing MNEs. However, it is probably more meaningful to recognize that the two types of analysis ask related but different questions: (1) how does expanding affiliate activity affect employment in parents and (2) how does employment growth compare in parents after undertaking FDI and similar non-MNEs during the same period? Both questions are both important and may have different answers.

Most existing studies using this methodology focus on European firms. Barba Navaretti and Castellani (2004) and Castellani *et al*. (2008) analyze samples of Italian firms in 1993-1998 and 1998-2001, respectively. The former study finds overseas "investments improve growth of total factor productivity and output" but had "no significant effects on employment" (abstract). Similarly, the second study (p. 81) finds that "the internationalisation of production activities did not reduce domestic employment in the parent companies neither for investments in developed or developing countries". They also find that "only firms investing in Central and Eastern European countries experience some skill upgrading relative to firms that remained national". Results from Barba Navaretti *et al*. (2010) compare the effects of FDI in advanced and developing economies on the employment of both French and Italian parents in 1993-2000. They (p. 255) "find no evidence of negative effects of investing abroad on firms' performance". The employment effects of initiating FDI in both developed and developing economies were positive but they were only significant at standard levels (5 percent or better) for FDI in developed hosts when a difference-in-difference estimator was used. For FDI in developing economies there was some weakly significant (at the 10 percent level) evidence of positive effects on parent employment by the second or third year. Similar results from Hijzen *et al*. (2009) suggest a positive employment effect for French manufacturing parents that made market-seeking investments in 1987-1999. For parents that

made factor-seeking investments, there were weak (insignificant) indications of an initial drop in employment at the time of investment, followed by a larger positive effect after two years.

Hijzen *et al*. (2007) studied a large sample of Japanese firms in 1995-2002, their results suggesting that outward FDI led to increased output and employment in parents, but had a generally insignificant effect on productivity. In short, results for Japanese firms are similar, whether based on PSM estimates of discrete effects or marginal effects on existing parents: more extensive activity appears to be positively related to parent employment or there is no significant relationship. For European firms, the results differ depending on methodology. Studies using PSM estimation find a result similar to that for Japan, but studies that focus only on existing EU parents find more evidence of negative effects on parent employment.

Finally, like this study, Debaere *et al*. (2010) account for discrete employment impacts of FDI from a newly advanced Asian economy, Korea during 1981-1995. Similarly, they also distinguish between investments in more- and less-advanced countries. They find that "moving to less-advanced countries decreases a company's employment growth rate especially in the short run" but that "moving to more-advanced countries does not consistently affect employment growth in any significant way" (p. 301). They thus conclude by saying that their findings "support the public anxiety about multinationals only in the short term and only for investments into less advanced countries" (p. 309).

3 Empirical Methodologies and Data

This section describes the two methodologies used to examine the effects of initial FDI and the marginal effects of expanding overseas operations on parent employment. It concludes by describing the data used to facilitate these analyses.

3.1 Estimating the Discrete Employment Effects

As discussed in the literature review, a substantial portion of the recent literature focuses on how the discrete decision to undertake FDI affects parent employment. Some of these studies

suggest that estimates of marginal employment effects in existing parents are subject to sample-selection bias because they ignore the fact that new investors are not selected randomly from a population of firms, but are self-selected in the sense that firm characteristics can predict which firms will engage in FDI and which ones will remain domestic. As explained above, we believe that emphasis on sample-selection bias may be exaggerated because the marginal effects of overseas activity on employment in existing parents are in themselves of economic interest. Nonetheless, it is also true that simply comparing averages for MNEs initiating FDI (the treated group) and non-MNEs in FDI in year t (the control group) will yield biased estimates of the differences between the two groups (the treatment effect).

The propensity score matching (PSM) method developed by Heckman *et al*. (1997, 1998) provides us with an appropriate approach. We define the treatment dummy variable $DFDIN_{it}$ as equal to 1 if a MNE engages in new FDI in year t (i.e., the firm's FDI stock [cumulative flows from 1998] was 0 in year t-1 and 1 in year t) and 0 if it not, and $DLOC_{it}$ as equal to 1 for all firms without FDI in any year.[6]

We then define $G1_{it}$ as the growth rate of employment in FDI parent firm *i* between year t and t+s (s=1, 2). Assuming the firm was not an MNE in year t-1, but became so thereafter; the treatment effect is observed and $DFDIN_{it}$ equals 1. Alternatively, for purely domestic firms which did not invest abroad between 1998 and year t and $DLOC_{it}$ is 1 and $G0_{it}$ denotes the employment growth rate. The average treatment effect is therefore:

$$E(G1_{it} - G0_{it} \mid DFDIN_{it} = 1) = E(G1_{it} \mid DFDIN_{it} = 1) - E(G0_{it} \mid DLOC_{it} = 1) \qquad (1)$$

Because $G0_{it}$ is unobservable, estimation of equation (1) requires construction of counterfactual observations to compare with observations for firms engaging in new FDI. This is only possible if one has data on both new investors and non-investors in the initial period, when the average employment growth rate differential between new MNEs and

[6] Because of data constraints, we have to define *DFDIN* as new FDI from firms with no FDI flows in years in 1998 forward. This is a potentially serious shortcoming in both this and the following marginal analysis. Moreover, because FDI stocks (and flows) can be used to finance investments in non-fixed assets (e.g., bank accounts, bonds, stocks, or inventory), many of which are only loosely related to employment or production. However, data constraints prevent the use of preferable measures such as foreign affiliate employment, sales, or value added. .

non-MNEs can be calculated from equation (1).

To construct a valid control group, Rosenbaum and Rubin (1983) suggest using the propensity scores matching (PSM) estimator. To do this, one first identifies the firm characteristics which can successfully predict whether a firm engages in new FDI or not, and then finds a group of non-FDI firms with characteristics similar to those of new FDI firms, and compares these domestic firms to the FDI firms. Because these groups of new FDI firms and local firms share important characteristics that determine whether a firm engages in FDI or not, differences between the two groups are assumed to reflect FDI-related differences between the two groups of firms.

The probability a firm engages in new FDI is estimated with the following regression.

$$DFDIN_{it} = \beta_{30} + \beta_{31} \ln SALE_{it} + \beta_{32} \ln(1 + PATENT)_{it} + \beta_{33} EXPR_{it} + \beta_{34} \ln TFP_{it} + u_{it} \quad (2)$$

where $SALE_{it}$ is firm i's sales in year t, $PATENT_{it}$ is the number of firm i's registered patents in year t, $EXPR_{it}$ is firm i's export-sales ratio in year t, TFP_{it} is firm i's total factor productivity in year t, and $DFDIN_{it}$, the new MNE dummy (also defined as in equation (1)). Larger firms, patent-intensive firms, and exporting firms are all expected to have a relatively high probability of having new overseas activity. Firms with higher productivity might also be expected to have a greater probability of taking on the risks of initially engaging in overseas activities, but it is also possible that firms with lower productivity could be motivated to move low productivity activities abroad and therefore be more likely to engage in new FDI.

The most important part of the matching process is to balance the distributions of firm characteristics between the new FDI firms and purely local firms (the control group). The seven-step algorithm proposed by Becker and Ichino (2002) is widely used for this purpose and is adopted here as well. Moreover, to ensure the robustness of the results, two alternative matching criteria (nearest-neighbor matching and kernel matching) are compared.[7]

[7] A third technique, caliper matching, was also tried but did not yield meaningful (converging) results in these relatively small samples. For an extensive discussion of matching methods, see Heckman *et al*. (1998).

3.2 The Marginal Employment Effects of Foreign Activity

Van Reenen's (1997) labor demand function is the point of departure for estimating the marginal effects of overseas activity on parent employment in Taiwan. He assumes a constant elasticity of substitution production function and that firms minimize the costs of producing gross output. Following Greenhalgh *et al*. (2001) the debt-equity ratio is added as a proxy for the firm-specific cost of capital, which is not accounted for in Van Reenan's model. In other words, the core model assumes that the log of employment in firm i for year t (ln EMP_{it}) is a function of the log of its annual wage payments per employee (ln $WAGE_{it}$), the log of its fixed capital stock (ln CAP_{it}), and its debt-equity ratio ($DEBTR_{it}$). In the Taiwanese context, it is also important to extend the model to account for four other factors likely to be correlated with firm employment. The first is the extent of innovative activity (measured as the log of the number of patent applications) because firms with better technology are expected to hire more workers, all other things constant (Yang and Lin 2008). The second is the firm's ability to export (measured as the export propensity, $EXPR_{it}$, Debaere *et al*. 2010); here again firms that are more successful exporting are generally expected to have relatively large work forces. The last two variables are the size of a firm's local market (measured as the log of domestic market sales, ln $SALES_{it}$) and the log of a firm's total factor productivity (ln $TFP_{it,}$), because relatively large and efficient firms are also expected to hire more workers, *ceteris peribus* (Lipsey 2004; Yamashita and Fukao 2010).

The ratio of cumulative total FDI to the value of a firm's common stock (FDI_{it}) is then added to the employment equation, its coefficient reflecting the marginal effect of overseas activity on employment in Taiwan's large firms. The resulting equation is:

$$\begin{aligned}\ln EMP_{it} = {} & \beta_{40} + \beta_{41} \ln WAGE_{it} + \beta_{42} \ln CAP_{it} + \beta_{43} DEBTR_{it} + \beta_{44} FDI_{it} \\ & + \beta_{45} \ln(1 + PATENT)_{it} + \beta_{46} EXPR_{it} + \beta_{47} \ln SALES_{it} + \beta_{48} \ln TFP_{it} + u_{it}\end{aligned} \quad (3)$$

FDI is then disaggregated by destination to investigate the potential for FDI in China to have different effects on parent employment than FDI in more advanced economies:

$$\begin{aligned}\ln EMP_{it} = {} & \beta_{50} + \beta_{51} \ln WAGE_{it} + \beta_{52} \ln CAP_{it} + \beta_{53} DEBTR_{it} + \beta_{54} FDIC_{it} \\ & + \beta_{55} FDIA_{it} + \beta_{56} \ln(1 + PATENT)_{it} + \beta_{57} EXPR_{it} + \beta_{58} \ln SALES_{it} \\ & + \beta_{59} \ln TFP_{it} + u_{it}\end{aligned} \tag{4}$$

where $FDIC_{it}$ and $FDIA_{it}$ are the ratios of the FDI stock in China and in more advanced economies, respectively, to the value of a firm's common stock.[8] Unfortunately, our data do not include information on FDI in other countries. Estimating equations (3) and (4) can thus facilitate analysis of how the extent of overseas activity in these important, alternative locations affects employment in Taiwan's largest firms.

Equations (3) and (4) are estimated with panel techniques in order to account for unobservable firm heterogeneity, but such estimates cannot account for potential endogeneity involving FDI and employment variables. Results of Wu-Hausman tests for endogeneity between the large firm employment and the three FDI variables in equations (3) and (4) indicated that there was endogenous causality between cumulative FDI in China and large-firm employment, but no endogeneity involving cumulative FDI in advanced countries.[9] Because these results suggest potential endogeneity, the generalized method of moments (GMM) estimator is combined with the use of instrumental variables to account for this problem. This approach also has the advantage of being robust in the presence of heteroscedasticity across firms, another potentially important problem in this context.[10]

The choice of instrumental variables is important and can influence results. Independent variables other than FDI are obvious choices for instruments. Another important instrument in this case is the dummy variable TTI_{it}, which is defined to take the value of 1 for firms that were potentially affected by the liberalization of policies toward FDI in China after November 2001.[11] As explained in the introduction and detailed in Yang *et al.* (2010), this

[8] More advanced economies are defined as Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States.

[9] To save space, we do not display the results of endogenous tests between investment (to China and developed countries) and employment. Those two tables are available by request.

[10] GMM is an asymptotically efficient estimator even under assumptions of weak exogoneity.

[11] More precisely this is an interaction dummy calculated as the product of a dummy variable identifying firms investing in China after November 2001 and another dummy variable identifying firms likely to be affected by this policy change. Most of the firms affected by this policy change (TTI_{it}=1) were in electronics.

change to a policy of "active openness and effective management" greatly reduced Taiwanese restriction on FDI in China, particularly in electronics. Because its primary effects were realized during the period under study, it is a particularly appropriate instrumental variable in this context.

3.3 Data

This study analyzes employment decisions in a sample of large firms listed on the Taiwan Stock Exchange (TSE) from 2000 to 2005.[12] This sample is not comprehensive and excludes small and medium enterprises, some of which have overseas activities. However, it includes most of Taiwan's outward investors and covers the vast majority of Taiwan's FDI abroad. After eliminating few firms with missing observations, the data set is an unbalanced panel of 621 firms with 3,628 observations (597-608 firms per year; authors' calculations).

Most of the firm-level data (on employment, wage payments, fixed capital stocks, debt-equity ratios, export propensities, and sales) come from annual financial statements of these firms, which are compiled by the Taiwan Economic Journal Company. Information on FDI to China and to other countries is taken from firm-level records on actual FDI provided by the Ministry of Economic Affairs' Investment Commission.[13] The number of patent applications is drawn from the Taiwan's Intellectual Property Office's database. TFP levels are calculated using Levinsohn and Petrin's (2003) semi-parametric approach.

Employment of sample firms grew slowly in the recession year of 2001 (0.1 percent), moderately in 2003-2004 (2.9-3.0 percent), and rapidly in 2002 and 2005 (6.4 and 8.3 percent, respectively; Table 1). In all years except 2005, sample firm employment grew faster than the average for Taiwan's manufacturing employees and MNE parent employment grew more rapidly than the sample average.[14] Correspondingly, MNE shares of sample firm

[12] According to the official definitions of the Small and Medium Enterprise Administration of the Ministry of Economic Affairs, in 2005 a firm with 200 or fewer employees and capital less than NT$80 million was classified as SME. However, the capital requirement for an initial public offering (IPO) on the TSE is NT$600 million.

[13] These data differ from published figures on approved investment (Investment Commission, various years).

[14] Ratios of employment in sample firms to total manufacturing employment as estimated in Taiwan's labor force surveys rose from 20 in 2000 to 24 percent in 2005 (Table 1; Directorate-General of Budget Accounting and Statistics 2011). There is a discrepancy between the firm-level data and the individual-level labor force data, but it

employment rose rather steadily 63 percent in 2000 to 85-88 percent in 2004-2005. In other words, simple comparisons suggest that these large firms, and particularly the large MNEs in the sample, were generally better able to create new employment opportunities than were non-MNEs in the sample or the generally smaller firms that were excluded from the sample. On the other hand, the large firms in these samples accounted for relatively small portions for total manufacturing employment, because excluded, small- and medium-sized firms account for most of the employment (three-fourths or more) in Taiwan's manufacturing.

The mean ratio of cumulative total FDI to common stock increased markedly from 17 to 26 percent in 2000-2002, but remained at 28-29 percent in 2003-2005 (Table 1). Likewise, the mean ratio of FDI in China to common stock grew from 13 to 21 percent in 2000-2002, but stagnated at 23-24 percent thereafter. In other words, investment in China accounted for the vast majority of FDI by sample firms, and accounted for most of the rapid growth (relative the value of common stock) in the early part of the sample, as well as the relative stagnation of FDI growth in the latter period. Table 1 also illustrates that electronics parents, particularly those investing in China, had larger FDI relative to total common stock than non-electronics firms and that they generated most of the employment by sample firms.

[Insert Table 1 about here]

4. Empirical Results

Results describing the discrete effects of new FDI on parent employment in subsequent years and the marginal effects of the scope of overseas operations on parent employment are analyzed in this section.

4.1 Discrete Effects of FDI on Subsequent Employment Growth

As explained in Section 3.1, estimating the determinants of whether a firm chooses to engage in initial FDI in a year or not (equation 1) is the first step in evaluating the discrete

is unlikely to be large (e.g., most employees reporting that they were in manufacturing are probably recorded as manufacturing firms).

employment effects of FDI because the decision to undertake initial FDI is the most important trait that distinguishes MNEs from non-MNEs theoretically. Table 2 presents the results obtained from logit regressions of this equation for all manufacturing firms, electronics firms, and non-electronics firms. Estimates for all firms combined indicate that the probability of having overseas activities is positively associated with sales (size), patent applications (technology intensity), and export propensities, but negatively associated with total factor productivity. Results are generally consistent with previous studies such as Chen and Yang (1999). However, the effects of patent applications and TFP are not significant for electronics firms, while the effects of exporting are not significant for other manufacturers. In other words, other manufacturers with relatively large sales and high technology-intensity, and electronics firms with relatively large sales and high export propensities are more likely to engage in new FDI than others.

[Insert Table 2 approximately here]

Probability ratios are retrieved from the logit model for firms engaging in new FDI and purely domestic firms. New FDI firms and purely domestic firms that have similar sales levels, patent applications, export-sales ratios, and TFP levels are identified using nearest-neighbor matching and kernel matching techniques, but caliper matching did not yield meaningful (converging) results. Differences in employment growth rates between matched pairs, or average treatment effects, are then calculated and reported for two periods between the year of FDI and the subsequent two years in Table 3.

[Insert Table 3 approximately here]

Panel A of Table 3 shows employment growth rate differentials between firms new FDI firms in all regions, in China, or in advanced economies, on the one hand, and similar domestic firms, on the other. Panel B shows similar differentials for electronics firms and other manufacturers in all regions. Small sample size prevents meaningful disaggregation by both region and industry of investment. Table 3 combines analysis of subsequent growth rate differentials over the entire period (2000-2005). For all industries combined, both in China and elsewhere, the kernel estimates generally suggest that growth rate differentials were

relatively large, but the reverse is true when electronics firms and other manufacturers are distinguished. However, both of these matching techniques both suggest that employment growth rate differentials were statistically insignificant in all of these samples. Because the effects of the 2001 policy change may have been larger in 2002-2003 than in other years, calculations similar to those in Panel A were also made for three two-year periods (2000-2001, 2002-2003, 2004-2005) but all growth rate differentials were statistically insignificant in these two-year samples as well.[15]

In short, PSM analyses provide no evidence that new FDI led to significant differences in net employment growth between new MNE parents and similar non-MNEs. This evidence contrasts starkly with public perceptions that outward FDI, and particularly outward FDI in China, is a major cause of job losses in Taiwan. The results also contrast with previous findings for Italy (Mariotti *et al*. 2003), France (Hijzen *et al*. 2007), and Korea (Debaere *et al*. 2010) because they suggest that new FDI in a developing economy, China, did not result in different employment effects than FDI in advanced economies. However, as Heckman and Navarro-Lozano (2004) emphasize, PSM estimates can be unreliable in small samples, and the fact that our sample contains relatively few non-MNEs may be one reason for the lack of statistically significant results. To get a more complete picture, it is thus important to compare these results with estimates of marginal employment effects.

4b. Estimating the Marginal Effects of FDI on Large Firm Employment

In order to facilitate comparisons with older studies of Japan, Sweden, and the United States (Blomström *et al*. 1997, Lipsey 2002, and Lipsey *et al*. 2000; and Yamashita and Fukao 2010), equations (3) and (4) were estimated in samples of MNEs parents alone.[16] Table 4 presents an alternative set of estimates for all MNEs using both (1) a fixed effects

[15] Results of these calculations are omitted for brevity but are available from the authors (see Appendix Table 1).
[16] The main results (coefficients on FDI variables) are also identical or qualitatively consistent (similar coefficient signs, size, and significance levels) if estimated in samples of all firms, including non-MNEs. (compare Tables 3-4 and Appendix Table 6 [estimates for MNEs only] with Appendix Tables 3-5 [estimates for all firms]).

GMM estimator [to correct for endogeneity bias] and (2) a simple panel, fixed effects estimator with lagged FDI variables for comparison. Table 5 then presents the GMM results alone for MNE parents in electronics and other manufacturing separately.[17] For the panel, fixed effects GMM estimator, results of an F-test developed by Staiger and Stock (1997) indicate that the null hypothesis of weak instruments is rejected and suggest that the instrumental variables used in these estimates are effective.

Results for most control variables are also similar in Tables 4 and 5. Consistent with theory, employment is negatively and strongly (significant at the 1 percent level) related to wage levels. On the other hand, large firm employment is also strongly and positively related to a firm's number of patents, export propensities and domestic sales, again as expected. In estimates for all firms (Table 4) the capital stock is negatively correlated with firm employment while the debt-equity ratio is positively and again strongly correlated, suggesting that capital is a substitute for labor in these firms as theoretically expected. Similar results also obtain when estimates are made for other (non-electronics) manufacturers but the capital variables are not strongly correlated (insignificant) in estimates for electronics firms (Table 5).

[Insert Tables 4 and 5 approximately here]

After accounting for the effects of these control variables, do firms with relatively larger stocks of cumulative outward FDI employ more or fewer workers? Results for all firms parents (Table 4, equation 4) suggest that the mean, marginal effect of cumulative FDI (relative to the common stock issued by a firm) on parent employment is positive and highly significant statistically. The panel, fixed GMM estimates of this equation indicates that the a one percentage point increase in the ratio of cumulative FDI to common stock results in a 0.004 percent increase in the parent's employment. Thus, the employment-enhancing impact of outward FDI is not large, but it is clearly positive and suggests that the positive effects of reallocating MNE resources internationally outweigh negative effects that result from shutting down specific production lines. This result is broadly consistent the results of Chen

[17] See Appendix Table 6 for panel, fixed effects estimates for MNE parents in each industry group, noting again that results are generally robust to estimation technique.

and Ku's (2005) industry-level study of Taiwan and with previous evidence for Sweden and Japan (see Section 2).

Estimates of equation (5) in Table 4 indicate that the positive effect on parent employment results from FDI in China but not from FDI in advanced economies. The positive effect is of FDI in China is highly significant statistically regardless of estimation method. On the other hand, the effect of FDI in advanced economies is negative and significant at standard (5 percent) levels when the GMM estimator is used but insignificant when using the panel, fixed effects estimator. Here again this result suggests a pattern that contrasts with popular perceptions and previous results for the United States, several European economies and Korea, which suggest negative employment effects for FDI in developing economies but not for FDI in advanced economies (see sections 2, 4.1 above).

Previous industry-level results (Chen and Ku 2005) suggested that the employment effects of outward FDI vary across industries. Table 5 explores this possibility for subsamples of electronics firms and other manufacturers (GMM estimates only). Results for electronics firms are similar to those for all firms combined. The employment effect of electronics FDI in all regions combined is positive, highly significant, and about 2.5 times larger than in samples of electronics firms and other manufacturers combined (Table 4). However, when FDI in China is distinguished from FDI in advanced economies, this finding only applies to FDI in China, while FDI in advanced economies is negatively and significantly related to employment in electronics' parents. In contrast, results for other manufacturers suggest negative effects for FDI in all regions combined and for FDI in China, but insignificant effects for FDI in advanced economies. These results thus suggest that the positive marginal effects of FDI on parent employment observed in Table 4 were concentrated in electronics firms investing in China. On the other hand, for electronics firms with FDI in advanced economies and other manufacturers investing in China, FDI was negatively related to parent employment, while FDI was unrelated to parent employment for other manufacturers investing in advanced economies.

These results again contrast with public expectations and previous evidence, especially by

suggesting that FDI in Chinese electronics, which is usually thought to involve vertically integrated production, had net positive effects on parent employment in Taiwan. As emphasized in the literature review and introduction, the distinction between vertical and horizontal FDI is often ambiguous statistically, and one potential explanation for these results might be that a substantial portion of the electronics FDI in China was more horizontal than vertical. Many of Taiwan's large electronics producers such as Acer, Asus, and BenQ, have developed important and rapidly growing final good markets in China. In addition, China is also an important market for intermediate goods, as well as intangible services (such as the fruits of R&D) produced by these parents. Thus, even vertical FDI by electronics firms in China can facilitate increased parent growth at home by allowing them to allocate resources more efficiently. Similarly, even though most electronics FDI in advanced economies is thought to be horizontal, it may actually be more vertical, serving as a means of accessing leading technologies and substituting for domestic R&D, and thus parent employment.

The negative employment effects observed parents in other manufacturers other industries in all countries and in advanced countries for other industries are more difficult to sort out because these firms are heterogeneous. However it is true that many firms in this group focus on acquiring advanced technologies and distribution networks in advanced countries, and it is possible that these activities substitute for related parent activities more than usually recognized. Unfortunately, small sample sizes prevent meaningful disaggregation of this group of heterogeneous firms, which might shed further light on this issue.

5. Conclusion

Although the effects of outward FDI on parent employment have attracted much attention in Europe, Japan, and the United States, these effects have only recently become a major concern in newly advanced economies like Korea and Taiwan. This issue is particularly important in Taiwan, which has witnessed concurrent increases in the unemployment rate and large, politically sensitive FDI outflows to China over the past decade. As a result, there is wide concern that these FDI outflows are an important cause of job destruction in Taiwan. To

evaluate these concerns, this paper uses a data on 621 large firms listed on the Taiwan Stock Exchange to explore the effects of outward FDI on parent employment during 2000-2005. It distinguishes FDI in China and FDI in advanced economies, as well as FDI in electronics and in other industries, and attempts to measure both the discrete effects of new FDI and the marginal impacts of larger overseas activity on parent employment.

To measure discrete impacts of new FDI, a propensity score matching methodology compares employment growth in similar groups of new MNEs and purely domestic firms in the years after initial FDI occurs. It found no statistically significant differences in subsequent employment growth between the two groups of firms. Results of fixed effects GMM estimation suggest that the marginal effects of FDI on parent employment were positive and statistically significant but small, when all destinations and industries are combined. When destinations and parent industries are distinguished, the positive effects were concentrated in electronics parents investing in China. On the other hand, parent employment was negatively and significantly correlated with FDI by other manufacturers in China and FDI by electronics parents in other regions, but there was no significant relationship between employment of non-electronics parents and FDI in other regions.

Both sets of results are consistent in suggesting that large increases FDI during this period have not led to net reductions in aggregate parent employment during this period. This result is important partially because it contrasts both with public perceptions that such FDI has contributed to Taiwan's increased unemployment in recent years. The fact that FDI's positive effects were concentrated in electronics parents with FDI in China is also of keen interest. The relaxation of restrictions on FDI in China by electronics' and other high-tech firms in late 2001 encouraged a number of electronics parents to move a number of production lines to China and probably reduced parent employment of relatively unskilled labor with low productivity (e.g., workers involved in assembly). However, electronics parents with relatively large operations in China were apparently able to expand employment even more in other areas and overall parent employment was positively correlated with the extent of FDI in China. In other words, this evidence is consistent with the view that FDI contributed to an

upgrading process in electronics parents, which probably involved increased concentration on high-tech manufacturing at home as well as the production of R&D services, capital equipment, and intermediate goods for affiliates in China, which focused on labor-intensive assembly.

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Table 1: Number of Employees and Ratios (in percent) of Cumulative FDI to Common Stock in Sample Firms

Variable, sample	2000	2001	2002	2003	2004	2005
Employees, all firms (EMP_{it})	536,563	537,247	571,546	588,806	605,853	655,875
MNE parents ($FDI_{it}>0$)	337,800	404,797	457,464	481,118	533,769	559,387
Electronics (MNEs only)	182,605	204,116	243,385	256,404	299,169	321,005
New MNEs ($DFDIN_{it}=1$)	81,269	109,536	141,474	161,132	197,660	216,161
Other manufacturers (MNEs only)	155,195	200,681	214,079	224,714	234,600	238,382
New MNEs ($DFDIN_{it}=1$)	57,110	124,249	144,725	157,717	167,861	172,034
Non-MNEs ($FDI_{it}=0$ [$FDIC_{it}=FDIA_{it}=0$])	198,763	132,450	114,082	107,688	72,084	96,488
FDI/Common Stock, all firms ($FDI_{it}>0$)	16.51	21.75	26.04	28.12	28.89	28.33
MNE parents ($FDI_{it}>0$)	31.69	34.97	37.66	37.90	37.65	36.11
Electronics (MNEs only)	39.38	44.27	47.67	46.95	45.62	41.57
New MNEs ($DFDIN_{it}=1$)	47.78	49.03	48.53	46.49	45.11	40.40
Other manufacturers (MNEs only)	23.10	24.68	26.91	28.57	29.58	30.44
New MNEs ($DFDIN_{it}=1$)	20.62	20.44	24.34	25.55	27.52	27.83
FDI in China/Common Stock, all firms ($FDIC_{it}>0$)	12.59	17.41	21.46	23.07	23.51	22.70
MNE parents ($FDI_{it}>0$)	24.16	27.99	31.03	31.10	30.63	28.93
Electronics (MNEs only)	32.82	37.95	40.92	40.00	38.14	33.93
New MNEs ($DFDIN_{it}=1$)	38.58	42.06	41.41	39.31	37.03	32.36
Other manufacturers (MNEs only)	14.50	16.97	20.40	21.92	23.04	23.75
New MNEs ($DFDIN_{it}=1$)	16.83	16.81	19.95	21.42	22.95	23.34

Sources: See details in Section 3.

Table 2 Determinants of Whether a Firm Has New FDI (Equation (3), 2000-2005), dependent variable =$DFDIN_{it}$, pooled, cross section, logit estimates)

Independent variable	All firms	Electronics Firms	Other manufacturers
ln $SALE_{it}$	0.427***	0.295***	0.585***
	(0.055)	(0.073)	(0.085)
ln (1+$PATENT$)$_{it}$	0.068*	0.012	0.225***
	(0.037)	(0.045)	(0.082)
$EXPR_{it}$	0.534***	0.563***	0.033
	(0.127)	(0.186)	(0.205)
ln TFP_{it}	-0.173**	0.035	-0.365***
	(0.079)	(0.101)	(0.135)
Constant	-5.739***	-5.672***	-6.201***
	(0.567)	(0.726)	(0.958)
Firms	453	242	211
Observations	2684	1424	1260

Notes: (1) Figures in the parentheses are standard errors obtained by 100 times bootstrap; (2) *** and * denote coefficients are significant at 1% and 10% statistical levels, respectively.

Table 3 Treatment Effects Comparing Employment Growth in Parents with New Outward FDI and Similar Firms with No FDI (Derived from Equations (3) and (4), PSM Estimation) 2000-2005

Panel A

Matching technique	All new FDI firms		New FDI in China		New FDI in advanced economies	
	Growth *t* to *t+1*	Growth *t* to *t+2*	Growth *t* to *t+1*	Growth *t* to *t+2*	Growth *t* to *t+1*	Growth *t* to *t+2*
Nearest Neighbor	-0.020	-0.016	-0.031	-0.003	0.008	0.017
	(-1.046)	(-0.651)	(-1.281)	(-0.112)	(0.271)	(0.468)
Kernel	0.001	0.001	0.007	0.007	0.006	0.006
	(0.069)	(0.064)	(0.498)	(0.449)	(0.311)	(0.270)
No. $DFDIN_{it}$=1	1130	1130	812	812	478	478
No. $DLOC_{it}$=1	1554	1554	1872	1872	2206	2206

Panel B

Matching technique	Electronics firms		Other manufacturers	
	Growth *t* to *t+1*	Growth *t* to *t+2*	Growth *t* to *t+1*	Growth *t* to *t+2*
Nearest Neighbor	-0.017	-0.052	-0.016	0.002
	(-0.567)	(-1.454)	(-0.812)	(0.073)
Kernel	-0.003	-0.003	-0.008	-0.008
	(-0.135)	(-0.135)	(-0.652)	(-0.708)
No. $DFDIN_{it}$=1	635	635	495	495
No. $DLOC_{it}$=1	789	789	765	765

Notes: (1) Figures in the parentheses are t value. (2) The propensity score function includes ln$SALE_{it}$, ln(1+$PATENT$) $_{it}$, $EXPR_{it}$, and ln TFP_{it}.

Table 4 The Employment Effects of FDI in All MNEs
(dependent variable = ln EMP_{it})

	Panel, Fixed Effects, GMM		Panel, Fixed Effects	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.595***	-0.591***	-0.606***	-0.606***
	(0.019)	(0.019)	(0.019)	(0.019)
ln CAP_{it}	-0.155***	-0.172***	-0.191***	-0.193***
	(0.036)	(0.035)	(0.033)	(0.033)
$DEBTR_{it}$	0.026***	0.024***	0.029***	0.028***
	(0.006)	(0.006)	(0.006)	(0.006)
FDI_{it}	0.004***			
	(0.001)			
$FDIC_{it}$		0.005***		
		(0.001)		
$FDIA_{it}$		-0.002**		
		(0.001)		
FDI_{it-1}			0.684E-03***	
			(0.168E-03)	
$FDIC_{it-1}$				0.82E-03***
				(0.17E-03)
$FDIA_{it-1}$				-0.55E-03
				(0.594E-03)
ln (1+$PATENT_{it}$)	0.060***	0.060***	0.063***	0.063***
	(0.007)	(0.007)	(0.007)	(0.007)
$EXPR_{it}$	0.004***	0.004***	0.005***	0.005***
	(0.001)	(0.001)	(0.491E-03)	(0.491E-03)
$SALES_{it}$	0.087***	0.085***	0.093***	0.093***
	(0.007)	(0.007)	(0.008)	(0.008)
ln TFP_{it}	0.092***	0.095***	0.121***	0.121***
	(0.019)	(0.019)	(0.018)	(0.018)
Constant	7.226***	7.281***	7.087***	7.087***
	(0.218)	(0.219)	(0.220)	(0.220)
F (first stage)	73.75***	62.34***		
R^2	0.488	0.489	0.489	0.490
Firms	453	453	453	453
Observations	2684	2684	2684	2684

Notes: (1) Figures in the parentheses are standard errors. *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively. (2) We instrument for FDI with ln $WAGE_{it}$, ln CAP_{it}, $DEBTR_{it}$, ln (1+$PATENT_{it}$), EXPR$_{it}$, $SALES_{it}$, ln TFP_{it}, and $TT1_{it}$. (3) F (first stage) is the weak instrument F-test. The null hypothesis of weak instruments is rejected when the F value is larger than 10, indicating that the instruments are effective.

Table 5 The Employment Effects of FDI
for Electronics MNEs and Other MNE Manufacturers
(dependent variable = ln EMP_{it}, Panel, Fixed Effects, GMM Estimation)

	Electronics firms Panel, Fixed Effects, GMM		Other manufacturers Panel, Fixed Effects, GMM	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.632***	-0.625***	-0.416***	-.4198***
	(0.027)	(0.027)	(0.024)	.023
ln CAP_{it}	-0.034	-0.069	-0.546***	-.537***
	(0.045)	(0.045)	(0.050)	.0485
$DEBTR_{it}$	0.021***	0.015*	0.031***	.0295***
	(0.008)	(0.008)	(0.010)	(0.010)
FDI_{it}	0.009***		-0.005***	
	(0.001)		(0.001)	
$FDIC_{it}$		0.010***		-0.005***
		(0.002)		(0.001)
$FDIA_{it}$		-0.002***		-0.002
		(0.001)		(0.001)
ln (1+$PATENT_{it}$)	0.057***	0.056***	0.036***	0.034***
	(0.009)	(0.009)	(0.011)	(0.011)
$EXPR_{it}$	0.003***	0.003***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
$SALES_{it}$	0.077***	0.072***	0.118***	0.112***
	(0.009)	(0.009)	(0.017)	(0.018)
ln TFP_{it}	0.118***	0.133***	0.032	0.040
	(0.029)	(0.028)	(0.025)	(0.026)
Constant	6.706***	6.750***	8.142***	8.148***
	(0.306)	(0.306)	(0.277)	(0.277)
R^2	0.514	0.515	0.528	0.5289
F (first stage)	33.01***	28.69***	67.03***	52.55***
Firms	242	242	211	211
Observations	1424	1424	1260	1260

Notes: (1) Figures in the parentheses are standard errors. *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively. (2) We instrument for FDI with ln $WAGE_{it}$, ln CAP_{it}, $DEBTR_{it}$, ln (1+$PATENT_{it}$), $EXPR_{it}$, $SALES_{it}$, ln TFP_{it}, and $TT1_{it}$. (3) F (first stage) is the weak instrument F-test. The null hypothesis of weak instruments is rejected when the F value is larger than 10, indicating that the instruments are effective; (4) Panel, fixed investments with lagged FDI variables are available from the authors for comparison.

Appendix Table 1 Definitions and Means for Major Variables (standard deviations in parentheses)

Variables	Definition	2000	2001	2002	2003	2004	2005
EMP_{it}	The number of employees in firm i for year t.	898.766	890.957	943.145	968.431	999.757	1078.742
		(1699.291)	(1918.242)	(1911.178)	(1948.016)	(1842.521)	(2222.123)
$WAGE_{it}$	Yearly wage per employee (NT$ thousand) in firm i for year t.	270.070	283.992	283.798	281.985	294.504	308.453
		(243.135)	(274.733)	(301.471)	(242.976)	(263.445)	(271.249)
CAP_{it}	The physical capital stock in firm i for year t. (NT$ million) (fixed assets)	4792.220	5654.492	5595.638	5505.967	5054.956	5149.173
		(9104.310)	(11619.19)	(11779.92)	(11639.94)	(9163.606)	(9858.168)
$DEBTR_{it}$	The debt to equity ratio (%) in firm i for year t	49.436	47.219	51.560	54.452	66.338	54.524
		(103.608)	(56.567)	(97.299)	(122.43)	(294.27)	(119.709)
FDI_{it}	The ratio of cumulative total outward FDI to the common stock issued by firm i in year t (%)	16.507	21.748	26.039	28.115	28.890	28.330
		(41.664)	(49.158)	(47.622)	(45.358)	(42.754)	(40.534)
$FDIC_{it}$	The ratio of cumulative FDI in China investment to the common stock issued by firm i in year t (%)	12.587	17.409	21.455	23.069	23.507	22.700
		(33.825)	(42.677)	(41.986)	(38.361)	(35.027)	(32.048)
$FDIA_{it}$	The ratio of cumulative FDI in advanced countries to the common stock issued by firm i in year t (%)[a]	3.919	4.339	4.583	5.045	5.383	5.629
		(23.291)	(22.262)	(20.474)	(21.60)	(23.091)	(23.001)
$PATENT_{it}$	The number of patent applications by firm i in year t	6.837	10.992	8.959	12.888	13.573	12.276
		(51.048)	(72.85)	(43.129)	(63.046)	(54.908)	(57.398)
$EXPR_{it}$	The ratio of exports to sales in firm i for year t (%)	40.424	42.987	43.526	44.858	46.908	47.149
		(35.284)	(35.883)	(35.917)	(36.385)	(36.855)	(37.126)
$SALES_{it}$	Domestic sales of firm i for year t (NT$ million)	7404.579	7550.98	9143.04	10611.80	12079.75	14097.20
		(15557.88)	(17152.62)	(21724.01)	(27786.3)	(32866.71)	(42580.07)
$TT1_{it}$	A dummy variable equal to 1 for firms affected by the liberalization of policy toward FDI in China from November 2001[a]		0.025	0.617	0.620	0.622	0.617
			(0.156)	(0.486)	(0.486)	(0.485)	(0.487)
TFP_{it}	Levinsohn and Petrin's (2003) measure of total factor productivity in firm i for year t (NT$ million)	31.302	31.706	36.314	45.044	45.499	52.746
		(29.854)	(36.318)	(39.917)	(102.506)	(56.305)	(111.908)
	Number of Firms	597	603	606	608	606	608

[a.] Advanced countries are defined in footnote 7 and the precise definition of TTI_{it} is given in footnote 10.

Appendix Table 2 Treatment Effects Comparing Employment Growth from year *t* to *t+1* in Subperiods in Parents with New Outward FDI and Similar Firms with No FDI
(Derived from Equations (3) and (4), PSM Estimation)

	2000-2001		2002-2003		2004-2005	
Matching technique	Nearest Neighbor	Kernel	Nearest Neighbor	Kernel	Nearest Neighbor	Kernel
All new FDI firms	0.009	0.015	-0.004	0.029	-0.010	-0.016
	(0.127)	(0.375)	(-0.096)	(0.980	(-0.272)	(-0.537_
No. $DFDIN_{it}$=1	170	170	219	219	183	183
No. $DLOC_{it}$=1	304	304	295	295	348	348
New FDI in China	0.057	-0.017	0.030	0.026	-0.027	-0.010
	(0.927	(-0.504)	(0.678)	(0.82)	(-0.644	(-0.32)
No. $DFDIN_{it}$=1	93	93	174	174	136	136
No. $DLOC_{it}$=1	381	381	340	340	395	395
New FDI in advanced	0.107*	0.063	0.040	0.047	-0.051	-0.003
economies	(1.668)	(1.473)	(0.610	(0.092	(-0.715	(-0.058
No. $DFDIN_{it}$=1	99	99	79	79	61	61
No. $DLOC_{it}$=1	375	375	435	435	470	470

Notes: (1) Figures in the parentheses are t value. (2) The propensity score function includes ln$SALE_{it}$, ln(1+$PATENT$) $_{it}$, $EXPR_{it}$, and ln TFP_{it}.

Appendix Table 3 The Employment Effects of FDI in Samples of All Firms
(dependent variable = ln EMP_{it})

	Panel, Fixed Effects, GMM		Panel, Fixed Effects	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.552***	-0.549***	-0.562***	-0.562***
	(0.017)	(0.017)	(0.017)	(0.017)
ln CAP_{it}	-0.130***	-0.142***	-0.155***	-0.156***
	(0.031)	(0.030)	(0.029)	(0.029)
$DEBTR_{it}$	0.019***	0.017***	0.023***	0.023***
	(0.006)	(0.006)	(0.006)	(0.006)
FDI_{it}	0.004***			
	(0.001)			
$FDIC_{it}$		0.005***		
		(0.001)		
$FDIA_{it}$		-0.002**		
		(0.001)		
FDI_{it-1}			0.71E-03***	
			(0.18E-03)	
$FDIC_{it-1}$				0.862E-03***
				(0.194E-03)
$FDIA_{it-1}$				-0.614E-03
				(0.648E-03)
ln (1+	0.058***	0.058***	0.061***	0.060***
$PATENT_{it}$)	(0.007)	(0.007)	(0.007)	(0.007)
$EXPR_{it}$	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.475E-03)	(0.475E-03)
$SALES_{it}$	0.089***	0.088***	0.093***	.09336***
	(0.007)	(0.007)	(0.007)	.007229
ln TFP_{it}	0.048***	0.050***	0.079***	0.079***
	(0.013)	(0.013)	(0.014)	(0.014)
Constant	7.283***	7.326***	7.099***	7.108***
	(0.171)	.16951	(0.179)	(0.179)
F (first stage)	95.93***	79.82***		
R^2	0.459	0.459	0.458	0.459
Firms	621	621	621	621
Observations	3628	3628	3628	3628

Notes: (1) Figures in the parentheses are standard errors. *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively. (2) We instrument for FDI with ln $WAGE_{it}$, ln CAP_{it}, $DEBTR_{it}$, ln (1+$PATENT_{it}$), EXPR$_{it}$, $SALES_{it}$, ln TFP_{it}, and $TT1_{it}$. (3) F (first stage) is the weak instrument F-test. The null hypothesis of weak instruments is rejected when the F value is larger than 10, indicating that the instruments are effective.

Appendix Table 4 The Employment Effects of FDI in Samples of All Electronics Firms and Other Manufacturers (dependent variable = ln EMP_{it}, Panel, Fixed Effects, GMM Estimation)

	Electronics firms Panel, Fixed Effects, GMM		Other manufacturers Panel, Fixed Effects, GMM	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.542***	-0.535***	-0.507***	-0.511***
	(0.024)	(0.024)	(0.021)	(0.021)
ln CAP_{it}	0.029	-0.007	-0.311***	-0.304***
	(0.049)	(0.048)	(0.035)	(0.035)
$DEBTR_{it}$	0.009	0.003	0.032***	0.030***
	(0.008)	(0.009)	(0.009)	(0.009)
FDI_{it}	0.010***		-0.007***	
	(0.002)		(0.002)	
$FDIC_{it}$		0.012***		-0.009***
		(0.002)		(0.002)
$FDIA_{it}$		-0.003***		-0.001
		(0.001)		(0.001)
ln (1+	0.054***	0.052***	0.041***	0.038***
$PATENT_{it}$)	(0.009)	(0.009)	(0.012)	(0.012)
$EXPR_{it}$	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
$SALES_{it}$	0.083***	0.076***	0.084***	0.081***
	(0.009)	(0.009)	(0.011)	(0.011)
ln TFP_{it}	0.044***	0.053***	0.114***	0.120***
	(0.017)	(0.017)	(0.021)	(0.021)
Constant	6.629***	6.741***	7.363***	7.356***
	(0.253)	(0.249)	(0.243)	(0.244)
R^2	0.470	0.470	0.499	0.499
F (first stage)	41.80***	34.70***	81.60***	63.74***
Firms	286	286	335	335
Observations	1639	1639	1989	1989

Notes: (1) Figures in the parentheses are standard errors. *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively. (2) We instrument for FDI with ln $WAGE_{it}$, ln CAP_{it}, $DEBTR_{it}$, ln (1+$PATENT_{it}$), $EXPR_{it}$, $SALES_{it}$, ln TFP_{it}, and $TT1_{it}$. (3) F (first stage) is the weak instrument F-test. The null hypothesis of weak instruments is rejected when the F value is larger than 10, indicating that the instruments are effective; (4) Panel, fixed investments with lagged FDI variables are available from the authors for comparison.

Appendix Table 5 The Employment Effects of FDI
for Electronics Firms and Other Manufacturers
(dependent variable = ln EMP_{it}, Panel, Fixed Effects Estimation)

	Electronics firms Panel, Fixed Effects		Other manufacturers Panel, Fixed Effects	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.577***	-0.578***	-0.520***	-0.519***
	(0.024)	(0.024)	(0.021)	(0.021)
ln CAP_{it}	-0090**	-0.092**	-0.267***	-0.267***
	(0.045)	(0.045)	(0.034)	(0.034)
$DEBTR_{it}$	0.020***	0.020**	0.027***	0.028***
	(0.008)	(0.008)	(0.009)	(0.009)
FDI_{it}	0.001***		-0.148E-03	
	(0.227E-03)		(0.370E-03)	
$FDIC_{it}$		0.001***		0.758E-04
		(0.245E-03)		(0.397E-03)
$FDIA_{it}$		-0.277E-03		-0.002
		(0.851E-03)		(0.001)
ln	0.065***	0.065***	0.031**	0.031**
(1+$PATENT_{it}$)	(0.009)	(0.009)	(0.012)	(0.012)
$EXPR_{it}$	0.006***	0.006***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
$SALES_{it}$	0.093***	0.093***	0.088***	0.090***
	(0.010)	(0.010)	(0.011)	(0.011)
ln TFP_{it}	0.083***	0.083***	0.071***	0.070***
	(0.020)	(0.020)	(0.019)	(0.019)
Constant	6.826***	6.840***	7.582***	7.570***
	(0.259)	(0.259)	(0.242)	(0.242)
R^2	0.454	0.455	0.489	0.490
Firms	286	286	335	335
Observations	1639	1639	1989	1989

Notes: (1) Figures in the parentheses are standard errors. (2) *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively.

Appendix Table 6 The Employment Effects of FDI
for Electronics MNEs and Other MNE Manufacturers
(dependent variable = ln EMP_{it}, Panel, Fixed Effects Estimation)

	Electronics firms Panel, Fixed Effects		Other manufacturers Panel, Fixed Effects	
Variable	Equation (4)	Equation (5)	Equation (4)	Equation (5)
ln $WAGE_{it}$	-0.677***	-0.678***	-0.432***	-0.428***
	(0.026)	(0.026)	(0.024)	(0.023)
ln CAP_{it}	-0.119***	-0.120***	-0.474***	-0.477***
	(0.044)	(0.044)	(0.047)	(0.047)
$DEBTR_{it}$	0.028***	0.028***	0.029***	0.030***
	(0.008)	(0.008)	(0.010)	(0.010)
FDI_{it}	0.001***		-0.211E-03	
	(0.206E-03)		(0.311E-03)	
$FDIC_{it}$		0.001***		0.906E-04
		(0.222E-03)		(0.333E-03)
$FDIA_{it}$		-0.228E-03		-0.002**
		(0.001)		(0.001)
ln	0.064***	0.064***	0.028**	0.027**
(1+$PATENT_{it}$)	(0.009)	(0.009)	(0.011)	(0.011)
$EXPR_{it}$	0.005***	0.005***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
$SALES_{it}$	0.088***	0.088***	0.125***	0.133***
	(0.010)	(0.010)	(0.017)	(0.017)
ln TFP_{it}	0.197***	0.197***	-0.008	-0.016
	(0.026)	(0.026)	(0.023)	(0.023)
Constant	6.426***	6.445***	8.211***	8.161***
	(0.313)	(0.313)	(0.280)	(0.280)
R^2	0.507	0.508	0.519	0.523
Firms	242	242	211	211
Observations	1424	1424	1260	1260

Notes: (1) Figures in the parentheses are standard errors. (2) *** and ** denote coefficients that are significant at 1% and 5% statistical levels, respectively.