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**by Wan-Hsin Liu
and Peter Nunnenkamp**

No. 1546 | Sept. 2009

Web: www.ifw-kiel.de

Kiel Working Paper No. 1546 | Sept. 2009

Domestic Repercussions of Different Types of FDI: Firm-level Evidence for Taiwanese Manufacturing*

Wan-Hsin Liu and Peter Nunnenkamp

Abstract: It is widely feared that outward FDI gradually hollows out domestic manufacturing and displaces local workers. We address this concern by drawing on exceptionally informative firm-specific data on Taiwanese multinationals in manufacturing. In particular, we assess whether repercussions at home depend on the size, location and type of outward FDI. We control for firm heterogeneity and estimate ordered probit models with the firms' own assessment of domestic production and employment effects as dependent variables. We find that the probability of negative effects increases slightly with the size of FDI. The effects of locating in China differ from those of locating in advanced countries not only in size but also in sign. In contrast to vertical and export-platform FDI, employment effects of horizontal FDI tend to be positive. The quantitative impact is typically small, however.

Keywords: FDI location, type of FDI, domestic employment, home production, firm heterogeneity

JEL classification: F23

Wan-hsin Liu

Kiel Institute for the World Economy
24100 Kiel, Germany
Telephone: +49-431-8814-269
E-mail: wan-hsin.liu@ifw-kiel.de

Peter Nunnenkamp

Kiel Institute for the World Economy
24100 Kiel, Germany
Telephone: +49-431-8814-209
E-mail: peter-nunnenkamp@ifw-kiel.de

* We would like to thank Michaela Rank for excellent research assistance.

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1. Introduction

Empirical evidence on the repercussions of FDI outflows in the home country of multinational enterprises (MNEs), notably their labor market impact, is still limited and inconclusive. Moreover, previous literature is largely restricted to advanced countries with high per-capita income, notably the United States and Sweden.¹ It is open to question whether earlier findings also apply to less advanced countries that have increasingly become important sources of FDI. Closing this gap is of obvious relevance. Public concerns that FDI gradually hollows out domestic manufacturing and displaces local workers are no less in emerging Asia than in the United States (particularly when NAFTA was formed) or in Europe (especially since transition countries in the East attract FDI from the West).

Taiwan offers a case in point. UNCTAD (2008: 259) ranks Taiwan among the top-3 non-OECD source countries with an estimated outward FDI stock of \$ 158 billion in 2007. The search for low-cost labor appears to be an increasingly important motive underlying FDI by Taiwanese companies (Chen 1992: 400). Labor-intensive operations, including manufacturing of traditional Taiwanese exports, have been relocated through FDI to low-wage host countries, especially to the nearby mainland China (Schive and Chen 2004; Chung 1996). Firms may improve their competitiveness in this way, but production and employment at home could be adversely affected (Sim and Pandian 2002; Liu and Huang 2005).

We address the concern that outward FDI impairs domestic production and employment by drawing on exceptionally informative firm-specific data on Taiwanese MNEs from the Manufacturing Foreign Investment Survey 2007 conducted by the Ministry of Economic Affairs in Taiwan. In particular, we assess whether repercussions at home depend on the location and type of outward FDI. We control for firm heterogeneity by considering various characteristics of Taiwanese parent firms. We estimate ordered probit models, taking firms' own assessment of domestic production and, respectively, employment effects as dependent variables. We find that the probability of negative effects increases slightly with the size of FDI. However, the effects depend on where Taiwanese MNEs locate and on which type of FDI they undertake.

2. Previous Literature and Open Questions

The coexistence of horizontal and vertical FDI makes theoretical predictions about labor market repercussions in the home market of MNEs ambiguous (Becker et al. 2005).² While

¹ Lipsey (2002) provides a comprehensive review of this literature.

² Likewise, as noted by Blonigen (2001), there are theoretical reasons to suggest both substitution and complementarity effects of foreign production on home-country exports.

horizontal FDI is generally driven by market-seeking motives, cost-saving motives are underlying vertical FDI. Horizontal FDI could be expected to involve substitution between the MNE's foreign and domestic activities, at least as long as FDI is undertaken in the tradable goods sector. FDI replaces trade in the Heckscher-Ohlin framework so that horizontal FDI would have a negative effect on production at home (Mundell 1957). By contrast, vertical FDI is often supposed to involve "an element of complementarity between the firm's domestic and foreign operations" (Braconier and Ekholm 2000: 448). However, vertical FDI may also involve labor substitution if upstream or downstream activities traditionally conducted at home are relocated to foreign affiliates.³ Net effects depend on whether cost savings through vertical fragmentation enable the parent company to improve its productivity and expand its market share, and on the degree of complementarity between foreign and domestic stages of production (Hanson et al. 2005).

Most of the empirical studies on the effects of FDI in the home country of MNEs report surprisingly benign findings, even though there is some evidence supporting the hypothesis that MNEs substitute labor across locations. Becker et al. (2005) show that German and Swedish firms respond to international wage differences so that jobs in parent firms and jobs in foreign affiliates tend to substitute for one another. According to Brainard and Riker (2001), US manufacturing firms' employment at home and abroad tend to be substitutes - but the degree of substitution turns out to be low. Desai et al. (2009) clearly reject the popular notion that US MNEs' expansions abroad reduce their domestic activity, when instrumenting for changes in foreign operations with GDP growth rates of the host countries. Employing propensity score matching to isolate the effect of FDI on employment in the home country, Kleinert and Toubal (2007) as well as Barba Navaretti and Castellani (2008) conclude that foreign production by German and Italian MNEs, respectively, does not reduce the growth of employment in the parent company at home. Becker and Muendler (2008) analyze linked employer-employee data for German MNEs with similar matching techniques to show that firms that expanded abroad retain more jobs at home than competitors without foreign expansion. Hijzen et al. (2007) also apply matching techniques for a large panel of Japanese firms; FDI tends to increase output and employment of parent companies in Japan.

The available empirical evidence leaves much to be desired, however. The present study addresses several of the remaining gaps. First of all, previous literature deals almost exclusively with MNEs from advanced countries such as United States, Germany, Sweden or

³ Marin et al. (2003: 159) argue that no change in relative wages or employment should be expected when West European countries undertake horizontal FDI in Eastern Europe, "while this should be expected if FDI is vertical."

Japan. Debaere et al. (2006) who employ propensity score matching to assess the employment implications of FDI by Korean firms represent a notable exception. As concerns Taiwan, Liu and Huang (2005) focus on “reverse imports”, i.e., foreign affiliate production exported back to Taiwan, as a major channel through which outward FDI may affect domestic production by Taiwanese manufacturing firms. Chen and Ku (2005) identify two opposing effects of FDI on domestic employment: (i) input replacement, i.e., foreign affiliate production of intermediates replacing Taiwanese employment at a given level of final goods production, and (ii) output expansion, i.e., cost savings through foreign inputs inducing more employment in final goods production at home.⁴

More research on FDI from relatively new sources is required as previous findings for MNEs based in technologically leading high-income countries may not apply to MNEs based in less advanced economies. The latter may have different motives to undertake FDI. Apart from so-called asset-augmenting FDI through which direct investors may gain access to state-of-the-art technology (Dunning 2000), survey results suggest that cost savings provide a relatively strong motivation for FDI by some emerging market economies, including Taiwan (UNCTAD 2006; Chen 1992). Related to cost motives, FDI in lower-wage host countries figures more prominently for home countries such as Taiwan and Singapore than for traditional home countries such as the United States or Germany.⁵ At the same time, FDI from relatively new sources tends to be concentrated in the manufacturing sector.⁶

Second, the relevance of firm heterogeneity is widely acknowledged by now in studies on the driving forces of FDI (Helpman et al. 2004).⁷ Firm heterogeneity has received considerably less attention when it comes to the repercussions of FDI in the home economy of the parent firm.⁸ Lipsey (2002: 16) notes that variables such as foreign affiliates’ output or employment in studies like Blomström et al. (1997) tend to incorporate “the influence of any home country firm characteristics that were associated with the size of affiliate production.”⁹

⁴ Chuang and Lin (1999) consider (outward and inward) FDI to be a possible alternative to local R&D by Taiwanese manufacturing firms.

⁵ See Ellingsen et al. (2006) for a comparison of Singapore with leading home countries.

⁶ See van Hoesel (1999: 106) as well as Chen and Ku (2005) for the case of Taiwan, where manufacturing accounted for the bulk of FDI. By contrast, manufacturing accounted for about 20-30 percent of overall FDI by major OECD countries (Ellingsen et al. 2006).

⁷ Chen (1992) and van Hoesel (1999) provide earlier studies on the determinants of outward Taiwanese FDI that take firm-specific characteristics into account.

⁸ This is even though several of the aforementioned studies employ propensity score matching to isolate the effects of FDI on employment in the home country. This approach makes use of firm characteristics such as productivity, scale and age to match firms that undertook FDI with a control group of firms that resembles the treated group as closely as possible, except that the control group did not undertake FDI.

⁹ More specifically, Harrison et al. (2007) stress the importance of distinguishing between small and large parent companies. In the context of Taiwan, small and medium sized firms play an important role in outward FDI (Sim and Pandian 2002), even though relatively large and leading players in specific industries were the frontrunners in the late 1970s and early 1980s (Schive and Chen 2004).

Liu and Huang (2005) provide a notable exception, showing that labor intensity and export orientation play an important role for Taiwanese firms' decisions on foreign and domestic production.¹⁰ Similarly, we control for various firm characteristics in our empirical analysis of the production and employment repercussions of FDI by Taiwanese MNEs below.

Third, most existing studies do not distinguish between different locations of outward FDI. The relevance of heterogeneous locations is evident from the literature assessing the effects of offshoring on the skill intensity of domestic production. For instance, Head and Ries (2002) find that employment in foreign affiliates of Japanese MNEs in low-income countries raises the skill intensity at home, while this effect diminishes when FDI is undertaken in higher-income countries. The question of whether overall employment effects of outward FDI depend on where foreign affiliates locate has received less attention. Furthermore, the available evidence is inconclusive.

According to Blomström et al. (1997), affiliate production in developing countries is negatively associated with parent employment for US-based MNEs, which is attributed to relocation of labor-intensive operations to low-wage host countries of US FDI. Harrison et al. (2007) stress the crucial distinction between US affiliates in low-income and high-income countries, with jobs in low-income (high-income) countries substituting for (complementing) US jobs. In contrast to the United States, domestic employment (of white-collar workers) by Swedish MNEs actually increases with more affiliate production in low-income countries.¹¹ Japanese firms resemble Swedish firms in this respect (Lipsey et al. 2000). Barba Navaretti et al. (2006) do not find evidence of a negative effect of FDI by French and Italian MNEs in low-income countries on economic activity at home.¹²

The analysis of Debaere et al. (2006) reveals that the employment repercussions of FDI by Korean companies depend on where they go, with FDI in less developed host countries reducing the employment growth in the parent companies. The location of FDI also appears to matter for employment repercussions in Taiwan (Liu and Huang 2005). However, Chen and Ku (2005: 125) argue that “FDI [in China], per se, is not to blame for the plight of labor; it is instead the fact that these investors belong to low-growth (or even declining) industries, as well as being small in size.”

¹⁰ Chuang and Lin (1999) control for firm characteristics such as capital intensity and age to isolate the effect of FDI on R&D.

¹¹ Results on Swedish MNEs reported by Braconier and Ekholm (2000) are similar to the findings of Blomström et al. (1997).

¹² Inconclusive results are also reported with respect to the employment repercussions of FDI in low-wage Central and Eastern Europe (e.g., Marin 2004; Becker et al. 2005; Konings and Murphy 2006).

Fourth, the location of FDI provides at best limited insights into the type of FDI which is likely to shape FDI repercussions at home. In particular, the effects of outward FDI may depend on whether foreign operations are horizontal or vertical in relation to operations at home. It is plausible to expect that horizontal FDI tends to substitute for parent activities at home, at least in manufacturing, while vertical FDI might add to parent activities. However, “there is not much evidence for this conjecture” (Lipsey 2002: 13). Data constraints render it “difficult to classify actual foreign operations into these theoretically neat categories” (ibid) of horizontal and vertical FDI. For the case of Taiwan, however, firm-specific information exists on the importance and regional structure of imported materials and intermediates.¹³ Making use of these data is a clear improvement over Liu and Huang’s (2005) attempt to capture vertical FDI by a dummy variable for upstream or downstream production by Taiwanese parent companies. Furthermore, available data on the relative importance of host-country markets, the Taiwanese home market and third-country markets as outlets of affiliate production allow us to capture export-platform FDI as a third type of FDI.

3. Data and Method

3.1. Stylized Facts

We draw on exceptionally informative firm-specific data from the Manufacturing Foreign Investment Survey in order to investigate repercussions of FDI on domestic production and employment of Taiwanese MNEs. This survey by the Ministry of Economic Affairs (MOEA) covers Taiwanese manufacturing companies with foreign investment activities. For this paper, we use most recent survey data referring to MNE operations in 2006. The MOEA had sent the survey questionnaire to 2268 operative Taiwanese manufacturing companies; 1770 questionnaires (78 percent) were completed and returned (MOEA 2007).

For the overall sample of responding MNEs, FDI figured quite prominently in 2006. Foreign affiliates accounted for almost half of total (domestic and overseas) employment of Taiwanese MNEs (Figure 1). The share of foreign affiliates in total turnover and fixed capital formation is about one third, whereas foreign affiliates performed less than one fifth of total R&D activities. The observation that the employment share of foreign affiliates clearly exceeds their share in fixed capital formation and R&D indicates that Taiwanese MNEs undertake FDI as a means to relocate relatively labor-intensive operations.

The timing and location of FDI also suggest that cost-savings motives play an important role for Taiwanese MNEs. According to the survey results, the timing of the first

¹³ See Head and Ries (2001) on why intermediate goods production as a measure of vertical integration matters for the export effects of outward FDI, as well as on the use of interaction terms to capture this point.

FDI project in what the Taiwanese MNEs rated their most important foreign location spans from 1967 to 2006. However, first FDI projects of this sort gathered momentum since the second half of the 1980s with the appreciation of the New Taiwan Dollar and rising labor costs in Taiwan (Chen and Ku 2000). Furthermore, almost three quarters of Taiwanese MNEs rank the mainland China as their most important FDI location; less than 10 percent of all sample MNEs report advanced countries such as the United States, Japan and Western European countries to be their most important foreign location.

In the context of the present paper, it is of particular interest to assess whether the production and employment repercussions at home depend on the motive and location of FDI by Taiwanese MNEs. In contrast to the literature reviewed in Section 2, we make use of the companies' own judgement on the effects of their FDI on domestic production and employment. The MOEA survey contains responses by all 1770 MNEs on whether they rate FDI effects to be positive, neutral, or negative. As shown in Table 1, most sample companies consider the effects on domestic production and employment to be neutral. Moreover, companies rating FDI effects to be positive outnumber those rating FDI effects to be negative with respect to both, domestic production and employment. For almost two thirds of the sample, the assessment is the same for production and employment (both positive, both negative, or both neutral). Yet, the assessment differs considerably between both dimensions. The ratio of positive to negative assessments is 2.79 in the case of domestic production. By contrast, this ratio is just 1.38 in the case of domestic employment. We perform estimations with both measures below in order to identify firm-specific and FDI-related factors that could explain why effects on employment appear to be less benign than effects on production.

Taking the companies' own assessment of FDI effects on domestic production and employment as our dependent variable has obvious limitations. The subjective survey results may not adequately reflect the actual impact of outward FDI. More specifically, responding managers may underrate negative effects in order not to fuel public reservations against outward FDI. These caveats notwithstanding, the subsequent analysis stills offers relevant insights. The fairly balanced survey results reported in Table 1 do not appear to be overly optimistic, recalling that most previous studies using actual employment data also rejected the view that FDI has adverse labor markets repercussions at home (Section 2). Even if the survey results were biased "upwards", this would not invalidate our approach. The ordered probit estimations, described in more detail in Section 3.2, focus on *relative* effects, i.e., possible factors affecting the probability that outward FDI has more favorable or less favorable effects on domestic production and employment.

The companies' subjective assessment may even be the preferred option if "objective" data on domestic production and employment are deficient. Note that time-series data are not available to us so that techniques such as propensity score matching cannot be applied here. With insufficient objective data, it is hardly possible to establish the counterfactual of what would have happened to production and employment if Taiwanese companies had not undertaken FDI with particular features in a specific location. By contrast, it appears reasonable to suspect that responding managers take into account how domestic production and employment would possibly have developed without FDI when answering the questionnaire on FDI effects. Similarly, the survey results are unlikely to suffer from reverse causation, whereas companies with objectively more favorable production and employment growth may self-select into particular FDI groups.

Concerning possible determinants of FDI effects, the MOEA survey offers detailed information on various firm characteristics as well as FDI-related operations. Taiwanese MNEs are also classified into four broadly defined industries; 43 percent of them belong to the IT and electronics industry, followed by metals and machinery (24 percent), the chemical industry (17 percent) and the consumer goods industry (16 percent). MNEs belonging to the IT and electronics industry stand out in that the share of neutral assessments is relatively low (Table 2, upper panel). Interestingly, the share of both positive and negative assessments is higher for IT and electronics companies than for companies in other industries. The share of companies rating FDI effects on domestic production and employment to be negative is lowest for metals and machinery. MNEs in all four industries have in common, however, that assessments are more positive for production effects than for employment effects.

In Table 3 as well as in the subsequent estimations, we consider several dimensions of firm heterogeneity. First of all, Taiwanese MNEs differ in size, measured by the number of employees.¹⁴ According to the official standard for classifying manufacturing companies by size (MOEASMEA 2005), about two thirds of the 1770 MNEs are small- and medium-sized enterprises (SMEs) with less than 200 employees working in the Taiwanese parent company.¹⁵ Despite the high share of SMEs engaged in FDI, larger Taiwanese companies are clearly more likely to undertake FDI, once it is taken into account that SMEs account for 97 percent of the total number of about 137,000 Taiwanese manufacturing companies in 2006 (MOEASMEA 2007). At the same time, we take into account that Taiwanese MNEs differ in terms of capital intensity, R&D intensity, and labor productivity (Table A1 in the

¹⁴ See also Table A1 in the Appendix for the detailed definition and summary statistics of variables relevant for this study.

¹⁵ If the employees working in foreign affiliates are added, the share of SMEs with less than 200 (domestic and foreign) employees declines to 43 percent.

Appendix).¹⁶ While the average number of employees varies only slightly between MNEs rating FDI repercussions at home to be positive, neutral or negative, MNEs rating FDI effects to be positive tend to be more productive and report higher capital and R&D intensity (Table 3).

Turning to FDI-related variables, Taiwanese MNEs for which FDI plays a more important role consider the FDI effects on domestic production and employment to be less favorable.¹⁷ Differentiating between FDI locations, the large number of MNEs reporting mainland China to be their most important foreign location tend to assess the domestic repercussions to be less favorably than the considerably smaller number of MNEs being engaged primarily in advanced OECD countries (Table 2, lower panel). All the same, positive assessments still outnumber negative assessments in the case of China, even with respect to employment effects.

In addition to the location of FDI, the MOEA survey offers detailed information on the sourcing and sales structure of the foreign affiliates of Taiwanese MNEs. We use this information to gain deeper insights into whether domestic production and employment effects depend on the type of FDI. The two upper panels of Figure 2 present the structure of inputs by major sources for the MNEs' foreign affiliates in their most important foreign location, while the lower panel presents the output structure by major destinations for all foreign affiliates.¹⁸ Foreign affiliates source about two fifths of their inputs from Taiwan, which may help explain the fairly positive assessment of production and employment effects of FDI at home. In addition to direct sourcing from Taiwan, foreign affiliates also tend to source from other Taiwanese companies in the host economy.

While foreign affiliates appear to vertically integrated with Taiwanese MNEs on the input side, Taiwan plays a minor role as a destination for the sales of foreign affiliates. The sales structure points to two major types of FDI: (i) horizontal FDI with foreign affiliates selling more than half of their output to local markets in the host economy, and (ii) export-platform FDI with almost one third of output being sold to countries other than Taiwan and the host economy (Figure 2). According to Table 3, a positive assessment of employment repercussions in Taiwan goes along with a particularly high share of local market sales. This is in striking contrast to negative assessments being associated with a relatively high share of sales to third-country markets. It remains to be seen, however, whether the case of Taiwanese

¹⁶ It should be noted that all firm-specific characteristics listed in Table 3 refer to the whole MNE group, including the domestic parent company and the foreign affiliates.

¹⁷ This applies to all indicators of the relative importance of FDI, including those not shown in Table 3.

¹⁸ Note that the MOEA survey does not contain information on the structure of inputs for the sum of foreign affiliates in all locations.

FDI is in conflict with the view that horizontal FDI involves substitution between the MNE's foreign and domestic activities (Section 2), while underscoring concerns that export-platform FDI adversely affects domestic production and employment through replacing exports from the MNEs' home base.

3.2. Method

We estimate two groups of ordered probit models to evaluate whether the repercussions of FDI on domestic production and employment of Taiwanese MNEs depend on the size, location and type of FDI, controlling for firm heterogeneity. The two groups of models differ only with respect to the outcome variable considered. In the first group we assess the effects on domestic production, and in the second group the effects on domestic employment. The basic structure of the model is as follows:

$$Y_i^* = X_i\beta + \varepsilon_i \quad (1)$$

$$Y_i = \begin{cases} 2 \text{ (positive effect)} & \text{if } \tau_2 \leq Y_i^* \\ 1 \text{ (neutral effect)} & \text{if } \tau_1 \leq Y_i^* < \tau_2 \\ 0 \text{ (negative effect)} & \text{if } Y_i^* < \tau_1 \end{cases} \quad (2)$$

where i refers to the Taiwanese MNE, Y is one of the two observed outcome variables ($Prod_scale_n_i$ or $Employment_n_i$), and Y^* is the corresponding latent outcome variable ranging from $-\infty$ to ∞ with τ_n as crucial cutpoints; X is a set of independent variables, and ε is a random error term. In ordered probit models, a standard normal CDF¹⁹ is assumed to measure the probability of the outcome variable being equal to one of the potential outcome categories (here: 0, 1, or 2), given a certain value combination of the independent variables. We take potential heteroscedasticity problems into account by estimating ordered probit models with robust standard errors (Huber-White-Sandwich estimator).

The full set of independent variables (X) includes the following five subgroups:

$$X_i = (X_i^{sfdi} \quad X_i^{fc} \quad X_i^{tfdi} \quad X_i^{hvfdi} \quad X_i^{int}) \quad (3)$$

where X^{sfdi} refers to measures of the relative scale of FDI, X^{fc} to various firm characteristics, X^{tfdi} to the timing and location of FDI, X^{hvfdi} to different types of FDI, and X^{int} to interaction terms between the scale and type of FDI.

Our baseline model includes only the first three subgroups of independent variables to capture general effects of FDI by Taiwanese MNEs on domestic production and employment.

¹⁹ CDF is short for cumulative distribution function.

We control for firm heterogeneity as well as the timing and location of FDI which were shown to be relevant in earlier studies (Section 2). We consider the share of overseas employees in overall employees of Taiwanese MNEs (Fdi_employ_i) as the standard measure of the relative scale of FDI (X^{sfdi}).²⁰ Firm characteristics (X^{fc}) include: firm size measured by the number of employees ($Logsize_i$), labor productivity proxied by turnover per employee ($Loglabprod_i$), as well as the capital and R&D intensity of firms given by the increase in fixed assets and, respectively, R&D expenditure per employee ($Logcapintr_i$ and $Logrdintr_i$). All firm characteristics are in logs.²¹ In addition, we account for industry-specific effects by introducing three dummy variables set equal to one for metals and machinery, IT and electronics, and chemicals, respectively. Regarding timing and location of FDI (X^{lfdi}), $Start_fdi_n_i$ captures timing and allows us to check whether the production and employment effects of FDI depend on how long the Taiwanese MNEs have been operative in the host location rated to be most important. We also include two dummy variables for the two major locations of Taiwanese FDI, namely mainland China ($Locate_fdi_cn_i$) and economically advanced host countries ($Locate_fdi_adv_i$).²²

The location of FDI provides only first clues as to the different motives of FDI (Görg et al. 2009) and their potential relevance for the production and employment repercussions at home. Therefore, we extend the baseline model in the next step by accounting for different types of FDI (X^{hvfdi}). More precisely, we differentiate between horizontal, vertical and export-platform FDI based on the share of major destinations in overall output of foreign affiliates of Taiwanese MNEs. Horizontal FDI is characterized by a high share of host-country markets in total affiliate sales ($Output_local_i$), while a high share of affiliate sales should be channeled back to Taiwan ($Output_tw_i$) or destined for third-country markets ($Output_others_i$) in the case of vertical and export-platform FDI. We first consider these three output share variables one-by-one.

Subsequently, we add interaction terms (X^{int}) of the output share variables with Fdi_employ_i to evaluate whether the different types of FDI tend to reinforce or dampen any adverse implications that more FDI might have on domestic production and employment in

²⁰ We perform a robustness test in Section 4.3 below to assess whether the production and employment effects depend on the measurement of the relative scale of FDI.

²¹ In order not to lose zero observations on the increase in fixed assets and R&D expenditure for some Taiwanese MNEs, we transform these two variables before taking logs. More precisely, $logcapintr = \log(10*(1+capint))$ and $logrdintr = \log(10*(1+rdint))$.

²² Location dummies are set equal to one if Taiwanese MNEs regard the corresponding location to be most important for them. The value of sales by foreign affiliates of Taiwanese MNEs is the defining criterion of the most important location according to survey guidelines. The group of advanced countries includes the United States, Canada, Western Europe, Japan, Australia and New Zealand.

Taiwan (Xfe_{xol_i} , Xfe_{xot_i} , Xfe_{xoh_i}). Note that the interpretation of interaction terms in nonlinear models is more complex than in linear models. As Ai and Norton (2003: 123) point out, “the magnitude of the interaction effect in nonlinear models does not equal the marginal effect of the interaction term;” it can even be “of opposite sign.” To the best of our knowledge, standard software does not yet offer build-in functions to calculate correct interaction effects in ordered probit models. Therefore, the calculation of interaction effects in this study is based on own programming, following the suggestions of Norton et al. (2004).

Next, we further extend the specification of the model by accounting for major sources of the foreign affiliates’ inputs in addition to their output structure. This allows for a refined differentiation between horizontal and vertical FDI. We assume that horizontal FDI is characterized by a high share of material inputs sourced from (local and Taiwanese) companies in the host country ($Inputm_{local_i}$). A high share of material inputs imported from Taiwan ($Inputm_{tw_i}$) is regarded as another characteristic of vertical FDI. Similar to the interaction terms involving the output structure, we consider interaction terms between the input share variables and Fdi_{employ_i} (Xfe_{xml_i} , Xfe_{xmt_i}).

4. Results

In the following, we present major estimation results. Section 4.1 discusses effects on domestic production, while we turn to effects on domestic employment in Section 4.2. In both cases, we start with a baseline specification in which we do not account for different types of FDI and then classify FDI according to the share of major destinations in overall sales of foreign affiliates. In Section 4.3, we present extended specifications of the estimation equations by adding major sources of the foreign affiliates’ inputs to classify FDI. We also offer some robustness tests.

Throughout this section, we are interested in the marginal effects of the explanatory variables on the probability that the production and employment effects in Taiwan are assessed to be more benign. Note that estimated coefficients in the ordered probit models cannot be interpreted directly as marginal effects. The marginal effects for non-interacted variables are calculated at the following reference point:²³ The dependent variable is set equal to two (positive FDI effect); metric independent variables are set at their means and dummy variables equal to zero.²⁴ We report the coefficients of the ordered probit estimations with the

²³ As noted in Section 3, the effect of interaction terms is calculated in line with Ai and Norton (2003) and Norton et al. (2004).

²⁴ All binary independent variables are set to be 0 due to the existing exclusiveness between complementary dummy variables. For example, the marginal effect of locating in China can only be correctly examined if the other location dummy “locate_fdi_adv” is set to be zero.

subjective assessment of production and employment effects as alternative dependent variables in Table A2-A4 in the Appendix.

4.1. *Repercussions on Domestic Production*

As for the marginal effects on domestic production, Table 4 underscores the relevance of firm heterogeneity when assessing FDI repercussions at home. Some firm characteristics often fail to pass conventional significance levels. But there is a strongly positive link between the R&D intensity of firms and FDI effects on domestic production. Firm size turns out to be significantly positive at the ten percent level in the baseline specification in column (1).²⁵ The evidence of larger firms rating FDI effects on domestic production to be more benign than smaller firms weakens slightly in columns (2) – (7). In some specifications, more productive firms tend to consider FDI repercussions at home to be less benign, possibly because they take into account that achieving higher productivity typically involves adjustment costs (see also Table 5 below). Note that heterogeneity matters also at the industry level. FDI effects on domestic production are assessed to be more favorable by firms in the metal and machinery industry and, to some extent, also by firms in the IT industry.

Turning to our FDI-related explanatory variables, the survey results appear to confirm public concerns about adverse FDI repercussions at home insofar as the relative scale of FDI, proxied by *Fdi_employ*, turns out to be significantly negative at the one percent level. In other words, Taiwanese firms whose foreign affiliates account for larger share in overall employment tend to perceive less favorable repercussions on domestic production. However, the effect is rather modest in quantitative terms. An increase in the employment share of foreign affiliates by one percentage point from its mean of 47.6 percent reduces the probability of FDI effects on domestic production to be rated positive by 0.1 percentage points to 32.9 percent.

As for timing and location of FDI, the former does not matter for effects on domestic production but the latter is clearly relevant. On the one hand, choosing mainland China as the most important FDI location tends to have a negative effect on domestic production. While the effect of *Locate_fdi_cn* is insignificant in the baseline estimation, it turns significant at the ten percent level in all other specifications shown in Table 4. This adds at least slightly to the plausibility of public concerns about hollowing out of Taiwanese manufacturing. On the other hand, FDI in economically advanced host countries is associated with more favorable

²⁵ The baseline model was estimated by using all 1770 observations.

repercussions on domestic production – as reflected by the strongly positive effect of *Locate_fdi_adv*.

The differences between major locations are hardly affected once the specification is extended by the share variables to account for different types of FDI.²⁶ When including the share of affiliate output channeled back to Taiwan as a proxy of vertical FDI in columns (2) and (3) the quantitative impact of *Fdi_employ* doubles to still modest 0.2 percentage points. At the same time, vertical FDI raises the probability of positive repercussions on domestic production. Quantitatively the impact is again fairly small. In column (2), an increase by one percentage point in the share of affiliate output channeled back to Taiwan would raise the probability of positive FDI effects on domestic production by just 0.1 percentage points. The effect of *Output_tw* per se becomes insignificant when adding the term *Xfe_xot* that interacts *Output_tw* with *Fdi_employ* in column (3).

As noted in Section 3, the interaction effect should be measured correctly by computing the corresponding cross-derivative; it is conditional on different combinations of all independent variables considered. The correct interaction effect of *Xfe_xot* on domestic production, presented in Figure 3 turns out to be significantly larger than zero over almost the whole sample (at the five percent level). Even though its magnitude is quite small, the positive sign of the interaction effect suggests that the negative effects of *Fdi_employ* on domestic production diminish with a higher share of affiliate output being channeled back to Taiwan. This implies that the repercussions of vertical FDI are not confined to replacing domestic production. Rather, offshoring labor intensive parts of production through FDI reduces costs and supports the competitiveness of more skill and capital intensive lines of production at home.²⁷

The picture is more ambiguous with regard to horizontal FDI. Adding only the share of affiliate output sold locally in the host country does not offer new insights (column 4). Countervailing effects emerge when also accounting for *Xfe_xol*, i.e., the interaction with *Fdi_employ* in column (5). *Output_local* by itself then turns significantly positive, and the negative effect of *Fdi_employ* is no longer statistically different from zero. At the same time, the interaction effect of *Xfe_xol* is significantly negative over essentially the whole sample (Figure 4). Taken together, horizontal FDI may affect domestic production positively by providing a means to gain access to new markets that were not accessible without FDI.

²⁶ The estimations including output share variables are based on 1631 observations, instead of 1770 observations, as some firms not reporting any information about their output structure had to be excluded.

²⁷ At the same time, vertical FDI tends to involve more inputs supplied from Taiwan; we return to this issue in Section 4.3.

However, this positive effect of horizontal FDI weakens when a higher share of affiliate sales in the local market is accompanied by additional FDI effort from the home country.

Compared to vertical and horizontal FDI, the production repercussions at home are rather unfavorable for export-platform FDI. In columns (6) and (7), the share of affiliate output sold in third-country markets, *Output_others*, enters significantly negative.²⁸ This suggests that traditional exports from the Taiwanese home base are replaced by export-oriented production in lower-cost locations, rather than MNEs exploring new third markets by establishing export platforms. This type of Taiwanese FDI is widely believed to be concentrated in mainland China. It should be noted, however, that the negative impact of export-platform FDI comes on top of that from locating in China according to findings in column (7) of Table 4.

4.2. *Repercussions on Domestic Employment*

Table 5 reports the marginal effects when replicating the same set of estimations with the assessment of employment repercussions as the dependent variable. Various findings carry over from Table 4, but there are also notable differences between production and employment effects. Among firm characteristics, firm size is now significant at the one percent level and the marginal effect is considerably larger than with respect to domestic production before. By contrast, the R&D intensity of firms has no effect on employment. Industry-level heterogeneity also becomes less relevant for employment effects.

The quantitative impact of *Fdi_employ* is again small, but negative and highly significant. As concerns FDI location, the differences between mainland China and economically advanced host countries are less pronounced in Table 5. This is even though the effect of locating in China remains significantly negative at the ten percent level. Taiwanese FDI in China is often associated with the relocation of labor intensive lines of production, thereby reducing the demand for less qualified labor at home. However, locating FDI in advanced host countries does not matter for employment repercussions, while repercussions on domestic production were assessed positive. The insignificance of locating in advanced host countries and that of firm-level R&D intensity may actually be related. Taiwanese FDI in OECD countries does not fit easily into the conventional horizontal versus vertical typology. It may rather be asset-seeking, i.e., FDI is used as a means to acquire superior foreign technology (UNCTAD 2006: 162-3). Hence, locating FDI in advanced host countries may go hand in hand with more R&D intensive production at home. This could have favorable

²⁸ The interaction effect in column (7) proves to be insignificantly different from zero over the whole sample (not shown).

repercussions on domestic production by enhancing the firms' competitiveness, while the shift to more sophisticated production techniques leaves domestic employment unaffected.

In contrast to the case of domestic production, none of the three interaction terms of *Fdi-employ* with the output share variables, serving as proxies to differentiate between major types of FDI, turns out to be significant over a considerable part of the overall sample in the estimations on employment reported in Table 5.²⁹ Yet it is clearly important to account for the type of FDI when it comes to assessing employment repercussions. Indeed, all three output shares *per se* are found to be highly significant – while the quantitative effects are again fairly modest.

Our proxy for vertical FDI, *Output_tw*, affects domestic employment negatively (columns 2 and 3). This is in sharp contrast to the positive impact on domestic production. The difference is plausible once it is taken into account that firms tend to improve their competitiveness by offshoring labor intensive parts of production. FDI-related cost reductions may stimulate domestic production, but (less skilled) labor is unlikely to benefit from expanding technologically more advanced lines of production.

For the remaining two types of FDI, horizontal and export-platform FDI, the employment effects work into the same direction as the production effects reported before. Domestic employment suffers, though only slightly, from export-platform FDI (columns 6 and 7 in Table 5). Any employment gains that could have resulted from complementarities between export production in the host countries and Taiwanese input supplies to these export platforms were less than employment losses due to the cost-related relocation of labor-intensive lines of production to countries hosting export-platform FDI. On balance, serving third-country markets from export platforms replaces domestic employment at least to some extent.

Output_local enters significantly positive in columns (4) and (5) of Table 5, thus corroborating the positive repercussions of horizontal FDI found for domestic production. An increase by one percentage point in the share of affiliate output sold in host-country markets (from its mean of 53.1 percent) would raise the probability of a positive assessment of employment implications by 0.1 percentage points to 21.4 percent. Horizontal FDI as a means to penetrate new markets may lead to higher profits of Taiwanese MNEs. Additional profits, in turn, may be used at least partly for expanding operations at home, leading to more demand for labor. At the same time, more horizontal FDI may promote operations at home to the

²⁹ Details are not shown to save space.

extent that more Taiwanese inputs are required to support higher affiliate sales in host-country markets. This issue is further explored in the subsequent section.

4.3. Extensions and Robustness Tests

As noted before, the survey data underlying the present analysis allow for a refined differentiation between vertical and horizontal FDI by accounting for major sources of foreign affiliates' inputs in addition to the destination of their sales. To assess the relevance of vertical FDI for production or employment repercussions we now enter the share of material inputs supplied from Taiwan, *Inputm_tw*, in combination with the share of affiliate output channeled back to Taiwan, *Output_tw*, in columns (1) and (3) of Table 6.³⁰ The combination of the shares of local supplies and output, *Inputm_local* and *Output_local*, proxies for horizontal FDI in columns (2) and (4).³¹ We also include the interaction terms of the input shares with *Fdi_employ*. The previously introduced interaction terms related to the output structure of affiliates (*Xfe_xol*, *Xfe_xot*) are kept if they were found to be significant in prior estimations (and are dropped otherwise).

In Table 6 we report the results only for the FDI-related variables of major interest.³² The marginal effects of all other variables, notably the firm characteristics and location dummies, are hardly affected by extending the specification with input shares. The dummy on locating in China provides an exception; its coefficient is still negative but no longer significant. It also remains that the relative scale of FDI, *Fdi_employ*, typically enters significantly negative with a modest quantitative impact on both domestic production and employment.

The repercussions of different types of FDI on domestic production are affected in fairly complex ways by the extension with input shares. In column (1) of Table 6 for vertical FDI, the marginal effect of *Output_tw* becomes significantly negative, though only at the ten percent level. It is rather the input-related proxy *Inputm_tw* that we find to be positively associated with domestic production. This implies that both the output and input structure of affiliate operations have to be taken into account to capture the repercussions of vertical FDI on domestic production. Countervailing effects are at work: On the one hand, the higher the

³⁰ The extended models with material input shares were estimated by using 1522 observations, instead of 1770 observations. Firms which did not report any information about their output structure or their input structure of materials were excluded.

³¹ Note that the survey presents the shares of different input sources separately for materials and intermediates. Consequently, we consider these two input shares as alternative proxies of the type of FDI. Inputs of intermediates would principally be preferred to differentiate between vertical and horizontal FDI, but this variable is missing for 600 observations. Hence, we rely primarily on material inputs (with only 188 missing observations) and use intermediate inputs as a robustness test.

³² Complete results are available on request.

share of affiliate output sold back to Taiwan the higher is the probability that domestic production is replaced by production in the host country. On the other hand, vertical FDI helps sustain or even increase the scale of production at home to the extent that it requires more material inputs imported from Taiwan. Indeed, the positive marginal effect of *Inputm_tw* is larger, in absolute terms, than the negative marginal effect of *Output_tw*. It must also be taken into account, however, that the interaction effect of *Xfe_xmt* is significantly negative over most sample observations (Figure 5). This implies that the positive impact of a higher share of inputs from Taiwan diminishes with increasing relative scale of FDI.³³

In the case of horizontal FDI (column 2), the marginal effect of *Output_local* as well as the effect of the corresponding interaction term (*Xfe_xol*) are as before in Table 4. However, the positive impact of *Output_local* is counteracted by the negative effect of *Inputm_local* once both the output and input structure of affiliates are accounted for. This is plausible. Horizontal FDI helps expand market shares of Taiwanese MNEs in the host countries, which may also add to production at home. On the other hand, host-country governments often impose so-called local content requirements on foreign investors undertaking horizontal FDI. This affects home production negatively assuming that MNEs prefer input supplies from Taiwan when given the choice. It fits into this reasoning that the interaction effect of *Xfe_xml* turns out to be significantly positive over a considerable part of the sample (Figure 6). Arguably, MNEs with larger FDI projects in the host country have more political clout to oppose strict local content requirements.

As for the employment repercussions of different types of FDI (columns 3 and 4 in Table 6), the extension with input shares is less relevant than for domestic production. In the case of vertical FDI, *Output_tw* remains significantly negative as in Table 5. The negative impact of affiliate sales in Taiwan is counteracted by the positive impact resulting from higher inputs delivered from Taiwan to affiliates abroad. However, the input-related proxy, *Inputm_tw* in column (3), enters significantly positive at the ten percent level only.³⁴ In the case of horizontal FDI, the positive employment effects of *Output_local* are not affected when extending the specification. The additional input-related proxy of horizontal FDI, *Inputm_local* in column (4), proves to be insignificant. The same applies to its interaction with the relative scale of FDI; note that *Xfe_xml* is insignificant over the whole sample (not shown).

³³ Note also that the interaction effect of *Xfe_xot* is hardly affected by extending the specification with the input share.

³⁴ Its interaction with the size of FDI (*Xfe_xmt*) plays no role (not shown).

In columns (5) – (8) of Table 6, we replicate the estimations of the extended specification by using input shares of intermediate goods, instead of material input shares. This reduces the sample to 1120 observations as various Taiwanese MNEs do not report any information on the structure of intermediate inputs. Nevertheless, major results are not affected. In particular, the differences between vertical and horizontal FDI are essentially as before. This is even though the quantitative impact of *Fdi_employ* increases somewhat for vertical FDI (columns 5 and 7), whereas it weakens for horizontal FDI (columns 6 and 8). As concerns the effects on domestic production, the quantitative impact of both output shares increases (in absolute terms), while the interaction effect of *Xfe_xit* weakens compared to that of *Xfe_xmt*. Changes in the effects of our proxies for vertical and horizontal FDI on domestic employment in Taiwan are few and marginal (*Inputi_tw* and *Xfe_xit* in column 7 and 8). It may also be noted that the location dummy for China (not shown in Table 6) regains its significance at the ten percent level, except for column (7), as found earlier in Tables 4 and 5.

In another robustness test, we substituted *Fdi_to* for *Fdi_employ* as a measure of the relative scale of FDI. We re-estimated all models presented in Tables 4-6. Results are not shown to save space.³⁵ It is reassuring to note, however, that all major results prove to be fairly robust to the measurement of the relative scale of FDI.³⁶ In particular, the repercussions of different types of FDI on domestic employment do not depend on whether FDI is measured in terms of employment or turnover of foreign affiliates, relative to the corresponding totals for foreign plus domestic MNE operations.

5. Summary and Conclusion

Public concerns that outward FDI gradually hollows out domestic manufacturing and displaces local workers are no less in emerging Asia than in the United States or in Western Europe. We draw on exceptionally informative firm-specific data from the Manufacturing Foreign Investment Survey in order to investigate repercussions of FDI on domestic production and employment of Taiwanese MNEs. We take the firms' own assessment of production and employment effects as dependent variables in ordered probit models. Controlling for firm heterogeneity, we assess whether the repercussions at home depend on the size, location and type of FDI.

³⁵ Complete results are available on request.

³⁶ The effects of *Fdi_to* on domestic production and employment are very similar to the effects of *Fdi_employ* for the estimations reported in Tables 4 and 5. The former are somewhat weaker than the latter for the extended specifications reported in Table 6. In the extended models, FDI repercussions on domestic production and employment are reflected mainly by the marginal effects of input share variables (i.e., the additional proxies of different types of FDI) when measuring FDI in terms of turnover. Moreover, the marginal effects of location dummies become larger and more significant when replacing *Fdi_employ* by *Fdi_to*.

We find public concerns to be justified inasmuch as the probability of negative production and employment effects increases with the size of FDI, i.e., the relative importance of foreign affiliates in the Taiwanese firm's overall operations. As for major locations, FDI in advanced host countries that is motivated at least partly by access to technology has favorable effects on domestic production, though not on domestic employment. By contrast, locating in mainland China affects domestic production and employment negatively. Yet there is little reason to blame FDI in China for hollowing out Taiwanese manufacturing as the quantitative impact turns out to be rather small.

The fairly complex repercussions of major types of FDI do not allow for rash generalizations, in contrast to what both critics and proponents of FDI may make us believe. Export-platform FDI affects both domestic production and employment negatively, implying that any complementarities between export production in the host countries and Taiwanese input supplies were insufficient to offset adverse effects resulting from cost-related relocation of labor-intensive lines of production to export platforms. The effects of vertical FDI on domestic production appear to more benign than those on domestic employment. Yet, the negative employment effects of higher affiliate sales in Taiwan diminish to the extent that vertical FDI also involves higher affiliate inputs from Taiwan. Horizontal FDI has highly ambiguous effects on domestic production once the importance of local sales and sourcing within the host country as well as their interaction with the relative scale of FDI are all taken into account. Yet the employment effects of horizontal FDI tend to be positive. While domestic employment benefits from the penetration of new markets through FDI, we find no significant evidence that this effect is offset by adverse employment implications of local sourcing in the host countries of Taiwanese MNEs. All these findings have in common, however, that the quantitative impact is fairly modest.

Obviously, the present paper does not attempt to provide a full account of the production and labor market repercussions of outward FDI. By relying on the subjective assessments of survey respondents we avoid problems of establishing the counterfactual of what would have happened to actual production and employment if Taiwanese companies had not undertaken FDI. This is not to ignore the limitations of this approach, however. The survey does not specify the number of workers perceived to be affected by outward FDI, nor does it provide a quantitative assessment by survey respondents of the effects on domestic production.

Furthermore, the labor market repercussions of outward FDI may go beyond employment within the surveyed firms. For instance, the survey data used here tend to

understate negative employment effects to the extent that Taiwanese MNEs undertake vertical FDI to offshore inputs that were traditionally sourced from other firms within Taiwan. Outward FDI may also affect domestic labor markets by intensified wage pressure on domestic workers, both within and outside the surveyed firms.

Data constraints render it almost impossible to address all these limitations in future research. Some extensions appear to be feasible, however, by combining the survey data on manufacturing FDI with Taiwanese census data. This would allow for forming a control group of Taiwanese firms without any outward FDI. The perspective on the effects of outward FDI could then be broadened by estimating two-step selection models. In particular, it would be possible to isolate the effects of the decision to undertake any FDI from the effects of subsequent decisions on the size, location and type of FDI.

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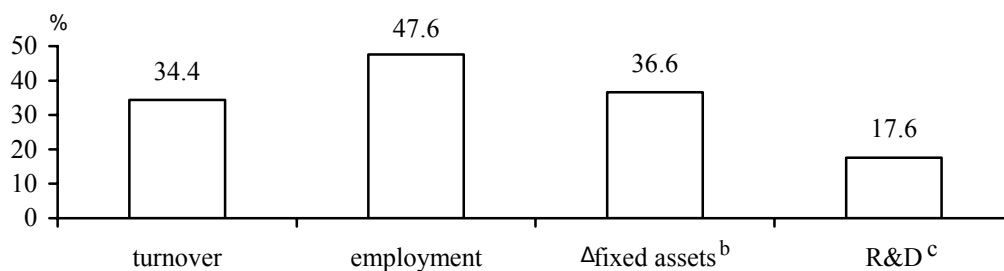
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Figure 1 - Relative importance of FDI by Taiwanese MNEs, ^a 2006

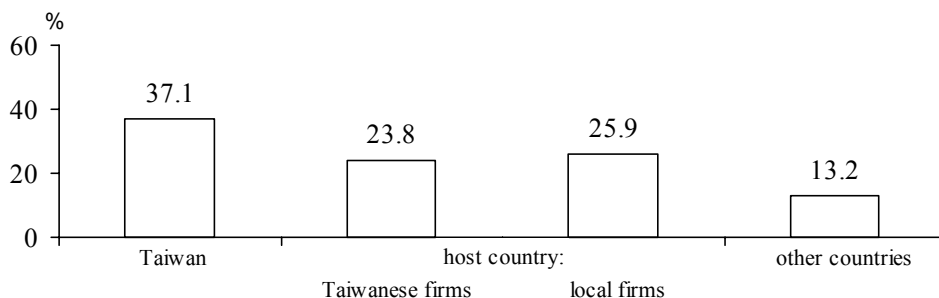


Notes: ^aAverage share of foreign affiliates in total (domestic plus foreign) turnover, employment, increase in fixed assets and R&D expenditure, respectively; refers to all 1770 Taiwanese MNEs if not mentioned otherwise. ^b Refers to the 1442 Taiwanese MNEs reporting an increase in fixed assets in 2006. ^cRefers to the 1274 Taiwanese MNEs reporting non-zero R&D expenditures in 2006.

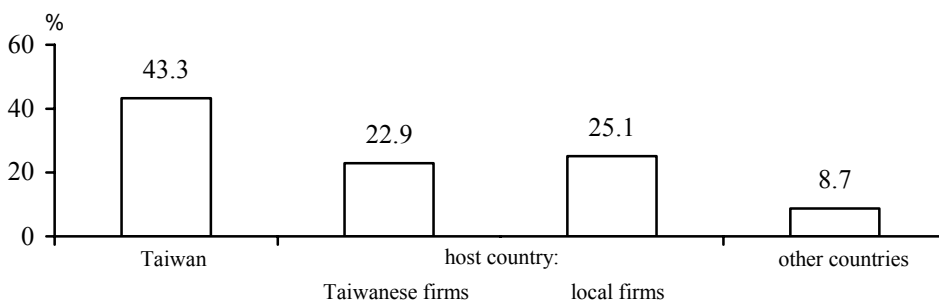
Own compilation, based on data from Taiwan Manufacturing Foreign Investment Survey 2007.

Figure 2 - Sources of inputs and destinations of output of Taiwanese subsidiaries, 2006

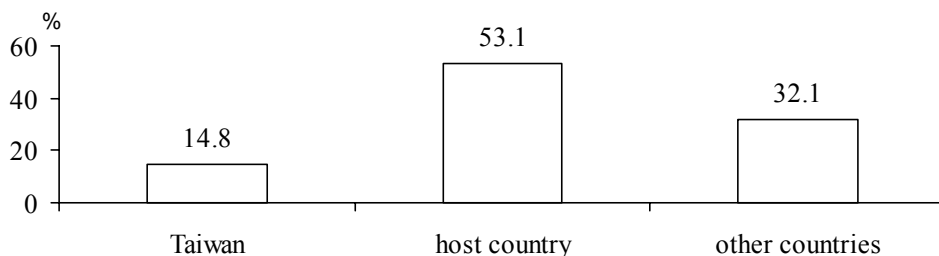
a) Materials, average share of input sources^a



b) Intermediate goods, average share of input sources^b



c) Sales, average share of destinations^c



Notes: ^aRefers to foreign affiliates in the most important FDI location of 1582 Taiwanese MNEs; 188 MNEs in the sample do not report the related input figures of materials at all. ^bRefers to foreign affiliates in the most important FDI location of 1170 Taiwanese MNEs; 600 MNEs in the sample do not report the related input figures of intermediate goods at all. ^cRefers to all foreign affiliates of 1631 Taiwanese MNEs; 139 MNEs in the sample do not report the related sales figures at all.

Own compilation, based on data from Taiwan Manufacturing Foreign Investment Survey 2007.

Figure 3a - Effects of the interaction term Xfe_{xot} on domestic production across the whole sample (correct and wrong, based on the same estimation model as in col.3 of Table 4)

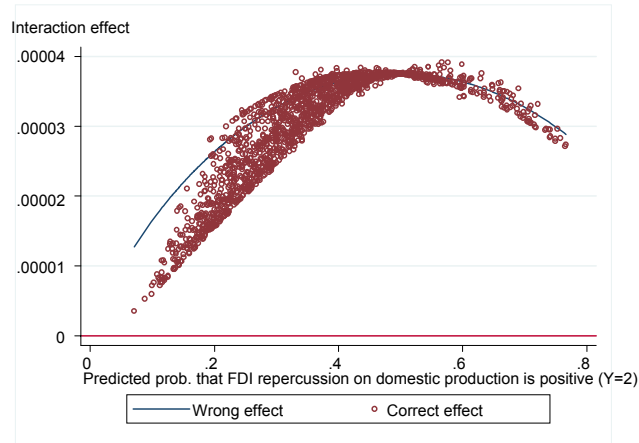


Figure 3b – Z-statistics of correct effects of the interaction term Xfe_{xot} presented in Graph 1a



Notes: z-statistics of all 1631 correct interaction effects are positive and 99.63% of them are located above the 1.96-line (upper boundary of the 95% confidence interval).

Figure 4a - Effects of the interaction term Xfe_{xol} on domestic production across the whole sample (correct and wrong, based on the same estimation model as in col.5 of Table 4)

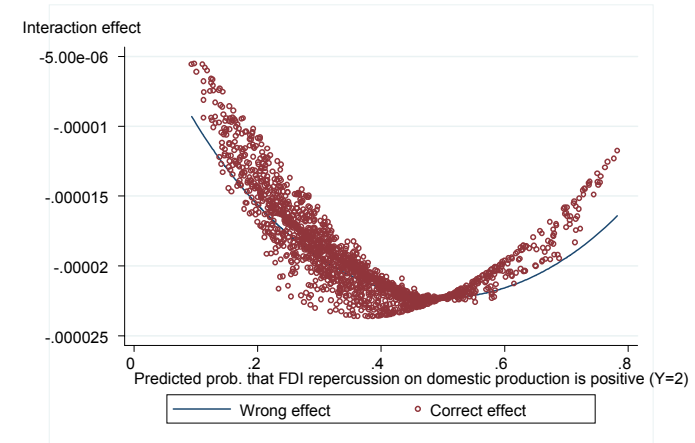
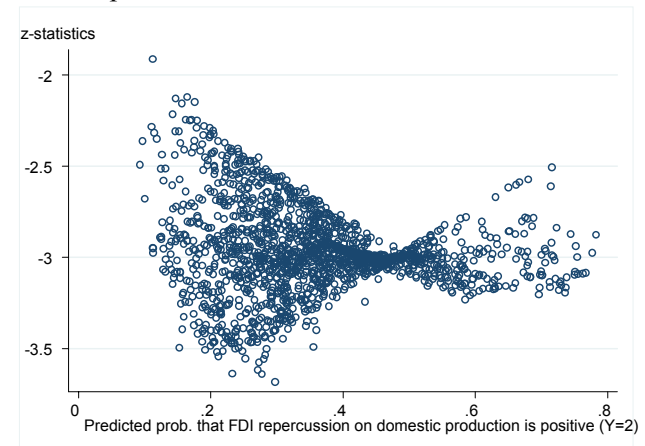


Figure 4b – Z-statistics of correct effects of the interaction term Xfe_{xol} presented in Graph 2a



Notes: z-statistics of all 1631 correct interaction terms are negative and 99.94% of them are located below the -1.96-line (lower boundary of the 95% confidence interval)

Figure 5a - Effects of the interaction term Xfe_xmt on domestic production across the whole sample (correct and wrong, based on the same estimation model as in col.1 of Table 6)

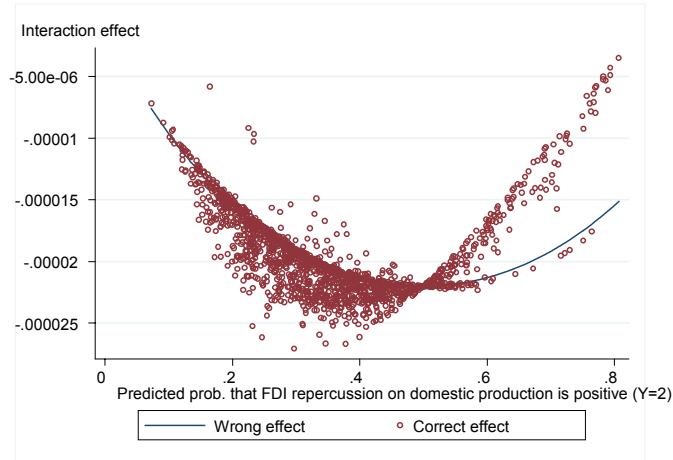


Figure 5b – Z-statistics of correct effects of the interaction term Xfe_xmt presented in Graph 3a



Notes: z-statistics of all 1522 correct interaction effects are negative and 96.65% of them are located below the -1.96-line (lower boundary of the 95% confidence interval).

Figure 6a - Effects of the interaction term Xfe_xml on domestic production across the whole sample (correct and wrong, based on the same estimation model as in col.2 of Table 6)

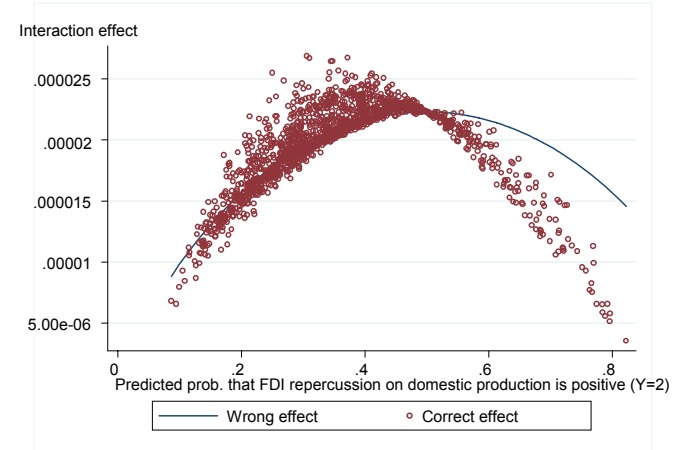
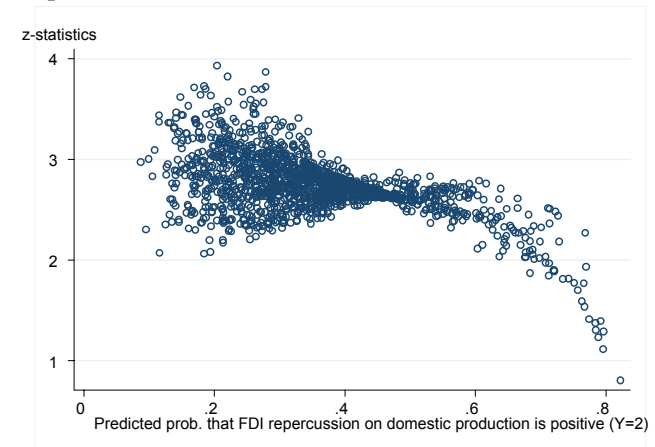


Figure 6b – Z-statistics of correct effects of the interaction term Xfe_xml presented in Graph 4a



Notes: z-statistics of all 1522 correct interaction effects are positive and 98.62% of them are located above the 1.96-line (upper boundary of the 95% confidence interval).

Table 1 - FDI impact on domestic production and employment: Taiwanese survey results 2006 (number of observations)

		FDI impact on production			
		positive	neutral	negative	sum
FDI impact on employment	positive	228	102	21	351
	neutral	333	769	62	1164
	negative	61	54	140	255
	sum	622	925	223	1770

Own compilation based on data from Taiwan Manufacturing Foreign Investment Survey 2007.

Table 2 - FDI impact on domestic production and employment: Survey results by industry and FDI location (percent of all companies in specific industry or location)

	FDI impact on employment			FDI impact on production		
	positive	neutral	negative	positive	neutral	negative
Major industries:						
- metals and machinery (426)	18.8	71.1	10.1	36.4	55.4	8.2
- IT and electronics (759)	22.4	61.0	16.6	44.1	41.2	14.6
- chemicals (305)	18.0	69.2	12.8	21.6	64.6	13.8
- consumer goods (280)	16.4	66.8	16.8	23.6	63.9	12.5
Major FDI locations:						
- China (1313)	18.4	65.6	16.1	33.3	51.9	14.9
- other low-income countries ^b (302)	20.9	67.9	11.3	32.8	59.3	7.9
- advanced OECD countries ^a (155)	30.3	63.2	6.5	55.5	41.9	2.6

Notes: Number in brackets refers to the number of MNEs in specific industry or FDI location. - ^a USA, Canada, West Europe, Japan, Australia and New Zealand. - ^b Latin America, Eastern Europe, Asia (except Mainland China and Japan), Africa and others.

Own compilation, based on data from Taiwan Manufacturing Foreign Investment Survey 2007.

Table 3 - Median of selected explanatory variables for sub-samples of Taiwanese MNEs with different assessments of FDI effects on production and employment in Taiwan

	FDI impact on employment			FDI impact on production		
	positive	neutral	negative	positive	neutral	negative
Company characteristics ^a						
- employees (number)	310	224	306	310	205	400
- capital intensity (increase in fixed assets in 1000 NT\$ per employee)	72.0	42.0	28.2	70.1	36.5	38.6
- R&D intensity (1000 NT\$ per employee)	30.8	17.6	12.3	46.5	10.0	15.9
- labor productivity (turnover in 1000 NT\$ per employee)	3687	2957	1786	3314	2858	2167
Relative importance of FDI						
- foreign share in total turnover (%)	25	20	45	20	23	46
- foreign share in total employment (%)	44	41	80	42.5	44	80
Foreign affiliates' sales structure ^b						
- back to Taiwan (%)	0	0	2	0	0	1
- to local market (%)	80	47.5	25	50	47	40
- to other markets (%)	1	0	30	1	0	22

Notes: ^a All four indicators refer to domestic plus foreign operations of all 1770 MNEs. ^b Excludes 139 MNEs that do not report sales to any destination.

Own compilation, based on data from Taiwan Manufacturing Foreign Investment Survey 2007.

Table 4 - Estimation results on domestic production: marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Pr(Y=2)</i>	0.330	0.342	0.345	0.341	0.336	0.348	0.346
<i>Fdi_employ</i>	-0.001*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001 (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
<i>Output_tw</i>		0.001** (0.000)	-0.001 (0.001)				
<i>Output_local</i>				1.35e-05 (0.000)	0.001** (0.000)		
<i>Output_others</i>						-4.70e-04* (0.000)	-9.93e-04** (0.000)
<i>Xfe_xot</i>			3.47e-05*** (0.000)				
<i>Xfe_xol</i>					-2.04e-05*** (0.000)		
<i>Xfe_xoh</i>							9.74e-06 (0.000)
<i>Logsize</i>	0.028* (0.016)	0.026 (0.016)	0.027 (0.017)	0.023 (0.016)	0.019 (0.016)	0.026 (0.017)	0.024 (0.017)
<i>Loglabprodt</i>	-0.028 (0.019)	-0.029 (0.020)	-0.030 (0.020)	-0.034* (0.020)	-0.033 (0.020)	-0.034* (0.020)	-0.033* (0.020)
<i>Logcapintr</i>	0.012 (0.012)	0.011 (0.013)	0.012 (0.013)	0.012 (0.013)	0.013 (0.013)	0.010 (0.013)	0.010 (0.013)
<i>Logrdintr</i>	0.057*** (0.012)	0.070*** (0.013)	0.069*** (0.013)	0.070*** (0.013)	0.068*** (0.013)	0.070*** (0.013)	0.069*** (0.013)
<i>Start_fdi_n</i>	0.002 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
<i>Indu_4m_mt</i>	0.088*** (0.031)	0.095*** (0.032)	0.093*** (0.032)	0.099*** (0.032)	0.104*** (0.032)	0.091*** (0.032)	0.092*** (0.032)
<i>Indu_4m_it</i>	0.050* (0.030)	0.052 (0.031)	0.044 (0.032)	0.060* (0.031)	0.062** (0.031)	0.056* (0.031)	0.058* (0.031)
<i>Indu_4m_cm</i>	-0.044 (0.030)	-0.044 (0.031)	-0.045 (0.032)	-0.043 (0.032)	-0.040 (0.032)	-0.050 (0.032)	-0.050 (0.032)
<i>Locate_fdi_cn</i>	-0.036 (0.025)	-0.047* (0.027)	-0.046* (0.027)	-0.049* (0.026)	-0.046* (0.026)	-0.052* (0.027)	-0.051* (0.027)
<i>Locate_fdi_adv</i>	0.103** (0.045)	0.123** (0.049)	0.130*** (0.049)	0.115** (0.049)	0.112** (0.048)	0.110** (0.048)	0.107** (0.048)

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses.

Reference point for measuring marginal effect: dependent variable is set equal to two, i.e., production effects are perceived to be positive; all metric independent variables are set at their mean levels, and all binary independent variables are set equal to 0 due to the existing exclusiveness between complementary dummy variables.

Table 5 - Estimation results on domestic employment: marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>PR(Y=2)</i>	0.199	0.200	0.200	0.213	0.213	0.211	0.211
<i>Fdi_employ</i>	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>Output_tw</i>		-0.001*** (0.000)	-0.001** (0.000)				
<i>Output_local</i>				0.001*** (0.000)	0.001** (0.000)		
<i>Output_others</i>						-0.001** (0.000)	-4.47e-04 (0.000)
<i>Xfe_xot</i>			2.40e-06 (0.000)				
<i>Xfe_xol</i>					1.60e-16 (0.000)		
<i>Xfe_xoh</i>							-2.14e-06 (0.000)
<i>Logsize</i>	0.044*** (0.013)	0.040*** (0.013)	0.040*** (0.013)	0.046*** (0.014)	0.047*** (0.014)	0.047*** (0.014)	0.047*** (0.014)
<i>Loglabprodt</i>	0.021 (0.016)	0.019 (0.017)	0.019 (0.017)	0.020 (0.017)	0.020 (0.017)	0.025 (0.017)	0.024 (0.017)
<i>Logcapintr</i>	0.013 (0.010)	0.013 (0.010)	0.013 (0.010)	0.010 (0.010)	0.010 (0.010)	0.010 (0.010)	0.010 (0.010)
<i>Logrdintr</i>	0.007 (0.010)	0.011 (0.010)	0.011 (0.010)	0.010 (0.011)	0.010 (0.011)	0.010 (0.010)	0.010 (0.011)
<i>Start_fdi_n</i>	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
<i>Indu_4m_mt</i>	0.037 (0.025)	0.048* (0.027)	0.048* (0.027)	0.033 (0.027)	0.033 (0.027)	0.034 (0.027)	0.034 (0.027)
<i>Indu_4m_it</i>	-0.000 (0.024)	0.011 (0.025)	0.011 (0.025)	0.005 (0.026)	0.005 (0.026)	-0.001 (0.025)	-0.001 (0.026)
<i>Indu_4m_cm</i>	0.021 (0.027)	0.030 (0.028)	0.029 (0.028)	0.016 (0.029)	0.016 (0.029)	0.021 (0.029)	0.020 (0.029)
<i>Locate_fdi_cn</i>	-0.030 (0.020)	-0.035* (0.021)	-0.035* (0.021)	-0.042* (0.022)	-0.042* (0.022)	-0.037* (0.022)	-0.038* (0.022)
<i>Locate_fdi_adv</i>	0.046 (0.036)	0.038 (0.038)	0.039 (0.038)	0.028 (0.039)	0.028 (0.039)	0.040 (0.039)	0.041 (0.039)

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses.

Reference point for measuring marginal effect: dependent variable is set equal to two, i.e., employment effects are perceived to be positive; all metric independent variables are set at their mean levels, and all binary independent variables are set equal to 0 due to the existing exclusiveness between complementary dummy variables.

Table 6 - Estimation results of extended specifications: marginal effects on domestic production and employment

	Production (1)	Production (2)	Employment (3)	Employment (4)		Production (5)	Production (6)	Employment (7)	Employment (8)
<i>PR(Y=2)</i>	0.343	0.333	0.188	0.198		0.389	0.382	0.189	0.206
<i>Fdi_employ</i>	-0.001*** (0.000)	-0.002*** (0.001)	-0.001*** (0.000)	-0.001* (0.000)	<i>Fdi_employ</i>	-0.002*** (0.001)	-0.001* (0.001)	-0.002*** (0.000)	-0.001 (0.001)
<i>Output_tw</i>	-0.001* (0.001)		-0.001*** (0.000)		<i>Output_tw</i>	-0.002*** (0.001)		-0.001*** (0.000)	
<i>Output_local</i>		0.001** (0.000)		0.001*** (0.000)	<i>Output_local</i>		0.002*** (0.000)		0.001*** (0.000)
<i>Xfe_xot</i>	3.82e-05*** (0.000)				<i>Xfe_xot</i>	4.71e-05*** (0.000)			
<i>Xfe_xol</i>		-2.04e-05*** (0.000)			<i>Xfe_xol</i>		-2.80e-05*** (0.000)		
<i>Inputm_tw</i>	0.002*** (0.000)		0.001* (0.000)		<i>Inputi_tw</i>	0.002*** (0.001)		1.75e-04 (0.000)	
<i>Inputm_local</i>		-0.002*** (0.000)		-2.76e-04 (0.000)	<i>Inputi_local</i>		-0.002*** (0.000)		-2.58e-04 (0.000)
<i>Xfe_xmt</i>	-2.03e-05** (0.000)		-4.11e-08 (0.000)		<i>Xfe_xit</i>	-1.08e-05 (0.000)		1.27e-05* (0.000)	
<i>Xfe_xml</i>		2.03e-05** (0.000)		-7.38e-06 (0.000)	<i>Xfe_xil</i>		2.02e-05** (0.000)		-1.07e-05 (0.000)

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses.

Reference point for measuring marginal effect: dependent variable is set equal to two, i.e., production or employment effects are perceived to be positive; all metric independent variables are set at their mean levels, and all binary independent variables are set equal to 0 due to the existing exclusiveness between complementary dummy variables. Marginal effects of other independent variables are not shown here.

Appendix

Table A1 - Definition of variables and summary statistics

Name	Definition	Mean	Std. dev.
<u>Observed outcome variables:</u>			
Prod_scale_n ^a	FDI effects on domestic production; survey results: 0=negative; 1=neutral; 2=positive	1.225	0.653
Employment_n ^a	FDI effects on domestic employment; survey results: 0=negative; 1=neutral; 2=positive	1.054	0.583
<u>Relative scale of FDI:</u>			
Fdi_employ ^a	Ratio of overseas employment to total (domestic and overseas) employment: 0-100	47.609	35.937
Fdi_to ^a	Ratio of overseas turnover to total (domestic and overseas) turnover: 0-100	34.442	32.034
Fdi_cap ^a	Ratio of increase in fixed assets overseas to total (domestic and overseas) increase in fixed assets: 0-100	29.832	37.254
Fdi_rd ^a	Ratio of overseas R&D expenditure to total (domestic and overseas) R&D expenditure: 0-100	12.651	26.125
<u>Firm characteristics, timing and location of FDI:</u>			
Logsize ^a	Number of employees; logged	2.444	0.727
Loglabprod ^a	Labor productivity; logged	3.430	0.591
Logcapintr ^a	Capital intensity; transformed due to log of zero problem and logged: log(10*(1+capint))	2.514	0.960
Logrdintr ^a	R&D intensity; transformed due to log of zero problem and logged: log(10*(1+rdint))	2.206	0.955
Start_fdi_n ^a	Starting year of the parent firm's most important FDI project	1998.479	4.841
Indu_4m_mt ^a	Industry dummy = 1 for metals/ machinery	0.241	0.428
Indu_4m_it ^a	Industry dummy = 1 for IT/ electronics	0.429	0.495
Indu_4m_cm ^a	Industry dummy = 1 for chemicals	0.172	0.378
Locate_fdi_cn ^a	Location dummy= 1 if the most important FDI project is located in mainland China	0.742	0.438
Locate_fdi_adv ^a	Location dummy = 1 if the most important FDI project is located in advanced country, including USA, Canada, West Europe, Japan, Australia and New Zealand	0.088	0.283
<u>Destination of foreign affiliates' output:</u>			
Output_tw ^b	Share of output sold in Taiwan: 0-100	14.814	27.684
Output_local ^b	Share of output sold in the host country: 0-100	53.086	42.256
Output_others ^b	Share of output sold in other countries: 0-100	32.100	39.468
<u>Sources of foreign affiliates' inputs:</u>			
Inputm_tw ^c	Share of materials from Taiwan; refers to the overseas operation in the most important FDI location: 0-100	37.121	37.456
Inputm_local ^c	Share of materials from local sources (domestic and Taiwanese companies in the host country); refers to the overseas operation in the most important FDI location: 0-100	49.664	38.722
Inputi_tw ^d	Share of intermediate inputs from Taiwan; refers to the overseas operation in the most important FDI location: 0-100	43.276	41.485
Inputi_local ^d	Share of intermediate inputs from local sources (domestic and Taiwanese companies in the host country); refers to the overseas operation in the most important FDI location: 0-100	48.002	41.662
<u>Interaction terms</u>			
Xfe_xot ^b	Interaction term between "fdi_employ" and "output_tw": 0-9500	731.026	1605.582
Xfe_xol ^b	Interaction term between "fdi_employ" and "output_local": 0-10000	2346.970	2760.886
Xfe_xoh ^b	Interaction term between "fdi_employ" and "output_others": 0-10000	1960.140	3041.415
Xfe_xmt ^c	Interaction term between "fdi_employ" and "inputm_tw": 0-10000	1603.407	2152.158
Xfe_xml ^c	Interaction term between "fdi_employ" and "inputm_local": 0-10000	2794.203	3009.540
Xfe_xit ^d	Interaction term between "fdi_employ" and "inputi_tw": 0-10000	1671.744	2359.349
Xfe_xil ^d	Interaction term between "fdi_employ" and "inputi_local": 0-10000	2694.838	3223.152

Notes: ^a1770 observations; ^b1631 observations; ^c1582 observations; ^d1170 observations.

Table A2 - Estimation results on domestic production: coefficients (corresponding marginal effects in Table 4)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Fdi_employ</i>	-0.004*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)	-0.002 (0.001)	-0.004*** (0.001)	-0.005*** (0.001)
<i>Output_tw</i>		0.002** (0.001)	-0.002 (0.001)				
<i>Output_local</i>				3.67e-05 (0.001)	0.003*** (0.001)		
<i>Output_others</i>						-0.001* (0.001)	-0.003** (0.001)
<i>Xfe_xot</i>			9.41e-05*** (0.000)				
<i>Xfe_xol</i>					-5.58e-05*** (0.000)		
<i>Xfe_xoh</i>							2.64e-05 (0.000)
<i>Logsize</i>	0.077* (0.044)	0.070 (0.045)	0.074 (0.045)	0.063 (0.045)	0.053 (0.045)	0.070 (0.045)	0.065 (0.045)
<i>Loglabprodt</i>	-0.078 (0.052)	-0.080 (0.054)	-0.079 (0.054)	-0.092* (0.054)	-0.090 (0.055)	-0.092* (0.054)	-0.090* (0.054)
<i>Logcapintr</i>	0.034 (0.033)	0.030 (0.034)	0.032 (0.034)	0.031 (0.034)	0.036 (0.034)	0.026 (0.034)	0.027 (0.034)
<i>Logrdintr</i>	0.159*** (0.033)	0.190*** (0.035)	0.186*** (0.035)	0.192*** (0.035)	0.185*** (0.035)	0.190*** (0.035)	0.187*** (0.035)
<i>Start_fdi_n</i>	0.006 (0.006)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)	0.004 (0.006)	0.003 (0.006)	0.003 (0.006)
<i>Indu_4m_mt</i>	0.234*** (0.081)	0.247*** (0.084)	0.242*** (0.084)	0.259*** (0.084)	0.272*** (0.084)	0.236*** (0.085)	0.240*** (0.084)
<i>Indu_4m_it</i>	0.134* (0.081)	0.137 (0.084)	0.118 (0.084)	0.158* (0.084)	0.164* (0.084)	0.148* (0.084)	0.154* (0.084)
<i>Indu_4m_cm</i>	-0.126 (0.085)	-0.122 (0.088)	-0.125 (0.088)	-0.121 (0.088)	-0.112 (0.089)	-0.141 (0.089)	-0.138 (0.089)
<i>Locate_fdi_cn</i>	-0.103 (0.069)	-0.131* (0.073)	-0.130* (0.074)	-0.138* (0.073)	-0.130* (0.073)	-0.146** (0.073)	-0.143* (0.073)
<i>Locate_fdi_adv</i>	0.272** (0.115)	0.320** (0.126)	0.337*** (0.125)	0.299** (0.125)	0.272** (0.124)	0.286** (0.124)	0.277** (0.124)
<i>Obs.</i>	1770	1631	1631	1631	1631	1631	1631
<i>Wald Chi2</i>	149.57***	170.79***	188.41***	168.57***	183.61***	173.58***	177.66***
<i>Pseudo R2</i>	0.040	0.049	0.052	0.048	0.050	0.048	0.049

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses. Values of estimated cutpoints are not shown here.

Table A3 Estimation results on domestic employment: coefficients (corresponding marginal effects in Table 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Fdi_employ</i>	-0.004*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)	-0.004*** (0.001)	-0.005*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
<i>Output_tw</i>		-0.003*** (0.001)	-0.003** (0.001)				
<i>Output_local</i>				0.003*** (0.001)	0.003** (0.001)		
<i>Output_others</i>						-0.002** (0.001)	-0.002 (0.001)
<i>Xfe_xot</i>			8.56e-06 (0.000)				
<i>Xfe_xol</i>					5.51e-06 (0.000)		
<i>Xfe_xoh</i>							-7.41e-06 (0.000)
<i>Logsize</i>	0.157*** (0.046)	0.144*** (0.047)	0.145*** (0.047)	0.160*** (0.047)	0.161*** (0.047)	0.162*** (0.047)	0.164*** (0.047)
<i>Loglabprodt</i>	0.076 (0.056)	0.068 (0.059)	0.069 (0.059)	0.070 (0.059)	0.070 (0.059)	0.085 (0.058)	0.084 (0.058)
<i>Logcapintr</i>	0.046 (0.034)	0.045 (0.035)	0.045 (0.035)	0.033 (0.035)	0.033 (0.035)	0.035 (0.035)	0.035 (0.035)
<i>Logrdintr</i>	0.026 (0.034)	0.039 (0.036)	0.039 (0.036)	0.034 (0.036)	0.034 (0.036)	0.033 (0.036)	0.034 (0.036)
<i>Start_fdi_n</i>	0.004 (0.006)	0.004 (0.006)	0.004 (0.06)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)
<i>Indu_4m_mt</i>	0.126 (0.087)	0.162* (0.089)	0.161* (0.089)	0.109 (0.089)	0.108 (0.089)	0.112 (0.090)	0.111 (0.090)
<i>Indu_4m_it</i>	-0.001 (0.087)	0.040 (0.088)	0.038 (0.088)	0.018 (0.088)	0.017 (0.088)	-0.001 (0.088)	-0.003 (0.088)
<i>Indu_4m_cm</i>	0.073 (0.094)	0.101 (0.097)	0.101 (0.097)	0.055 (0.097)	0.054 (0.097)	0.070 (0.097)	0.069 (0.097)
<i>Locate_fdi_cn</i>	-0.114 (0.073)	-0.132* (0.077)	-0.132* (0.077)	-0.153** (0.077)	-0.153** (0.077)	-0.137* (0.077)	-0.138* (0.077)
<i>Locate_fdi_adv</i>	0.156 (0.117)	0.130 (0.126)	0.131 (0.127)	0.092 (0.126)	0.093 (0.126)	0.132 (0.126)	0.134 (0.126)
<i>Obs.</i>	1770	1631	1631	1631	1631	1631	1631
<i>Wald Chi2</i>	88.87***	102.26***	102.43***	113.31***	114.75***	102.38***	102.93***
<i>Pseudo R2</i>	0.027	0.033	0.033	0.036	0.036	0.033	0.033

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses. Values of estimated cutpoints are not shown here.

Table A4 - Estimation results of extended specifications: coefficients (corresponding marginal effects in Table 6)

	Production (1)	Production (2)	Employment (3)	Employment (4)		Production (5)	Production (6)	Employment (7)	Employment (8)
<i>Fdi_employ</i>	-0.005*** (0.001)	-0.005*** (0.002)	-0.005*** (0.001)	-0.003* (0.002)	<i>Fdi_employ</i>	-0.005*** (0.002)	-0.004* (0.002)	-0.007*** (0.002)	-0.003 (0.002)
<i>Output_tw</i>	-0.003* (0.002)		-0.004*** (0.001)		<i>Output_tw</i>	-0.005*** (0.002)		-0.004*** (0.001)	
<i>Output_local</i>		0.003** (0.001)		0.003*** (0.001)	<i>Output_local</i>		0.004*** (0.001)		0.004*** (0.001)
<i>Xfe_xot</i>	1.04e-04*** (0.000)				<i>Xfe_xot</i>	1.23e-04*** (0.000)			
<i>Xfe_xol</i>		-5.61e-05*** (0.000)			<i>Xfe_xol</i>		-7.34e-05*** (0.000)		
<i>Inputm_tw</i>	0.005*** (0.001)		0.002* (0.001)		<i>Inputi_tw</i>	0.004*** (0.001)		0.001 (0.001)	
<i>Inputm_local</i>		-0.004*** (0.001)		-0.001 (0.001)	<i>Inputi_local</i>		-0.005*** (0.001)		-0.001 (0.001)
<i>Xfe_xmt</i>	-5.51e-05** (0.000)		-1.52e-07 (0.000)		<i>Xfe_xit</i>	-2.82e-05 (0.000)		4.69e-05* (0.000)	
<i>Xfe_xml</i>		5.59e-05*** (0.000)		-2.65e-05 (0.000)	<i>Xfe_xil</i>		5.30e-05** (0.000)		-3.75e-05 (0.000)
<i>Obs.</i>	1522	1522	1522	1522		1120	1120	1120	1120
<i>Wald Chi2</i>	174.15***	165.51***	105.88***	114.18***		155.67***	154.69***	87.37***	99.88***
<i>Pseudo R2</i>	0.053	0.049	0.036	0.040		0.064	0.064	0.042	0.047

Notes: ***, **, * significant at one, five and ten level, respectively; robust standard error in parentheses. Estimated coefficients of other independent variables and values of estimated cutpoints are not shown here.