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The Impact of Foreign Production Activities:

Firm-Level Evidence from Taiwan's Multinationals

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Abstract

A prominent phenomenon characterizing the increasing level of globalization is that many firms move some or all of their production activities abroad for different reasons. One of the main concerns is that the domestic industries will be hollowed out, and only the most skilled labor will survive. On the other hand, some people argue that firms' foreign production activities may be a complement to domestic production and even raise the domestic employment level. Must foreign production activities result in job-exportation?

Using firm-level data from Taiwan, this paper finds that while increasing the proportion of foreign output has a negative impact on both the domestic m

1 Introduction

A prominent phenomenon characterizing the increasing level of globalization is that many firms move some or even all of their production activities abroad for different reasons. One of the main concerns is whether the domestic industries will be hollowed out when the production activities are moved abroad. Many people in more developed countries are worrying about losing their jobs because the cheaper foreign labor will prompt firms to relocate more production activities outside their home countries.

For instance, in Germany, workers fear that cheaper labor in the new eastern EU member countries will attract companies to invest there and shut down domestic plants. In the United States, giant companies such as General Electric, IBM, and United Technologies have recently taken many of their operations overseas. It seems that those multinationals are exporting jobs rather than goods (BusinessWeek, 2006; 2008). Besides the anecdotal evidence, earlier empirical studies have found that the outward foreign direct investment (FDI) can have negative impacts on domestic output and employment.[1]

However, more recent studies also find that the effect of outward FDI can be quite mixed. For

Table 1-1 Outward FDI Flow and Stock in Asia

Unit: Millions of the U.S. dollars

Outward FDI	flows			stock		
	2004	2005	2006	1990	2000	2006
East Asia	62924	49836	74099	49032	509636	923403
China	5498	12261	16130	4455	27768	73330
Hong Kong	45716	27201	43459	11920	388380	688974
Korea, Republic of	4658	4298	7129	2301	26833	46760
Taiwan	7145	6028	7399	30356	66655	113910
Other East Asia countries	-93	48	-18	0	0	429
Japan	30951	45781	50266	201441	278442	449567
South Asia	2247	2579	9820	423	2503	14198
India	2179	2495	9676	124	1859	12964
Other South Asia countries	68	84	144	299	644	1234
South-East Asia	14212	11918	19095	9220	84045	171396
Indonesia	3408	3065	3418			

3 Relevant Research and Industry-level Information of Taiwan

Earlier research on issues regarding the activities of Taiwanese multinationals often classified the outward FDI into expansionary and defensive categories.[8] The former and the latter could result in horizontal and vertical firms, respectively. Using Taiwan's data from 1986 to 1994, Chen and Ku (2000) find that either types of outward FDI (expansionary and defensive) are neutral to domestic employment. They argue that the trend of manufacturing employment decline during that period seems to be driven by the structural change toward the capital-intensive industries.

To determine the types of outward FDI, the aforementioned research compares the wage rate in the host country and that in the home country (or some other benchmark level). If the former is higher than the latter, the outward FDI is regarded as expansionary, or it is classified as defensive if the wage rate in the host country is lower than that in the home country.[9] However, recently, many Taiwanese firms investing in China, where the wage rate is much lower than that in Taiwan, are not just seeking cheaper labor, but are also accessing the market there or meeting the customers' needs, etc. (MOEA, 2002; 2003; 2004). Thus, it would be dubious for these investments to be classified as defensive simply because the wage rate in the host country is lower.

Another issue is that the firms' motivations to invest in low-wage countries are often mixed.[10] Classifying each firm's outward FDI to be one of the two mutually exclusive parts might oversimplify the whole story. For example, Hanson, Mataloni, and Slaughter (2001) find the fact that U.S. multinationals were shifting activities towards low-income countries is consistent with vertical FDI where factor-cost differences matter, and also with horizontal FDI since many of these host countries were characterized by growing markets.

Recently, the survey on Taiwanese multinationals' foreign activities conducted by the Ministry of

[8] For example, see Chen and Chen (1995).

[9] In Taiwan, the practice is appropriate before the early nineties because most outward FDIs to low-wage countries then were to seek cheap labor (Chun, 1996).

[10] Chen and Ku (2000) argue that when investing in lo

coefficients for industry dummies.

The results show that when the foreign production ratio increases by 1%, on average, the domestic non-skilled labor employment will decrease by 0.19%

Table 3-1 The Impact on Manufacturing Employees (Industry-level Linear Regression)[13]

Dependent variable : Lnonskl (Natural log of non-skilled employees) Number of industries = 24 ; Period = 9 ; Number of observations = 216		
	Random effect (GLS)	Fixed effect

are not available for 2003.

As a result, this paper only uses the data from 2001 to 2003. Furthermore, to approximate each firm's proportion of foreign output for 2001 and 2002, this paper uses the industry-level data from TEDC's database (See Table 2-1).[17] Finally, this paper assumes that the status of intra-firm trade for each multinational in 2003 is the same as that in 2002, and each firm's total assets for 2003 is estimated by summing its net assets (after depreciation) of 2002 and its investment of 2003.[18]

Other remaining issues are, first, in the survey, firms that do respond to the questionnaire in a particular year but fail to do that later might still survive. This means that treating them as exiting the market at some time is inappropriate. Second, even for those firms who do respond to the survey annually, some of them might not provide complete information, and it causes the issue of missing values.

To simplify things, this paper will just extract observations without missing values in the dependent and independent variables from the MOEA's survey. As a result, there will be 692, 678, and 666 multinationals with domestic manufacturing sectors in 2001, 2002, and 2003, respectively, and there will be 658, 654, 643 multinationals with domestic R&D sectors in these three respectively years.[19] The above treatment, howeverem wis bh?8x?S.?BiO0?8q?&SkBoO0.h?8x?yRlSjj-N?8q?R?SBeO0j8itg0j8.

Table 4-1 Share of the Sum of the Sample Output

Year	Sales (NT$ 1 billion in 2001 price)		[C] = [A]/[B]	Number of firms [D]
	Sample [A]	Manufacturing total [B]		
2001	2463.59 (2484.00)	8404.60	29.31% (29.56%)	692 (658)
2002	2263.51 (2284.71)	9079.42	24.93% (25.16%)	678 (654)
2003	2696.47 (2618.16)	9657.51	27.92% (27.11%)	666 (643)

Figures with and without parenthesis are from the sample with firms with domestic manufacturing and R&D sectors, respectively (Except column [B]).

5 Model

Since the employment status is classified into shortage, balance, or surplus, there are two different ways of analyzing the dependent variable y_{it}. Let us denote firm i's shortage in manufacturing (or R&D) employees in year t by y_{it}^{*} (y_{it}^{*} is unobservable). When $y_{it}^{*} > 0$, it has an incentive to hire more employee. Otherwise, it might want to lay off some employees (or at least not to hire more

the cheaper foreign labor, the multinationals might want to assemble their products in developing countries.) Luckily, they are both part of the available information. Other independent variables include: 1) total sales or total assets; 2) sum of domestic and foreign employees; 3) domestic and foreign investments; 4) domestic and foreign R&D expenses; 5) dummy variables for years; 6) dummy variables for industries; 7) motivation to be a multinational; and 8) whether the foreign affiliate uses the intermediates provided by the parent firm (and vice versa).

For a discrete choice model with panel data, pooled estimation fails to account for the individual specific effect. In a nonlinear model, this can lead to inconsistent estimates of β.[21] To solve this issue, the fixed effect and random effect models are proposed. However, not every fixed effect model can have a consistent estimator due to the incidental parameters problem (Neyman and Scott, 1948). For instance, there is no consistent estimator for a fixed effect probit model (Hsiao, 1986; Wooldridge, 2002).

Similarly, most fixed effect logit models are inconsistent. One exception is within the class of binary choice logit models. Anderson (1973) and Chamberlain (1980) suggest the conditional likelihood approach and apply it on the binary choice logit model. They demonstrate that the corresponding estimator is consistent. However, since this approach excludes those observations with $y_{it} = 1$ or $y_{it} = 0$ all the time, it is less efficient.[22]

Alternatively, in a random effect model, α_i is treated as a random disturbance term under the specified distribution. Since the logit model inherits more restriction from the multivariate logistic distribution, the probit model is more popular when considering the random effect model (Maddala,

6 Empirical Results

To find whether the multinationals' foreign production activities result in job-exportation, this section uses the MOEA's survey from 2001 to 2003 to investigate the impacts on domestic manufacturing and R&D employees, respectively. The definitions of the variables are shown in Table 6-1.

Table 6-2 shows that: 1) the average foreign production ratio (i.e., proportion of foreign output to global output) is around one third and demonstrates an increasing trend; 2) more and more Taiwanese multinationals engage in foreign production activities in developing countries (77% of them do so in 2001 and that proportion increases to 81% in 2003); 3) multinationals in the sample are large firms in terms of the number of global employees.[25]

Table 6-3 reveals that: 1) firms are more likely to report shortages in R&D employees rather than shortages in manufacturing employees; and 2) firms with higher foreign production ratios are more likely to report "surplus" in their domestic manufacturing employees (i.e., there exists a negative correspondence between foreign production ratio and domestic manufacturing employment), while for firms with domestic R&D employees, the extent of this negative correspondence (in terms of percentage change) is much smaller.

Let us consider the impact on domestic manufacturing employees first. This paper int&SkBuOk.8RN&BrO0?8kR.jj

f_liv are not significant, which implies that the multinationals in “light industries” are less likely to report shortages in manufacturing employees than those in “heavy industries” or high-tech sectors.[26] In M-3 and M-4, none of the coefficients of industry dummies are significant. Nevertheless, although the coefficients of f_inf and f_liv in M-3 and M-4 are all negative, the coefficients of f_liv are larger in terms of absolute values. These findings suggest that the situation of job-exportation is more likely to happen to multinationals in light industries.

Second, the coefficients of the variable f_fpr are negative and significant in M-1 and M-2 (in M-3 and M-4, they are negative but not significant). These findings suggest that increasing the proportion of foreign output, as expected, has negative iNH.H.Hk

Taiwan, while other production activities are gradually moved abroad. These findings conform to the implication from the knowledge capital model, which predicts that for a small and skilled-labor abundant country (in a relative sense) like Taiwan, the vertical multinationals headquartering at home and producing abroad would be the prevalent type of organization provided that the trade cost is not too high.

Table 6-1 Definition of the Variables

Dependent variable			
d_man	:	Model 1:	= 1 if the firm has a shortage in domestic manufacturing employees; = 0 otherwise.
		Model 2:	= -1 if the firm has a surplus in domestic manufacturing employees; = 0 if the firm's domestic manufacturing employment status is balance; = 1 if the firm has a shortage in domestic manufacturing employees.
d_rea	:	Model 1:	= 1 if the firm has a shortage in domestic R&D employees; = 0 otherwise.
		Model 2:	= -1 if the firm has a surplus in domestic R&D employees; = 0 if the firm's domestic R&D employment status is balance; = 1 if the firm has a shortage in domestic R&D employees.
Independent variables			
f_sal	:	Total sales	
f_tas	:	Total assets	
f_met	:	= 1 if the firm belongs to Metal, Machinery, or Transportation Equipment industry = 0 otherwise	
f_inf	:	= 1 if the firm belongs to Computer, Electronic Parts and Components, and Electrical Machinery industry = 0 otherwise	
f_liv	:	= 1 if the firm belongs to Food, Tobacco, Textile, Apparel, wood and bamboo product, Furniture and Fixture, Non-Metallic Mineral Products Manufacturing industry = 0 otherwise	
f_ing	:	= 1 if the foreign affiliate locates at a developing country (China, Indonesia, Malaysia, Philippine, Thailand, Vietnam, and Other South Asia countries) = 0 otherwise	
f_fpr	:	Proportion of foreign output (Foreign output / Total output)	
m_exp	:	= 1 if the firm has the market expansion motivation to engage in foreign production = 0 otherwise	
m_cos	:	= 1 if the firm has the cost-saving motivation to engage in foreign production = 0 otherwise	
i_fdi	:	Amount of foreign investment	
i_dom	:	Amount of domestic investment	
r_for	:	R&D expenditures by the foreign affiliate	
r_dom	:	R&D expenditures in the home country	
v_tpi	:	= 1 if the foreign affiliate uses intermediates produced by parent firm in Taiwan = 0 otherwise	
v_fpi	:	= 1 if the parent firm uses intermediates produced by foreign affiliate = 0 otherwise	
$\gamma_{\square\square}$	:	Lower bound of the interval for $\gamma_{\square\square}$ which corresponds to the "balance" status	
$\gamma_{\square}$	:	Upper bound of the interval for $\gamma_{\square\square}$ which corresponds to the "balance" status	

Table 6-2 Summary Statistics

		2001	2002	2003
Statistics for firms with domestic manufacturing sectors. Figures without (with) the parenthesis are the means (standard errors).				
d_man	Number of observations (**s** □ **1; b or s** □ **0**)[27] (**s** □ **1; b** □	692 0.1012(0.3018)	678 0.0855(0.2799)	666 0.1607(0.3675)

Table 6-4 The Impact on Manufacturing Employees

Dependent variable : d_man ; Number of firms (in 2001; 2002; 2003) = (692; 678; 666) Random effect probit with: (1) Binary choice (M-1 and M-2); (2) Three-ordered (M-3 and M-4)				
Model:	M- 1	M- 2	M- 3	M- 4
f_sal	-0.0128		-0.0050	
	(0.0107)		(0.0037)	
f_tas		-0.0235		

Table 6-5 The Impact on R&D Employees

Dependent variable : d_rea ; Number of firms (in 2001; 2002; 2003) = (658; 654; 643)
Random effect probit with: (1) Binary choice (R-1 a

Since over 75% of Taiwanese multinationals engage in foreign production activities in developing countries, the above findings suggest that non-skilled employees are more likely to be harmed compared to the situation of skilled employees, which provides some evidence of the division of labor suggested by the knowledge capital model.

More extension and refinement of this kind of study could be done in the future. For example, although this paper does consider whether the parent firm produces the intermediates for the foreign affiliate (and vice versa), due to the limitations of the data, the exact trade volume in these intermediates is not considered. Obviously, more accurate data on trade in intermediates would allow researchers to make better estimates.

Furthermore, in this paper, the sample is composed of relatively large multinationals. However, there are also many smaller firms that are headquartered domestically and moving their production activities abroad. Although the empirical evidence of this paper suggests that larger multinationals are less likely to hire new manufacturing labor, some anecdotal evidence from Taiwan shows that for the smaller multinationals not considered in this paper, the proportion of foreign output could be higher and thus the negative impact on domestic manufacturing employees could be stronger. If that is the case, this paper would underestimate the aforementioned negative impact.

Another point is that the only available dependent variable is simply the firm's assessment of its employment status. However, besides the issue that there could be other causes that might result in shortage or surplus of a firm's employment, as mentioned in Section 4, it is also plausible that a firm which reports the status "balance" for a specific kind of employee has already laid off or recruited some employees ex ante. Apparently, using the exact number of employees as the dependent variable would yield better estimates.

Finally, in Taiwan, despite the promising economic growth figures in recent years, many people have kept complaining that their salaries are almost stagnant. It seems that the economic improvement is only enjoyed by a small group of people, especially the most skilled employees who work in the high-tech sectors. In fact, this can be verified by the worsening income distribution in

Taiwan during recent years.

Many empirical studies for other countries have found that the multinationals' foreign production activities could have a negative impact on the wage rates of domestic employees.[28] Thus, in addition to studying the impact on domestic employment, the impact on wages is also worth investigating. However, although there are industry-level wage data for different categories of employees, there are no firm-level counterparts in MOEA's survey. More comprehensive surveys shall definitely benefit future studies.

[28] For example, see Feenstra and Hanson (1996; 2001), Hsieh and Woo (2005), and Goldberg and Pavcnik (2007).

Appendix

A-01 Random Effect Probit Estimation with Binary Choice Model

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