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Testing for Export Performance Differential and FDI Externalities:A Firm Level Analysis of Thai Manufacturing Plants

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ABSTRACT

Thailand has been considered as one of the export driven economies in Asia, plants in manufacturing sector mainly contribute to this statue of the nation. In spite of their principal role in Thai's economy, the micro level studies on the manufacturing sector' export are relatively inadequate. Theoretically, the presence of foreign plant in the industries would generate the positive externalities to local-operated plant through three channels of spillover, information externalities, the competition effects and the demonstration effects. Previous studies mostly found a weak empirical evidence of these FDI externalities. Differentiated from previous studies, this paper firstly investigates whether foreign controlled plant statistically performs better than the local plant. Results from different approaches conventionally report that the multinational status of the plant could significantly influence not only plants' export probability, but also the plants' export intensity. However, we found weak evidence that the presence of foreign plant in industries/related industries could significantly influence either the chance to export of local plant or the export intensity of the local plant. It is actually the local plant's TFP, their product development that can increase their probability to export.

1. Introduction

As the vehicle of globalization, Multinational corporations have played the leading role in this era; many host nations have been participating in the fierce competition to attract for the entrance and presence of multinational plants. With the perception that their presence could eventually contribute to the development in their nations through various measures; for example, host nation's economic growth, balance of payment, A vast number of researches have been conducted to empirically test these aggregate impacts of FDI on host nations. However a much less studied issue is the indirect impacts of Foreign Direct investment or the MNCs' externalities to local firms. An attempt to solve this question could further provide a passage to the question of whether those provided privileges given to FDI is empirically justified . As same as other developing nations in Asia, Thailand has experienced a net inflow of foreign direct investment since the 1980 and the amount is consistently grow, and its accumulated position reached the amount of U$ 185 Billion in the year 2012.

Due to their established global network, Multinational corporations is perceived as an export catalyst for host nation's exporting activities; many of the host nation authorities, including Thailand, have been striving to attract the foreign direct investment from MNC with the underlying wisdom of promoting their nation exporting activities. Previous empirical researches reveals that the existing of Multinational Corporation in the industries would not always leads to a higher exportation of domestic firms, results vary across the industries, and even more interestingly, some of the empirical researches, which study the export performance differential between MNC and local firms in developing nation, found that in some sector/industries local firm perform better than multinational corporation in this aspect.

2. Literature Reviews

The origin of the theory of MNC is derived from Hymer (1960)'s dissertation, which fundamentally explain why this type of firms directly invest abroad. At the center of his framework, there is a firm specific advantage , which is specific asset possessed by a group of multinational corporations. This firm specific asset could allow MNCs to competitively compete with local plants in their unfamiliar markets. This possession could potentially enable multinational plants to have a higher productivity than the domestic plant.

2.1. Literatures Reviews: Export Performance Differentials

In term of export performance; Due to MNCs' superiority in their establishment of global marketing network, their international trade, which result in low transaction cost in relative to local firm's cost Ramstetter (2006). As Aitken, Hanson and Harrison (1997)'s market specific cost, Ramstetter (2006) further reviewed the whether the tendency of firm's export is related to the level of foreign participation. His work employed Probit to verify whether foreign plants has greater export possibility and ordered Probit to test whether export propensity of plant is influence by multinational status of the plant and Hed found that foreign plants are more likely to have higher export possibility and export probability than local plants. Subsidies of foreign plants have easier access to foreign markets' information or established distribution network, as they are part of the established multinational networks. Their increased cost to export to foreign markets would be less than the incremental cost to export of local operated plants; for example, plants with multinational status could use the established transport infrastructure, distribution network or existing marketing know-how. However, local operated plants do not possessed those established infrastructure and know-how, this implies that the incremental cost to export, Krungman (1989) rendered these type of incremental cost as fixed cost, is higher in the local plant sample. As a result, foreign plants are likely to have higher export performance than the local plants.

Heterogeneity productivity model (Helpman 2006) recently suggest that multinational plants are a group of plants which possess high productivity in relative to exporting plants and non-exporting plants; respectively. If we further compare the output per worker of the non-exporting and exporting plants in local establishment sample, we found that the output to labor of exporting plants, regardless of their export ratio, are greater than the output per labor of non-exporting plants. In addition, if we further compare the labor productivity across foreign and local sample, we found that output per labor in foreign-controlled plant sample is higher than output per labor in local plants in every categories of plants' export share. With this simple indicator of labor productivity, the export behavior and foreign participation of plants in Thailand relatively comply with this recent theoretical framework. Related empirical works by Hallward, Giuseppe, and Kenneth (2002) found that firm with foreign ownership and exporting firm are more productive than non-exporting firm, and the disparity is larger in less developed markets.

The purpose of this study is also to investigate whether the presence of foreign-controlled plant could statistically enhance the local plants' productivity as frequently claimed by FDI promoting authority in many host nations. Differentiated from other export spillover papers, this paper firstly verify whether the export performance gap between foreign and local plants as claimed. As the prerequisite for spillovers to arise, the gap between foreign and local plants must firstly exist. Next, we discuss the literature on export spillovers.

2.2. Literature Review: Export Spillovers

The presence of their foreign plants could potentially generate externalities to local plants; this externality to local plants is called spillover effects . The spillover toward local plants' export performance is called export spillovers. Greenaway, Sousa and Walelin (2004) pointed out that there are 3 channels of spillover through information externalities, demonstration and competition effects. Competition effect is expressed as the MNCs' employment share, while MNCs' R&D share in the industry represents demonstration effects. MNCs' export intensity represents spillovers through information externalities channel in which local plants learn from the foreign plants' export subsidies; this transmission of knowledge could potentially increase the probability to export of local plants which are existing exporters or non-exporters. Sun (2009) also found the positive spillover effect in China. In the early findings; however, Barrios, Görg and Strobl (2001) found insignificant influence from the presence of multinational firms in Spain manufacturing industries during 1990-1997. Among the findings in ASEAN countries, Blalock and Simon (2009) study the export spillover in Indonesia, and they found an evidence of spillover from the presence of foreign plants in the downstream industries. While Anwar and Nguyen (2011), study the impact of MNC's presence on both possibility to export and export share of

local plants in Vietnam, and horizontal spillovers and spillover from the existence of foreign plants in the upstream industries were reported. Jongwanish and Kohpaiboon (2010) study the export spillovers in Thailand, and they found that these positive trade externalities to local plants were reported; however, these spillover effects are not always incurred.

From the review of above literatures, the theory of MNCs advised us that MNCs are a group of firms which has proprietary asset which enable them to prevail over the local plants, and we also found that foreign plant can be an catalyst for the export activity of the local plants in the identical industries.

3. Objectives and Methodologies

Most of the plant level studies have been dedicated to verify the impact of foreign presence on local plant's export performance; however, much less studies have been designed to test for the export performance differential between foreign-invested and local plants. We perceive that both testing are interrelated and they cannot be discretely performed; to be specific, the testing involved in export performance differential is a prerequisite for the export spillover topic. As one of the main supposition of export spillover topic is the superiority of foreign plants over local operated plants, and these claimed are not always valid in every industries. In general, there are two main objectives in this study; **first objective** is to verify whether the foreign-invested plants have better export performance than local operated plants. **Secondly**, we aim to test whether the presence of foreign-invested plants could statistically influence the export performance of local plants.

The following section discusses the estimation models which are designed to test for the export performance differentials and export spillovers. **Export decision** and **Export propensity** of plant i are used as the main indicators for the analysis of both export differentials and spillovers.

After controlling other factors which could influence plant i's export performance; hence, we can observe a direct effect of multinational status of plant i toward plant i' s decision to export or export propensity. As the previous models, the control variables of capital intensity, age, size of plant i and whether plant i receive investment privileges are added to regressions. Hence the regression for probability to export (Export decision) of plant i could be written as follow.

$$Dex_i = \beta_0 + \beta_1 (K/L)_i + \beta_2 (SK/L)_i + \beta_3 productivity_i + \beta_4 DAGE_i + \beta_5 DSIZE_i + \beta_6 DBOI_i + \beta_7 DproductDEV_i + \beta_8 DMNC_i + \varepsilon_i \quad \text{eq.1}$$

For export intensity's of the plant

$$Exratio_i = \pi_0 + \pi_1 (K/L)_i + \pi_2 (SK/L)_i + \pi_3 productivity_i + \pi_4 AGE_i + \pi_5 DSIZE_i + \pi_6 DBOI_i + \pi_7 DproductDEV_i + \pi_8 DMNC_i + \varepsilon_i \quad \text{eq.2}$$

Where Dex_i is 1 when plant i engage in export, while 0 otherwise, $(Exratio)_i$ is the export ratio of plant i. While $(K/L)_i$ is capital intensity of plant i, which is quantified by the total fixed asset (beginning of the year value) divided by no. of employee in plant i, $(SK/L)_i$ is the skill intensity of the plant, it measured by number of skilled labor divided by plant's no of labor. $DAGE_i$ take value of 1 if plant i is older than industry average age, 0 otherwise. $DSIZE_i$ is 1 if sale of plant i is higher than industry average sale. $DBOI_i$ takes the value of 1 if plant i receive investment privileges from Thailand's Board of investment. $DproductDEV_i$ is dummy variable on the product development activity of the plant, if plant engage in the development of product, this variable would be marked as 1, and 0 otherwise. $DMNC_i$ is the dummy variable, 1 if the plant is foreign controlled plant[1], 0 otherwise.Since the increase in capital intensity of the plant can influence the labor productivity as more machine is available for each labor and an increase in labor productivity could influence the plants' export probability or the export propensity of the existing exporters[2]. Conversely, Ramstetter (2006) and Archanun (2011) had stated that the relationship between (K/L) and export performance should be negative in order to reflect the comparative advantage of Thailand's export structure. While K/L represents physical skill intensity, (SK/L) represents non-physical skill intensity of the plants; hence, the expected sign for this variable is also expected to be inconclusive as capital to labor ratio.

[1] As many previous studies, we considered plant as foreign controlled plant if there is 10% and above foreign participation in the plant; however, in order to enhance the interpretation; we also replace this multinational status with other types of foreign plant classification, minority foreign, majority foreign and wholly owned foreign.

[2] Please see heterogeneity productivity model [Helpman (2006)]

$$Dex_{ij}^{L} = \alpha_0 + \alpha_1 (K/L)_i^L + \alpha_2 (SK/L)_i^L + \alpha_3 productivity_i^L + \alpha_4 DAGE_i^L + \alpha_5 DSIZE_i^L + \alpha_6 DBOI_i^L$$
$$+ \alpha_7 DproductDEV_i^L + \alpha_8 Hindex_j + \alpha_9 industryex_j + \alpha_{10} SEI_j + \alpha_{11} Horizontalspill_j + \varepsilon_i \quad \text{eq.3}$$

For export propensity of local exporting plant, the response equation.

$$Exratio_{ij}^{L} = \alpha'_0 + \alpha'_1 (K/L)_i^L + \alpha'_2 (SK/L)_i^L + \alpha'_3 productivity_i^L + \alpha'_4 DAGE_i^L + \alpha'_5 DSIZE_i^L + \alpha'_6 DBOI_i^L$$
$$+ \alpha'_7 DproductDEV_i^L + \alpha'_8 Hindex_j + \alpha'_9 industryex_j + \alpha'_{10} SEI_j + \alpha'_{11} Horizontalspill_j + \varepsilon_i \quad \text{eq.4}$$

Dex^{L}_{ij} is the export decisions of the local plant i, reside in industry J. $Exratio^{L}_{ij}$ is the export propensity of local exporting plants i in industry j. Superscript L represents local operated plant.

$Hindex_j$ is the concentration ratio of industry j, measured by the number of employees by top5 plant in the industry j. The variable $industryex_j$ is the industry's export by domestic plant in relative to total export by domestic plant, this variable is added in order to control for the importance of domestic export in the industry in relative to export by domestic plant in manufacturing sector. SEI_j is added to control for potential influence from the significant of the industry j in relative to manufacturing sector toward plant's export performance who reside in industry j. This SEI_j is measured as industry j's employment in relative to total employment in manufacturing sector. Other control variables remain the same as previous section.

$Horizontalspill_j$ is the presence of foreign controlled plants in industry j. If foreign plants' export could influence the export performance of local plants through information externalities channel, then α_{11} and α''_{11} should be positive and significance. To reflect all channels of spillovers, the key variable *Horizontalspillj* would be further replaced with other measurement of each channel of spillovers, the following table summarizes the information on the measurement of each channel.

Table-1. Channel of spillover and their measurement

	Information Externalities	**Competition Effects**	**Demonstration Effects**
Measurement	$\left[\frac{Export^{MNC}}{Export^{All}}\right]_j$	$\left[\frac{Output^{MNC}}{Output^{All}}\right]_j$	$\left[\frac{R\&D^{MNC}}{R\&D^{All}}\right]_j$

As Kneller and Pisu (2007) has stated, the Heckman sample selection model (through Maximum likelihood method) should be applied in order to avoid the potential selection biased problem, while we are operating the export intensity equation. As we could not identify whether 0 export ratio indicate that either the plant is not willing to export or their export ratio is inherently 0 (although they are willing to export).

Sample selection model would firstly decide in the selection model (eq.(3) in this case) whether the particular observation is in the group of observation that will enter to the response equation (eq(4)). If the unobservales in equation 3 is not statistically correlated to the unobservable in the response equation (4), then the reported rho coefficient from Heckman selection model would not significant. This can further imply that selection process to the second equation is already random., then OLS is appropriate. By pursuing the Heckman selection method as the first step, we are allowed to verify whether an decision to export of the local plant (eq.(3)) is related to the decision on how much should they export (eq.4). In the next section we discuss the data and the scope of this study

4. Data and Scope

The data from NSO 2006's industrial census are employed throughout this study. Industrial in the census is classified by ISIC code. There are 23 ISIC main classified industries comprise of 457,968 plants of which 73,931 plant's information are in database.

However there are large discrepancies between the report from NSO and statistical report from other organizations; for example, department of labor, as well as the problem of duplication of data due to the misperception by respondents; hence the removal of observation' duplications are needed. If any two or more observations simultaneously have identical registered categories of industry, value of fixed asset, and gross sale, they would be treated as duplicated series, and one of them would be disregarded from the list. I intend to exclude Tobacco [ISIC 16], Petroleum & refinery [ISIC 23] and recycling [ISIC 37] industries from my analysis since there is limited number of foreign controlled plants in these industries.

In addition, in order to avoid disproportion representation of the firms and relatively untrustworthy response in some establishment. Thus I scope my analysis to plants with the size (classified by no. of

labor) in categories 6 and above, which have no. of workers greater than 15, and establishment which has sale per labor above Baht 5,000, and fixed asset per labor above Baht 5,000 per year. There are 12,000 plants in our study and twenty seven percent of them have been exporting the product to foreign market(s)[3].

Two third of the plants with export are medium to large plants, which have no of employees per plant exceed 50. While two third of the non-exporting plants are small plant who has number of employees less than 50 persons per plant. In the next section, we revealed the results of the study. The following table reveals the descriptive statistics of the employed observations.

Table-2. Descriptive statistics: Foreign controlled plant (at least 10% foreign capital participation) and local controlled plant[4]

	Local plants		**Foreign plants**	
Total number of plants	10,420		1,580	
Number of plants with exportation	2,348	100%	1,102	100%
Number of plants with 1% to 49% export share	1,232	52%	449	41%
Number of plants with 50% to 99% export share	828	35%	475	43%
Number of plants with 100% export share	288	12%	178	16%
Total Output (Q^{all}) by all plants (in million Baht)	1,764,383		1,400,957	
Total Capital (K^{ex}) by exporting plants (in million Baht)	437,469		465,415	
Total Labor (L^{ex}) by exporting plants (in million Baht)	651,307		524,418	
Value added (VA^{ex}) by exporting plants (in million Baht)	541,303		418,568	
Total Output (Q^{ex}) by exporting plants (in million Baht)	982,703	100%	1,103,766	100%
Total Export value (Ex) (in million Baht)	494,069	50%	689,924	63%
Total Domestic sale (Q^{ex}) - (Ex) (in million Baht)	488,634	50%	413,842	37%
Weighted Average export value per plant (in million Baht)	210.42		626.07	
Weighted Average export value per labor (in million Baht)	0.76		1.32	
Weighted Average export value per capital (in million Baht)	1.13		1.48	
Labor productivity of exporting plants (Q^{ex}/L^{ex}) (in millic Baht)	1.50		2.10	

About two out of three foreign plants export their products to abroad, while only one of five local plants engage in export activities. In term of exporting plants, fifty eight percent of total number of foreign plants has export share greater or equal to half of their manufactured outputs.

Furthermore, the export value of foreign plants is on average 2.90 times greater than the export value of local plant. Foreign plants also outweigh local operated plants in both export value per labor and export value per capital.

In term of labor productivity, we found that foreign plants have higher labor productivity than local plants in both output and value added per labor. These indicators imply the superiority of foreign plants in both export performance and productivity over the local operated plants.

5. RESULTS

5.1. Export Performance Differential

First, we further verify whether the multinational status of the plant could enhance the relative export performance of the plant.

As shown in table 2 under the selection equation of Heckman selection model, we found that multinational status of the plants can positively influence the export probability of the plant.

[3] 8677 plants contain the record of skill labors

[4] Further detail are shown in the appendix

Table-3. Results from sample selection models (Maximum likelihood), number in parenthesis is the p value of coefficient, coefficients, figure reported with **bold** figure and marked with * are significant with 0.05 significance level, figures reported with bold only are significant at 0.10 significance level. RHO(ρ) is estimated correlation between the error terms of selection and response equations.

	PROBIT	**Heckman selection**		**OLS**	
		Maximum Likelihood			
		Selection	**Response**		
C	**-2.19***	**-1.22***	0.79	**-0.01***	C
	(0.00)	(0.00)	(0.08)	(0.03)	
LOG(K/L)	-0.00	**-0.05***	**-0.18***	**-0.00***	K/L
	(0.36)	(0.02)	(0.00)	(0.00)	
LOG(Sk/L)	**0.33***	-0.01	0.06	**0.03***	Sk/L
	(0.00)	(0.70)	(0.05)	(0.00)	
PRODUCTIVTY	**0.05***	0.02	-0.02	**0.00***	PRODUCTIVITY
	(0.00)	(0.24)	(0.26)	(0.00)	
DMNC	**0.36***	**0.39***	**0.35***	**0.07***	DMNC
	(0.00)	(0.00)	(0.00)	(0.00)	
ADEDUMMY	**0.29***	**0.28***	-0.02	0.00	ADEDUMMY
	(0.00)	(0.00)	(0.67)	(0.10)	
SIZEDUMMY	**(0.13)***	**0.14***	0.09	0.00	SIZEDUMMY
	(0.04)	(0.03)	(0.06)	(0.30)	
BOIDUMMY	**3.87***	**3.77***	0.31	**0.46***	BOIDUMMY
	(0.00)	(0.00)	(0.37)	(0.00)	
PRODUCTDEV	**0.32**	**0.28***	**-0.15***	-0.01	PRODUCTDEV
	(0.00)	(0.00)	(0.01)	(0.05)	
RHO		0.09			
		(0.49)			
Wald test $\chi^2(16)$		2,609 (0.00)		0.4925	R-squared
Log likelihood		-6,301.85		1,379.13	Log likelihood
Total observation	12,000	8,677		12,000	
R-square	0.7489				

To response to the export propensity question, the response equation indicates that the multinational status of the plant could also influence the export propensity of the plant too. Wald test which reflects the goodness of fit of the model is statistically significant; however, RHO (ρ) is not statistically different from 0 which implies that both export decision and export intensity equations of the plant are not statistically related. Then, we can separately regressed the eq.(2) without sample selection biased concern. Hence the result of OLS model is also separately shown in the column in the above table. Results from probit model for export probability, OLS for export intensity of the plant also confirm the superiority of foreign plant over local plant in export. We also found that plants with BOI privileges are more export oriented than the plants without BOI privileges, and we also found that the TFP of the plant are positively related to the export propensity of the plant. The skill intensity of the plant can increase the export intensity of the plant. To conclude this export performance differential section, we found the foreign plants has greater probability to export or higher chance to be fitted in a group of plants with high export propensity than domestic plant, In addition, we also found that the foreign status of the plant in those exporting plant could lead to greater export propensity of the establishment. Our results conform with the previous studies on the comparison of plants' export probability; for example, Ramstetter(2006). Next we discuss whether this superiority of foreign plant in export performances could statistically transmitted to local control plants.

5.2. Export Spillovers

The following table presents the results from eq.(3) and eq.(4) by each channel of spillover.

Table-4. Results from sample selection models through Maximum likelihood , number in parenthesis is the p value of coefficient, coefficients, figure reported with bold figure and marked with * are significant with 0.05 significance level, figures reported with bold only are significant at 0.10 significance level. RHO (ρ) is estimated correlation between the error terms of selection and response equations. Similar results could be found from the pursuing OLS on equation (4), results are available upon the request.

Independent variables:	**Information externalities**		**Competition Effect**		**Demonstration Effect**	
	Selection	Response	Selection	Response	Selection	Response
C	**-1.50***	0.77	**-1.44***	0.75	**-1.50***	0.69
	(0.00)	(0.21)	(0.00)	(0.25)	(0.00)	(0.27)
log(K/L)	-0.03	**-0.19***	-0.03	**-0.19***	-0.03	**-0.19***
	(0.14)	(0.00)	(0.15)	(0.00)	(0.14)	(0.00)
Log(SK/L)	-0.00	0.05	-0.00	0.05	-0.00	0.05
	(0.92)	(0.22)	(0.91)	(0.22)	(0.92)	(0.22)
TFP Constant	**0.04**	-0.02	**0.04**	-0.02	**0.04**	-0.02
	(0.08)	(0.38)	(0.08)	(0.37)	(0.08)	(0.38)
Agedummy	**0.29***	-0.04	**0.29***	-0.05	**0.29***	-0.05
	(0.00)	(0.41)	(0.00)	(0.40)	(0.00)	(0.40)
Sizedummy	**0.24***	**0.14***	**0.23***	**0.14***	**0.24***	**0.15***
	(0.00)	(0.03)	(0.00)	(0.02)	(0.00)	(0.02)
BOIdummy	**3.80***	0.39	**3.81***	0.34	**3.80***	0.36
	(0.00)	(0.41)	(0.00)	(0.51)	(0.00)	(0.46)
Productdev	**0.27***	**-0.28***	**0.27***	**-0.29***	**0.27***	**-0.29***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HLABOR5	-0.05	0.37	-0.01	0.38	-0.04	0.37
	(0.79)	(0.09)	(0.94)	(0.08)	(0.81)	(0.08)
IDEI	0.41	0.77	-0.08	1.74	0.41	2.13
	(0.87)	(0.78)	(0.97)	(0.51)	(0.86)	(0.42)
ISI	0.41	1.55	1.33	0.26	0.45	-0.32
	(0.89)	(0.65)	(0.66)	(0.93)	(0.88)	(0.92)
Foreign presence	0.01	-0.18	-0.18	-0.08	0.02	0.04
	(0.90)	(0.25)	(0.37)	(0.70)	(0.80)	(0.65)
Rho	0.11		0.09		0.10	
	(0.56)		(0.64)		(0.59)	
Wald test $\chi^2(22)$	1,952.39 (0.00)		1,949.76 (0.00)		1,951.62 (0.00)	
Log likelihood	-4,629.99		-4,630.18		-4,630.51	
Total observation	7,426		7,426		7,426	

Results indicates that the export share of MNC, the output share of MNC, and the R&D share of MNC in the industry could neither influence export probability of the local plant, nor the export intensity of the local plants. Regardless of channel of spillovers and employed techniques, the presence of foreign plant in the industry could neither increase the export probability nor export intensity of local counterparts[5].

We further extend our analysis to include the presence of foreign plants in supplying industries and the presence of foreign plants in downstream industries to the base line equations eq.(3) and eq.(4); the extended models are described in the appendix section. Table 5 depicts the results from the extended model.

[5] Due to page limitation, the results of Probit, OLS and models are shown in appendix part C.

Table-5. Spillover from foreign presence in all layers, the extended model eq.(A.1) and eq.(A.2) with sample selection model, Probit, and OLS model . Number in parenthesis is the p value of coefficient, coefficients, reported with bold figure and marked with * are significant with 0.05 significant level. Coefficients marked with bold figure are significant at 0.10 significant levels.

Independent	**Sample selection model**		**Export probability**	**Export intensity**	**Independent variable**
Variables	Selection	Response	Probit	OLS	
C	**-1.38***	0.69	**-2.17***	-0.01	C
	(0.00)	(0.29)	(0.00)	(0.18)	
log(K/L)	-0.03	**-0.19***	-0.00	**-0.00***	K/L
	(0.14)	(0.00)	(0.53)	(0.00)	
log(SK/L)	-0.00	0.04	**0.32***	**0.02***	SK/L
	(0.92)	(0.25)	(0.00)	(0.00)	
TFP Constant	**0.04**	-0.02	**0.05***	**0.00***	TFP Constant
	(0.07)	(0.34)	(0.00)	(0.00)	
Agedummy	**0.29***	-0.05	**0.29***	0.00	Agedummy
	(0.00)	(0.40)	(0.00)	(0.34)	
Sizedummy	**0.23***	**0.14***	**0.22***	**0.01***	Sizedummy
	(0.00)	(0.02)	(0.00)	(0.00)	
BOIdummy	**3.81***	0.36	**3.89***	**0.45***	BOIdummy
	(0.00)	(0.47)	(0.00)	(0.00)	
Productdev	**0.27***	**-0.28***	**0.33***	**-0.02***	Productdev
	(0.00)	(0.00)	(0.00)	(0.00)	
HLABOR5	-0.02	**0.48***	-0.06	0.02	HLABOR5
	(0.92)	(0.03)	(0.71)	(0.11)	
IDEI	-0.43	-0.38	0.24	-0.10	IDEI
	(0.88)	(0.90)	(0.92)	(0.61)	
ISI	1.59	3.66	1.02	0.40	ISI
	(0.68)	(0.39)	(0.76)	(0.15)	
Spillfromup	-0.03	-0.41	0.03	-0.01	Spillfromup
	(0.90)	(0.21)	(0.88)	(0.36)	
Horizontalspill	-0.08	-0.26	-0.10	-0.02	Horizontalspill
	(0.73)	(0.33)	(0.63)	(0.22)	
Spillfromdown	-0.20	**0.58**	-0.08	0.03	Spillfromdown
	(0.53)	(0.10)	(0.77)	(0.11)	
RHO	0.10				
	(0.61)				
Wald test $\chi^2(26)$	1,953 (0.00)		0.7138	0.4628	R square
Log Likelihood	-4628.08		-1591.18	2290.58	Log Likelihood
Total observation	7,426		10,420	10,420	Total observation

We still found no evidences that the foreign presence either in the same industries or their presence in supplying industries could statistically increase the local plant's chance to export; or, their export intensity. For the local plant' export-output ratio, we found very weak evidence of spillovers from the foreign presence in downstream. Instead, we found that it is an increase in the productivity of plants i that can statistically increase their export probability. We also found that the chance to export of local plant can be influenced by the age, size and whether that particular local plant had received BOI privileges, or whether the plant had engaged in the product development.

6. Limitation and Further Study

As Lipsey (2002); the relationship between plants in different industries could conceptually be separately verified by observation of variables that represent the different layer of spillover effect. Practically, plants in the same classified industry could interact as supplier-manufacture or manufacturer-

buyer. This disarrangement could potentially alleviate the statement, obtained from the analysis; for example, a horizontal effect in table 3 is potentially overstated, since the measurement of foreign plants in the industry includes not only foreign counterpart but also foreign suppliers or buyers. We suggest any further researches to not only check industry code; but, they should also check other type of establishment's information; for example, product code.

Spillover from upstream and downstream industries are restrictedly measured as only foreign presence in upstream manufacturing industries or downstream manufacturing industries, the measurement could not be extended to include the foreign presence in the upstream/downstream in other sectors. With the increasing presence of MNCs in hotel, commercial banks, retail business in Thailand and the outward FDI by those service firms. This extension to service sectors could be the vital input for the policy makers to decide whether the privileges provided to those MNCs in service sectors are empirically justified. The new business census conducted in 2012 (micro level data are expected to be available in 2015) enlisted establishments in service and retail sectors, any further study should consider the extension of the analysis to the foreign sale in these retail and service sectors.

7. Policy Implication and Conclusion

Being as a part of the global network, foreign-controlled plants are conceptually perceived as having superiority in export performance over the local operated plants. We employed various employed methodologies, sample selection model, Probit and OLS techniques. Despite the testing techniques, the results are relatively robust across the methodologies. We found that multinational status of the plant could statistically increase both export probability and export intensity of the plants. Then, we further response to the next question of whether this superiority of foreign plant' performance could be statistically transmitted to local controlled plants. Theoretically, the externalities from foreign presences to local plants are potentially feasible through three channels of spillovers, information externalities, competition effect and demonstration effects. Regardless of how the foreign presences are measured, we found no evidence of externalities from foreign presence toward the local-operated plant. This study also acknowledge that the potential spillovers from foreign presence in upstream and downstream industries; however, we found weak evidence that only the presence of foreign plants in downstream industries could increase the export intensity of the local plant. Our results suggest that the existing of foreign plants could increase industry's export performance; and, eventually the manufacturing sector's export performance. However, there is no evidence of externalities from their presence on local plants' export performances as frequently claimed by investment promotion authorities. Authorities should instead consider the development of local plants' productivity; further encourage the investment in product development. Since these variable can increase the probability to export of local plant.

8. Acknoledgement

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APPENDIX

Part A.

To enlist the foreign presence in both supplying and buying industries. we further add two independent variables to the baseline regression (3) and (4), the model could be shown as follow.

Selection equation

$$Dex_{ij}^{L} = \alpha_0 + \alpha_1 (K/L)_i^L + \alpha_2 (SK/L)_i^L + \alpha_3 productivity_i^L + \alpha_4 DAGE_i^L + \alpha_5 DSIZE_i^L + \alpha_6 DBOI_i^L + \alpha_7 DproductDEV_i^L + \alpha_8 Hindex_j + \alpha_9 industryex_j + \alpha_{10} SEI_j + \alpha_{11} Spillfromup_j + \alpha_{12} Horizontalspill_j + \alpha_{13} Spillfromdown_j + \varepsilon_i \quad \text{eq.5}$$

Response equation

$$Exratio_{ij}^{L} = \alpha'_0 + \alpha'_1 (K/L)_i^L + \alpha'_2 (SK/L)_i^L + \alpha'_3 productivity_i^L + \alpha'_4 DAGE_i^L + \alpha'_5 DSIZE_i^L + \alpha'_6 DBOI_i^L + \alpha'_7 DproductDEV_i^L + \alpha'_8 Hindex_j + \alpha'_9 industryex_j + \alpha'_{10} SEI_j + \alpha'_{11} Spillfromup_j + \alpha'_{12} Horizontalspill_j + \alpha'_{12} Spillfromdown_j + \varepsilon_i \quad \text{eq.6}$$

and the measurement of the keys variable are illustrated in the following table

Table-A1. Measurement of foreign presence in upstream, downstream industries, and horizontal spillover the coefficients $\varphi_{mj}, and\ \sigma_{jk}$are input-output coefficients obtained from input-output table. Output, employment and R&D share are used as the proxies for the competition, worker mobility and imitation channel of spillovers.

	Spillover from upstream	Horizontal spillover	Spillover from downstream
Measurement	$\sum_{m\ if\ m\neq j} \varphi_{mj} \left[\frac{Output^{MNC}}{Ouput^{All}}\right]_m$ Where φ_{mj} is portion of industry m output to industry j	$\left[\frac{Output^{MNC}}{Output^{All}}\right]_j$	$\sum_{k\ if\ k\neq j} \sigma_{jk} \left[\frac{Output^{MNC}}{Ouput^{All}}\right]_k$ Where σ_{jk} is portion of industry j output to industry k

While the input-output coefficients ($\sigma_{jk}\ and\ \varphi_{mj}$) were obtained from NESDB (Thailand's Office of National Economic and Social Development Board). One of the challenges for investigation of vertical spillover is the integration of Input Output table to industrial census. To match with ISIC industry

classification, we had complied NESDB's input output coefficients with the NSO industrial classification. We had decided to match them at the most disaggregate level (ISIC 4 digits code) in order to effectively reflect the foreign presence in the industry. In addition, the matching at the most ISIC 4 digit code could also further enable us to outline the study to each main industry.

Part-B. As referred from the data and scope section, the descriptive statistic of the data are described as follow.

Table-A2. Summary of the number of exporting and non-exporting plants in each industry

	Export	**Non Export**	**All plants**
No. of plants	3,450	8,550	12,000
No. of local plants	2,348	8,072	10,420
Plants with ≥10% and <50% of foreign	450	302	752
Plants with ≥50% and <100%of foreign	325	109	434
Wholly owned foreign	327	67	394
No. of plant classified as MNC	1,102	478	1,580
Size			
Small <50 employees	776	5,604	6,380
Medium ≥50 and < 200 employees	1,295	2,254	3,549
Large> 200 employees	1,379	692	2,071
Industries			
Food products and Beverage	589	1,454	2,043
Textiles	353	764	1,117
Wearing apparel	252	573	825
Luggage and footwear	97	240	337
Wood and wood products	174	440	614
Paper and paper products	114	284	398
Oil and Refinery	12	34	46
Chemical and Chemical products	209	575	784
Rubber and plastic product	337	773	1,110
Other non-metallic mineral product	229	620	849
Basic metal	86	211	297
Fabricated metal	269	836	1,105
General machinery and equipment	152	422	574
Office and Accounting equipment	6	23	29
Electronic machinery	81	188	269
Radio, TV, and Communication devices	79	163	242
Optical instrument, Watch and clock	12	22	34
Automotive and parts	112	253	365
Other transportation vehicle	36	110	146
Other manufacturing industries	252	567	819
Output (Q) (in million Baht)	2,086,469	1,078,871	3,165,340
Capital (K) (in million Baht)	902,884	369,627	1,272,511
Material (M) (in million Baht)	1,184,043	635,444	1,819,487
Labor (L)	1,175,725	721,293	1,897,018
Capital intensity (K/L) (in million Bath per person)	0.77	0.51	0.67
Output per labor (Q/L) (in million Bath per person)	1.77	1.50	1.67

Part-C. As the supplement to Table 4, the results from Probit and OLS model are described in the following table.

Table-A3. Results on spillovers to all local plant, foreign presence in each categorized industry is defined through different channels of spillovers. The export dummy regression is operated with Probit model, while OLS, are separately applied to the regression which export ratio is endogenous variable. Number in parenthesis is the p value of coefficient, coefficients, reported with **bold** figure and marked with * are significant with 0.05 significant level.

	Information externalities		**Competition Effect**		**Demonstration Effect**	
Independent variable	Export probability PROBIT	Export Ratio OLS	Export probability PROBIT	Export ratio OLS	Export probability PROBIT	Export ratio OLS
C	**-2.25***	-0.00	**-2.18***	-0.00	**-2.23***	-0.01
	(0.00)	(0.52)	(0.00)	(0.53)	(0.00)	(0.36)
Capital intensity	-0.00	**-0.00***	-0.00	**-0.00***	-0.00	**-0.00***
	(0.53)	(0.00)	(0.53)	(0.00)	(0.53)	(0.00)
Skill per labor	**0.33***	0.01	**0.32***	0.01	**0.33***	0.01
	(0.00)	(0.23)	(0.00)	(0.23)	(0.00)	(0.23)
TFP Constant	**0.05***	**0.00***	**0.05***	**0.00***	**0.05***	**0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Agedummy	**0.29***	0.00	**0.29***	0.00	**0.29***	0.00
	(0.00)	(0.33)	(0.00)	(0.33)	(0.00)	(0.33)
Sizedummy	**0.23***	**0.02***	**0.22***	**0.02***	**0.23***	**0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
BOIdummy	**3.89***	**0.45***	**3.89***	**0.45***	**3.89***	**0.45***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Productdev	**0.33***	**-0.02***	**0.33***	**-0.02***	**0.33***	**-0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HLABOR5	-0.08	0.02	-0.05	0.02	-0.08	0.02
	(0.64)	(0.21)	(0.74)	(0.21)	(0.64)	(0.19)
IDEI	0.66	-0.03	0.08	-0.03	0.39	-0.00
	(0.77)	(0.89)	(0.96)	(0.88)	(0.85)	(0.99)
ISI	0.34	0.24	1.32	0.25	0.73	0.21
	(0.90)	(0.42)	(0.62)	(0.38)	(0.78)	(0.45)
Foreign presence at 4 digits	0.04	-0.00	-0.14	-0.00	0.00	0.00
	(0.72)	(0.97)	(0.45)	(0.89)	(0.96)	(0.51)
R square	0.7137	0.4531	0.7138	0.4531	0.7137	0.4531
Log likelihood	-1591.44	948.83	-1591.23	948.83	-1591.49	949.04
No. of Obs.	10,420	7,426	10,420	7,426	10,419	7,426

Results are still relatively similar to the results from Table 4 in the content; the coefficients of foreign presence at the 4 digits industry classified code are still reported as insignificant. The reported directions of other control variables are remain the same as the interpretation of Table 4.