

Home-Country R&D and Productivity Spillovers from FDI in Thailand

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ABSTRACT

Foreign direct investment (FDI) may raise the productivity of a host country. Furthermore, FDI from a home country with greater research and development (R&D) may boost productivity even more. This study employs establishment-level data from Thailand's Industrial Census together with the World Bank's R&D expenditure data to examine the influence of home-country R&D on productivity spillovers in Thailand. The combined data consists of 2018 establishments with FDI and 44 home countries. The results indicate that an establishment with FDI from a home country with high R&D expenditure tends to be more productive than others. Therefore, the government should try to attract more FDI from countries with substantial R&D expenditure.

Keywords: Research and development; Foreign direct investment; Thai.

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1. INTRODUCTION

Foreign direct investment (FDI) has increased, especially in developing nations. Such a phenomenon motivates researchers to explore the influences of FDI on several aspects of host nations. Prior studies has shown positive influences of FDI on employment, remuneration, and productivity, and many others in host nations. Therefore, FDI is an essential basis of growth for many developing nations.

There are numerous evidence that FDI results in positive productivity spillovers in host nations. Kokko *et al.* (1996) discovered positive spillovers in Uruguay. Girma (2005) and Haskel *et al.* (2007) also found similar spillovers in the United Kingdom. Blömstrom and Sjöholm (1999), Khalifah and Adam (2009), Zhao and Zhang (2010), and Behera (2015) all found the same in Indonesia, Malaysia, China, and India. Kohpaiboon (2006, 2009), Srithanpong (2014a), and Wiboonchutikula *et al.* (2016) all found similar positive spillovers in Thailand.

Positive spillovers from FDI may occur as a result of technological transfer. Therefore, FDI from a home nation with advanced technology may result in greater spillovers. In other words, FDI coming from a nation with a great deal of R&D may increase a host country's productivity even further.

Several prior researches have observed the positive influence of R&D on the productivity of establishments. Crépon *et al.* (2006) discovered that R&D increased the productivity of establishments in France. Benavente (2006) found a similar result in

Chile. Griffith *et al.* (2006) found the same in France, Germany, Spain, and the United Kingdom. Jefferson *et al.* (2006), Arvanitis (2008), and Lee (2008) all found similar results in China, Switzerland, and Malaysia. Berger (2009) and Srithanpong (2014b) both found similar results in Thailand.

Despite the fact that several studies have been carried out to investigate the effect of an establishment's R&D on its productivity, none have been conducted to my knowledge to investigate the influence of home-country R&D activities. The goal of this study is therefore to explore the consequence of home-country R&D on FDI spillovers.

Using establishment-level data from Thailand's Industrial Census and World Bank R&D expenditure data, this article studies the consequence of home-country R&D on the productivity of establishments with FDI in Thailand. The combined data set includes 2018 establishments with FDI and 44 home nations. The findings suggest that an establishment with FDI from a high-R&D-spending home country tends to be more productive than others.

The rest of this article is structured in the following fashion. The subsequent section outlines the data and Section 3 states the empirical model. Section 4 reports the findings whereas the final section provides conclusions.

2. DATA

This study employs establishment-level data from the 2007 Industrial Census, which was done by Thailand's National Statistical Office. This census year is unique since it is the only year in which detailed questions on research and development are asked. Therefore, this census year is used so that establishment R&D can be included as a control variable.

The census data are processed and calculated as follows. To calculate labor productivity, the value added is divided by the amount of labors. The value added is computed by deducting the costs of intermediate inputs from sales and other revenues. The variable *Labor Productivity* is then the natural logarithm of the calculated value. To calculate the capital-to-labor ratio, we divide the value of the stock of capital by the amount of workers. The value of capital stock is the average of the starting and ending values of fixed assets for the year. The variable *Capital-to-Labor Ratio* is then the natural logarithm of the calculated value.

The descriptions of other variables are provided in Table 1. *Foreign Ownership* indicates the foreign ownership of an establishment. *Foreign Share of Value-Added* and *Foreign Share of Employment* indicate foreign presence in an industry. *R&D Dummy* and *R&D Expenditure* indicate the R&D activity of an establishment. *Home-Country R&D* indicates the R&D level of a home or source country. *Skilled Labor Ratio* indicates the quality of labor. *Export Dummy* and *Import Dummy* indicate the export and import activities of an establishment. *Medium Dummy* and *Large Dummy* indicate the size of an establishment.

Table 1 Variable descriptions

Variable	Description
<i>Labor Productivity</i>	The natural logarithm of labor productivity, which is computed by dividing the value added by the amount of labors.
<i>Capital-to-Labor Ratio</i>	The natural logarithm of capital-to-labor ratio, which is computed by dividing the value of capital stock by the amount of labors.
<i>Foreign Ownership</i>	The percentage of shareholding by foreign entities.
<i>Foreign Share of Value-Added</i>	The foreign share of industry value-added, which is computed by dividing the total value of foreign-owned establishments by the total value of all establishments within the same industry.
<i>Foreign Share of Employment</i>	The foreign share of industry employment, which is calculated by dividing the employment of foreign-owned establishments by the total employment of all establishments within the same industry.
<i>R&D Dummy</i>	A dummy variable designating whether an establishment involves in R&D.
<i>R&D Expenditure</i>	The percentage of an establishment's expenditure on R&D from its sales.
<i>Home-Country R&D</i>	The percentage of R&D expenditure from GDP of the source or home nation of the foreign entity with highest shareholding.
<i>Skilled Labor Ratio</i>	The ratio of skilled employee to all employees.
<i>Export Dummy</i>	A dummy variable designating whether an establishment exports its product.
<i>Import Dummy</i>	A dummy variable designating whether an establishment imports its inputs.
<i>Medium Dummy</i>	A dummy variable designating whether an establishment employs 51–200 employees.
<i>Large Dummy</i>	A dummy variable designating whether an establishment employs more than 200 employees.

Summary statistics are stated in Table 2. The majority of establishments are medium-sized (40.1%), followed by large-sized establishments (33.3%). The majority of establishments export their outputs (67.7%) and import their inputs (68.0%). A fraction of establishments engage in R&D (19.5%). Foreign-owned establishments account for an average of 29.4% of total industry employment and 35.0% of total industry value added.

Table 2 Summary statistics

Variable	Average	S.D.	Minimum	Maximum	Observations
<i>Labor Productivity</i>	12.986	1.003	7.200	17.336	2,018
<i>Capital-to-Labor Ratio</i>	12.845	2.018	-7.879	17.607	2,018
<i>Foreign Ownership</i>	61.610	32.013	1	100	2,018
<i>Foreign Share of Value-Added</i>	0.350	0.186	0	0.841	2,018
<i>Foreign Share of Employment</i>	0.294	0.187	0	0.848	2,018
<i>R&D Dummy</i>	0.195	0.396	0	1	2,018
<i>R&D Expenditure</i>	1.123	6.067	0	100	2,018
<i>Home-Country R&D</i>	2.341	0.873	0.024	3.725	2,018
<i>Skilled Labor Ratio</i>	0.724	0.355	0	1	2,018
<i>Export Dummy</i>	0.677	0.468	0	1	2,018
<i>Import Dummy</i>	0.680	0.466	0	1	2,018
<i>Medium Dummy</i>	0.401	0.490	0	1	2,018
<i>Large Dummy</i>	0.333	0.472	0	1	2,018

3. MODEL

In accordance with previous studies on productivity spillovers, this study adopts the following baseline specification, which stems from a Cobb-Douglas production function.

$$\begin{aligned}
 \text{Labor Productivity}_{ij} = & \alpha + \beta_1 \text{Capital-to-Labor Ratio}_{ij} + \beta_2 \text{Foreign Ownership}_{ij} \\
 & + \beta_3 \text{Foreign Share}_j + \beta_4 \text{R \& D}_{ij} \\
 & + \beta_5 \text{Home-Country R \& D}_{ij} + X_{ij}'\delta + \varepsilon_{ij}
 \end{aligned}$$

where i is an index of establishment and j is an index of industry. *Foreign Share* can be either *Foreign Share of Value-Added* or *Foreign Share of Employment*. *R&D* can be either *R&D Dummy* or *R&D Expenditure*. X is a vector of other establishment characteristics.

Since *Home-Country R&D* indicates the R&D expenditure of a source or home country and an establishment with FDI from a high-R&D-spending source country should be more productive than others, the coefficient of *Home-Country R&D* is expected to be positive.

While estimating the above model, robust clustered standard errors are utilized to accommodate for any heteroskedasticity. Specifically, clustered standard errors allow observations within the same industry to be correlated.

4. RESULTS

The results of the regression analysis performed on labor productivity are presented in Table 3. *Foreign Share of Value-Added* is used in the first two specifications, while

Foreign Share of Employment is used in the last two specifications. *R&D Dummy* is used in the first and the third specifications, while *R&D Expenditure* is used in the second and the fourth specifications.

The results from Table 3 show that an establishment with FDI from a high-R&D-expenditure home country tends to be more productive than others. The coefficient of *Home-Country R&D* is always significant and positive at the one percent level. This finding suggests that there exist greater productivity spillovers from FDI originating in a nation with a great amount of R&D spending.

The findings also indicate that an establishment with R&D activities tends to be more productive than others. The coefficient of *R&D Dummy* is always significant and positive at the one percent level. This also means the above finding is robust to controlling for the R&D activities of an establishment.

Table 3 Labor productivity and home-country R&D

	(1)	(2)	(3)	(4)
<i>Capital-to-Labor Ratio</i>	0.151*** (0.0337)	0.151*** (0.0343)	0.151*** (0.0347)	0.150*** (0.0353)
<i>Foreign Ownership</i>	0.00253*** (0.000861)	0.00230** (0.000900)	0.00292*** (0.000896)	0.00269*** (0.000929)
<i>Foreign Share of Value-Added</i>	0.262 (0.234)	0.275 (0.240)		
<i>Foreign Share of Employment</i>			0.0174 (0.230)	0.0326 (0.232)
<i>R&D Dummy</i>	0.251*** (0.0545)		0.254*** (0.0561)	
<i>R&D Expenditure</i>		0.00482 (0.00405)		0.00483 (0.00404)
<i>Home-Country R&D</i>	0.106*** (0.0325)	0.107*** (0.0317)	0.111*** (0.0323)	0.113*** (0.0316)
<i>Skilled Labor Ratio</i>	0.0650 (0.0656)	0.0688 (0.0678)	0.0711 (0.0660)	0.0749 (0.0682)
<i>Export Dummy</i>	0.0880 (0.0815)	0.0910 (0.0811)	0.0844 (0.0801)	0.0875 (0.0798)
<i>Import Dummy</i>	0.148* (0.0701)	0.169** (0.0731)	0.155* (0.0709)	0.176** (0.0741)
<i>Medium Dummy</i>	-0.0718 (0.0695)	-0.0584 (0.0700)	-0.0682 (0.0705)	-0.0546 (0.0709)
<i>Large Dummy</i>	-0.391*** (0.0754)	-0.363*** (0.0760)	-0.383*** (0.0751)	-0.355*** (0.0757)

	(1)	(2)	(3)	(4)
<i>Constant</i>	10.46*** (0.413)	10.48*** (0.416)	10.50*** (0.429)	10.52*** (0.431)
Observations	2018	2018	2018	2018
R^2	0.173	0.164	0.171	0.162

Note: *Labor Productivity* is the dependent variable. Numbers in parentheses are clustered standard errors. The 10-, 5-, and 1-percent-level significances are designated by *, **, and ***, respectively.

The findings also suggest that an establishment with FDI inclines to be more productive than others. The coefficient of *Foreign Ownership* is always significant and positive at the five percent level or better. An establishment that import their inputs tends to be more productive than others. That of *Import Dummy* is always significant and positive at the ten percent level or better. A large-sized establishment tends to be less productive than others. That of *Large Dummy* is always significant and negative at the one percent level.

In sum, the findings indicate that an establishment with FDI from a home country that invests a large amount in R&D inclines to be more productive than others. In other words, there are stronger productivity spillovers from FDI coming from a nation that has a great amount of R&D.

5. CONCLUSION

This article studies the impact of home-country R&D on productivity spillovers that are caused by FDI in Thailand using establishment-level data from Thailand's Industrial Census and World Bank R&D expenditure data. The combined data set contains 2018 establishments with FDI as well as 44 home nations.

According to the findings, establishments that receive FDI from countries that have high R&D spending at home have a high tendency to be more productive than those that do not. In other words, FDI from a country with a high R&D expenditure leads to greater productivity spillovers. The finding is robust to controlling for an establishment's R&D activities.

Since the government normally provides tax incentives to attract FDI, the practice of FDI promotion is quite costly. To reap more benefits and increase spillovers, the government may seek to attract more FDI from nations with great R&D spending rather than those with little R&D spending.

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