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R&D and Productivity Spillovers from FDI: Evidence from the Thai Manufacturing Industry

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ABSTRACT

Research and development (R&D) as well as foreign direct investment (FDI) have been found to increase the Thai manufacturing sector's productivity. R&D in Thai plants may enhance the productivity spillovers from FDI. The aforementioned effect, however, has never been studied in Thailand. This study, therefore, aims to assess the impact of R&D on productivity spillovers from FDI in Thailand's manufacturing sector. This study utilizes data from Thailand's Industrial Census, which also gathered data on R&D activities. The regression results not only indicate that R&D increases the labor productivity of a plant, but also indicate that the R&D enhances the positive spillovers from FDI. In other words, a plant with R&D tends to gain benefits from spillovers more than one without R&D. To boost productivity, the government may encourage businesses, especially in an industry with a high foreign presence, to engage in R&D. Also, the government may want to attract more FDI into an industry where domestic firms actively engage in R&D.

INTRODUCTION

It is normally believed that foreign direct investment (FDI) is among one of the significant sources of growth for many emerging economies, including Thailand. FDI can improve the productivity of a host country via several channels, including technological transfer, trained labor, and increased competition. Consequently, developing economies' governments are trying to attract more FDI into their countries.

FDI has been found to positively affect the productivity of a host country in many prior studies. Kokko et al. (1996) and Blomstrom and Sjoholm (1999) found this positive effect in Uruguay and Indonesia. In addition, Liu and Wang (2003), Dimelis and Louri (2004), Haskel et al. (2007), Yasar and Paul (2007), Chudnovsky et al. (2008), Kosteas (2008), Khalifah and Adam (2009), and Behera (2015) also discovered such positive effects in China, Greece, the United Kingdom, Turkey, Argentina, Mexico, Malaysia, and India, respectively. In the case of Thailand, Kohpaiboon (2006, 2009) discovered that FDI positively impacts the productivity of the Thai manufacturing sector. Furthermore, Srithanpong (2014a) and Wiboonchutikula et

al. (2016) also discovered the same results in Thailand. These previous studies suggest positive productivity spillovers from FDI.

Productivity is also hugely determined by research and development (R&D). Many researchers have found that R&D positively impacts the productivity of the manufacturing industry. Benavente (2006), Crepon et al. (2006), Jefferson et al. (2006), and Arvanitis (2008) found this positive effect in Chile, France, China, and Switzerland, respectively. Janz et al. (2004) found similar results in Sweden and Germany, while Griffith et al. (2006) discovered similar findings in France, Spain, as well as the United Kingdom. In the case of Thailand, Berger (2009) and Srithanpong (2014b) found that R&D increases the productivity of the Thai manufacturing industry. All of these studies point to the significance of R&D for productivity.

R&D may impact productivity and also affect how FDI increases productivity. R&D may allow domestic companies to better imitate and learn from overseas companies. Blomstrom and Kokko (1998) argued that the positive impact of FDI possibly increases with the degree of local capability. Kokko et al. (1996) discovered that only domestic firms with at least some capability benefit from FDI spillovers. This indicates the significance of absorptive capacity.

Even though it is generally thought that absorptive capacity can influence the magnitude of productivity spillovers, there is no consensus on what is a good measure of absorptive capacity. Some prior studies, such as Khordagui and Saleh (2013) and Nguyen (2016), use human capital and institutional quality to proxy for absorptive capacity at a macro level. On the other hand, other prior studies, such as Kinoshita (2001), Barrios et al. (2004), Chudnovsky et al. (2008), Fu (2008), and Suyanto et al. (2009), use R&D as a proxy for absorptive capacity at a firm level. R&D, thus, may affect productivity not only by itself, but also via absorptive capacity.

R&D has been found to positively affect productivity spillovers from FDI. Kinoshita (2001), Chudnovsky et al. (2008), and Suyanto et al. (2009) discovered such positive impacts of R&D on FDI spillovers in the Czech Republic, Argentina, and Indonesia, respectively. Barrios et al. (2004) found the same finding in Greece, Ireland, and Spain. These studies suggest the significance of R&D to absorptive capacity.

Since Thailand relies greatly on FDI, numerous researchers looked into FDI in Thailand. Most of them concentrated on the determinants of FDI in Thailand, while only a few studies, such as Kohpaiboon (2006, 2009), studied the influence of FDI on productivity. So far, no prior studies on FDI in Thailand have focused on its absorptive capacity. This study, therefore, intends to assess the impact of R&D on productivity spillovers from FDI in the Thai economy.

So as to study R&D as well as productivity spillovers from FDI in the Thai economy, this study utilizes plant-level data from Thailand's Industrial Census. It was carried out by the National Statistical Office and one round of the census asked plants about R&D activities. This census is thus suitable for studying the influences of both R&D and FDI on productivity.

The results of this study indicate that R&D positively affects productivity spillovers from FDI in Thailand. This finding contributes to the current literature by offering additional evidence of absorptive capacity proxy measured by R&D in an emerging economy. The remainder of this paper is structured as follows. The subsequent section explains the data used and the method utilized, Section 2 reports the results, and the last section provides conclusion.

1. DATA AND METHOD

Plant-level dataset used in this study are retrieved from Thailand's Industrial Census, which was carried out by the National Statistical Office. The census reports information on plant characteristics. It is essential to note that, unlike censuses from other years, the 2007 one includes information on plant R&D activities. R&D expenses are specifically reported only in the 2007 census. The raw data contained more than 70,000 plants. After dropping those with missing values, there are more than 50,000 plants left in the dataset.

In this study, variables acquired from the census are plant's industry (four-digit ISIC categories), foreign ownership, export and import activities, skilled and unskilled labour employment, intermediate costs,

inventory, revenue, fixed assets, and R&D expenditure. To calculate a plant's value added; its intermediate costs are deducted from its total revenue and a change in its inventory. The capital stock of a plant is defined to be the average of its fixed assets between the start and end of a year.

This study employs the subsequent regression specification, which is developed from the Cobb-Douglas production function, in accordance with prior literature on productivity spillovers.

$$\ln\left(\frac{Y_{ij}}{L_{ij}}\right) = \alpha + \beta_1 \ln\left(\frac{K_{ij}}{L_{ij}}\right) + \beta_2 ForOwn_{ij} + \beta_3 RnD_{ij} + \beta_4 ForIndShare_j + \beta_5 \left(RnD_{ij} \times ForIndShare_j\right) + X_{ij}^{'}\delta + \varepsilon_{ij}$$

where *i* is an index of plant and *j* is an index of industry. *Y* is the plant's value added, *L* is its employment, and *K* is its capital stock. Therefore, *Y/L* is labour productivity and *K/L* represents the capital intensity of a plant. *ForOwn* represents foreign ownership of a plant, while *RnD* captures its R&D. *ForIndShare* captures the foreign presence in an industry. *X* is a vector of plant characteristics. The interaction term is included to allow R&D to affect productivity spillovers from foreign presence.

Foreign ownership of a plant or *ForOwn* may be represented by either a dummy variable or the share of foreign ownership. Specifically, *ForOwn_01* is a dummy variable, takeing a value one if foreign entities own 10 percent or more, and zero otherwise. *ForOwn_Pct* is the percentage share owned by foreign entities. Similarly, R&D activities or *RnD* may be measured by either a dummy variable or R&D expenditure. Specifically, *RnD_01* is a dummy variable, takeing a value one if a plant involves in R&D, and zero otherwise. *RnD_Pct* is the R&D expenses as a percentage of sales.

Foreign presence in an industry or *ForIndShare* can be represented by either the foreign share of value added in an industry, *ForIndShare_VA*, or the foreign share of employment in an industry, *ForIndShare_Emp*. Specifically, *ForIndShare_VA* is computed as the value added ratio of foreign plants to total value added in each industry. Similarly, *ForIndShare_Emp* is calculated as the employment ratio of foreign establishments to total employment in each industry.

Plant characteristics may include the ratio of skilled labour to aggregate labour, *Skill*, an export dummy, *Export*, an import dummy, *Import*, and size dummies, *Medium* and *Large*. Specifically, *Export* takes a value one if a plant exports its output, and zero otherwise. *Import* takes a value one if a plant imports its inputs, and zero otherwise. *Medium* takes a value one if a plant hires 50-199 employees, and zero otherwise. *Large* takes a value one if a plant hires 200 or more employees, and zero otherwise.

The data set consists of more than 50,000 plants in 125 industries. Summary statistics are reported in Table 1. Note that *Y/L* and *K/L* are included in their natural logarithm forms. The correlation matrix is reported in the Appendix.

Table 1. Summary statistics

Variable	*Mean*	*Minimum*	*Maximum*	*Standard Deviation*	*Observations*
ln(Y/L)	11.563	2.731	17.955	1.422	51,055
ln(K/L)	11.572	-8.570	18.638	2.229	51,055
ForOwn_01	0.047	0	1	0.212	51,055
ForOwn_Pct	2.998	0	100	14.935	51,055
RnD_01	0.055	0	1	0.229	51,055
RnD_Pct	0.345	0	170	3.426	51,055
ForIndShare_VA	0.266	0	0.841	0.217	125
ForIndShare_Emp	0.218	0	0.848	0.202	125
Skill	0.748	0	1	0.378	51,055
Export	0.113	0	1	0.317	51,055
Import	0.122	0	1	0.328	51,055
Medium	0.140	0	1	0.346	51,055
Large	0.062	0	1	0.240	51,055

Source: own

In the data set, most of the plants are small plants (79.8%), followed by medium plants (14.0%) and large plants (6.2%). Only some plants export their outputs (11.3%) and some plants import their inputs (12.2%). A small fraction of plants have foreign ownership exceeding 10 percent (4.9%). Also, only a small fraction of plants engage in R&D activities (5.5%). In terms of foreign presence, plants with foreign ownership account for, on average, 26.6% of aggregate value added and 21.8% of total employment in each industry. This indicates the significant existence of foreign investment and foreign entities in the Thai economy and its manufacturing sector.

2. RESULTS

The results from regressions of labour productivity are stated in Tables 2 and 3. To take care of possible heteroscedasticity, robust clustered standard errors are employed. Particularly, clustered standard errors permit correlations between observations or plants in the same industry. In both tables, *ForOwn_01* is employed in the first, third, and fifth specifications, while *ForOwn_Pct* is employed in the second, fourth, and sixth specifications or columns. The interaction term in the first and second specifications uses *RnD_01*, while that in the third and fourth specifications uses *RnD_Pct*. On the other hand, the fifth and sixth specifications include both interaction terms. Also, *ForIndShare_VA* is used in Table 2, while *ForIndShare_Emp* is used in Table 3. All other control variables, *ln(K/L)*, *RnD_Pct*, *Skill*, *Export*, *Import*, *Medium,* and *Large*, are included in all regression specifications.

Table 2. Regressions of labour productivity on R&D and FDI using value added

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ln(K/L)	0.270*** (0.0243)	0.270*** (0.0243)	0.270*** (0.0243)	0.271*** (0.0243)	0.270*** (0.0243)	0.270*** (0.0243)
ForOwn_01	0.213*** (0.0456)		0.219*** (0.0460)		0.214*** (0.0458)	
ForOwn_Pct		0.00201** (0.000738)		0.00207** (0.000742)		0.00203** (0.000742)
RnD_Pct	0.00562** (0.00229)	0.00555** (0.00228)	0.0162*** (0.00450)	0.0161*** (0.00452)	0.0157*** (0.00430)	0.0157*** (0.00430)
ForIndShare_VA	0.775*** (0.250)	0.784*** (0.250)	0.839*** (0.248)	0.849*** (0.249)	0.789*** (0.251)	0.798*** (0.251)
Skill	0.0462 (0.0598)	0.0462 (0.0598)	0.0435 (0.0599)	0.0435 (0.0599)	0.0460 (0.0598)	0.0460 (0.0598)
Export	0.321*** (0.0405)	0.331*** (0.0404)	0.326*** (0.0402)	0.336*** (0.0400)	0.318*** (0.0404)	0.329*** (0.0403)
Import	0.485*** (0.0519)	0.494*** (0.0522)	0.500*** (0.0533)	0.509*** (0.0537)	0.482*** (0.0517)	0.491*** (0.0520)
Medium	0.570*** (0.0485)	0.573*** (0.0484)	0.581*** (0.0481)	0.585*** (0.0480)	0.568*** (0.0483)	0.571*** (0.0482)
Large	0.382*** (0.0530)	0.386*** (0.0531)	0.403*** (0.0536)	0.408*** (0.0537)	0.379*** (0.0528)	0.384*** (0.0529)
RnD_01 x ForIndShare_VA	0.708*** (0.165)	0.716*** (0.165)			0.811*** (0.157)	0.820*** (0.157)
RnD_Pct x ForIndShare_VA			-0.0218 (0.0134)	-0.0216 (0.0135)	-0.0396*** (0.0115)	-0.0395*** (0.0115)
Constant	8.031*** (0.378)	8.027*** (0.378)	8.018*** (0.377)	8.013*** (0.378)	8.030*** (0.377)	8.025*** (0.378)
Observations	51055	51055	51055	51055	51055	51055
R^2	0.336	0.335	0.335	0.334	0.336	0.335

Note: The dependent variable is *ln(Y/L)*. Values in brackets are robust clustered standard errors. The symbols *, **, and *** designate significance at the levels of 10, 5, and 1%.

From Tables 2 and 3, the results indicate that productivity spillovers from FDI exist in the Thai economy. The coefficients of *ForIndShare_VA* and *ForIndShare_Emp* are always positive and significant at the one percent level. This indicates that a higher foreign existence in an industry is associated with the higher productivity of a plant in the same industry. This finding is consistent with Kohpaiboon (2006, 2009) as well as Srithanpong (2014a).

The results also show that R&D at a plant boosts labour productivity. The coefficients of *RnD_Pct* are always positive and significant at the five percent level. This means that a plant's R&D expenditure is positively linked to its productivity. This finding is in accordance with Berger (2009) and Srithanpong (2014b).

Table 3. Regressions of labour productivity on R&D and FDI using employment

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ln(K/L)	0.267*** (0.0231)	0.268*** (0.0231)	0.267*** (0.0230)	0.268*** (0.0230)	0.267*** (0.0231)	0.268*** (0.0230)
ForOwn_01	0.176*** (0.0527)		0.179*** (0.0534)		0.175*** (0.0531)	
ForOwn_Pct		0.00140 (0.000853)		0.00143 (0.000861)		0.00140 (0.000861)
RnD_Pct	0.00817*** (0.00239)	0.00811*** (0.00240)	0.0184*** (0.00357)	0.0183*** (0.00358)	0.0182*** (0.00350)	0.0182*** (0.00351)
ForIndShare_Emp	1.289*** (0.275)	1.302*** (0.275)	1.348*** (0.275)	1.362*** (0.275)	1.307*** (0.277)	1.321*** (0.277)
Skill	0.0334 (0.0564)	0.0333 (0.0564)	0.0316 (0.0564)	0.0315 (0.0564)	0.0329 (0.0564)	0.0329 (0.0563)
Export	0.320*** (0.0400)	0.331*** (0.0398)	0.322*** (0.0394)	0.333*** (0.0392)	0.317*** (0.0398)	0.328*** (0.0396)
Import	0.471*** (0.0496)	0.480*** (0.0500)	0.477*** (0.0502)	0.487*** (0.0507)	0.467*** (0.0493)	0.477*** (0.0498)
Medium	0.565*** (0.0471)	0.568*** (0.0470)	0.570*** (0.0465)	0.574*** (0.0464)	0.563*** (0.0468)	0.566*** (0.0467)
Large	0.373*** (0.0535)	0.378*** (0.0535)	0.385*** (0.0535)	0.390*** (0.0536)	0.370*** (0.0532)	0.375*** (0.0532)
RnD_01 x ForIndShare_Emp	0.424* (0.209)	0.433* (0.209)			0.614*** (0.212)	0.623*** (0.213)
RnD_Pct x ForIndShare_Emp			-0.0396*** (0.0129)	-0.0395*** (0.0129)	-0.0539*** (0.0134)	-0.0541*** (0.0134)
Constant	8.040*** (0.363)	8.035*** (0.363)	8.034*** (0.362)	8.029*** (0.362)	8.039*** (0.363)	8.035*** (0.363)
Observations	51055	51055	51055	51055	51055	51055
R^2	0.342	0.341	0.342	0.341	0.342	0.342

Note: The dependent variable is ln(Y/L). Values in brackets are robust clustered standard errors. The symbols *, **, and *** designate significance at the levels of 10, 5, and 1%.

The results in both tables also show that a plant with foreign ownership has a tendency to have higher labour productivity. The coefficient of *ForOwn_01* is always positive and significant at the one percent level. The coefficient of *ForOwn_Pct* is always positive and almost always significant. Also, a plant that exports its output or imports its inputs tends to have higher labour productivity. The coefficients of *Export* and *Import* are always positive and significant at the one percent level. The results also indicate that medium and large plants tend to be more productive. The coefficients of *Medium* and *Large* are always positive and significant at the one percent level.

Importantly, the results suggest that R&D engagement increases productivity spillovers from FDI. The coefficients of *RnD_01 x ForIndShare_VA* and *RnD_01 x ForIndShare_Emp* are always positive and almost always significant at the ten percent level. This indicates that a plant with R&D tends to absorb the benefits

from spillovers more than one without R&D. This may be because a plant with R&D has more capability to absorb spillovers from foreign plants in the same industry. This finding is consistent with Kinoshita (2001), Barrios et al. (2004), Chudnovsky et al. (2008), and Suyanto et al. (2009) discovered in other countries.

The results also suggest that, given R&D engagement, an increase in R&D spending decreases the productivity spillovers from FDI. The coefficients of *RnD_Pct x ForIndShare_VA* and *RnD_ Pct x ForIndShare_Emp* are always negative and almost always statistically significant. This means that a plant with a high R&D spending tends to absorb the benefits from spillovers less than one with a low R&D spending. This could be because a plant with high R&D expenditure already has high productivity, resulting in a smaller technological gap between such plants and foreign plants, and thereby smaller productivity spillovers. Note that a threshold regression with the R&D expenditure as an endogenous threshold yields a similar finding. The outputs from the threshold regressions are shown in the Appendix.

Table 4. Regressions of labour productivity on R&D and FDI—robustness checks

	(1) *Robust*	*(2)* *Robust*	*(3)* *Median*	*(4)* *Median*
ln(K/L)	0.358*** (0.00217)	0.354*** (0.00216)	0.324*** (0.00299)	0.322*** (0.00307)
ForOwn_ Pct	0.00125*** (0.000355)	0.000862** (0.000354)	0.00122*** (0.000371)	0.00113*** (0.000356)
RnD_Pct	0.0112*** (0.00236)	0.0138*** (0.00203)	0.0139*** (0.00411)	0.0157*** (0.00182)
ForIndShare_VA	0.788*** (0.0336)		0.885*** (0.0341)	
ForIndShare_Emp		1.169*** (0.0381)		1.239*** (0.0402)
Skill	-0.0320** (0.0126)	-0.0409*** (0.0125)	-0.0210 (0.0138)	-0.0279* (0.0141)
Export	0.271*** (0.0192)	0.270*** (0.0192)	0.272*** (0.0170)	0.265*** (0.0180)
Import	0.405*** (0.0180)	0.396*** (0.0179)	0.405*** (0.0167)	0.399*** (0.0178)
Medium	0.538*** (0.0148)	0.535*** (0.0148)	0.545*** (0.0133)	0.538*** (0.0145)
Large	0.366*** (0.0228)	0.361*** (0.0228)	0.366*** (0.0182)	0.369*** (0.0196)
RnD_01 x ForIndShare_VA	0.585*** (0.0788)		0.672*** (0.0861)	
RnD_Pct x ForIndShare_VA	-0.0275*** (0.00720)		-0.0318** (0.0119)	
RnD_01 x ForIndShare_Emp		0.452*** (0.0937)		0.566*** (0.0899)
RnD_Pct x ForIndShare_Emp		-0.0415*** (0.00763)		-0.0485*** (0.00862)
Constant	7.106*** (0.0266)	7.136*** (0.0263)	7.482*** (0.0370)	7.509*** (0.0377)
Observations	51055	51055	51055	51055
R^2 or pseudo R^2	0.447	0.451	0.211	0.215

Note: The dependent variable is *ln(Y/L)*. Values in brackets are robust clustered standard errors. The symbols *, **, and *** designate significance at the levels of 10, 5, and 1%.

To check the robustness of the findings, different regression specifications, estimation methods, and subsamples may be utilized. Table 4 and 5 employ similar regression specifications as the last ones in Table 2 and 3. To check whether the results are affected by estimation methods, Table 4 employs robust

regression and median regression instead. Since they are resistant to outliers, the results may not be driven by outliers.

Table 5. Regressions of labour productivity on R&D and FDI—subsamples

	(1) *Domestic plants*	*(2)* *Domestic plants*	*(3)* *Foreign plants*	*(4)* *Foreign plants*
ln(K/L)	0.273***	0.270***	0.148***	0.148***
	(0.0244)	(0.0230)	(0.0280)	(0.0290)
ForOwn_ Pct	0.0329	0.0259	0.00285***	0.00328***
	(0.0207)	(0.0218)	(0.000848)	(0.000871)
RnD_Pct	0.0134***	0.0169***	0.0193	0.00873
	(0.00443)	(0.00398)	(0.00975)	(0.00627)
ForIndShare_VA	0.825***		0.287	
	(0.265)		(0.231)	
ForIndShare_Emp		1.428***		-0.0158
		(0.297)		(0.233)
Skill	0.0488	0.0346	0.0606	0.0654
	(0.0603)	(0.0564)	(0.0589)	(0.0592)
Export	0.348***	0.344***	0.0709	0.0693
	(0.0400)	(0.0385)	(0.0878)	(0.0865)
Import	0.514***	0.495***	0.175**	0.187***
	(0.0532)	(0.0509)	(0.0628)	(0.0633)
Medium	0.580***	0.572***	-0.0376	-0.0295
	(0.0515)	(0.0503)	(0.0646)	(0.0652)
Large	0.456***	0.453***	-0.343***	-0.329***
	(0.0571)	(0.0573)	(0.0739)	(0.0736)
RnD_01 x ForIndShare_VA	0.949***		0.530***	
	(0.187)		(0.138)	
RnD_Pct x ForIndShare_VA	-0.0351**		-0.0514	
	(0.0125)		(0.0299)	
RnD_01 x ForIndShare_Emp		0.775**		0.530***
		(0.274)		(0.180)
RnD_Pct x ForIndShare_Emp		-0.0524***		-0.0295
		(0.0153)		(0.0282)
Constant	7.974***	7.984***	10.65***	10.71***
	(0.377)	(0.360)	(0.352)	(0.365)
Observations	48653	48653	2402	2402
R^2	0.314	0.322	0.155	0.149

Note: The dependent variable is *ln(Y/L)*. Values in brackets are robust clustered standard errors. The symbols *, **, and *** designate significance at the levels of 10, 5, and 1%.

From Table 4, the results confirm the augmenting effect of R&D on productivity spillovers from FDI. The coefficients of *RnD_01 x ForIndShare_VA* and *RnD_01 x ForIndShare_Emp* are still positive and significant at the one percent level. This confirms that the results are not driven by outliers.

In Table 5, the first and second specifications use only domestic plants, while the third and fourth specifications use only foreign plants. Specifically, domestic plants are those with no foreign ownership or less than 10 percent of foreign ownership, while foreign plants are those with at least 10 percent of foreign ownership.

From Table 5, the results again confirm the augmenting influence of R&D on productivity spillovers from FDI. The coefficients of *RnD_01 x ForIndShare_VA* and *RnD_01 x ForIndShare_Emp* are positive and significant at the one percent level in both subsamples. This indicates that the results are not driven by foreign plants.

To sum up, the regression results indicate the prevalence of productivity spillovers from FDI and the augmenting effect of R&D on such spillovers in the Thai manufacturing industry. The results are robust to different regression specifications, estimation methods, and subsamples.

CONCLUSIONS

This paper studies the effect of R&D on productivity spillovers from FDI in the Thai economy. This study utilizes plant-level data from 2007 Thailand's Industrial Census, which is the only round of census asking plants about their R&D activities. The dataset used in this study contains more than 50,000 plants from 125 industries. In this study, an interaction term between R&D and FDI is incorporated to allow R&D to affect productivity spillovers from FDI. R&D, therefore, may be regarded as a proxy for absorptive capacity.

The results indicate that productivity spillovers from FDI exist in the Thai economy. This means that a plant in an industry with a high foreign presence has a tendency to be more productive than others. The results also indicate that R&D boosts plant productivity. In other words, a plant with R&D has a tendency to be more productive than one without R&D. These findings are consistent with prior studies.

Interestingly, the results show the augmenting influence of R&D on productivity spillovers from FDI. Specifically, a plant with R&D tends to get productivity spillovers more than one without R&D. This is possibly because a plant with R&D has more capability to absorb spillovers from foreign plants in the same industry.

The results also suggest that, given R&D engagement, an increase in R&D spending lowers the productivity spillovers from FDI. This means that a plant with a high R&D spending tends to receive productivity spillovers less than one with a low R&D expenditure. This is possibly because a plant with significant R&D expenditure already has high productivity, resulting in a smaller technological gap between such plants and foreign plants, and hence less productivity spillovers.

The government can boost the productivity of the manufacturing sector by encouraging businesses to engage in R&D. In doing so, the government can focus on firms in an industry with a high foreign presence. It is because R&D would also allow them to absorb more productivity spillovers from foreign firms within the same industry. In addition, the government may focus on businesses that have not yet engaged in R&D. It is because they tend to get more productivity spillovers than those already engaged in R&D. In attracting FDI, the government may want to give privileges to investors in an industry where domestic plants actively engaged in R&D. This is because there will be more productivity spillovers in such industry.

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APPENDIX

Table A1. Correlation matrix

	ln(Y/L)	*ln(K/L)*	*ForOwn_01*	*ForOwn_Pct*	*RnD_01*	*RnD_Pct*	*ForIndShare_VA*	*ForInd-Share_Emp*	*Skill*	*Export*	*Import*	*Medium*
ln(K/L)	0.487	1										
ForOwn_01	0.215	0.124	1									
ForOwn_Pct	0.203	0.120	0.901	1								
RnD_01	0.202	0.107	0.122	0.110	1							
RnD_Pct	0.083	0.049	0.050	0.047	0.415	1						
ForIndShare_VA	0.180	0.074	0.218	0.229	0.083	0.043	1					
ForIndShare_Emp	0.231	0.104	0.241	0.255	0.092	0.045	0.896	1				
Skill	0.020	0.070	-0.018	-0.016	-0.045	-0.012	0.018	0.029	1			
Export	0.291	0.154	0.379	0.372	0.252	0.092	0.163	0.193	-0.035	1		
Import	0.313	0.167	0.376	0.374	0.264	0.114	0.217	0.245	-0.040	0.528	1	
Medium	0.234	0.094	0.160	0.147	0.167	0.050	0.104	0.117	-0.080	0.255	0.229	1
Large	0.174	0.081	0.241	0.242	0.218	0.084	0.096	0.130	-0.058	0.416	0.333	-0.103

Table A2. Regression of labour productivity on R&D and FDI—endogenous threshold

	(1) Threshold		*(2) Threshold*	
ln(K/L)	0.269*** (0.00493)		0.266*** (0.00487)	
ForOwn_ Pct	0.00229*** (0.000361)		0.00165*** (0.000364)	
RnD_Pct	0.00488 (0.00251)		0.00211*** -0.00207	
ForIndShare_VA	0.839*** (0.0353)			
ForIndShare_Emp			1.356*** (0.0394)	
Skill	0.0485*** (0.0145)		0.365** (0.0144)	
Export	0.313*** (0.0185)		0.310*** (0.0185)	
Import	0.477*** (0.0170)		0.455*** (0.0170)	
Medium	0.554*** (0.0147)		0.543*** (0.0146)	
Large	0.358*** (0.0215)		0.339*** (0.0216)	
Threshold Variable: *RnD_Pct*	= 0	> 0	= 0	> 0
RnD_Pct x ForIndShare_VA		-0.0178*** (0.00763)		
RnD_Pct x ForIndShare_Emp				-0.0383*** (0.00837)
Constant	8.0248*** (0.0565)	8.429*** (0.0655)	8.0399*** (0.0557)	8.447*** (0.0647)
Observations	51055		51055	
BIC	15038.274		14477.526	
HQIC	14959.311		14398.563	

Note: The dependent variable is *ln(Y/L)*. Values in brackets are robust clustered standard errors. The symbols *, **, and *** designate significance at the levels of 10, 5, and 1%.