Comparing Productivity in Foreign-Invested and Local Plants in Thai Manufacturing

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Abstract. This study investigates productivity differentials between foreign-controlled plants and local plants in Thai Manufacturing industries using the firm-level data from the NSO 2005 industrial census. With Translog production function; first we compare the total factor productivity (TFP) and labor productivity of multinational plants and local plants. Results revealed that only 8 out of 18 industries were reported with superiority of multinational plants in TFP and labor productivity over local plants. If both intercept and all of the slope coefficients are allowed to vary across foreign and local plant' samples, we found that multinational plants' production function significantly differs from production function of local plants in smaller numbers of industries. In addition, the disparity in local and foreign plant's labor productivity functions are reported in only 6 industries. Regardless of the employed approaches, there is a group of industries which were consistently reported with productivity differential. This group comprise of manufacture of chemical and chemical product [ISIC24], rubber & plastic product [ISIC25], fabricated metal [ISIC28], general machine and equipment [ISIC29], and motor vehicle [ISIC34] industries. As previous studies, the productivity gap between foreign and local plants is empirically less convincing than its conceptual frameworks as most of the industries were reported with insignificant difference. However, our results repetitively report that productivity differential statistically exist in stated industries which are industries which require high start up cost.

Keywords: Multinational Corporation, FDI, SME.

1. Introduction

As the vehicle of globalization, Multinational corporations have been playing 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 presences could eventually contribute to the development in their nations through various measures; for example, host nation's 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, which could potentially serve as the passage to solve the puzzle of whether those privileges provided to attract the flow of FDI, are empirically justified. However the prerequisite for those impact studies is a closer examination on whether productivity differential between foreign-controlled and local controlled plants is statistically valid as suggested by conceptual frameworks. The primary aim of this paper is not only to investigate whether this gap exists in Thai manufacturing industries but it also strive to verify in which industries productivity differential does exist. Thus the findings could potentially assist policy makers to design both investment privileges provided to multinational plants and competitiveness development schemes for local plants.

First, this paper compares the total factor productivity (TFP) of local and foreign plants. Then we further compare foreign plants' labor productivity with local plants' labor productivity. In order to allow not only intercept but also all slope coefficients to vary across local and foreign plant samples, both of the local and foreign plants' production function and labor productivity function are additionally compared. Hence multinational plants in the industries which could withstand all of the above 4 analysis approaches could be perceived as they inherently differ from local plants.

2. Review of Literatures

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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 overcome the incremental cost of doing business abroad, competitively compete with local plants in unfamiliar markets/ supply chain networks and rule and regulation during their entrance or their presence in host nations.

The possession of the firm specific assets would give multinational plants with some market power or cost advantage in competing with local plant in the host countries. To be specific, Dunning's (1977) commented that this advantage is potentially possible through the possession of resources like brand names (marketing abilities), skilled labor and knowledge of technology, size, and efficient production process. To support this particular claim through the case of previous studies in Thai manufacturing industries; Jongwanich and Kohpaiboon (2010) revealed that most of the registered patents in Thailand were granted to foreign entity 90% during 2006-2008 while only 10% of registered patents were granted to local entities. A hypothesis on the productivity differential between foreign-controlled and local controlled units could be developed because foreign-plants possess this kind of firm specific assets, which mostly in form of intangible production, marketing knowhow and management practice as generally concluded by Ramstetter (2006). This possession could potentially enable multinational plants to have a higher productivity than the domestic plants.

Among the first batch of empirical papers on this area originated by Lall (1976), which analyzed the performance gap between MNCs and local firms by using firm level data by using simple descriptive statistic. Liu (2000) which conduct the study in China, their results revealed that multinational status could significantly enhance labor's productivity of the firm. Doms and Jansen (1998) used various definition of productivity; their results generally reveal that the productivity of foreign plants is significantly greater than the productivity of locally owned plants in USA. Ito (2002) particularly focus on the plant productivity in Thai Automobile Industry; and he found that foreign plan generally has higher labor productivity than local firm; and this superiority is concluded as a result of a higher capital intensity of foreign firm in the Automotive industry.

Through the use of Translog production function which requires less restrictive assumptions than the basic Cobb Douglas production function. Ramstetter (2002, 2006) found a greater no. of industries with the reports in production technology differential than the previous Cobb Douglas version. However most of the industries were reported with insignificant disparity, and even more surprisingly; authors found that in those reported industries, multinational plants were not necessarily shown with a greater productivity. Similar result is also found in the case of Vietnamese manufacturing firms (Ramstetter 2008).

3. Methodology and Data

Translog production function, which has more flexibility to describe the relationship between firm's production activities and firm's factor of production than Cobb Douglas production function, is employed. To compare the local and foreign plants' TFP, the following Translog model is used.

$$\ln(y)_i = \beta_0 + \beta_1 . ln[K_i] + \beta_2 . ln[L_i] + \beta_3 . [ln[K_i]]^2 + \beta_4 . [ln[L_i]]^2 + \beta_5 . [ln[K_i] . ln[L_i]] + \sum_{k=1}^{n} \beta_k X_{ki} \qquad (1)$$

Where y is the output of the firm, K is capital, L is labor, and X_{ki} is the vector of control variables. Subscript i represent firm i. With capital, two types of labors, firm's age and size as the list of control variables, the above translog model could be rewritten as estimating model as

$$\ln(V)_i =$$
$$\beta'_0 + \beta'_1 . ln[K_i] + \beta'_2 . ln[OPL_i] + \beta'_3 . ln[NONOPL_i] + \beta'_4 . [ln[K_i]]^2 + \beta'_5 . [ln[OPL_i]]^2 + \beta'_6 . [ln[NONOPL_i]]^2 +$$
$$\beta'_7 . [ln[K_i] * ln[OPL_i]] + \beta'_8 . [ln[K_i] * ln[NONOPL_i]] + \beta'_9 . [ln[OPL_i] * ln[NONOPL_i]] + \beta'_{10} . dMNC_i +$$
$$\beta'_{11} . dSize_i + \beta'_{12} . dAge_i + \beta'_{13} . dBOI_i + \epsilon_i \qquad (2)$$

Where V is the value added of the firm as plant's output, K is capital, OPL is working hour of blue collar workers, and NONOPL is the working hour of white collar workers. MNCstatus is the dummy on multinational status of the plant (0 if plant is locally controlled plants, 1 otherwise). As Ramstetter 2003;

dSize, dAge and dBOI are the dummy variable on firm's size age and whether the firm had received investment promotion privileges. ϵ_i is the residual of the regression. To investigate if foreign plants are more productive than local plants we observe β'_{10} whether it is significant and positive. To compare the production functions of local and foreign plant as stated in the objective, we would drop dMNC variable from the above regression and separately run the model to each local and foreign samples[1].

To particularly test for the labor productivity differential, eq.2 is adjusted to the following regression

$$\ln(V_i/L_i) = \gamma_0 + \gamma_1.ln[K_i/L_i] + \gamma_2.ln[Skill_i/L_i] + \gamma_3.[ln[K_i/L_i]]^2 + \gamma_4.[ln[SKill_i/L_i]]^2 \qquad (3)$$
$$+ \gamma_5.[ln[K_i/L_i] * ln[Skill_i/L_i]] + \gamma_6.dMNC_i + \gamma_7.dSize_i + \gamma_8.dAge_i + \gamma_9.dBOI_i + \varepsilon_i$$

Where V/L is the value added per worker, and K/L is capital intensity of the firm. While $SKill/L$ is the skill intensity of the firm, and it is measured as portion of skilled and white collar labor to total labor. The supremacy of foreign firm in labor productivity over local firm's could be observed, if γ_6 is significant. To compare the local plants' and foreign plants' labor productivity functions, dMNC would be dropped from the above regression and separately run with local and foreign samples and the test statistic is similarly set as shown in footnote 1.

The data from NSO 2005'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 duplication is 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 they would be disregarded from the list. With the consideration of firm's size and the removal of duplicated series, the sample is reduced to 14,771 establishments.

4. Results

Result of each objective is shown in accordance to its alternative hypothesis.

4.1. Ha₁: TFP of Multinational Plants is Greater than TFP of Local Plants

In term of total factor productivity, we found multinational plants statistically outperform the local plants in 8 industries. Which are manufacture of woods & wood product(ISIC 20), chemical and chemical product(ISIC 24), Rubber & Plastic products (ISIC 25), Fabricated metals(ISIC 28), General Machinery and equipments(ISIC 29), Automobile and Part(ISIC 34), Furniture(ISIC 3610) and manufacture of toy, leisure and Sport equipments(ISIC 3692to94). For instance; foreign plants in manufacture of chemical industry (ISI24) has higher TFP than local plants in the same industry by 29%. From the list of reported industries, multinational plants have higher TFP than local plants not only in high technology industries but also in other types of industries; for example, manufacture of woods and furniture industries. However; foreign plants are reported with insignificant gap in other industries as previous studies. The result from this section further invited me to explore the production technology differential between these two groups of firms.

4.2. Ha₂: There is a Production Technology Differential in Local and Foreign Plants

If we allow both intercept and all slope coefficients of the regression to vary across both samples. The null hypothesis of an identical production technology between foreign and local plants could be rejected only in 5 industries. These industries are the subset of the reported industries in the above paragraph. However, only high tech industries (manufacture of chemical and chemical' products, Rubber & Plastic products, manufacture of fabricated metals, General Machinery and equipments, manufacture of Automobile and Part

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[1] As the test involving the equality of coefficients of different regressions (Pindyck & Rubinfeld1997), the test statistic is $\frac{(ESS_R - ESS_{UR})/k}{ESS_{UR}/(N+M-2k)}$ where ESS_r and ESS_{ur} are error sum of square residual of restricted (ESS from all types of firm sample) and unrestricted regression (combination of ESS from local and foreign sample) respectively.

industries) were prevailed with significant difference in this production function comparison. Next we particularly explore the difference in labor productivity between foreign and local plants.

4.3. Ha$_3$: Labor Productivity of Multinational Plants is Higher than Local Plants' Labor Productivity

Labors in multinational plants have greater productivity than the labors, who are working in local plants, in 9 industries. The list of these reported industries is almost identical to the list stated in the case of TFP comparison, with manufacture of textile industries as added industry. In conjunction with the results produced from the 4.1 section, most of the industries with the report of the multinational plants' supremacy in TFP are also reported with superiority in labor productivity. Interestingly, local plants in manufacture of footwear and luggage industry significantly have higher labor productivity than their foreign counterparts.

4.4. Ha$_4$: Labor Productivity Function of Foreign Plants is Not Identical to Labor Productivity Function of Local Plants

In relative to the results from section 4.3, the general perception on labor productivity differential between foreign and local plants is less supporting in this approach. Foreign firm's labor productivity regression statistically differs from local firm's labor productivity regression in only 6 industries. Mostly; there are capital intensive industries, manufacture of chemical and chemical product, Rubber & Plastic products, Basic metal (ISIC 27), fabricated metals, General machinery and equipment, Automobile and part.

The following table summarizes the results from all of the 4 approaches, presented through their null hypothesis. Results are relatively robust across approaches

Table 1: Summary table from all testing approaches

ISIC code	Industry	HO$_1$: TFP of MNC equals to TFP of local plants?	HO$_2$: Identical Production functions?	HO$_3$: LP of MMC equal to the LP of local plants?	HO$_4$: Identical Labor productivity functions?
15xx	Food products and beverages	Do not reject	Do not reject	Do not reject	Do not reject
17xx	Textiles	Do not reject	Do not reject	Reject HO : [+]	Do not reject
18xx	Wearing apparel	Do not reject	Do not reject	Do not reject	Do not reject
19xx	Luggage and footwear	Do not reject	Do not reject	Reject HO : [-]	Do not reject
20xx	Wood and wood product	Reject HO : [+]	Do not reject	Reject HO : [+]	Do not reject
21xx	Paper and Paper product	Do not reject	Do not reject	Do not reject	Do not reject
24xx	Chemicals and chemical pro.	Reject HO : [+]	Reject HO	Reject HO : [+]	Reject HO
25xx	Rubber and plastics products	Reject HO : [+]	Reject HO	Reject HO : [+]	Reject HO
26xx	Other non-metallic mineral pro.	Do not reject	Do not reject	Do not reject	Do not reject
27xx	Basic metals	Do not reject	Do not reject	Do not reject	Reject HO
28xx	Fabricated metal products	Reject HO : [+]	Reject HO	Reject HO : [+]	Reject HO
29xx	General Machinery and equip.	Reject HO : [+]	Reject HO	Reject HO : [+]	Reject HO
30-33xx	Electrical related industry	Do not reject	Do not reject	Do not reject	Do not reject
34xx	Automotive and parts	Reject HO : [+]	Reject HO	Reject HO : [+]	Reject HO
35xx	Other transport vehicle	Do not reject	Do not reject	Do not reject	Do not reject
3610	Furniture	Reject HO : [+]	Do not reject	Reject HO : [+]	Do not reject
3691	Jewelry	Do not reject	Do not reject	Do not reject	Do not reject
3692-94	Musical, Sport equip. and toys	Reject HO : [+]	Do not reject	Reject HO : [+]	Do not reject

Reject H0 implies the null hypothesis could be rejected at 0.05 level of significant. [+] implies foreign plants could statistically outperform the local plants, while [-] means local plants outperform foreign plants. Full information is available upon the request.

From the above table, productivity (either defined as Total Factor Productivity and Labor Productivity) and their function of multinational plants in {[1] manufacture of chemical and chemical products, [2] rubber and plastic product, [3] fabricated metal, [4] general machine and equipment, and [5] manufacture of automotive vehicle and part industries} statistically differ from local plants, because these industries have

been consistently reported with the rejection of null hypothesis in all testing approaches. Interestingly, they are industries which require high initial investment. Other type of industries; for instance, manufacture of textile, woods, furniture, have been reported with superiority of foreign plants in TFP and labor productivity over local plants. However; the comparison of production and labor productivity functions between foreign and local samples do not concur with this gap in this type of industry.

5. Conclusion

Conform to the previous studies, most of the industries were not reported with significant gap as suggested by conceptual framework. With various seemingly related approaches, we could identify the 5 stated industries which foreign plants inherently differ from local plants. The plausible explanation for these disparities between foreign and local plants in this group of high start up cost industries is the accessibility to financial capital by multinational corporations. Since this accessibility to financial sources is considered as a form of MNC's firm specific assets. The underlying aspiration of this study is to assist authorities to design and develop investment promotion scheme through the acknowledgement of productivity differential between foreign and local plants.

6. Acknowledgement

7. References

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