The effects of outward FDI on home-country productivity
Do location of investment and market orientation matter?

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Abstract
Purpose – The paper aims to examine the effects of outward foreign direct investment (O-FDI) on home-country productivity.

Design/methodology/approach – A panel data set for 15 Taiwanese manufacturing industries over the period between 1991 and 2007 is employed for a model in which productivity is regressed on a measure of O-FDI.

Findings – The study finds no significant positive or negative effect of O-FDI on productivity. Breaking down the data by location of the investment, however, we find that O-FDI in other countries enhances productivity in Taiwan, while O-FDI in China does not. We interpret the positive role of O-FDI in other countries as relating to the outcome of strategic asset-seeking nature of Taiwanese investments in these countries.

Research limitations/implications – In order to analyse the productivity effect of O-FDI more precisely, one would need to compare the firm outcomes in the presence of multinational production with the outcomes that would have prevailed in the absence of multinational production. Unfortunately, we cannot observe what would have happened to firms that did engage in multinational production had they not done so.

Practical implications – The findings suggest that the Taiwanese Government should distinguish the level of liberalization towards O-FDI for different locations and in different types of industries. In particular, the government should channel more investment towards export-oriented industries especially those in “other countries”.

Originality/value – The paper employs a contingency approach, examining the conditions under which O-FDI impacts upon home productivity.

Keywords Outward foreign direct investment, Productivity, Manufacturing, Taiwan, China, Manufacturing industries, Market orientation

Paper type Research paper
1. Introduction

It is often argued that going offshore is one mechanism to increase productivity at home (Damijan et al., 2007). Yet, the home country productivity effect of outward foreign direct investment (O-FDI) has received only scant attention in the empirical literature. This is surprising given that a large body of work has investigated whether O-FDI would cost production, employment, export, domestic investment and R&D that would have taken place in the home country to instead take place abroad. We argue in this paper that the home country effect of O-FDI might be more appropriately judged on the basis of its long-run effects on industry productivity at home. Productivity is a particularly useful barometer not only because O-FDI’s numerous effects will be directly or indirectly reflected (Chung et al., 2003) but also because of its particular importance in driving a country’s long-term economic growth.

The literature on inward FDI suggests that the presence of multinational firms bring benefits to host countries, such as transfer of new technologies and management know-how, which should potentially enhance the performance and competitiveness of locally owned industries (Caves, 1974; Feinberg and Majumdar, 2001). As such, numerous studies have examined the productivity effect of FDI on local firms in the host country (Caves, 1974; Globerman, 1979; Liu et al., 2000, Zhao and Zhu, 2000; Buckley et al., 2007). Inward FDI is, however, only half of the story. Theory suggests that home country productivity effects may also arise as a result of relocation of production abroad (Head and Ries, 2003; Helpman et al., 2004). Hence, a logical extension of the study on the effect of O-FDI on host country productivity is to examine the effect of O-FDI on home country productivity. Although the empirical literature has recently begun to weigh in on this issue, the research has only produced mixed results. While some studies find that O-FDI is positively associated with productivity at home (van Pottelsberghe de la Potterie and Lichtenberg, 2001; Barba Bavaretti and Castellani, 2004; Bitzer and Görg, 2005; Herzer, 2008), other studies show either negative or no association between the two (Andersson and Fredriksson, 1996; Barba Navaretti et al., 2006).

Although prior studies have improved our understanding of the home country productivity effects of O-FDI, we still understand less about the heterogeneity that may exist in these productivity effects across industries. A common drawback of the existing studies is that they treat location- and industry-specific effects as external to the effect of O-FDI on productivity. For these reasons, previous studies find only average effects, which hide more than they reveal and mask significant heterogeneity across different locations of investment and different types of industries. To our best knowledge, there have been no published empirical studies on the analysis of the home country productivity effects of FDI, where such location- and industry-specific effects have explicitly been taken into account. This study aims to fill this gap.

2. Theoretical framework

A stream of literature argues that productivity is a key determinant of O-FDI. Head and Ries (2003) and Helpman et al. (2004) describe the relationship between firm productivity and the engagement in different stages of internationalization of the firm. They suggest that highly productive firms become multinationals because they find it profitable to expand abroad through FDI, while less-productive companies serve foreign markets by exports, and the least productive firms stay on their domestic
markets. The implication of this argument is that relocation of the most productive firms overseas reduces productivity in the home country due to a structural effect. This argument is line with Dunning’s (1988) and Dunning and Narula (1995) paradigm, which suggests that firms invest overseas because they have specific ownership advantages which enable them to overcome the “liabilities of foreignness” and earn supernormal profits in foreign markets.

Hence, a pre-requisite for firms to conduct foreign investment activities is that they are more productive than host country locally owned firms. Along this line, there has been a great deal of research examining whether foreign-invested enterprises exhibit higher levels of productivity than local non-foreign-invested enterprises (Aitken and Harrison, 1999; Blomström and Sjöholm, 1999; Siler et al., 2003). The wide acceptance of ownership advantage-based FDI theory has also prompted a large literature that examines the host-country productivity effect of inward FDI. Many studies argue and find that the presence of foreign technologically advanced firms in the host country produces technological spillover effects which enhance productivity in local firms (Kokko, 1996; Aitken and Harrison, 1999; Buckley et al., 2002).

Vahter and Masso (2006) decompose the home country effect of O-FDI into two parts. The first is the “own-firm effect” – the effect of making O-FDI on the performance of the home operation of the multinational enterprise (MNE). The second part is the various external or spillover effects on other national firms in the home economy of the investor. Such effects are arguably similar to those of inward FDI. Both parts of the effect should lead to O-FDI to impact upon the productivity of home industries. Most scholars agree that O-FDI can enhance productivity at home. First, firms locating abroad are able to improve their performance at home as they become exposed to international competition and best practice (Bitzer and Görg, 2005), similar to the idea of “learning-by-exporting” advocated by Clerides et al. (1998). Also, multinational firms may source technology abroad (Fosfuri and Motta, 1999; Barba Navaretti et al., 2006), in particular, if these firms locate their plants in knowledge-intensive industries in the host country, and this should benefit productivity of the parent firm at home. Additionally, the scale effect may improve efficiency of the firm (Barba Navaretti et al., 2006). Second, standard trade theory suggests that O-FDI facilitates increased specialization which is beneficial for the economy as it allows reallocation of resources to their best use (Görg et al., 2008). O-FDI allows firms to import intermediate goods from foreign affiliates at lower prices, to produce a greater volume of final goods abroad at lower cost (Herzer, 2008), and to reorganize production by keeping the most efficient stages in the home country (Görg et al., 2008), all of which should improve productivity of the parent firm. Put differently, O-FDI allows firms to combine home country production with foreign production to reduce costs and to increase their competitiveness both domestically and internationally (Desai et al., 2005). Third, a structural effect of O-FDI may occur and prove to be beneficial for home productivity. Through O-FDI, the technology will be updated, and a better resource allocation will stimulate the service sector that then absorbs employment released from the manufacturing sector (Lin and Yeh, 2005).

The direction of the O-FDI effect, however, is not always clear cut. Barba Navaretti and Castellani (2004) put forward three main reasons why dispersing production abroad can affect productivity at home: the exploitation of firm- and plant-level scale economies; the change in the composition of inputs used in production; and the
opening of new channels of international sourcing of technological and managerial knowledge. However, they also point out that these sources of productivity change at home may work in both directions, depending on the features of the investment. In a similar vein, Vahter and Masso (2006) point out three reasons why the productivity effect may occur:

- (1) opening of new channels of international sourcing of technological, managerial, and host country conditions/market-related knowledge;
- (2) the exploitation of firm-level scale economies; and
- (3) possible changes in composition of production inputs, i.e. specialisation effect – taking advantage of international division of labour within a MNE.

They further argue that the scale of home country activities could decline or increase; technologies could be acquired in foreign markets or get depleted to foreign competitors; home country activities could get strengthened or impoverished by changes in their factor use. An overall negative effect may even arise where O-FDI abroad reduces the likelihood of concurrent investments at home, implying that it inevitably substitutes foreign for domestic output (Stevens and Lipsey, 1992). This means that the direction of the impact of O-FDI on productivity is ambiguous; it could be either positive or negative.

The fact that theory does not provide a clear prediction on the productivity effect signals that the direction and strength of the relationship between O-FDI and home country productivity may vary with industry heterogeneity in terms of economies of scale, factor proportion of production, market orientation, government policy and technological opportunities. For instance, while the Taiwanese Government has adopted a favourable attitude towards outward investment, distinct episodes in the evolution of the policy (especially on China) can be identified in which sectoral FDI restrictions were either tightened or loosened. Such sectoral heterogeneities matter because we expect them to be associated with differential productivity effects across industries.

One key factor that is thought to be likely to moderate the productivity effect is the market orientation of home country firms. The literature on technology-sourcing argues that foreign entry into a market is likely to increase the strategic assets of the firm (Mutinelli and Piscitello, 1998; Fosfuri and Motta, 1999). The acquired new strategic assets, such as knowledge or technology, may spill over to the firm’s parent firm or other firms in the home country. If this argument holds, there are reasons to expect more international productivity spillovers to accrue to non-exporting home country firms than to exporting firms. This is based on the argument that export-oriented home country firms have already faced competition from the world market and have had the opportunity to learn from and to imitate their foreign competitors (Blomström and Sjöholm, 1999). This means that in sectors where home country firms focus on the domestic market, one would expect more international spillovers to these firms because these sectors have not previously been exposed to foreign competition and experience (Castellani and Zanfei, 2006).

There exists, however, an opposite conjecture, one that suggests that exporting home country firms reap more international spillovers than their non-exporting counterparts. The degree of internationalization through exports reflects the productive and innovatory capacity of a firm, and thus acts as a good proxy for
absorptive capacity (Castellani and Zanfei, 2006). Exporting home country firms may draw on their accumulated competencies and show a greater ability to take advantage of O-FDI by other firms and absorb international spillovers. If this is the case, export-oriented home country firms may actually benefit more from O-FDI in their sector than domestic market-oriented firms in the home country.

3. Data and methodology

We use a panel dataset for 15 distinct Taiwanese manufacturing industries (two-digit international standard industrial classification) over the period between 1991 and 2007, i.e. the period during which Taiwanese FDI entered a more active phrase and was gaining credibility. The data were obtained from two different databases, both of which were published by the Ministry of Economic Affairs (MOEA) of Taiwan. FDI-related data were collected from several issues of monthly report published by the Investment Commission, MOEA. Data for other variables employed could be found from the web site of MOEA Economic Statistics Database and National Statistics (www1.stat.gov.tw). Official data from MOEA are the most detailed and reliable data to date for studying O-FDI by Taiwanese firms.

The 15 industries include:

1. food, beverage, tobacco;
2. textiles, mills;
3. wearing apparel and clothing accessories;
4. wood and bamboo products, furniture;
5. pulp, paper and paper products, printing and reproduction of recorded media;
6. plastic products; and
7. non-metallic mineral products;

Schumpeter industries include:

8. leather, fur and related products;
9. chemical materials and products, petroleum and coal products, medical products;
10. rubber products;
11. basic metal products, fabricated-metal products;
12. machinery and equipment, manufacturing not elsewhere classified;
13. electronic parts and components, computers, electronic products and equipment;
14. motor vehicles and parts, other transport equipment; and
15. precision, optical products, medical equipment, watches and clocks.

The datasets contain a wide range of data for each industry including sales, employment, capital, export, R&D and most importantly, the amount of direct capital investment in foreign countries and in mainland China separately. Together, with a range of other sectoral attributes, the datasets provide a rich statistical source directly amenable to economic analysis. Disaggregated data that can be used for studying hollowing-out effects of O-FDI by firms from newly industrialized economies (NIEs),
such as Taiwan, for a heterogeneous set of industries rarely exist in a comprehensive and comparable form. To my best knowledge, this is the first study to use such detailed industry-level data from a NIE country.

Employing industry-level data presents several unique advantages. First, industry-level data provide useful information on the link between domestic and foreign investments. Aggregated macro-level data miss channels through which domestic and foreign activities interact. Firm-level data have a disadvantage because it disregards the general equilibrium effects of FDI for the investment of other firms. If some firms engage in FDI, other firms might be affected as well. For instance, a substitution at the level of the firm may be accompanied with complementarities at the industry-level when spillover effects between firms are taken into account (Seo and Suh, 2006). This explains why the empirical literature has so far been concerned mainly with the effect on the investing firm (Lipsey, 2002). Castellani and Zanfei (2006) suggest that domestic MNEs have a positive impact on non-internationalized domestic firms as well. The industry-level study takes account of the impact of both investing firms and non-internationalized domestic firms.

Second, many of the determinants of exports, employment, investment, productivity and R&D are industry-wide, implying that a substantial part of the effect of O-FDI may occur at the industry-level in which the firm operates and carries out most of its external relations. For instance, the degree of competition and technology policies are well-known important factors influencing productivity and R&D but they cannot be adequately captured in firm-level research. In addition, our data show that a large share of Taiwanese O-FDI in China is undertaken by firms in the Heckscher-Ohlin industries, and similarly a large share of Taiwanese O-FDI in other countries is undertaken by firms in Schumpeter industries. This pattern of regional and industrial distribution of Taiwanese O-FDI suggests the importance of analysing the effect of O-FDI at the industry-level.

Third, while government agencies in many countries (especially those in developing countries and newly industrialized countries) have adopted a generally favourable attitude towards O-FDI, policy making is often implemented at the industry-level. A firm’s industry is an important part of the milieu within which government policies are framed and executed. Although the Taiwanese Government permitted outward direct investments by Taiwanese firms, Taiwan is a country that has experienced a wide range of O-FDI-related policies. Distinct policy regimes can be identified in which restrictions on O-FDI, particularly to China, were either tightened or loosened at sectoral levels. For example, the Taiwanese Government determines sector-specific restrictions on O-FDI to China on an industry-by-industry basis. There is more variation in the O-FDI variables in industry-level data as a result of the discriminating policy towards O-FDI on an industry-by-industry basis. The Taiwanese experience, therefore, presents an opportunity to examine the effects of a variety of policy initiatives on the effect of FDI outflow.

The standard approach of examining the impact of inward FDI on the productivity of host country productivity firms is to test whether the productivity of host country industries is a function of foreign presence, together with a number of other industrial characteristics (Caves, 1974; Globerman, 1979; Liu et al., 2000; Zhao and Zhu, 2000; Buckley et al., 2007). We follow this approach to investigate the impact of O-FDI on the productivity of home country industries. In order to do so, we set up an augmented
Cobb-Douglas production function which relates labour productivity of home industries to a measure of O-FDI:

\[
LP_{it} = \alpha_0 + \alpha_1 \text{TOFDI}_{it-1} + \alpha_2 \text{TOFDI}^2_{it-1} + \alpha_3 \text{IFDI}_{it-1} + \alpha_4 \text{KL}_{it-1} \\
+ \alpha_5 \text{RDE}_{it-1} + \alpha_6 \text{SKILL}_{it-1} + \alpha_7 \text{SIZE}_{it-1} + \alpha_8 D + \varepsilon \\
\text{(1)}
\]

\[
LP_{it} = \alpha_0 + \alpha_1 \text{OFDIC}_{it-1} + \alpha_2 \text{OFDIC}^2_{it-1} + \alpha_3 \text{OFDIO}_{it-1} + \alpha_4 \text{IFDI}_{it-1} \\
+ \alpha_5 \text{KL}_{it-1} + \alpha_6 \text{RDE}_{it-1} + \alpha_7 \text{SKILL}_{it-1} + \alpha_8 \text{SIZE}_{it-1} + \alpha_9 D + \varepsilon \\
\text{(2)}
\]

Where, the subscript \( t \) denotes time while subscript \( i \) refers to industry. \( LP \) is labour productivity of an industry in Taiwan, measured as sales per employee. \( \text{TOFDI} \) is the total annual FDI flows from Taiwan. Following Brouthers et al. (1996), who argue that firms with different motivations of internationalization choose different locations of investment, we examine the extent to which the relationship between O-FDI and the home country effect varies with the location of the investment by distinguishing Taiwanese O-FDI in China and in other countries. \( \text{OFDIC} \) is annual FDI flows from Taiwan to China in each industry, and \( \text{OFDIO} \) is FDI flows from Taiwan to other countries in each industry. As predicted in Section 2, the sign of the three variables for O-FDI could be either positive or negative. A negative sign implies that O-FDI impedes productivity of home country industries and a positive sign supports the opposite.

We also control a number of variables that have been shown in previous studies to influence exports. \( \text{IFDI} \) is inward FDI flows to Taiwan. As previously discussed, there are great quantities of literature linking the presence of inward FDI to host country productivity. \( \text{KL} \) is capital intensity. The literature suggests that it should exert a positive impact on productivity because capital-intensive industries are generally associated with increased levels of employee skill. Numerous studies suggest that the level of R&D input is positively associated with productivity. We, therefore, include \( \text{RDE-employee (RDE)} \) ratio which is defined as R&D expenditure per employee in the model. Theoretical models of economic growth, such as Lucas (1988), emphasize that the engine of productivity improvements is the unlimited accumulation of human capital[1]. A higher value of human capital may be seen as evidence of higher learning efforts, or a larger effective labour force (Wang et al., 2002). We, therefore, include skill level of employment (\( \text{SKILL} \)), which is measured as average wages, to capture the effects of human capital. The firm size variable (\( \text{SIZE} \)) is average firm size, defined as fixed capital employed per firm. Firm size has generally been posited as a determinant of innovative activity in the literature in a neo-Schumpeterian tradition (Schumpeter, 1942). Theory suggests that it should be positively related to labour productivity (Wang and Tsai, 2003). \( D \) is time dummy to control the effects of the transition of power from the China Nationalist Party to pro-independence Democratic Progressive Party (DPP) in 2000 because the shift of power represents a change of political and economic policies towards China. In particular, the DPP government tended to use various measures to restrict investments in Mainland China. In both equations, the data are transformed into natural logarithms; therefore, both models should be taken as being linear in the logarithmic data. Table I displays descriptive statistics of all the dependent and independent variables.

With respect to the predictor variables (TOFDI, OFDIC and OFDIO), however, there could be a problem of two-way causality. While O-FDI is likely to influence the productivity efforts at home, the intensity of O-FDI activities may itself depend on the
level of productivity at home. It is plausible that productive firms are more likely to conduct investment overseas (Helpman et al., 2004). Similarly, the level of a firm’s productivity could be high because of outward orientation of the firm, or vice versa. This leads to the well-known problem of endogeneity of the regressors, which has dogged research on productivity analysis for a long time (Griliches and Mairesse, 1995). Not controlling for endogeneity could make parameter estimates both biased and inconsistent. A limited number of studies that have examined the effects of O-FDI overlook the problem of simultaneity (Barba Navaretti et al., 2006)[2]. Instrumental variable estimation can be implemented to resolve this issue. However, in our database we do not have good instruments, because the variables available that could be used as instruments are also correlated with productivity. An alternative solution would be to construct a structural model, wherein various variables were determined jointly. However, such an approach is appropriate only when causality is postulated between the dependent variable and one or two independent variables. It is hardly appropriate in the present context, where the level of productivity is being explained in terms of variation in a number of independent variables. In the presence of the possibility of simultaneity between the dependent variable and several independent variables, the process of constructing a structural model itself becomes a cumbersome process.

Therefore, we address the issue of endogeneity by including the O-FDI terms at time $t - 1$. This procedure also allows us to examine whether there is an effect on our dependent variable that is related to the FDI activity of the previous year. Contemporaneous correlations between O-FDI and home country productivity, which characterize previous studies in fact do not imply causation, and thus these studies may suffer from serious endogeneity biases (Herzer and Schrooten, 2008). Similarly, to account for the issue of possible endogeneity with respect to other (control) variables, we have also adopted a one-year lag structure for these variables in the models.

Table II shows the correlation matrix for the independent variables. Among the correlations we concern, only two are higher than 0.70, reducing any concerns about the deleterious effects of multi-collinearity on our coefficient estimates. This has enhanced our confidence that the results are not distorted by spurious correlations between variables.

4. Results
The results of the estimation of both equations (1) and (2) are displayed in Table III. We estimated the two regressions in the first instance with both FE and RE models.
The significant Hausman (Hausman specification) statistics (Baltagi, 1995, p. 68) support the FE model for both equations. We estimated both equations with a squared term of O-FDI variables included, but found no evidence of a curvilinear effect in our data. We, therefore, only present the results for the two equations without the curvilinear terms.

Column (1) shows that in aggregate there appears to be no significant productivity arising from O-FDI. This result suggests that Taiwanese O-FDI neither depresses nor enhances productivity at home. Apparently, this finding is not in line with previous studies (Barba Navaretti and Venables, 2004), which find that investing abroad significantly enhances total factor productivity and output at home. Our discussion in the literature review section suggests both positive and negative productivity effects. The neutral effect may occur because the two types of effects cancel each other out. Nevertheless, the finding reflects the decision by multinational companies not to locate highly productive parts of the production process abroad, which would reduce overall industry-level productivity in Taiwan, at least in the short-run, through a compositional effect. The result also suggests that Taiwanese O-FDI is not driven entirely by strategic asset-seeking or knowledge-seeking. As highlighted in Section 2, this type of outward investment can potentially enhance productivity at home when acquired assets or knowledge is transferred back home through formal or informal channels.

The results in Column (3) show that the productivity effect differs significantly between China and the other country group. Our data show that O-FDI in China has produced a negligible effect on productivity. Technology-sourcing literature suggests that technology-sourcing tends to target technology leaders which have accumulated substantial scientific and technological capabilities that are accessible to foreign companies that set up production and research facilities within their boundaries (Fosfuri and Motta, 1999; Herzer, 2008). The insignificant productivity effect of O-FDI in China occurred because China is in general not considered a technology leader (when compared to Taiwan), and, therefore, the O-FDI in China is, in general, not driven by strategic asset-seeking. However, this does not mean that Taiwanese O-FDI in China generates no productivity effect at all. In fact, it can still promote productivity growth through a “battling average” effect as low value-added activities are moved to China, but this effect alone cannot make the O-FDI variable significant in our data.

In a marked contrast with the insignificant effect of O-FDI in China, Column (3) shows that the role of O-FDI in the other country group is positive and significant. Although, there is no direct evidence, we suspect this significant effect to be largely caused by technology-sourcing by the Taiwanese investors. This finding is not without

<table>
<thead>
<tr>
<th>Variables</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TOFDI</td>
<td>0.92</td>
<td>0.66</td>
<td>0.60</td>
<td>0.46</td>
<td>0.34</td>
<td>0.44</td>
<td>0.39</td>
</tr>
<tr>
<td>2. OFDIC</td>
<td>0.46</td>
<td>0.58</td>
<td>0.58</td>
<td>0.47</td>
<td>0.30</td>
<td>0.49</td>
<td>0.38</td>
</tr>
<tr>
<td>3. OFDIO</td>
<td>0.49</td>
<td>0.31</td>
<td>0.31</td>
<td>0.27</td>
<td>0.31</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>4. IFDI</td>
<td>0.45</td>
<td>0.43</td>
<td>0.43</td>
<td>0.47</td>
<td>0.47</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>5. KL</td>
<td></td>
<td>0.39</td>
<td>0.39</td>
<td>0.86</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. RDE</td>
<td></td>
<td></td>
<td>0.44</td>
<td>0.44</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. SKILL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
</tr>
<tr>
<td>8. SIZE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table II. Correlation matrix of variables
### Table III.
The impact of O-FDI on productivity

<table>
<thead>
<tr>
<th>Dependent variable: linear prediction</th>
<th>FE model (1)</th>
<th>RE model (2)</th>
<th>FE model (3)</th>
<th>RE model (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-2.725 (-0.75)</td>
<td>-3.692 (-1.14)</td>
<td>-0.503 (-0.14)</td>
<td>-2.494 (-0.77)</td>
</tr>
<tr>
<td>TOFDI</td>
<td>0.022 (1.09)</td>
<td>0.009 (0.47)</td>
<td>0.003 (0.17)</td>
<td>-0.012 (-0.65)</td>
</tr>
<tr>
<td>OFDIC</td>
<td>0.027 (3.22)***</td>
<td>0.023 (2.75)***</td>
<td>0.012 (1.11)</td>
<td>-0.009 (0.47)</td>
</tr>
<tr>
<td>OFDIO</td>
<td>-0.013 (-1.11)</td>
<td>-0.010 (-0.88)</td>
<td>-0.021 (-1.75)*</td>
<td>-0.016 (-1.35)</td>
</tr>
<tr>
<td>IFDI</td>
<td>-0.435 (-2.48)***</td>
<td>-0.001 (-0.01)</td>
<td>-0.444 (-2.56)***</td>
<td>-0.019 (-1.15)</td>
</tr>
<tr>
<td>KL</td>
<td>0.092 (2.48)***</td>
<td>0.084 (2.70)***</td>
<td>0.074 (2.01)***</td>
<td>0.074 (2.36)***</td>
</tr>
<tr>
<td>RDE</td>
<td>0.823 (2.49)***</td>
<td>1.052 (3.54)***</td>
<td>0.615 (1.85)*</td>
<td>0.942 (3.16)***</td>
</tr>
<tr>
<td>SKILL</td>
<td>0.458 (3.63)***</td>
<td>0.270 (3.02)***</td>
<td>0.475 (3.84)***</td>
<td>0.292 (3.24)***</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.018 (-0.24)</td>
<td>-0.190 (-3.27)***</td>
<td>0.027 (0.37)</td>
<td>-0.155 (2.64)***</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.741</td>
<td>0.287</td>
<td>0.751</td>
<td>0.287</td>
</tr>
<tr>
<td>$F$-value</td>
<td>33.685***</td>
<td>14.752***</td>
<td>33.910***</td>
<td>13.030***</td>
</tr>
<tr>
<td>$n$</td>
<td>240</td>
<td>240</td>
<td>240</td>
<td>240</td>
</tr>
</tbody>
</table>
| Hausman test                          | $\chi^2(7) = 21.167$*** | $\chi^2(8) = 26.381$*** |}

**Notes:** Significance at: *10, **5 and ***1 per cent levels; figures in parentheses are t-statistics (two-tailed tests)
precedents in the empirical literature. For example, Barba Navaretti and Castellani (2004) find that Italian O-FDI enhances home productivity. Our finding supports van Pottelsberghe de la Potterie and Lichtenberg (2001), which relates the positive effect of O-FDI on domestic productivity to technology-sourcing in the host country. It is also broadly consistent with Chen and Ku (2000), who find that O-FDI has contributed to the growth and upgrading of the home country industries.

The coefficient of inward FDI is not significant in Column (1), indicating that there is no spillover effect arising from inward FDI in Taiwan. There could be many reasons for this result and one of them may be the small amount of inward FDI in Taiwan. Nevertheless, the finding seems to be consistent with an increasing number of empirical studies (Aitken and Harrison, 1999; Jordaan, 2005), which seriously challenge the evidence of positive effects by other studies (Caves, 1974; Globerman, 1979). Indeed, some recent studies even show evidence of negative spillovers (Aitken and Harrison, 1999; Konings, 2000; Buckley et al., 2007), and our finding of a negative and significant productivity effects in Column (3) adds to this emerging body evidence.

Striking is, contrary to our expectations, capital intensity (KL) is not an important determinant of exports Taiwanese firms. A reason for this might be that SIZE already captures this effect. Indeed, this unexpected result may be caused by our definition of capital intensity. Owing to the high correlation between KL and some of our variables, we employed several sensitivity analyses to ensure the robustness of our finding. The correlation between KL and SKILL is 0.86, and perhaps this explains partly why KL is negatively significant. We ran our model regressions without KL and then ran our model regressions without SKILL. Our key results did not change qualitatively. Similarly, the correlation between KL and SIZE is 0.86, and perhaps this is the reason for the unexpected coefficient of KL. We ran model regressions without KL, and then regressions including KL but without SIZE, but the results remain qualitatively the same. More research is needed to disentangle the true relationship between capital intensity and productivity in the Taiwanese industries.

RDE and SKILL are both positive and significant throughout. Given the fact that Taiwan in general remains a technology follower rather than leader, it is possible that R&D is used not to create new technology but to enhance a firm’s ability to assimilate and exploit already existing technology. This is the second “face”of R&D as pointed out by Cohen and Levinthal (1990). This finding is also consistent with the evidence of relocation of labour-intensive production abroad which produces a structural effect of increasing the importance of R&D and human capital at home. SIZE is significant, suggesting that Taiwanese firms increasingly consider the scale of the operation to be a strategic factor that can enhance productivity. Finally, the time dummy variable (D) is not significant, indicating that the productivity effect of O-FDI is not associated with the change of government. This is understandable as productivity measures the long-term effect of O-FDI.

The coefficients reported in Table III are averages over a number of industries, and hence, hide differences in the relationship between O-FDI and home productivity across industries. In order to examine the extent to which the productivity effect is moderated by market orientation of the industry, we use the median of export intensity (export/sales) to break the sample into “domestic market-oriented sectors” and “export-oriented sectors”. Industries with low value of export intensity are classified into the “domestic market-oriented sectors”, whereas industries with high value of export intensity are
classified into “export-oriented sectors”. We have estimated equation (2) for both groups, respectively. The results are reported in Table IV[3].

The results in Table IV show that the impact of O-FDI in China on productivity remains insignificant in both domestic market-oriented sectors and export-oriented sectors. This suggests that the productivity effects of Taiwanese FDI in China are indeed not associated with market orientation of the firm. This finding demonstrates that the insignificant role of O-FDI found for the full sample (Table III) is not due to industry effects. A similar result was obtained for O-FDI in other countries in the domestic market-oriented sectors. This is somewhat surprising given the difference in the nature and sectoral composition of the Taiwanese O-FDI to China and to other countries. An interesting future project would be to see whether further disaggregating of data on Taiwanese O-FDI by sectors would provide more evidence of cross-country differences in the effect of O-FDI on productivity.

Interestingly, O-FDI in other foreign countries is positively related to the productivity of export-oriented sectors at home. As pointed out previously, Taiwanese O-FDI in other foreign countries is more technology-intensive than that in China, meaning that it may be able to generate international technological spillovers to home country firms. Our finding is consistent with our theoretical predictions in the literature section, which suggest that export-oriented firms have greater capabilities than their domestic market-oriented counterparts to take advantage of O-FDI by other firms and absorb the associated technological spillovers. Combining the results in Table III, we conclude that the overall positive productivity effect of O-FDI in other countries is mainly accounted for by the investment in export-oriented sectors. Overall, the findings for the subsamples demonstrate the role of industry heterogeneity in influencing the productivity effect of O-FDI. The estimates for other variables except KL remain stable across sectors, in line with the previous results. This suggests that the strength of the relationship between these factors and productivity is not associated with market orientation of the firm.

5. Conclusions
This paper set out to explore the effects of O-FDI on domestic productivity in the Taiwanese manufacturing industry. Although in general, we find no significant positive effect on productivity, we also observe no significant negative effect as some observers feared. In other words, the productivity effect is neutral. Breaking down the data by location of the investment, however, we find that the productivity effect varies with the location of the investment. In particular, we show that O-FDI in other countries enhances productivity in Taiwan, while O-FDI in China does not. This finding corroborates the notion that the nature of the investment by multinationals varies between different host countries, leading to different patterns of the relationship between O-FDI and home country productivity. We interpret the positive role of O-FDI in other countries as relating to the strategic asset-seeking nature of Taiwanese investments in these countries. The implication of this finding is that policies aimed at limiting investments overseas may deprive firms of an important strategic option with long-term positive effects on the domestic economy.

Further down the road, we show that not all manufacturing industries in Taiwan benefit from O-FDI in other countries. The data show that the segments of home-owned industry that are best able to benefit from O-FDI in other countries are export-oriented
### Table IV.
The impact of overall O-FDI on productivity by classification of industries (FE model)

<table>
<thead>
<tr>
<th>Dependent variable: linear prediction</th>
<th>Domestic market-oriented sectors</th>
<th>Export-oriented sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>$C$</td>
<td>8.489 (15.25)***</td>
<td>-8.070 (-2.20)**</td>
</tr>
<tr>
<td>OFDIC</td>
<td>0.005 (0.17)</td>
<td>-0.004 (-0.16)</td>
</tr>
<tr>
<td>OFDIO</td>
<td>0.017 (1.02)</td>
<td>0.019 (1.21)</td>
</tr>
<tr>
<td>IFDI</td>
<td>-0.029 (-1.06)</td>
<td>-0.029 (-1.14)</td>
</tr>
<tr>
<td>KL</td>
<td>0.396 (2.39)**</td>
<td>0.169 (1.96)**</td>
</tr>
<tr>
<td>RDE</td>
<td>0.141 (2.50)***</td>
<td>0.232 (4.03)***</td>
</tr>
<tr>
<td>SKILL</td>
<td>1.484 (4.22)***</td>
<td>1.484 (4.22)***</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.654</td>
<td>0.690</td>
</tr>
<tr>
<td>$F$-value</td>
<td>20.100***</td>
<td>23.438***</td>
</tr>
<tr>
<td>$n$</td>
<td>112</td>
<td>112</td>
</tr>
</tbody>
</table>

**Notes:** Significance at: *10%, **5% and ***1 per cent levels; figures in parentheses are $t$-statistics (two-tailed tests)
industries. We interpret this finding as relating to the greater ability of export-oriented firms to take advantage of O-FDI by other firms, thereby absorbing the associated technological spillovers. Therefore, export-oriented industries benefit more from O-FDI in other countries than domestic market-oriented industries. Overall, the findings of this paper contribute to the literature by highlighting the role of the location of investment and industry characteristics in explaining the effect of O-FDI on home productivity. The study also adds to the debate concerning the relationship between O-FDI and productivity in the source country, a debate – especially in Taiwan – according to which the delocalisation/relocation of production activities towards China is responsible for the somewhat constrained productivity upturn.

Even though the advantages of segmenting data on account of revealing the role of heterogeneity in influencing the role of O-FDI in home-country productivity have become evident in this paper, the particular limitations of this paper should also be acknowledged. In order to analyse the productivity effect of O-FDI more precisely, one would need to compare the firm outcomes in the presence of multinational production with the outcomes that would have prevailed in the absence of multinational production. Unfortunately, we cannot observe what would have happened to firms that did engage in multinational production had they not done so. Even though home country productivity declines, we do not know if it would have declined even more if these firms had not invested overseas. Along this line, we suggest that future study should focus on the mechanisms underlying the relationship between O-FDI and home country productivity. Buckley et al. (2002) examines both productivity and non-productivity-related spillovers to host country locally owned firms. Following the same line and for a more comprehensive understanding of the home country effects of O-FDI, future research could also analyse, for instance, the effects of O-FDI on the profitability of firms in Taiwan.

Our findings carry important policy implications. They suggest that the Taiwanese Government should distinguish the level of liberalization towards O-FDI for different locations and in different types of industries. In particular, the government should channel more investment towards export-oriented industries especially those in "other countries". This will enhance productivity and the long-run competitiveness of Taiwanese industries. While elsewhere in this thesis, we suggest the importance of investing in China for other types of benefits such as exports and domestic investment, the complex effects of O-FDI mean that the Taiwanese Government should consider all the pros and cons of investments in different locations and different industries to maximize all types of benefits and minimize all types of negative effects.

Notes
1. Raut (1995) points out that regressing productivity on average wages raises potential simultaneity problems, since wages may be simultaneously determined with productivity. We have, therefore, adopted a one-year lag to tackle this issue.
2. Helpman et al. (2004) and Damijan et al. (2007) test whether there is a relationship between productivity levels of firms and the number of foreign markets firms serve. They find that more productive firms are more likely to invest in foreign affiliates.
3. The correlation matrix shows that some variables are highly correlated to each other. To avoid multi-collinearity in the model estimation, we chose not to enter those highly correlated variables in the same regression at one time.
References


Further reading


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