

# Heterogeneous Impact of Trade Liberalization on Vertical FDI: Evidence from Japanese Firm-level Data<sup>1</sup>

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**Abstract:** This paper empirically explores the reason why a recent surge of FDI to developing countries mainly has been driven by less productive firms. To this end, we present a simple model of FDI with vertical division of labor in heterogeneous firm framework. From the theoretical point of view, in countries with low unskilled worker wage and low trade cost, high productivity firms invest abroad and engage in international division of labor. Furthermore, if trade cost has further reduced, productivity cut-off level becomes lower and the middle range of productivity firms will start investing in low wage countries. Our empirical analysis using logit estimation or a multinomial logit model of Japanese firms' FDI choices reveals that a reduction in tariff rates attracts even less productive VFDI firms. This result is consistent with a different definition of VFDI. Because developing countries, particularly East Asian countries, have experienced a relatively rapid decrease in tariff rates, our results indicate that the increase in VFDI through tariff rate reduction led to the recent relative surge of FDI in developing countries.

**Keywords:** Multinational firm; Firm heterogeneity; Productivity

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## 1. Introduction

In these two decades, foreign direct investments (FDIs) from developed countries to developing countries have increased significantly compared with FDIs between developed countries. Navaretti and Venables (2004) report that *although FDI goes predominantly to advanced countries, the share of developing countries has been rising*. They show that the share of worldwide FDI received by the developing and transition economies jumped from 24.6% in the period 1988-93, to more than 40% in the period 1992-97. FDI to developing countries are considered as the investment which is intended to exploit low price-production factors of the host country and engages in the vertical division of labor among production stages between home country and host country. Such a division of labor is clearly important for the economic growth of developing countries. In case of Japan, many firms have actively invested in developing countries, particularly in East Asia in 1990s and 2000s.

There have been a number of theoretical papers that have sought to clarify the mechanics of the vertical division of labor among production processes (e.g., Jones and Kierzkowski, 1990). Academically this division of labor has become virtually interchangeable with the terms fragmentation, outsourcing, or vertical specialization. Fragmentation is the splitting of a product process into two or more steps that lead to the same final product. When a fragmented production block is placed beyond national borders, the fragmentation is called “international fragmentation” or “cross-border fragmentation”. International fragmentation is also discussed within the context of vertical foreign direct investment (VFDI). Studies show that theoretically once fragmentation becomes possible due to trade cost reductions, multinational enterprises (MNEs) in a country (often termed a developed country) locate their affiliates in a country (often termed a developing country) which has a comparative advantage in assembly processes. Obviously, since trade liberalization has progressed globally, particularly in developing countries, trade cost reduction due to trade liberalization is a driving force for the rapid increase of FDIs in developing countries.

However, “traditional” theories of the vertical division of labor do not incorporate heterogeneity in terms of firm’s productivity. As for firm heterogeneity in terms of productivity, the papers by Helpman et al. (2004) and Chen and Moore (2010) examine the relationship between productivity and horizontal FDI. Due to the presence of fixed entry cost for FDI, only firms with productivity beyond a cutoff can afford to pay the entry costs to invest abroad; thus, they become multinationals. Since their framework is

based on horizontal FDI, which is motivated to avoid high trade cost when supplying products to the market, the productivity cutoff for FDI become lower (higher) as trade costs has increased (decreased). Therefore, this extended version of HFDI in heterogeneous firm framework cannot demonstrate that trade liberalization plays a crucial role in increasing low productive firms' FDIs in developing countries.

In this paper, we extend the Helpman et al. (2004) model to incorporate vertical division of labor, namely VFDI. Subsequently, we theoretically summarize the situations regarding the relationship between trade cost reduction and firms' decision to conduct FDI. Next we empirically examine those predictions for Japanese FDIs in five Asian countries—China, Thailand, Malaysia, the Philippines and Indonesia—by employing firm-level data. We estimate the discrete choice model regarding firms' FDI decision. In the classification of VFDI, we adopt various criteria such as export or import intensity of each affiliate and qualitative question items on the motivation for investing abroad. Their reduction induces firms in the middle range of productivity distribution to follow VFDI. Because developing countries, particularly East Asian countries, have experienced a relatively rapid decrease in tariff rates, our findings imply that the increase in VFDI through tariff rate reduction has resulted in the recent relative surge of FDIs in developing countries.

This paper builds upon earlier theoretical and empirical works that examine the decision of heterogeneous firms to participate in international markets by extending the Helpman et al. (2004) model: Grossman et al. (2006), Aw and Lee (2008), Yeaple (2009), Chen and Moore (2010), Hur and Hyun (2011), and Hayakawa and Matsuura (2011). Grossman et al. (2006) theoretically investigate the complex types of FDI incorporating vertical division of labor in the framework of heterogeneous firm. Aw and Lee (2008) consider Taiwanese HFDI as the investment of middle income country firms in terms of wage levels and have four options: domestic production, investment in a lower wage country (China), investment in a higher wage country (the US), and investment in both higher and lower wage countries. Then, they examine the ranking of firms' productivity according to the option chosen and find it as follows: domestic production, FDI in China, FDI in the US, and FDI in both China and the US. Yeaple (2009) and Chen and Moore (2010) examine the relationship of productivity cutoff with several host country characteristics in HFDI in the US and France, respectively. For example, they show that the cutoff for investing is lower in countries with larger markets. Recently, Hur and Hyun (2011) examine the role of firm heterogeneity in choosing FDI type by using Korean firm-level data. They distinguish FDI types, including HFDI, VFDI, and combined FDI, and demonstrate a pecking order of firm

productivity across FDI types<sup>2</sup>. The paper by Hayakawa and Matsuura (2011) is closely related to this paper. They conduct the detailed analysis on MNEs which get engaged in vertical division of labor more than two countries in heterogonous firm framework and using spatial econometric analysis, demonstrate that there is an interrelation among foreign affiliates that belong to same MNEs. Using a simplified version of model of Hayakawa and Matsuura (2011), this paper examines productivity cutoff for VFDI, shedding light on changes in tariff rates and their effect on VFDI, as in Chen and Moore (2010).

The remainder of this paper is organized as follows. The next section illustrates a model to motivate our empirical analysis. Empirical analyses and their results are reported in Sections 3 and 4, respectively. Section 5 concludes.

## 2. Theoretical Framework

This section examines the decision to conduct VFDI in order to clarify which type of country attracts those firms that engages in international division of labor. To do that, it is essential to extend the model of FDI in heterogeneous firm framework to two-production stage setting. This section describes the kinds of country that can attract investment from the home country, while allowing for heterogeneity among firms in terms of productivity. It should be noted that the aim of this section is not to provide a general equilibrium model of VFDI, but simply to obtain insights into the driving forces working behind VFDI in a partial equilibrium model.

### 2.1. Settings

Suppose that there are three countries: country 1 (home country), country 2 (foreign country), and a country in the outside economy. In this supposition we consider finished products that are horizontally differentiated. Each of a continuum of firms manufactures a different brand with zero measure. For simplicity, the finished products are consumed only in the outside economy,<sup>3</sup> and are transported from any of the two countries without charge.<sup>4</sup> A representative consumer in the outside economy country

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<sup>2</sup> While the model of Hur and Hyun (2011) focus only on the differences in factor prices for unskilled worker between home country and host country, our paper considers trade costs differences as well as factor price differences.

<sup>3</sup> You may assume that country 2 is East Asian country and the outside economy is U.S. or European countries. Indeed, in the 1990s, around 80% of finished machinery goods produced in East Asia were exported to other regions, particularly to U.S. and European countries (Kimura et al., 2007).

<sup>4</sup> The assumption of no trade costs may be thought too unrealistic. However, as long as we assume

has a constant elasticity of substitution utility function over varieties. As usual in the literature, utility maximization yields

$$x(k) = A p(k)^{-\varepsilon},$$

where  $x(k)$  is the demand for the variety  $k$  and  $p(k)$  is its price.  $\varepsilon$  is the elasticity of substitution between varieties, and is assumed to be greater than unity. The brand name  $k$  is omitted from this point onwards for brevity.  $A \equiv P^{1-\varepsilon}Y$ , where  $P$  is the price index and  $Y$  is total income in the outside country.  $A$  is a measure of the demand level and is taken as exogenous by producers.

The market structure of the finished products sector is monopolistic competition. For simplicity, firms and their headquarters are assumed to locate only in country 1 (home country). Firms are heterogeneous in terms of their cost efficiency  $a$ . The finished products are produced in two stages of production. The production function in each stage is kept as simple as possible to bring out the nature of the dependence among production stages. Our Leontief-type production structure is as follows. A first stage product (intermediate goods) is produced by inputting  $a$  units of skilled labor; a second stage product (finished goods) is produced with input of one unit of the first stage product and  $a$  units of unskilled labor.<sup>5</sup> Factor prices for skilled labor, and unskilled labor are represented by  $r$ , and  $w$ , respectively.

For simplicity, we assume that  $w_1 \geq w_2$  and  $r_2 \geq r_1$ , respectively, indicating that country 1 (the home country) has higher wages for unskilled labor. The assumption of factor prices order indicates simply that country 2 have location advantages in producing the second-stage products. There are iceberg trade costs  $t (\geq 1)$  for the shipment of intermediate goods from home country to foreign country. Although firms do not need to pay any fixed costs if they produce all stage products only in country 1, they must incur plant set-up costs  $f$  if they locate plants abroad.

Let  $c_D$  and  $c_V$  be total cost in the production pattern for domestic production and vertical FDI, respectively. Then  $c_D$ , and  $c_V$  are given by:

$$\begin{aligned} c_D &= (r_1 a + w_1 a)x, \\ c_V &= (tr_1 a + w_2 a)x + f. \end{aligned}$$

The profit-maximizing strategy yields  $p = \varepsilon c_x / (\varepsilon - 1)$ , where  $c_x = d c / d x$ , so that profits

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that countries 1 and have identical trade costs with the outside economy, the assumption of positive trade costs do not change qualitatively our results, which are later provided. Indeed, the trade costs with U.S. or European countries are not so different among East Asian countries, which are supposed as samples of country 2 in our empirical analysis.

<sup>5</sup> Our results are qualitatively unchanged even if assuming the different input coefficients of production factors among products.

are given by:

$$\begin{aligned}\pi_D &= (r_1 + w_1)^{1-\varepsilon} \Theta \\ \pi_V &= (tr_1 + w_2)^{1-\varepsilon} \Theta - f,\end{aligned}$$

where  $\Theta \equiv A \varepsilon^{-\varepsilon} (\varepsilon - 1)^{\varepsilon-1} a^{1-\varepsilon}$ . We call  $\Theta$  the productivity measure. Since  $\varepsilon > 1$ , the smaller the cost efficiency  $a$  is, the larger the measure  $\Theta$  is.

## 2.2. Domestic production and VFDI

We consider the problem of selecting production patterns, i.e., domestic type and VFDI type. If the location advantages in producing the second-stage products in country 2 is trivial compared with country 1,  $\pi_D$  is always higher than  $\pi_V$  due to the existence of trade costs between host and home countries. To shed light on the production pattern of interest in this study, i.e., the international production-stage division of labor, we restrict ourselves only to the cases where the location advantages in countries 2 are relevant. Specifically, we assume  $(1 - t) r_1 > w_1 - w_2$ . Then, drawn as a function of the productivity measure  $\Theta$ , the slope of  $\pi_V$  is steeper than  $\pi_D$ . As a result, since VFDI firms must incur fixed set-up costs  $f$  for the plant in country 2, a profit line in each production type can be drawn as in figure 1. Figure 1 shows productivity cutoff dividing firms between domestic and VFDI categories. This figure shows that more productive firms choose VFDI whereas less productive firms concentrate on production activity at home.

In this setting, a reduction in trade costs increases revenues for VFDI firms, inducing that the slope of  $\pi_V$  becomes steeper and thus that productivity cutoff level get lowered. The reduction of unskilled workers' wages in country 2 has the same kind of effects on the productivity cutoff. As a result, the reduction of trade costs or unskilled workers' wages in country 2 encourages firms that do not invest in the initial year to start setting up overseas affiliates for international vertical division of labor. Obviously, such firms have the lower productivity than firms who already have overseas affiliates but the higher productivity than firms who leave both production stages in country 1. In this sense, we may say that trade liberalization in potential host countries encourages firms with a medium range of productivity to conduct VFDI in those countries.

==== Figures 1 ====

## 3. Empirical Framework and Data

This section first takes an overview of Japanese FDI. Then, after explaining our empirical specification, we present our variables to be examined and their data sources.

### 3.1. Overview of Japanese FDI

This section explains our empirical strategies. Before discussing the empirical specification, we present some preliminary findings on Japanese manufacturing FDI by using the micro database of *Kaigai Jigyō Katsudō Kihon (Doukō) Chōsa (Survey on Overseas Business Activities*, hereafter SOBA) prepared by the Research and Statistics Department, Ministry of Economy, Trade and Industry (hereafter, METI). SOBA aims to obtain basic information on the activities of foreign affiliates of Japanese firms. The survey covers all Japanese firms that have affiliates abroad. SOBA includes items such as the year of establishment of the affiliate, and a breakdown in sales and purchases, employment, costs, and research and development.

Table 1 reports the number of new Japanese overseas affiliates by year and region. This table is restricted to the first investment in each country for firms, which implies that we include the first investment in one country by firms who have invested in different countries but do not count the second investment. In our sample, the total number of new investment was highest in 1995 and then gradually decreased toward 2003. As for regional distribution, the number of firms investing in North America and Europe were 109 and 189, respectively, new investment toward Asia<sup>6</sup> accounted for 856 among total 1,212 investments from 1995 to 2003.

=== Table 1 ===

Table 2 shows the ratio of export-intensive overseas affiliates by region and industry. We define as an export-intensive affiliate, an affiliate whose share of exports in total sales is greater than the industry average of all sampled affiliates. Export intensity in MNEs' affiliates is sometimes used as a proxy for the extent of VF<sub>FDI</sub><sup>7</sup> because, although HF<sub>FDI</sub> is an investment to avoid broadly defined trade costs by setting up

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<sup>6</sup> In this table, Asia includes not only East Asian countries but also South Asian countries. Whereas North America consists of the US and Canada, Europe includes not only Western European countries but also Eastern European countries.

<sup>7</sup> For example, Fukao et al. (2003) compares the share of sales destination in total sales for Japanese and US MNE affiliates among regions and finds that for both Japanese and US MNEs, although the share of local sales by MNE affiliates in Europe and Latin America exceed 50% or 60%, that for affiliates in East Asia was less than 50%. Because VF<sub>FDI</sub> is considered as investments that take advantage of the differences in factor prices and export the output to foreign countries, they conclude that FDI in East Asia is more likely to be “vertical” in nature.

plants within a targeted market/country rather than by exporting from the home country, VFDI is intended to exploit low price-production factors of the host country. In other words, most of the goods produced by HFDI affiliates are intended for sales in the host country; however, sales of products from VFDI affiliates are not aimed at the host country. Thus, the larger export share suggests that overseas affiliates are more likely to be involved in vertical production networks.

== Table 2 ==

The findings from Table 2 are as follows. Clearly, affiliates in Asia are more likely to fall into the category of export-intensive affiliates than those in developed countries. For example, in electric machinery manufacturing sector, while the ratios of export-intensive affiliates for North America and Europe are 24% and 18%, respectively, that for Asia is 47%. Export-intensive affiliate ratio in Asia exceeds 50% for Textile, Information and Communication devices and Precision Instrument. It suggests that MNEs in these industries are investing in Asia to exploit low price-production factors of the host country and engages in the vertical division of labor among production stages between home country and host country.

Asian countries have experienced gradual trade liberalization through the 1990s and 2000s. Panels (a) and (b) in Figure 2 present the changes in tariff rates against products from Japan (the simple-average in manufacturing sectors) by region or certain Asian countries. Our tariff rates data source is the World Integrated Trade Solution (WITS), particularly TRAINS raw data. Panel (a) shows that tariff rates in regions other than Asia remained almost unchanged during the sample period, but those in Asia gradually decreased. In other words, Asia has achieved greater trade liberalization in terms of tariff rate reductions than other regions. Panel (b) reports the trend in tariff rates in five Asian countries: China, Thailand, Malaysia, the Philippines, and Indonesia.

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