Labor Training and Foreign Direct Investment

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Abstract

Evidence shows that most foreign direct investment (FDI) flows from developed to developed countries (North-to-North) in skilled-labor-intensive industries. This paper builds a model which incorporates labor training to the proximity-concentration tradeoffs to analyze multinationals' entry mode to a foreign country. Production requires both skilled labor and unskilled labor. A multinational taking FDI needs to provide training to some workers in the host country to equip them with skills which are specific to the firm's production. Labor training and skill specificity leads to contract friction. We show that in skilled-labor-intensive industries, FDI increases with the host country's economic development level; but in unskilled-labor-intensive industries, the reverse is true. This paper provides a theoretical explanation to the empirical findings on the prevalence of North-to-North FDI in skilled-labor-industries and North-to-South FDI in unskilled-labor-intensive industries.

Keywords: Labor training; Contract frictions; Export; FDI; Heterogenouse firms; Skill intensity.
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1 Introduction

What determine the flows of foreign direct investment (FDI)? The traditional view, i.e., the proximity-concentration view (Markusen, 1984), predicts that when choosing between export and FDI to serve the foreign markets, multinationals tend to choose FDI to enter large markets. More recent studies show that FDI is more likely to occur between countries with more similar factor endowments (Markusen and Venables, 2000), or between countries with a similar stage of development (Fajgelbaum et al, 2011). In particular, Fajgelbaum et al (2011) provide a theory to explain the Linder hypothesis for FDI: the prevalence of North-to-North FDI and the rise of South-to-South FDI. All these predictions are supported by evidence. In the present paper, we explore FDI pattern at both the country level as well as at the industry level. Specifically, we offer a new explanation for the observed North-to-North FDI in skilled-labor-intensive industries and the North-to-South FDI in unskilled-labor-intensive industries. The new explanation relies on labor training and contract friction.

Evidence shows that most FDI flows occur between developed countries,[1] and in those North-to-North FDI flows, most are in skilled-labor-intensive industries (Markusen, 1995).[2] To explain this phenomenon, in this paper we incorporate labor training to the Helpman et al (2004) model to analyze firms' entry mode to a foreign country. Production requires both skilled labor and unskilled labor. Industries differ in their intensities of skilled labor in production. In each industry, firms are different in their productivity a la Melitz (2003). A firm undertaking FDI needs to provide training to some workers in the host country to equip them with skills which are specific to the firm's production (Becker, 1964). However, labor training involves contract friction. If the trained workers quit, the firm then needs to use unskilled labor to substitute the trained, skilled labor, which causes a production efficiency loss. Such a threat forces the firm to bargain with the trained workers, ex post, to share the surplus arising from the services of the skilled workers. Such a bargaining reduces ex ante labor training and so the resulting FDI profit of the firm. The profit or efficiency loss to the firm is less severe in a more developed host country than in a less developed host country because in the former the firm can find higher quality workers than in the latter to replace the trained workers who have quit. Thus, the potential efficiency loss would be smaller in the former than in the latter. Hence, FDI profit in a more developed host country is higher than that in a less developed country, other things equal. Such a profit difference is bigger in more skilled–labor-intensive

[1] The 49 least developed countries attracted only 0.3 percent of world FDI in 2000 (United Nations, 2001). According to Markusen (1995), the bulk of the world FDI is from developed countries to host countries with similar per capita incomes.

[2] Helpman et al (2004) also find that the U.S. outward FDI is more significant in industries with higher productivity dispersion, which at the same time is discovered to be highly positively correlated with the number of skilled-workers per establishment in those industries.

industries than in less skilled-labor-intensive industries. However, wage rate is lower in a less developed host country than in a more developed host country. We show that these conflicting effects together lead to the following results: in skilled-labor-intensive industries, FDI increases with the host country's economic development level; but in unskilled-labor-intensive industries, the reverse is true. Therefore, we should observe more North-to-North FDI in skilled-labor-intensive industries and more North-to-South FDI in unskilled-labor-intensive industries.

Labor training has long been emphasized as one of the important activities taken by multinationals in both developing and developed countries (Dunning, 1993)."The International Labour Organisation (1981) and Lindsey (1986) have respectively documented the importance by the training activities of multinationals in several developing countries. Gerschenberg (1987) and Djankov and Hoekman (1999) provide evidence showing that foreign multinationals provide more labor training than domestic firms in Kenya and Czech Republic, respectively. multinationals also provide labor training in developed host countries. Using survey data from sixty-nine Japanese subsidiaries operating in Australia in 1994, Purcell et al (1999) find that almost every subsidiary reports having both off-the-job and on-the-job training programs. Kuwaja (1986) finds similar evidence for Japanese affiliates in the U.S. Sousa (2001) finds similar evidence on foreign multinationals in the UK.

Brainard (1997) shows that after controlling for the proximity-concentration factors (e.g., economies of scale, transportation cost, and market size), the ratio of the U.S. firms' foreign affiliate sales to export sales is decreasing in the gap of GDP per capita between the U.S. and the host country concerned. That is, relatively more FDI flows to more developed (higher income) foreign countries. On the other hand, using industry-level data from the U.S. outward FDI and exports to 39 countries, Yeaple (2003) finds that in skilled-labor-intensive industries, there is more U.S. FDI to countries with relative human capital abundance. These empirical findings are consistent with the predictions from our model. Our theory offers an explanation to these important findings.

There is a vast literature, both theoretical and empirical, on the determination of FDI flows. What distinguishes our theory from the existing studies is its emphasis on labor training as a key factor in explaining the flow of North-to-North FDI in skilled-labor-intensive industries and the flow of North-to-South FDI in unskilled-labor intensive industries. In the literature, the proximity-concentration view (Markusen, 1984; Brainard, 1997; Helpman et al, 2004) indicates that firms will choose export (concentration of production) when plant-level economies of scale are high, and FDI (proximity to consumers) when transport costs and/or firm-level economies of scale are high. Host country's market size is conducive to FDI. Markusen and Venables (2000) combine Helpman-Krugman (1985) and Heckscher-Ohlin models to show that FDI is more likely to occur if the two countries are more similar in their factor endowments. They allow for FDI in one sector only. In our model, the case where the host country is more developed also means that its factor endowment is more similar to the home country (the untrained workers' skill is higher in a more developed country). However, we show that such an FDI pattern depends on the type of industries: country similarity in development level only leads to more FDI in skilled-labor-intensive industries, but less FDI in unskilled-labor-intensive industries. Moreover, this pattern does not hold if there is no contract friction in labor training.

Fajgelbaum et al (2011) introduce product quality and non-homothetic preference to a 4-country model featuring proximity-concentration tradeoff. They show that FDI will arise between North and North, or between South and South. That is because both Northern countries have higher demand for high quality goods, and so firms from one Northern country producing high quality goods will face a larger market in the other Northern country than in other Southern countries. The proximity-concentration tradeoff then suggests that the firms will choose FDI over export. A similar reason can be given to the explanation for the rise of South-to-South FDI in low quality goods. Thus, their paper explains regional FDI (i.e., North-to-North and South-to-South) in production of goods with different quality. Our paper explains both regional FDI (North-to-North) and cross-regional FDI (North-to-South). In addition, it shows that such FDI patterns are linked with different industries with different skilled-labor intensities.[3] Due to labor training, we show that the dependence of the different types of FDI on the host country's development level is crucially affected by contract friction.

Our paper is also related to another literature which stresses the importance of contract frictions in international trade and FDI. Antràs (2003) and Antràs and Helpman (2004, 2008) highlight the importance of contract friction in shaping firms' global sourcing strategies. In their empirical work, Nunn (2007) and Nunn and Trefler (2008) show that contract incompleteness explains more of the world trade pattern than capital and skilled labor combined. Similar to those papers, our paper also takes contract friction seriously. However, we analyze a very different issue: how contract friction arising from labor training affects firms' choice between export and FDI in industries with different degrees of skilled-labor intensity.

In this paper, we first describe the model in Section 2. Then, in Section 3, we examine firms' optimal profits from FDI and export, respectively. We derive the equilibrium and the main results in Section 4. Section 5 gives concluding remarks.

[3]In the literature on proximity-concentration tradeoffs, Nocke and Yeaple (2007) also show that FDI depends on industry characteristics. In particular, they find that in industries where firms differ mainly in their mobile (non-mobile) capabilities, the most (least) efficient firms engage in cross-border M&As.

2 Model

Consider the following modified model of Melitz (2003) and Helpman et al (2004). There are two countries, home (H) and foreign (F). Firms from N industries of the home country make their decisions to enter the foreign market, via either export or FDI. Firms produce differentiated products in each of the N industries. The home market and foreign market are segmented and so we can just focus our analysis on the foreign market.

In the foreign market, there is demand for goods of these N industries and goods of other industries as well. To focus on the N differentiated-goods industries, we treat all other industries as one homogenous-good industry. A representative consumer in F derives the following utility from consuming z units of the homogeneous good and $x_n(v)$ units of variety v from industry n:

$$U = \left(1 - \sum_{n=1}^{N} \mu_n\right) \log z + \sum_{n=1}^{N} \mu_n \log \left(\int_{v \in V_n} x_n(v)^{\alpha_n} dv \right)^{\frac{1}{\alpha_n}},$$

where V_n denotes the measure of available varieties in industry n, μ_n is the fraction of expenditure spent on industry n's goods, and $(1 - \sum_{n=1}^{N} \mu_n)$ is the fraction spent on the homogenous goods. The parameter $\alpha_n \in (0,1)$ gives $\varepsilon_n = \frac{1}{1-\alpha_n} > 1$, which is the elasticity of substitution across varieties within an industry (n). The elasticity of substitution across goods from different industries is unity, which implies constant expenditure spent on each industry. As a result, we can carry our analysis in each industry independently. In what follows, we focus on one industry and drop industry index n when it causes no confusion. Given any budget constraint, consumer's utility maximization yields the following demand for each variety in the given industry:

$$x(v) = Ap(v)^{-\varepsilon},$$

where A is the industry's aggregate consumption index.[4]

All the differentiated goods considered above are produced by firms from H. Each variety is produced by a single firm and there is free entry to the industry. As in Melitz (2003), to enter the industry, a firm needs to pay a fixed entry cost equal to f_E. Upon paying this fixed cost, the firm draws a productivity level θ from a cumulative distribution $G(\theta)$. θ is independent of the size of production. After realizing its productivity level, the firm decides whether to exit or to stay in the industry. If it exits, then the game is over for the firm. If it stays in the industry, it needs to decide how to serve the foreign market. If it chooses export, it pays an overhead cost f_X and bears an iceberg transport cost $\tau \in (0,1)$ (i.e., only $1-\tau$ fraction of the goods shipped will reach the export market). If it chooses FDI, it pays an overhead cost

[4] Due to Helpman et al (2004), the derivation and expression of this demand has become standard.

f_I to set up a production plant in F. Thus, $f_I - f_X$ represents the extra fixed cost of serving the foreign market through FDI. As it is common, assume $f_I - f_X > 0$. In order to focus on the optimal choice between export and FDI, we ignore the home market, which has no important consequence because of the above assumptions (especially about the market segmentation and constant productivity θ).[5] As a result, firms either exit, export, or undertake FDI. The type of pure domestic firms does not exist in our model.

Labor is the only factor for production. All labors are unskilled to beginning with. However, efficient production needs both skilled and unskilled labor. A firm can train some (unskilled) labor to become skilled. Assume Cobb-Douglas production function for firm θ (the firm with the drawn productivity θ): if the firm uses m skilled labors and l unskilled labors in production, its output will be

$$x = \theta \left(\frac{m}{\eta}\right)^{\eta} \left(\frac{l}{1-\eta}\right)^{1-\eta}, \qquad 0 < \eta < 1,$$

where η is the skilled-labor intensity of production in the corresponding industry.

The production of homogeneous goods exhibits constant returns to scale. In particular, in H one (unskilled) labor is needed to produce one unit of the homogeneous good, but in F one (unskilled) labor can produce only w (< 1) unit of the homogeneous good, reflecting technology backwardness of the foreign country. Suppose that in each country, (unskilled) labor is inelastically supplied and there is no cost associated with the homogeneous goods' trade between countries. Then, we can treat the homogenous goods as a numeraire good and consequently, the market wage is one in H and w in F. Labor is immobile between countries.

3 Firm Decision

To obtain a firm's optimal entry decision, we first derive its respective FDI profit and export profit, and then compare the two profits.

3.1 FDI

If the firm undertakes FDI, then, it needs to train some workers in F. Assume that the cost of training each worker in F is t. Following the labor economics literature, we assume that such labor training

[5]However, since we have assumed the absence of domestic production, even in the case of export, the firm must incur a fixed cost of setting up the production plant at home, say f_S, in addition to the fixed cost of export f_X. It is natural to assume that $f_S + f_X < f_I$. To reduce the burden of notation, we normalize $f_S = 0$. It is straightforward to see that the rest of the analysis and qualitative results of the paper does not depend on such a normalization.

provides workers the firm-specific skill (see Becker, 1964; Weiss, 1986; Parsons, 1986), which is not useful for other firms.[6] That is, a trained labor in one firm becomes an unskilled labor in any other firm. Once trained, the skill becomes the workers' human capital. Due to the inalienability of human capital, the firm and the trained workers (i.e., skilled workers) cannot contract ex ante upon the skilled workers' future services, and these workers could always withdraw their human capital at anytime (Hart and Moore 1994). Therefore, after the training is completed, there will be a surplus arising from the relationship between the firm and the trained workers: if the firm and the trained workers stay together, they can produce efficiently; if they separate, the firm has to employ the unskilled labor from the market to perform the skilled workers' task, which results in a loss of efficiency. The existence of such a surplus enables the skilled workers to bargain with the firm over the surplus by their threat to quit.[7] Suppose that the trained workers act as a union and so bargain jointly with the firm, à la Nash. This bargaining, caused by the ex post hold-up problem, will distort the firm's ex ante investment in training.

We now analyze the bargaining. To obtain the bargaining outcome, we need to first derive the outside option of the firm and that of the trained workers should the bargaining break down. If the bargaining fails, the firm has to hire new and untrained labor at the market wage to fill the positions of the departed, trained workers.[8] Because of the loss in production efficiency, the new production will be only a fraction, $\delta \in (0,1)$, of the previous level. Moreover, the firm's training costs are sunk. Hence, the firm's payoff from its outside option is

$$\delta^\alpha A^{1-\alpha}\theta^\alpha \left(\frac{m}{\eta}\right)^{\alpha\eta} \left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)} - wm - tm - wl - f_I,$$

where the first term is the revenue, the second term is the wage payment to the unskilled workers hired to replace the departed trained workers, the third is the sunk training cost, the fourth is the wage payment to the unskilled workers, and the last is the fixed FDI cost. Due to firm specificity of skills, in the case where the trained workers leave the firm and get employed in other firms, they will earn the market wage as other unskilled labor. Hence, the trained workers' total payoff from their outside option is wm.

If the firm and the trained workers reach an agreement in the bargaining, their joint payoff is

$$A^{1-\alpha}\theta^\alpha \left(\frac{m}{\eta}\right)^{\alpha\eta} \left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)} - tm - wl - f_I.$$

[6] An alternative theory based on adverse selection argues that training could be general. However, due to information asymmetry on the employee's ability, if the employee quits the current firm, he will suffer a discount in his earning because the new employer does not know his productivity. Thus, the employee is also locked in (see Acemoglu and Pischke, 1998 and 1999).

[7] The quitting threat of the unskilled-workers is not credible, because they could be replaced by the outside workers without causing a loss in the output.

[8] Suppose that the positions have to be replaced one to one, and the firm cannot rescale the production due to a large rescaling cost. Allowing rescaling will not change the results qualitatively.

Thus, the surplus for the firm and the skilled workers from the cooperation is

$$(1-\delta^{\alpha})A^{1-\alpha}\theta^{\alpha}\left(\frac{m}{\eta}\right)^{\alpha\eta}\left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)}. \tag{1}$$

Suppose that the firm and the trained workers have equal bargaining power. Then, they share the above surplus equally.

Since there is a positive surplus, they will always reach an agreement. Thus, the firm's profit is its payoff from its outside option plus half of the surplus, which is given by

$$\frac{1}{2}(1+\delta^{\alpha})A^{1-\alpha}\theta^{\alpha}\left(\frac{m}{\eta}\right)^{\alpha\eta}\left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)}-(w+t)m-wl-f_I.$$

The firm makes its hiring decision, m and l, to maximize the above payoff, which gives the following first-order conditions:

$$\begin{aligned}\frac{1}{2}(1+\delta^{\alpha})A^{1-\alpha}\theta^{\alpha}\alpha\left(\frac{m}{\eta}\right)^{\alpha\eta-1}\left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)} &= w+t,\\ \frac{1}{2}(1+\delta^{\alpha})A^{1-\alpha}\theta^{\alpha}\alpha\left(\frac{m}{\eta}\right)^{\alpha\eta}\left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)-1} &= w.\end{aligned}$$

To capture the reality, we assume that a more developed foreign country has a higher wage rate and a lower training cost because the general labor's skill or quality is higher. To make the case simpler, we let $t=1-w$. Our qualitative results do not depend on this special specification as long as t and w do not have a strong positive correlation. Then, solving the above first-order conditions yields the optimal input levels

$$m^* = \left(\frac{1}{2}\right)^{\frac{1}{1-\alpha}}\eta A\theta^{\frac{\alpha}{1-\alpha}}\alpha^{\frac{1}{1-\alpha}}w^{\frac{-\alpha(1-\eta)}{1-\alpha}}(1+\delta^{\alpha})^{\frac{1}{1-\alpha}}, \tag{2}$$

$$l^* = \left(\frac{1}{2}\right)^{\frac{1}{1-\alpha}}(1-\eta)A\theta^{\frac{\alpha}{1-\alpha}}\alpha^{\frac{1}{1-\alpha}}w^{\frac{\alpha\eta-1}{1-\alpha}}(1+\delta^{\alpha})^{\frac{1}{1-\alpha}}. \tag{3}$$

As common in the literature, assume that ex ante the firm could impose a lump-sum payment, T, to the workers who enter the training. This will allow the firm to grasp all the profits from the relationship, leaving the trained workers in the break-even position. Then, substituting the above solutions to the surplus expression (1) and using that we can obtain the firm's optimal profit from FDI

$$\pi_I(w,\eta,\delta,\theta)=A\psi_I(w,\eta,\delta)\theta^{\frac{\alpha}{1-\alpha}}-f_I, \tag{4}$$

where $\psi_I(w,\eta,\delta)\equiv 2^{\frac{-1}{1-\alpha}}(2-\alpha)\alpha^{\frac{\alpha}{1-\alpha}}w^{\frac{\alpha\eta-\alpha}{1-\alpha}}(1+\delta^{\alpha})^{\frac{\alpha}{1-\alpha}}$.

3.2 Export

In the case of export, production takes place in the home country. The firm has to train some local workers to become skilled labor and hire some other workers as the unskilled labor. As we focus on the case where the home country is a highly developed one, it is natural to assume that the general labor skill in this country is higher and so training is less costly. It also implies that the efficiency loss from bargaining breakdown is smaller in this country. In order to focus on the role of the foreign country's economic development level in affecting the home firm's choice between FDI and export, we suppose that the home country's general labor skill or development level is not only higher but also perfect. As a result, there is no training cost (in fact, this is automatically implied by $t = 1 - w_H = 0$ as we have $w_H = 1$) and $\delta_H = 1$ in the home country.

With the above discussion, we have the following profit function for export

$$(1-\tau)^{\alpha} A^{1-\alpha}\theta^{\alpha}\left(\frac{m}{\eta}\right)^{\alpha\eta}\left(\frac{l}{1-\eta}\right)^{\alpha(1-\eta)} - m - l - f_X.$$

The firm makes the domestic hiring decisions, m and l, to maximize the above profit. The optimal profit can be obtained as given below

$$\pi_X(\tau,\theta) = A\psi_X(\tau)\theta^{\frac{\alpha}{1-\alpha}} - f_X, \tag{5}$$

with $\psi_X(\tau) \equiv \alpha^{\frac{\alpha}{1-\alpha}}(1-\alpha)(1-\tau)^{\frac{\alpha}{1-\alpha}}$.

4 Equilibrium

The case of export differs from that of FDI in two ways. First, in export, production takes place in the home country and so the firm saves the fixed FDI cost f_I, but pays the smaller fixed cost of export f_X. Second, in export, there is a trade cost on per unit of export, such as tariff and international transportation, which is absence in the case of FDI. Such a comparison leads to the proximity-concentration tradeoff between export and FDI.

To analyze the tradeoff, we directly compare the two profit functions, $\pi_X(\tau,\theta)$ and $\pi_I(w,\eta,\delta,\theta)$. It is easily observed that both profits are linearly increasing in $\Theta \equiv \theta^{\frac{\alpha}{1-\alpha}}$. Hence, $\psi_X(\tau)$ and $\psi_I(w,\eta,\delta)$ are the respective slopes of the two profit lines. Since $f_I > f_X$, a necessary and sufficient condition for the existence of FDI is that the two profit lines (expressed in Θ not θ) has a single crossing. Since Θ can be very large, this condition is reduced to $\psi_I(w,\eta,\delta) - \psi_X(\tau) > 0$. As Θ is a strictly increasing transformation from θ, we also call Θ the productivity level, for convenience.

Let Θ_X be the productivity level at which the profit of export is zero. Then, we have

$$\Theta_X(\tau) = \frac{f_X}{A\psi_X(\tau)}.$$

Given the existence of the above-mentioned single crossing, let Θ_I be the productivity level at which the two profit lines cross. We obtain

$$\Theta_I(w, \eta, \delta) = \frac{f_I - f_X}{A[\psi_I(w, \eta, \delta) - \psi_X(\tau)]}. \tag{6}$$

It is clear that export will not be observed in the industry if $\Theta_X > \Theta_I$. This is a less interesting case and so let us suppose the otherwise, i.e., $\Theta_X < \Theta_I$.

The above two cutoff points immediately allows us to obtain the following sorting pattern: the most productive firms ($\Theta > \Theta_I$) choose FDI, the median productive firms ($\Theta \in (\Theta_X, \Theta_I]$) choose export, and the least productive firms ($\Theta \leq \Theta_X$) exit.

This sorting pattern is not new and has been derived in many models such as Helpman et al (2004). While the proximity-concentration approach says that higher FDI fixed cost reduces the profitability of FDI while higher trade cost reduces the profitability of export, the derived sorting pattern indicates that the proximity-concentration comparison result is different for different firms with different productivities. To highlight how contract friction affects the sorting pattern and what new results it brings about, in what follows we first examine the benchmark case, in which contract friction is absent, and then analyze the equilibrium in the presence of contract friction. In each case, we will conduct a "comparative statics" analysis to generate some empirically testable hypotheses on how the level of economic development affects the FDI flows. In the present model, the level of economic development of the foreign country is captured by the general labor skill (or wage rate), training cost, and efficiency loss in the case of bargaining breakdown. Generally, when these factors change, each individual firm will respond by adjusting its optimal choice between export and FDI (and exit). This is the direct effect. On the other hand, the adjustment by all individual firms will also bring changes to the market competition, captured by A. Firms also respond to this market size/demand change by adjusting their entry modes. This is the indirect effect. As it is well understood from the proximity-concentration view that a large market in the host country favors FDI over export, in order to see the impact of the economic development level, we ignore the indirect effect in our "comparative statics" analysis below. Accordingly, we can view the following exercise as comparing two foreign countries which differ in their economic development levels, but have the same market demand/size (A) due to other differences (e.g., population size) which do not affect the home firms' entry mode directly except through A.

Let a single variable e represent the foreign country's economic development level.

4.1 Benchmark Case: No Contract Friction

Suppose $\delta = 1$. In this case there is no surplus to bargain over and there is no contract friction between the firm and the skilled workers. Moreover, $e = w$, that is, wage rate alone fully represents the economic development level of the foreign country. Then, we can rewrite the FDI profit as $\pi_I(w, \eta, \theta) = A\psi_I(w, \eta)\theta^{\frac{\alpha}{1-\alpha}} - f_I$, where $\psi_I(w, \eta) = \frac{1}{2}(2-\alpha)\alpha^{\frac{\alpha}{1-\alpha}} w^{\frac{\alpha\eta-\alpha}{1-\alpha}}$. Using this in (6), we have

$$\frac{\partial \Theta_I}{\partial e} = \frac{\partial \Theta_I}{\partial w} > 0.$$

This immediately allows us to establish the following result.

Proposition 1. *Suppose that there is no contract friction ($\delta = 1$). Then, a more developed country will received less FDI inflows than a less developed country.*

The intuition is very clear. Without contract friction, two factors are crucial in affecting a firm's FDI profit: unskilled labor's wage rate and the training cost. As wage rate and training cost are supplements, i.e., $t + w = 1$, the development level's impact on skilled labor is constant and so the only factor that matters is wage rate for unskilled labor. Thus, a more developed country means higher labor cost, which reduces the location advantage associate with FDI, and so discourage FDI. This can be seen from the following: with higher wage, the firm will train fewer workers [$\frac{\partial m^*}{\partial w} < 0$ from (2)] and hire fewer unskilled workers [$\frac{\partial l^*}{\partial w} < 0$ from (3)] in its FDI production, which results in lower FDI profit [$\frac{\partial \pi_I}{\partial w} < 0$ from (4)].

Although this intuition is simple from the model, the prediction of Proposition 1 is not consistent with the evidence that there are more FDI to a more developed countries even after controlling for market size and demand. This suggests that some important factors are missing. We show next that contract friction matters.

4.2 Contract Friction and FDI

We now examine the main model in which contract friction in the foreign country presents. Note $\frac{\partial \Theta_I}{\partial \delta} < 0$ from (6). Thus, if the efficiency loss from bargaining breakdown is less, or the damage from contract friction is lower, more firms will choose FDI in the foreign country. This is because with lower contract friction, the firm will train more workers [$\frac{\partial m^*}{\partial \delta} > 0$ from (2)] and correspondingly also hire more unskilled workers [$\frac{\partial l^*}{\partial \delta} > 0$ from (3)] in its FDI production, which results in higher FDI profit [$\frac{\partial \pi_I}{\partial \delta} > 0$ from (4)]. This force works opposite to the wage.

It is generally accepted that in bargaining, the firm's outside option is better (higher δ) in a more developed foreign country. There are at least two reasons. First, as augured by Antràs and Helpman (2004), there are better market institutions (for example, better contract enforcement and better property rights protection) in a more developed country. This tends to reduce the risk of contract breakdown and the subsequent profit losses. Second, the education level and the quality of labor force is higher in a more developed country, as pointed out by Barro and Lee (1996). When bargaining breaks down, the firm has to hire new workers to replace the trained workers. The production loss from the skilled labor replacement will be lower when the skill and quality of the new workers are higher. Since wage rate represents the development level of the foreign country when $\delta = 1$, we can then consider δ as an increasing function of w. For simplicity, we assuming $\delta = w^{\frac{1}{\alpha}}$. Then, even though δ is also another dimension of economic development, we can still use wage rate alone to represent the foreign country's economic development level, i.e., $e = w$, but the interpretation of an increase in e should always go with an increase in wage rate and a reduction of contract friction (or increase in δ). Therefore, the FDI profit (4) can be rewritten as

$$\pi_I(w, \eta, \theta) = A\psi_I(w, \eta)\theta^{\frac{\alpha}{1-\alpha}} - f_I, \tag{7}$$

with $\psi_I(w, \eta) \equiv 2^{\frac{-1}{1-\alpha}}(2-\alpha)\alpha^{\frac{\alpha}{1-\alpha}} w^{\frac{\alpha\eta-\alpha}{1-\alpha}}(1+w)^{\frac{\alpha}{1-\alpha}}$. Note

$$\ln \psi_I(w, \eta) = \ln(2-\alpha) - \frac{1}{1-\alpha}\ln 2 + \frac{\alpha}{1-\alpha}\ln \alpha + \frac{\alpha}{1-\alpha}\ln(1+w) - \frac{\alpha(1-\eta)}{1-\alpha}\ln w.$$

Then,

$$\frac{\partial \psi_I(w, \eta)}{\partial \eta} = \psi_I(w, \eta)\frac{\partial \ln \psi_I}{\partial \eta} = \psi_I \frac{\alpha}{1-\alpha}\ln w < 0 \tag{8}$$

because $w < 1$. Hence, $\partial \pi_I / \partial \eta < 0$. Moreover,

$$\frac{\partial \psi_I(w, \eta)}{\partial e} = \frac{\partial \psi_I(w, \eta)}{\partial w} = \psi_I \frac{\partial \ln \psi_I}{\partial w} = \psi_I \frac{\alpha}{1-\alpha}\frac{\eta(1+w)-1}{w(1+w)} \begin{cases} < 0 & \text{if } \eta < \frac{1}{1+w} \\ > 0 & \text{if } \eta > \frac{1}{1+w} \end{cases}. \tag{9}$$

The above results are summarized in the following proposition that shows the effects of industry heterogeneity and the host country's development level on FDI profits.

Proposition 2. *(1) A firm's FDI profit is decreasing in the skilled-labor intensity of production:* $\frac{\partial \pi_I}{\partial \eta} < 0$.

(2) In unskilled-labor-intensive industries, FDI profit is decreasing in e : $\frac{\partial \pi_I}{\partial e} < 0$*; but in skilled-labor-intensive industries, FDI profit is increasing in* e : $\frac{\partial \pi_I}{\partial e} > 0$.

The first result above is clear. Training is costly, and so the skilled labor's cost is higher than the unskilled labor's. Naturally, firms in industries with higher skilled-labor intensity will have lower FDI profit, holding for the same productivity level θ.

Part (2) of the proposition are the results of two effects. First, a more developed foreign country has a higher labor cost, which reduces the FDI profit. This is straightforward and can be confirmed by the analysis in the benchmark case where $\frac{\partial \pi_I}{\partial w} < 0$ for any given industry. This can be referred to as the *wage effect*. Second, a more developed foreign country has a less serious contract friction problem (i.e., higher

δ) and so FDI profit will be higher: $\frac{\partial \pi_I}{\partial \delta} > 0$ as shown at the beginning of this subsection. This can be referred to as the *contract friction effect.*

The above two effects work jointly, in opposite directions, in all industries. The net effect depends on the skilled-labor intensity. In unskilled-labor-intensive industries, the wage paid to the unskilled labor contributes more to the FDI cost, and so the wage effect dominates. Consequently, in a more developed foreign country, FDI profit is lower due to the higher wage rate. In contrast, in skilled-labor-intensive industries, the underinvestment due to contract friction affects FDI profit more, and so the contract friction effect dominates. As a result, in a more developed foreign country, FDI profit is higher because of the lower contract friction.

We now turn to the equilibrium FDI flows to the foreign country. We want to see how the flows depend on the host country's economic development level. With $\delta = w^{\frac{1}{\alpha}}$, we have

$$\Theta_I(w, \eta) = \frac{f_I - f_X}{A[\psi_I(w, \eta) - \psi_X(\tau)]} \tag{10}$$

as the new cutoff productivity level separating export and FDI. Since $\frac{\partial \psi_I(w,\eta)}{\partial \eta} < 0$ from (8), we immediately have $\frac{\partial \Theta_I(w,\eta)}{\partial \eta} > 0$ by (10). Moreover, from (8) and (10) it is straightforward to obtain the following inequalities

$$\frac{\partial \Theta_I(w, \eta)}{\partial e} = \frac{\partial \Theta_I(w, \eta)}{\partial w} \begin{cases} > 0 & \text{if } \eta < \frac{1}{1+w} \\ < 0 & \text{if } \eta > \frac{1}{1+w} \end{cases} .$$

The above analysis allows us to establish the main result of the paper

Proposition 3. *(1) FDI in the foreign country is less in more skilled-labor-intensive industries:* $\frac{\partial \Theta_I}{\partial \eta} > 0$.

(2) In unskilled-labor-intensive industries, a more developed foreign country will receive less FDI than a less developed foreign country: $\frac{\partial \Theta_I}{\partial e} > 0$.

(3) In skilled-labor-intensive industries, a more developed foreign country will receive more FDI than a less developed foreign country: $\frac{\partial \Theta_I}{\partial e} < 0$.

Since skill intensity and economic development level of the foreign country do not directly affect the home firms' export profits, the results in Proposition 3 follow immediately from those in Proposition 2. That is, the higher FDI profit in one situation than another immediately implies more FDI flows in the former situation than the latter. This can be seen more vividly from Figure 1. When η increases, FDI profit drops, which makes π_I to rotate clockwise, resulting in the right move of Θ_I: reducing FDI. When e increases but η is small, FDI profit drops too, resulting in similar changes as those with the increase in η. However, when e increases but η is large, FDI profit rises, which makes π_I to rotate anti clockwise, leading to the left move of Θ_I: raising FDI.

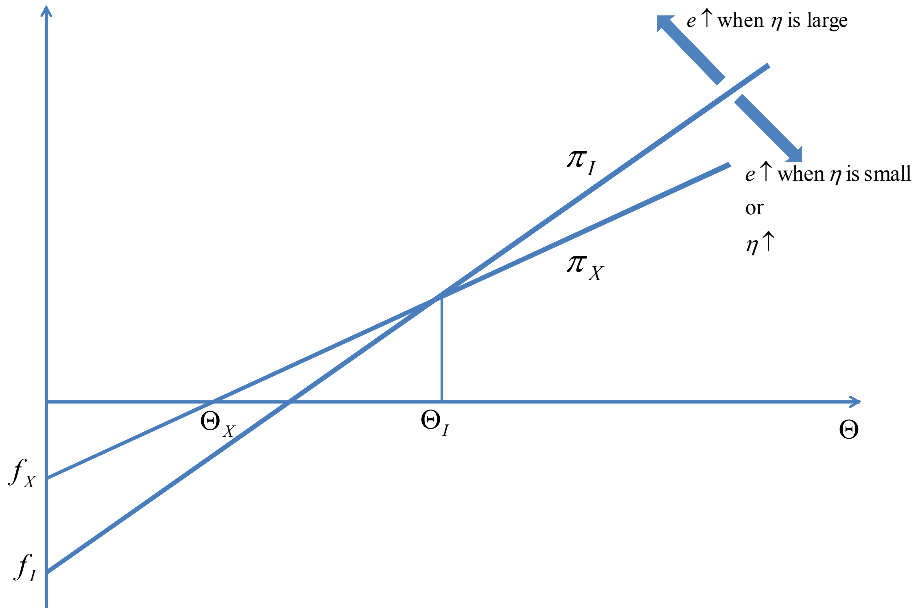

Figure 1: **FDI and export sorting: The effects of changing economic development levels**

In Helpman et al (2004), the normal conditions imply that π_I is steeper than π_X as shown in our Figure 1. This ensures that there always exist some very productive firms undertaking FDI. However, such a result is harder to guaranteed when e is very small and η is very large. When η is very large, the home firm does not benefit much from the low cost for unskilled labor (low e implying low w) in the foreign country, but it suffers a lot from the efficiency loss due to severe contract friction (low e implying low δ). Hence, the firm's FDI profit will be very low even if it has very high productivity. Then, all firms choose export. That is, the least developed countries will not be able to attract any FDI from high skilled-labor-intensive industries.

5 Concluding Remarks

The proximity-concentration tradeoffs between export and FDI play a key role in explaining multinationals' decision on foreign market entry. The tradeoffs vary with the host countries' economic conditions, the industries' characteristics, and the firms' productivities. Unlike most models of proximity-concentration tradeoffs, our paper includes heterogeneity at all three levels: country, industry and firms. Like Helpman et al (2004), in each industry and for each host country, only the most productive firms choose FDI (over export). However, our analysis predicts that there will be more FDI in a more developed host country in skilled-labor-intensive industries, but there will be more FDI in a less developed host country in unskilled-labor-intensive industries. The key to this prediction is labor training and the associated contract friction. Because with FDI in a more developed host country, the firm has a higher outside option in its bargaining with the trained workers, and so the host country's development level mitigates the hold-up problem, resulting in higher FDI profit. However, the wage rate of unskilled labor is also higher in a more developed host country, lowering FDI profit. The positive effect dominates the negative effect in skilled-labor-intensive industries while the reverse is true in unskilled-labor-intensive industries.

Although we believe the qualitative aspects of the main results derived in this paper are not sensitive to most assumptions made in our model, it is interesting to relax some of the assumptions so that we can derive more results. For example, suppose that $t \neq 1 - w$. Then, we can compare the relative importance of the effects of training cost to unskilled-labor's wage rate on FDI flows. We can allow δ to take different forms of increasing function of w to examine the relative importance of contract friction to wage rate effects.

We have derived our main results by taking the partial "comparative statics" approach in the sense that we treat A as constant. This is done partly for simplicity, and partly for isolating the economic development level effect from the market size effect. The qualitative aspects of our results would not change should we take the full "comparative statics" analysis. Take skilled-labor-intensive industries as an example. Holding A constant, we have shown that more FDI is associated with higher development level of the host country. This is because the contract friction effect dominates the wage effect. When there are more firms switching from export to FDI, A will drop because a firm tends to charge a lower price with FDI than with export (due to lower wage rate in the host country and the absence of trade cost). The drop of A, which represents a "smaller" market size, tends to reduce FDI. However, this effect is secondary. In equilibrium, the net effect cannot be a reduction in FDI for otherwise both the drop in A and the higher e will push the cutoff point Θ_I to the same direction: to the left again. That is, considering the effect of A will not change the sign of $\frac{\partial \Theta_I}{\partial e}$, but only the magnitude of the derivative.

Yeaple (2004) offers an earlier empirical study on FDI pattern taking into account both country level and industry level heterogeneity. More research along this line should be encouraged in order to have a better understanding about FDI flows. For example, more country characteristics [such as education level, wage rate, income per capita, research and development (R&D) expenditure, and contract enforcement, in addition to human capital abundance considered by Yeaple (2004)] and industry features [such as quality of the goods, capital intensity and R&D intensity, in addition to skilled-labor intensity considered by Yeaple (2004)] should be included in future empirical study. Our analysis has offered some predictions with regard to these factors, and can be easily extended to generate more empirically testable hypotheses, including firm level characteristics.

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