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Foreign Direct Investment and Labor Quality in Developing Countries

*Nobuyuki Iwai and Stanley R. Thompson**

Abstract

The quality of local labor is an important factor in a multinational corporation's (MNC) decision to set up production operations in a developing country. It is often observed that developing country governments attempt to attract MNCs by enhancing labor quality. This paper studies the interaction between an MNC and a local government which has superior information on local labor quality. The local government has an incentive to enhance the labor quality and share that information with the MNC because it increases both its net tax revenue and profit of the MNC. The paper provides an explanation for recent findings of FDI in developing countries: the bulk of FDI has been directed toward a limited number of countries and human capital plays an increasingly important role in attracting FDI.

1. Introduction

Over the last decade, the volume of foreign direct investment (FDI) flowing to developing countries has increased from an annual average of US$175 billion in 1995–99 to US$488 billion by 2005–09.[1] The bulk of FDI, however, has been targeted to a small number of developing countries, clearly distinguishing those that have been successful in attracting FDI from those that have not (Zhang and Markusen, 1999; Noorbakhsh et al., 2001). What are the factors that determine which countries attract FDI? The conventional view of FDI in developing countries is that vertically integrated multinationals take advantage of differences in factor endowments between countries (Helpman, 1984; Zhang and Markusen, 1999). Other important determinants have been the host country's market size, especially under import-substitution policies, and natural resource abundance for resource-seeking FDI. Thus, the conventional view expects the composition of human capital in a developing country to negatively or insignificantly affect the flow of FDI to that country.

Recent empirical studies, however, find that human capital composition in developing countries or regions *positively* affects FDI inflows (Noorbakhsh et al., 2001; Gao, 2005). Using various measures of human capital composition in developing countries, Noorbakhsh et al. (2001) concluded that human capital is one of the most important determinants in attracting FDI, and its importance has increased over time.[2] Other empirical studies suggest that a developing country must clear a threshold level of human capital to attract FDI and adopt advanced foreign technology (Borensztein et al., 1998).[3] The current paper presents a model to explain these stylized facts. First,

* Iwai: International Agricultural Trade and Policy Center, Food and Resource Economics Department, University of Florida, G085 McCarty Hall B, Gainesville, FL 32611, USA. Tel: +1-352-392-1881 (ext. 211); E-mail: niwai@ufl.edu. Thompson: Department of Agricultural, Environmental and Development Economics, Ohio State University, 335 Agricultural Administration Building, 2120 Fyffe Road, Columbus, OH 43210, USA. Tel: +1-614-292-6225; E-mail: thompson51@osu.edu. The authors wish to thank Priyodorshi Banerjee, Don Larson, Ian Sheldon, Kiyoshi Matsubara, and Katie Bovitz for their helpful comments. They also thank all seminar participants at University of Florida and Ohio State University, but especially, Robert Emerson, Takao Yurugi, and Naoya Kaneko for their insightful comments.

a model is provided that explains the positive relationship between human capital composition and FDI inflows. Second, the model endogenously determines the threshold level of human capital, denoted as the *take-off point*, at which the developing country government initiates the attraction of FDI through human capital enhancement (HCE). The *take-off point* clearly distinguishes those countries that succeed in attracting FDI through HCE from those that do not. Third, the present model elaborates the role of information on local human capital composition (local labor quality).

The role of information asymmetries occupies a central position in the theory of FDI. The literature has focused on the choice between FDI and licensing to a local firm in an environment where a multinational corporation (MNC) sells in the host-country market (Ethier and Markusen, 1996; Horstmann and Markusen, 1996). These studies have focused on the advantage that FDI provides of internalizing information about technology and local demand. Generally, FDI takes place when a firm combines the ownership-specific advantages with the location-specific advantages of host countries through internalization (Dunning, 1981). Accordingly, it is important to find a location that offers factors that match the technology and governance of the firm (Lall, 2000).

It is common for large MNCs to invest in developing countries to create export platforms from which they serve foreign markets (Helpman, 2006). For these export-oriented MNCs the payoff from FDI is more related to the quality of the local factors, including labor, than it is to local demand. Since an MNC is naturally at a disadvantage with regard to information on the host country, the government has an incentive to intervene in the FDI promotion process to overcome information-related market failures (Moran, 1998; Lall, 2000; te Velde, 2002). Reviewing many illustrative examples of government interventions, te Velde (2002) emphasized the importance of overcoming information asymmetries, especially regarding local human capital, by concluding, "In order to attract FDI and make FDI work for development, governments need to address a series of market failures related to the market for skills and technology and need to overcome information barriers" (p. 31). The present model provides a theoretical justification for the local government to share information on the local labor quality with an MNC.

Also provided is an explanation for the observed policy combination whereby a developing country's government encourages FDI through HCE (United Nations Conference or Trade and Development (UNCTAD), 1998, 1999; Lall, 2000; te Velde, 2002; Organisation for Economic Co-operation and Development (OECD), 2002). The OECD (2002) emphasized the important role of local government as follows: "The major impact of FDI on human capital appears to have occurred not so much through the efforts of individual MNCs as from government policies designed to attract FDI via enhanced human capital" (p. 122).

In this model, the MNC invests in the developing country and offers contracts to local laborers. Precise information on local labor quality for the industry leads to a more efficient contract, which is the source of information rent. Since the local government has superior information about the quality of its labor force, it exploits this advantage by sharing this information with the MNC and taxes its profits. Furthermore, the local government has an incentive to use these tax revenues to enhance labor quality which raises the value of the information and, thus, the profits of the MNC.

The remainder of the paper is organized as follows: section 2 presents the basic structure of the model, in section 3 the MNC's principal–agent contract with local labor is analyzed, section 4 investigates the determination of a local government policy on the HCE and the tax rate to maximize its net tax revenue, and in section 5 the welfare effect of the policy is illustrated. Conclusions follow in section 6.

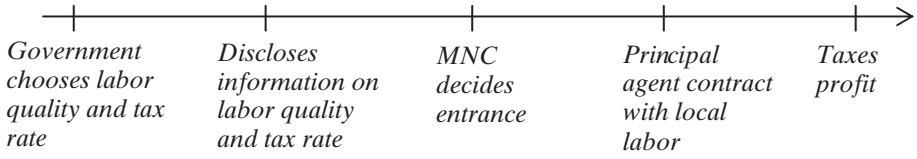

Figure 1. Sequence of Actions in the Model

2. Model Description

The sequence of actions in the model is as follows. First, the local government chooses the target local labor quality and tax rate and discloses this information to the MNC. Then, the MNC makes its decision to enter based on labor quality, tax rate, and fixed set-up cost. Next, given the precise information on the local labor quality, the MNC implements a principal–agent contract with local labor. Finally, the local government taxes the profit of the MNC. This sequence is shown as Figure 1 and the model is solved by backward induction.

3. MNC's Principal–Agent Contract with Local Labor

Consider an MNC setting up a factory in a developing country and implementing a principal–agent contract with local labor. First, the case is analyzed with precise information on labor quality, and then it is looked when only the labor quality probability distribution is available. The MNC sells a product competitively as a price taker in the global market; thus, it can sell as much of the product as it wants at $p = 1$ (price is normalized to one). The firm is owned by shareholders with globally diversified portfolios, which results in risk-neutrality of the firm with respect to profit from this site.[4] Within the developing country, the labor supply for the specific industry is fixed (also normalized to one).[5]

There are two types of labor (skilled and unskilled) for the industry. The reservation utilities for each type of labor are normalized to zero, as in the standard screening contract model. While a laborer knows her own type, outsiders cannot distinguish an individual laborer's type. One can imagine the proportion of skilled labor P $(0 \le P \le 1)$ to be the indicator of local labor quality. It is assumed that the government can increase, but cannot decrease, the level of P with some HCE cost.

If the MNC knew the precise value of P, it would implement a screening contract:

$$\max_{x_1,x_2,w_1,w_2} P(x_1 - w_1) + (1-P)(x_2 - w_2) - F$$

$$\begin{aligned} \text{subject to } & w_1 - c_1(x_1) \ge 0 \\ & w_2 - c_2(x_2) \ge 0 \\ & w_1 - c_1(x_1) \ge w_2 - c_1(x_2) \\ & w_2 - c_2(x_2) \ge w_1 - c_2(x_1), \end{aligned}$$

where, i = type of labor (1 if skilled, 2 if unskilled), $x_i \ge 0$ is the production level of labor type i, w_i is the wage of labor type i, c_i is the disutility from working for labor type i, and $F > 0$ is a fixed set-up cost for the MNC. The constraints are standard; the first two are the participation constraints guaranteeing each type of labor their reservation utility,

and the next two are the incentive compatibility constraints ensuring that a laborer of type i prefers the contract (x_i, w_i). The following assumption is imposed:

ASSUMPTION 1. *$c_i(x)$ is continuous and twice differentiable for* $x \geq 0$. $c_i(0) = 0$, $c_i'(0) = 0$, *and for* $x > 0$, $0 < c_1(x) < c_2(x)$, $0 < c_1'(x) < c_2'(x)$ *and* $0 < c_1''(x) < c_2''(x)$.

These are standard assumptions; disutility is increasing and convex in effort, and unskilled labor suffers a larger disutility than skilled labor. Solving this screening contract problem with the precise value of P leads to the first-order conditions:

$$w_1 = c_1(x_1) + w_2 - c_1(x_2), \tag{1}$$

$$w_2 = c_2(x_2), \tag{2}$$

$$c_1'(x_1) = 1, \tag{3}$$

$$c_2'(x_2) = 1 - P + Pc_1'(x_2). \tag{4}$$

The MNC's problem yields the optimal strategy vector $(x_1(P), w_1(P), x_2(P), w_2(P))$. Let $\Pi^*(P, F)$ denote optimal profit for the MNC. Further, $a_i(P) = x_i(P) - w_i(P)$ and $b(P) = x_1(P) - w_1(P) - (x_2(P) - w_2(P))$ are defined, where $a_i(P)$ is the profit from a contract with a laborer of type i, and $b(P)$ is the extra profit earned from a contract with a skilled laborer over that with an unskilled laborer. From equations (1)–(4) and Assumption 1, one has $a_2(P) \geq 0$, $a_2'(P) \leq 0$, $b(P) > 0$ and $b'(P) \geq 0$.[6] One further has,

LEMMA 1. *$\Pi^*(P, F)$ is increasing and convex in P.*

Next, the case in which the MNC does not know the precise value of P is investigated, however, its distribution is common knowledge. Let $f(P)$ be the probability density function of P, and let $\bar{P}\ (0 < \bar{P} < 1)$ be the mean of P. Knowing this probability distribution, the MNC seeks to design the contract to maximize expected profit. It is straightforward to show that the optimal contract involves the same first-order conditions (equations (1)–(4)), but uses $\bar{P}$ instead of P. Thus, the MNC sets the target value to $\bar{P}$. Given the target value, one denotes $(x_1(\bar{P}), w_1(\bar{P}), x_2(\bar{P}), w_2(\bar{P}))$ as the strategy vector chosen by the firm. The contract using this strategy vector successfully distinguishes skilled from unskilled labor regardless of the real value of P, implying that profits earned from each kind of labor are fixed at those with $\bar{P}$. The MNC can compute its profit from this contract for each real value of P as,

$$\Pi(P, \bar{P}, F) = P[x_1(\bar{P}) - w_1(\bar{P})] + (1 - P)[x_2(\bar{P}) - w_2(\bar{P})] - F = a_2(\bar{P}) + b(\bar{P})P - F, \tag{5}$$

where $a_2(\cdot)$ and $b(\cdot)$ are previously defined. Equation (5) gives the reservation profit $(\Pi(P, \bar{P}, F))$of the MNC when it does not know the real value of P. Since $b(\bar{P}) > 0$, the reservation profit is increasing and linear in P (see Figure 2).[7] If the firm knows the real value of P, optimal profit is

$$\Pi^*(P, F) = a_2(P) + b(P)P - F. \tag{6}$$

The gain to the firm from knowing the real value of P is therefore the difference between (6) and (5). This difference is called information rent and is denoted as,

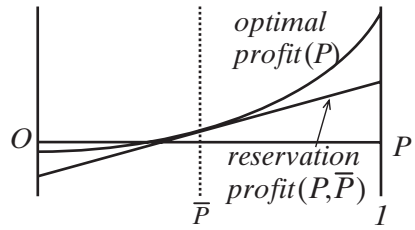

Figure 2. Optimal Profit and Reservation Profit

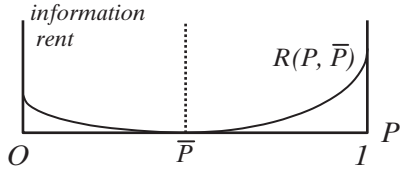

Figure 3. Information Rent

$$R(P, \bar{P}) = [a_2(P) + b(P)P] - [a_2(\bar{P}) + b(\bar{P})P]. \tag{7}$$

From Lemma 1, optimal profit is increasing and convex in P. From (5), reservation profit is increasing and linear in P. These two are equal at $P = \bar{P}$, which means that, if the expected value $\bar{P}$ is equal to the real value P, information rent is zero and, there is no loss of efficiency. At any other point $\Pi^*(P, F) > \Pi(P, \bar{P}, F)$. Reservation profit is shown in Figure 2 as the line tangent to the optimal profit curve at $\bar{P}$. The vertical distance between the two is information rent, which is shown in Figure 3.

Having defined the MNC's profit function with and without real value of labor quality, the local government's policy on HCE is now analyzed.

4. Local Government Policy

Human Capital Enhancement

As shown in equation (7) the MNC can increase profit from knowing the labor quality P (i.e. the true probability that a randomly selected local laborer is skilled for the industry). The local government can exploit that interest by sharing information with the MNC in exchange for tax revenues. Furthermore, the government can use these revenues for HCE.[8] Given the MNC profit function with precise information about local labor quality ($\Pi^*(P, F)$) and without it ($\Pi(P, \bar{P}, F)$), the local government maximizes tax revenue less HCE cost. The local government optimization problem is,

$$\max_{P,t} \left[t\Pi^*(P, F) - \int_{P_0}^{P} C(P)\, dP \right]$$

$$\begin{aligned} &\text{subject to } (1-t)\Pi^*(P, F) \geq \Pi(P, \bar{P}, F), \\ &\qquad (1-t)\Pi^*(P, F) \geq 0, \\ &\qquad P \geq P_0, \end{aligned} \tag{8}$$

where t is the tax rate on the MNC profit, P is the portion of skilled labor *after* HCE, P_0 is the portion of skilled labor *before* HCE, $C(P)$ is the marginal cost of HCE, $\Pi^*(P, F)$ and $\Pi(P, \bar{P}, F)$ are defined earlier. This constrained optimization problem has a double principal–agent structure. The local government is the principal to the MNC and the MNC is the principal to local labor. Given the principal–agent contract strategy of the MNC, the local government chooses the tax rate and the labor quality to maximize tax revenue less the cost of HCE. The first constraint guarantees that the *after tax* profit of the MNC is larger than, or equal to, the reservation profit (incentive compatibility).[9] The second constraint guarantees the *after tax* profit of the MNC to be non-negative (participation constraint). The third constraint means that the government cannot lower the labor quality from the initial level.[10] Combining the first and second constraint one has $(1-t)\Pi^*(P^*, F) \geq \max[\Pi(P^*, \bar{P}, F), 0]$ where P^* is the chosen level of labor quality. Next, the cases $\Pi(P_0, \bar{P}, F) > 0$, and $\Pi(P_{\tilde{d}}, \bar{P}, F) \leq 0$ are respectively considered, where $P_{\tilde{d}}$ is the intersection of the marginal profit and marginal HCE cost curve.

Case 1. $\Pi(P_0, \bar{P}, F) > 0$

Since the reservation profit is increasing in P (section 3), the above condition indicates $\Pi(P, \bar{P}, F) > 0$ for any $P \geq P_0$. Because $P^* \geq P_0$ from the final constraint in (8), $\max[\Pi(P^*, \bar{P}, F), 0] = \Pi(P^*, \bar{P}, F)$. Hence, the incentive compatibility is relevant but the participation constraint is not. When only the incentive compatibility is relevant one has the constraint: $(1-t)\Pi^*(P, F) \geq \Pi(P, \bar{P}, F)$. Since $0 < \Pi(P, \bar{P}, F) \leq \Pi^*(P, F)$ and $0 \leq t \leq 1$, this constraint is satisfied with equality and can be transformed as:

$$\Pi^*(P, F) - \Pi(P, \bar{P}, F) - t\Pi^*(P, F) = 0. \Rightarrow R(P, \bar{P}) - t\Pi^*(P, F) = 0,$$

where $R(P, \bar{P})$ is the information rent defined earlier. Substitution of this into the objective function in (8) results in the following local government optimization problem,

$$\max_{P,t} \left[R(P, \bar{P}) - \int_{P_0}^{P} C(P)\, dP \right] \tag{9}$$

subject to

$$R(P, \bar{P}) - t\Pi^*(P, F) = 0, \tag{10}$$

$$P \geq P_0. \tag{11}$$

The local government chooses P so as to maximize the information rent less the cost of HCE. It then sets the tax rate so that the *after tax* profit of the MNC is equal to reservation profit at P. From Figure 3 one knows that the marginal information rent is negative at any point $P < \bar{P}$ and positive at any point $P > \bar{P}$. Also, marginal information rent is increasing everywhere. The following assumption is now made about the marginal cost of HCE.

Assumption 2. *Marginal cost of HCE, C(P), is non-negative and increasing in P. C(P) is zero at P = 0 and goes to infinity as P approaches 1.*

The government distributes HCE expenditure equally among potential laborers for the industry but, owing to the heterogeneity in ability, some become skilled more easily

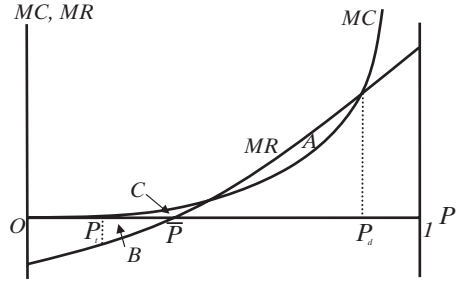

Figure 4. As Long as $P_0 < P_t$ There is No Incentive for HCE; However, Once P_0 Equals P_t the Government Immediately Jumps to $P = P_d$. This Point (P_t) is the Take-off Point

than others. Naturally, marginal cost of HCE increases as laborers with less ability are left unskilled. Marginal HCE cost (*MC*) and marginal information rent (*MR*) are shown in Figure 4. Note both *MC* and *MR* are increasing everywhere, but the latter is negative up to $\bar{P}$ while the former is non-negative everywhere. Therefore, if *MC* and *MR* do not intersect at least twice, the government has no incentive for HCE and simply retains the current level of labor quality. In other words, the government would not enhance human capital until it meets the minimum requirement of cost efficiency in the sense that *MC* intersects *MR* twice. For economy of space, the following analysis focuses on the case in which *MC* and *MR* intersect twice.[11] Cases with more than two intersections are straightforward applications.

In Figure 4, P_d is the second intersection of *MC* with *MR*.[12] Beyond P_d, *MC* is higher than *MR* so the government has no incentive to go beyond P_d. Next, suppose that a developing country has the initial labor quality level $P_0 = P_t$ such that the area A = B + C in Figure 4. Here the government is indifferent between choosing the initial level P_t and $P = P_d$. As long as $P_0 < P_t$ there is no incentive for HCE because its cost exceeds the rent earned; however, once P_0 reaches P_t the government immediately jumps to $P = P_d$. The point (P_t) is termed the *take-off point*.[13] Since reservation profit is positive at the chosen level of labor quality (P_0 or P_d), *after tax* profit of the MNC, which is set equal to reservation profit, is also positive. So, the local government can always successfully invite FDI, whether it implements HCE or not. The important findings are summarized as:

Proposition 1. *In case 1, the local government has no incentive for HCE when $P_0 < P_t$; however, once P_0 reaches P_t the government immediately jumps to $P = P_d$. The government can successfully invite FDI whether it implements HCE or not.*

Case 2. $\Pi\left(P_{\tilde{d}}, \bar{P}, F\right) \leq 0$ where $P_{\tilde{d}}$ is intersection of marginal profit and marginal HCE cost curve.

Since reservation profit is increasing in P (section 3), the above condition indicates $\Pi\left(P, \bar{P}, F\right) \leq 0$ for any $P \leq P_{\tilde{d}}$. As shown below there is no incentive for the government to choose $P > P_{\tilde{d}}$. That is, reservation profit at such a chosen level of P would not be positive, so the participation constraint is relevant but incentive compatibility is not.[14] When only the participation (the second constraint in (8)) is relevant, one has the following combined constraint: $(1 - t)\Pi^*(P, F) \geq 0$.

Since $0 \leq t \leq 1$, the local government chooses $t = 1$ with labor quality (P) which makes the profit of MNC positive.[15] Substituting $(1 - t)\Pi^*(P, F) = 0$. into the objective function in (8), the local government optimization problem becomes

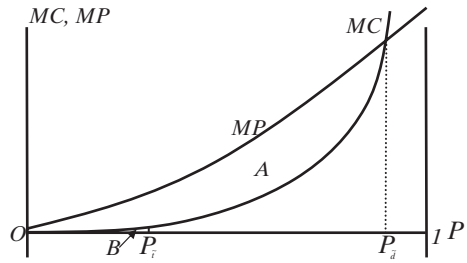

Figure 5. Marginal HCE Cost (MC) Curve and Marginal Profit (MP) Curve

$$\max_{P}\left[\Pi^*(P, F)-\int_{P_0}^{P} C(P)dP\right] \quad \text{subject to } P \geq P_0.$$

To solve this problem one can use Figure 5, which is similar to Figure 4 except that the marginal information rent (*MR*) curve is replaced by the marginal profit (*MP*) curve which is drawn by making a parallel shift of the *MR* curve upward by a constant ($b(\bar{P})$).

The *MP* curve is positive and increasing everywhere (from Lemma 1) while the *MC* curve is zero at $P = 0$ and goes to infinity as P approaches 1. Again one has the same mechanism of a jumping process, but this time the destination point (denoted $P_{\bar{d}}$) is the intersection of the *MP* and *MC* curves. The location of the destination point ($P_{\bar{d}}$) is higher than that in case 1 (P_d).

While the government can always profitably invite FDI in case 1, in case 2 the profit less HCE cost must be positive at $P_{\bar{d}}: \Pi^*(P_{\bar{d}}, F)-\int_{P_0}^{P_{\bar{d}}} C(P)\,dP > 0$ for the government to have an incentive to invite FDI. One can then define the *take-off point* ($P_{\bar{t}}$) at which $\Pi^*(P_{\bar{d}}, F)-\int_{P_{\bar{t}}}^{P_{\bar{d}}} C(P)\,dP = 0$. The *take-off point* is shown as $P_{\bar{t}}$ in Figure 5, and at this point the area A + B is equal to $F - a_2(0)$.[16] As long as P_0 is lower than $P_{\bar{t}}$ there is no incentive for either HCE or FDI invitation. Once P_0 reaches $P_{\bar{t}}$, the local government improves labor quality to $P_{\bar{d}}$ and initiates FDI promotion. It is easy to show $P_{\bar{t}} < P_t$, but this requires careful interpretation. While $P_{\bar{t}}$ is the threshold for both HCE and FDI promotion, P_t is the threshold only for HCE. Recall in case 1, the local government always has the incentive to invite FDI no matter whether it implements HCE or not. The findings are summarized as,

Proposition 2. *In case 2, the local government has no incentive for HCE or FDI invitation when $P_0 < P_{\bar{t}}$; however, once P_0 reaches $P_{\bar{t}}$ the government immediately jumps to $P = P_{\bar{d}}$ and initiates FDI promotion.*

Case 3. $\Pi(P_d, \bar{P}, F) \leq 0$ and $\Pi(P_{\bar{d}}, \bar{P}, F) > 0$

Since $\Pi(P, \bar{P}, F)$ is continuous and increasing in P, the above condition means there exists a $P_{\underline{d}}$ at which $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$ for $P_d \leq P_{\underline{d}} < P_{\bar{d}}$. Then, the case 1 strategy (only incentive compatibility constraint binding) can be used for $P > P_{\underline{d}}$, and the case 2 strategy (only the participation constraint or both are binding) can be used for $P \leq P_{\underline{d}}$. Repeating the same arguments as in cases 1 and 2, net tax revenue to the government is decreasing in P when using Case 1 strategy for $P > P_d$, and is increasing in P when using case 2 strategy for $P \leq P_{\bar{d}}$. Net tax revenue from the case 1 and case 2 strategies are equalized at $P = P_{\underline{d}}$ where $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$:

$$\Pi^*(P_{\underline{d}}, F)-\Pi(P_{\underline{d}}, \bar{P}, F)-\int_{P_0}^{P_{\underline{d}}} C(P)dP = \Pi^*(P_{\underline{d}}, F)-\int_{P_0}^{P_{\underline{d}}} C(P)dP.$$

Then, focusing on P in $P_d \le P \le P_{\bar{d}}$, it can be shown that the net tax revenue to the government is maximized using the case 2 strategy at $P_{\underline{d}}$. Further, since $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$ and $\Pi(P, \bar{P}, F)$ is continuous and increasing in P, one has $\Pi(P, \bar{P}, F) < 0$ for any $P < P_{\underline{d}}$. Then, the case 2 strategy must be used for any $P < P_{\underline{d}}$. The same argument can be repeated as in case 2 with the revised definition of the *take-off point* at which $\Pi^*(P_{\underline{d}}, F) - \int_{P_{\underline{t}}}^{P_{\underline{d}}} C(P)\,dP = 0$ where $P_{\underline{t}} > P_{\bar{t}}$. This is summarized as,

Proposition 3. *In case 3, the local government has no incentive for HCE or FDI invitation when $P_0 < P_{\underline{t}}$; however, once P_0 reaches $P_{\underline{t}}$ it immediately jumps to $P = P_{\underline{d}}$ and initiates FDI promotion. $P_{\underline{d}}$ is the point at which $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$, and $P_d \le P_{\underline{d}} < P_{\bar{d}}$.*

Case 4. $\Pi(P_0, \bar{P}, F) \le 0$ and $\Pi(P_d, \bar{P}, F) > 0$

Since $\Pi(P, \bar{P}, F)$ is continuous and increasing in P, the above condition implies there exists a $P_{\underline{d}}$ at which $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$ where $P_0 \le P_{\underline{d}} < P_d$. With a similar argument as in case 3, it can be shown that the optimum policy is using the case 2 strategy with destination $P_{\underline{d}}$ if $P_{\underline{d}} \le P_t$; and using the case 1 strategy with destination P_d if $P_t < P_{\underline{d}}$.

Note that the acceptable range of P_0 is $P_0 \le P_{\underline{d}} \le P_t$ when $P_{\underline{d}} \le P_t$. A value of P_0 higher than $P_{\underline{d}}$ is inconsistent with the condition for case 4 ($\Pi(P_0, \bar{P}, F) \le 0$). As in case 3, the local government initiates HCE and FDI promotion at the *take-off point* ($P_{\underline{t}}$) at which $\Pi^*(P_{\underline{d}}, F) - \int_{P_{\underline{t}}}^{P_{\underline{d}}} C(P)\,dP = 0$.

In contrast, when $P_t < P_{\underline{d}}$, the location of P_0 does not affect HCE or FDI promotion policy. When P_0 is higher than or equal to P_t (that is $P_t \le P_0 < P_{\underline{d}}$ or $P_t < P_{\underline{d}} = P_0$),[17] jumping to P_d is the optimum choice for the case 1 strategy anyway. When P_0 is lower than P_t (that is $P_0 < P_t < P_{\underline{d}}$), net tax revenue is higher by retaining P_0 than by jumping to P_d. However, the case 1 strategy can be used only for P larger than $P_{\underline{d}}$, so retaining P_0 is impossible. Further, net tax revenue from the case 1 strategy for P in $P_{\underline{d}} < P < P_d$ is strictly lower than that at P_d. Thus, when $P_t < P_{\underline{d}}$ the local government chooses P_d using the strategy from case 1 regardless of the location of P_0. In Table 1, the local government policy is summarized regarding labor quality and FDI promotion for all possible conditions of reservation profit and locations of P_0.

Table 1. Local Government Policy Given Conditions of Reservation Profit and Location of P_0

	Reservation profit at						
	P_0	P_d	$P_{\bar{d}}$	*Location of P_0*	*P after HCE*	*FDI*	*Binding constraint*
Case 1	+	+	+	$P_0 < P_t$	P_0	Yes	Incentive
	+	+	+	$P_t \le P_0$	P_d	Yes	Incentive
Case 2	−	−	−	$P_0 < P_{\bar{t}}$	P_0	No	Participation
	−	−	−	$P_{\bar{t}} \le P_0$	$P_{\bar{d}}$	Yes	Participation
Case 3	−	−	+	$P_0 < P_{\underline{t}}$	P_0	No	Participation
	−	−	+	$P_{\underline{t}} \le P_0$	$P_{\underline{d}}$	Yes	Participation
Case 4 with $P_{\underline{d}} \le P_t$	−	+	+	$P_0 < P_{\underline{t}}$	P_0	No	Participation
	−	+	+	$P_{\underline{t}} \le P_0$	$P_{\underline{d}}$	Yes	Participation
Case 4 with $P_t < P_{\underline{d}}$	−	+	+	$P_0 < P_t$	P_d	Yes	Incentive
	−	+	+	$P_t \le P_0$	P_d	Yes	Incentive

Notes: –includes zero. Since reservation profit increases in P, it is impossible to have the following conditions: (+ − −), (+ + −), (+ − +), (− + −); $P_{\underline{d}}$ is the level at which $\Pi(P_{\underline{d}}, \bar{P}, F) = 0$. In case 3, $P_d \le P_{\underline{d}} < P_{\bar{d}}$. In case 4, $P_0 \le P_{\underline{d}} < P_d$.

In summary, when incentive compatibility constraint is binding (reservation profit is positive), the optimum HCE policy is either jumping to P_d or retaining P_0, the decision of which will be based on the criteria that P_0 is higher than, or equal to the *take-off point* (P_t).[18] Too, whenever reservation profit is positive, the local government has an incentive to invite FDI, whether it implements HCE or not. In contrast, when the participation constraint is binding (reservation profit is not positive), the local government cannot invite FDI without HCE. It does not initiate either HCE or FDI promotion until P_0 reaches the *take-off point* ($P_{\tilde{t}}$ in case 2 and $P_{\underline{t}}$ in cases 3 and 4). Once P_0 reaches the *take-off point*, the local government enhances the labor quality to $P_{\tilde{d}}$ (case 2) or to $P_{\underline{d}}$ (cases 3 and 4) and initiates FDI promotion.

The present model provides an explanation for the observed policy combination wherein a developing country's government promotes FDI by enhancing human capital (UNCTAD 1998, 1999; Lall, 2000; te Velde, 2002; OECD, 2002). Existence of the threshold level of labor quality also elucidates the empirical finding that the bulk of FDI has been directed toward only a limited number of countries (Noorbakhsh et al., 2001), and a developing country must clear a threshold level of human capital to attract FDI and adopt advanced foreign technology (Borensztein et al., 1998).

Tax Policy

Now the tax policy of the local government is investigated. First, the focus is on the cases in which incentive compatibility constraint is binding in Table 1. Repeating equation (10), tax rate t is adjusted so that the local government earns information rent as tax revenue:

$$t\Pi^*(P, F) = \Pi^*(P, F) - \Pi\left(P, \bar{P}, F\right) \geq 0. \tag{12}$$

This is non-negative because the optimal profit is at least as high as the reservation profit for any P. If the local government enhances the labor quality to $P = P_d$, tax revenue is positive because $\bar{P} < P_d$ is known from the previous section. If the local government retains the initial level of labor quality ($P = P_0$), equation (12) is satisfied with equality only when $P_0 = \bar{P}$. At any other value of P_0, tax revenue is strictly positive. In summary, when the incentive compatibility constraint is binding the tax revenue of the local government is non-negative; it is zero only when $P_0 = \bar{P}$, given no HCE.

Now consider the cases in which the participation constraint is binding (reservation profit is not positive) in Table 1. Since the local government sets the tax rate equal to one (or a statutory maximum level), it earns tax revenue higher than the cost of HCE whenever it has incentive to invite FDI. That is, the local government invites FDI and earns positive tax revenue, if $\Pi^*\left(\tilde{P}, F\right) - \int_{P_0}^{\tilde{P}} C(P)\,dP > 0$ where $\tilde{P} = P_{\tilde{d}}$ or $P_{\underline{d}}$ depending on the conditions in Table 1. It earns zero tax revenue and spends zero on HCE when it does not invite FDI.[19]

5. Welfare Analysis

This section investigates the welfare effects of HCE and information sharing about local labor quality in an effort to promote FDI. The optimization problem (8) satisfies the incentive compatibility constraint for the MNC; it earns *after tax* profit greater than, or equal to, its reservation profit. It also satisfies the participation constraint for both the local government and the MNC; the former earns non-negative tax revenue less HCE cost and the latter earns non-negative *after tax* profit. So, neither agent has an

incentive to deviate from its own strategy, given that of the other (Nash equilibrium). Since the local government has perfect information, it can make a Pareto efficient contract with the MNC. The welfare analysis details for the specific cases are shown as follows.

Cases with Incentive Compatibility Constraint Binding

From the tax policy analysis presented earlier, when the incentive compatibility constraint is binding (MNC reservation profit is positive), the local government earns positive tax revenue except when $P_0 = \bar{P}$, given no HCE. Tax revenue is always at least as large as the HCE cost, because the local government could choose simply to retain the initial level of human capital with zero HCE cost. Thus, the local government is strictly better off except when $P_0 = \bar{P}$, given no HCE.

Is the MNC better off by making FDI with precise information about local labor quality? The answer depends on whether the *after tax* profit is compared to the profit without FDI, or to the reservation profit from FDI. When the incentive compatibility constraint is binding, *after tax* MNC profit is set equal to reservation profit (equation (10)) which is strictly positive. Hence, the MNC is strictly better off by making FDI with information than it is by forgoing FDI. This also suggests that the MNC is not better off compared with the case of earning reservation profit from FDI. However, reservation profit increases with HCE. From equation (5) the reservation profit is increasing in P, so that $\Pi(P_d, \bar{P}, F) > \Pi(P_0, \bar{P}, F)$. In other words, the MNC implicitly shares in higher profit gained from HCE implemented by the local government. This is summarized as,

Proposition 4. *When incentive compatibility constraint is binding, the government is strictly better off except when* $P_0 = \bar{P}$, *given no HCE. The after tax MNC profit is strictly higher compared to that with no FDI, but it is retained at the same level as reservation profit from FDI. However, reservation profit increases whenever the local government implements HCE.*

When incentive compatibility constraint is binding, the positive MNC reservation profit always enables the local government to successfully invite FDI by sharing the profit from the local operation. Further, the increased profit by HCE is shared by both the local government and the MNC.

Cases with Participation Constraint Binding

When the MNC reservation profit is non-positive, the local government sets the *after tax* MNC profit equal to zero to satisfy the participation constraint. The zero profit after tax indicates that the MNC is as well off as making no FDI; however, it is still better off compared with cases of earning negative reservation profit by making FDI without information acquisition. So, the benefit for the MNC is concentrated in the information acquisition, saving it from earning negative reservation profit without the information.

When the incentive compatibility constraint is binding (reservation profit is positive), the local government can successfully invite FDI whether it implements HCE or not. When the participation constraint is binding (reservation profit is not positive), however, the local government must implement HCE to be able to host FDI. Furthermore, profit less HCE cost at a chosen level of P must be positive for the FDI invitation to be profitable. That is, the necessary and sufficient condition for profitable FDI

invitation is given as $\Pi^*(\tilde{P}, F) - \int_{P_0}^{\tilde{P}} C(P)\,dP > 0$, where $\tilde{P} = P_{\bar{d}}$ or $P_{\underline{d}}$ depending on the conditions shown in Table 1. This is summarized as:

PROPOSITION 5. *When the participation constraint is binding, the MNC is as well off as in the case of no FDI, but is strictly better off compared with the case of earning negative reservation profit from FDI without information acquisition. The local government is strictly better off if and only if* $\Pi^*(\tilde{P}, F) - \int_{P_0}^{\tilde{P}} C(P)\,dP > 0$, *where* $\tilde{P} = P_{\bar{d}}$ *or* $P_{\underline{d}}$ *depending on the conditions in* Table 1.

Local Labor Welfare

The effects of government policy on local labor welfare are now investigated. First, if local labor welfare is compared with and without FDI, the conclusion is that local labor always gains from FDI. The more interesting welfare implication is the effect of HCE and information sharing on local labor given FDI.

When there is neither information sharing nor HCE, the MNC uses $\bar{P}$ as the target value as shown in section 3. The total labor surplus (W_0) without information sharing and HCE depends on the initial and expected labor quality as

$$W_0(P_0, \bar{P}) = P_0[w_1(\bar{P}) - c_1(x_1(\bar{P}))] + (1 - P_0)[w_2(\bar{P}) - c_2(x_2(\bar{P}))].$$

Using equations (1) and (2) yields

$$W_0(P_0, \bar{P}) = P_0[c_2(x_2(\bar{P})) - c_1(x_2(\bar{P}))]. \tag{13}$$

With the information sharing and HCE, the total labor surplus (W) becomes

$$W(P) = P[c_2(x_2(P)) - c_1(x_2(P))]. \tag{14}$$

First the case with positive HCE is analyzed so that $P = P_d > P_0$ in equation (14).[20] Using Assumption 1, and $0 < \bar{P} < 1$ and $0 < P_d < 1$, it can be shown that the expressions in square brackets in (13) and (14), which correspond to skilled labor surplus, are strictly positive. Then, $P_d > P_0$ means that more laborers will enjoy positive surplus by converting to skilled laborers (skill-acquisition effect). In contrast, surplus per skilled laborer decreases as more skilled laborers become available in the market (congestion effect).[21] The total effect of the HCE depends on the relative size of these offsetting effects. Using $dx_2/dP = [c_2''(x_2) - Pc_1''(x_2)]^{-1}[c_1'(x_2) - 1]$ and the first-order Taylor approximation, the condition for the positive HCE effect is given by

$$[c_2(x_2(P_d)) - c_1(x_2(P_d))](P_d - P_0) + \frac{[c_2'(x_2(P_d)) - c_1'(x_2(P_d))][c_1'(x_2(P_d)) - 1]}{c_2''(x_2(P_d)) - P_d c_1''(x_2(P_d))}(P_d - \bar{P})P_0 > 0.$$

It can be shown that the first term is positive and the second term is negative. The above inequality is more easily satisfied as the initial labor quality P_0 becomes lower and the expected labor quality $\bar{P}$ becomes higher for a given P_d. The former means that HCE converts large portion of local labor force into skilled labor (high skill-acquisition effect), while the latter means that HCE has little effect on surplus per laborer (low congestion effect).

In the case of no HCE, P is set to P_0 in (14). It can then be shown that information sharing increases the total labor surplus if and only if P_0 is lower than $\bar{P}$. Since there is

no HCE, only the surplus per laborer (the expression in square brackets in equations (13) and (14)) matters, and it is decreasing in P.

6. Conclusion

Recent empirical findings in developing countries suggest that the bulk of FDI has been directed toward only a limited number of countries, and that those countries enhancing their human capital succeed in attracting FDI (Noorbakhsh et al., 2001). An explanation for this observation is provided in the context of information asymmetry between the MNC and the local government. Moran (1998) and Lall (2000) regarded information asymmetry to be one of the major reasons for the prevalence of government intervention targeted to attract FDI. In the present model, both precise information and enhanced local labor quality are the sources of a more efficient and profitable labor contract for the MNC. The local government, which has superior knowledge about local labor quality, has an incentive to enhance labor quality and share this information with the MNC.

An important finding regarding human capital enhancement (HCE) by the local government is that it suddenly jumps to a certain level of human capital once it reaches the *take-off point*. However, it has no incentive for HCE before reaching the *take-off point*. This elucidates the empirical finding that a developing country must clear a threshold level of human capital to attract FDI and advanced foreign technology (Borensztein et al., 1998).

HCE and information sharing make both the government and the MNC at least as well off as without them, but it does not always benefit local labor. HCE has two offsetting effects: more laborers will enjoy positive surplus by converting to skilled laborers (skill-acquisition effect), but the surplus per skilled laborer will decrease as more skilled laborers become available (congestion effect). The total effect on local labor welfare depends on the relative size of these offsetting effects.

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Notes

1. UNCTAD (2010).
2. Menon and Sanyal (2007) showed that low quality of labor such as high incidences of labor conflict has negative effect on FDI inflows.
3. Also, see Zhao and Zhang (2010) for an empirical study showing that the contribution of FDI to industry productivity is enhanced by human capital in the specific industry.
4. Ethier (1985) used a similar assumption to establish risk-neutrality of a firm. In the following adverse selection type setting, no other agent faces a risk.
5. Alternatively one can assume volume of an unpaid local resource such as infrastructure is fixed.
6. For economy of space, all mathematical proofs have been omitted. They can be obtained from the authors upon request.
7. $a_2(\bar{P}) - F$ is the intercept and $b(\bar{P})$ is the slope of reservation profit in Figure 2.
8. Tax revenue is used for HCE before production takes place. One can think of the government as having access to credit at zero percent interest rate. The introduction of a (small) positive interest rate does not change the results qualitatively.
9. For simplicity it is assumed that the government imposes no tax when there is no information sharing. The introduction of a fixed tax rate in no-information-sharing case does not change the results qualitatively.
10. Note that it is simply assumed that the government tells the MNC the true value of P. However, this truth-telling can be made the optimal strategy with the following assumptions. First, the government cannot reveal false information. Second, the MNC has knowledge about the constrained optimization problem of the government.
11. The following rather general condition can be shown to be sufficient for at least two intersections: $\{P : 0 < P < 1, MR(P, \bar{P}) > MC(P)\} \neq \phi$.
12. This immediately leads to $P_d > \bar{P}$ because MR is zero at $\bar{P}$.
13. When $P_d \leq P_0$, there is no possibility of HCE in any condition. It is assumed that $P_d > P_0$ hereafter in order to retain the possibility of HCE.
14. When $\Pi(P, \bar{P}, F) = 0$, both constraints are relevant. However, one ends up with the same form of combined constraint as in the case with only the participation constraint binding: $(1 - t)\Pi^*(P, F) = 0$.
15. There may be maximum statutory tax rate t_{max}. As long as t_{max} is a constant, there is no qualitative change in the following arguments.
16. $a_2(0)$–F is the MNC profit at $P = 0$. If it is positive P_t becomes zero.
17. $P_t < P_{\underline{d}} < P_0$ is not acceptable since it is inconsistent with the case 4 condition: $\Pi(P_0, \bar{P}, F) \leq 0$.
18. The only exception is case 4 with $P_0 < P_t < P_{\underline{d}}$.

19. Even if the MNC voluntarily enters without contacting the local government, the tax revenue would be zero for any tax rate, owing to the non-positive reservation profit.
20. When the participation constraint is binding, P_d is changed to $P_{\bar{d}}$ or $P_{\underline{d}}$ depending on the conditions in Table 1. There is no other change in arguments.
21. One can show $[c_2(x_2(P)) - c_1(x_2(P))]$ is decreasing in P using $x_2'(P) < 0$ and Assumption 1.