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Protection of Intellectual Property Rights and Subsidy Policy for Foreign Direct Investment

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This paper provides a theoretical setup for an analysis of strategic relationships inherent to activities of an innovative multinational enterprise (MNE) and a local company in a host country. Additionally, we explore the incentives of the host country's government to provide subsidies to attract foreign direct investment (FDI) and to protect outcomes of R&D activities conducted by the MNE. We show that the MNE's commercial interests may collide with local companies' over protection of IPRs. Therefore, the extent of knowledge spillovers from the MNE to the local company and the magnitude of incentives to the MNE perform a crucial function in determining the optimal policy mix of IPR protection and FDI subsidies of the host country's government.

Keywords: Foreign direct investment, Multinational enterprises, Strategic investment policy, Knowledge spillovers, Intellectual property rights
JEL Classification: F12, F13, F21, F23

I. Introduction

With the advent of the globalization era, most governments of developing countries in the world have started to pay attention to positive impacts of foreign direct investment (hereafter, FDI) on their economic development. Developing countries, mostly being lack of capital, have set various policy tools, such as tax holidays, tax credits, and even subsidies, in order to attract more FDI. To some extent, theoretical and empirical works have been successful to show positive impacts of these policies on FDI performance.

From previous literature on this matter, it has been well known that knowledge

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spillovers from multinational enterprises (hereafter, MNEs) to local companies in host countries play an important role in positively affecting economic development of those host countries. Even though activities of MNEs can increase the risk of reducing market shares of local companies in markets of host countries in the short run, those countries have been eager to attract more FDI, hoping knowledge from MNEs would be widely disseminated to local companies in host countries. According to Aitken *et al*. (1997), Pack and Saggi (2001), and Blalock and Gertler (2005), the effects of FDI on host countries depend on whether it generates knowledge spillovers to host economies. In addition, Kang (2010) theoretically showed that subsidies to attract FDI would be effective only if FDI can generate knowledge spillovers to local companies in host countries.

However, it has been controversial how protection of intellectual property rights (hereafter, IPRs) affects knowledge spillovers from MNEs to local companies in host countries. Some non-governmental organizations with a negative view of globalization have argued that protection of IPRs would be of benefit only to MNEs because developing countries have little things to be protected due to poor R&D environment. However, empirical evidences show that strongly enforcing protection of IPRs encouraged intra-firm technology transfers and FDI performance of host countries, even though these positive evidences have been found in developed countries, such as the United States [Branstetter *et al.* (2006), Branstetter *et al.* (2007), Nunnenkamp and Spatz (2003), and Popovici (2006)], Europe [Javorcik (2004)], and Japan [You and Katayama (2005), Wakasugi and Ito (2007)].[1]

Summing up, we realized that incentive programs are effective to promote FDI if it generates knowledge spillovers, while stronger protection of IPRs would affect the extent that FDI generates technology transfers from MNEs to local companies in host countries. Having understood these stylized facts, this paper tries to set up a theoretical framework to analyze strategic relationship between FDI subsidy policy and IPR protection policy in host countries and then provides policy recommendations to developing countries.

The empirical analyses, as discussed before, showed that parent enterprises of MNEs expand technology transfers to foreign subsidiaries or affiliates in host countries when these countries strongly enforce IPR protection. However, host countries would have an incentive to enforce weakly IPR protection in

[1] It could be due to availability of firm-level data in developing countries. Therefore, it has not been scientifically proven yet to evaluate this controversial issue.

order to generate further knowledge spillovers from MNEs to their local companies. Therefore, stronger protection of IPRs would attract more FDI, whereas it could limit the extent of knowledge spillovers and technology transfers to local companies. This situation will definitely change strategic motivation of developing countries to provide subsidies to attract FDI. In this paper, we explore strategic policy mix of these two policy tools: FDI subsidies and protection of IPRs.

In Section 2, we construct a standard model and analyze basic strategic relationship between MNEs and local companies in host countries. And we explore how MNEs and local companies respond to policy tools, such as FDI subsidies and IPR protection, set by the host country's government. Section 3 focuses on the optimal policy mix of the host country's government in order to maximize its domestic welfare, considering the local company's profits, consumer surplus and the cost of providing FDI subsidies. We also attempt to assess the channel in which FDI subsidies and IPR protection influence the strategic relationship among MNEs and local companies. Interpreting findings and results of this model, we provide relevant implications and summarize the study in Section 4.

II. A Standard Model of FDI Subsidy and IPR Protection

1. Basic Setup

We establish a standard model for the analysis of strategic aspects of policies designed to attract FDI and protect IPRs, extending the model of Kang (2006, 2010) to one that includes FDI subsidies and IPR protection. In our model, there is a developing country, where an MNE competes with a local company in the market of a homogenous product in this country, in a Cournot fashion. The MNE is conducting R&D activities to reduce its marginal cost, while the local company has no R&D activities.

The host country has a policy mix: FDI subsidies and IPR protection. It wants to attract more FDI by expecting technology transfers from the MNE to the local company. Moreover, the second expectation will be determined by to what extent the outcomes of the R&D activities conducted by the MNE would be protected. Weakly enforced protection of IPRs will make the MNE less interested in FDI, but lead greater technology transfers to the local company. However, strongly enforced protection of IPRs will make the MNE better off, but limit

technology transfers.

This model is predicated on a three-stage game in which the MNE, the local company, and the government of the host country play together as follows:

The Standard Game:

Policy Stage: The government of the host country simultaneously chooses a policy mix: an FDI subsidy rate (s) to attract foreign direct investment and protection level of IPRs ($\theta \in [0, 1]$), where the government of the host country perfectly enforces IPR protection if $\theta = 0$, but has no protection if $\theta = 1$;

R&D Stage: Observing the policy mix of the government of the host country, the MNE determines its R&D activity level (x); and

Output Stage: Observing the policy mix of the government of the host country and the R&D activities of the MNE, the local company and the MNE simultaneously determine their output levels (y^s, y^n).

Allow y^s to represent the sales of the local company in the host country (South) and let y^n be the sales of the northern MNE, with a total output of $q = y^s + y^n$. Let the inverse demand function be $p = p(q)$ and assume that it is linear:

$$p = a - b\left(y^s + y^n\right), \tag{1}$$

where $a > 0$ and $b > 0$.

As we discussed before, the MNE is assumed to conduct R&D activities and to generate knowledge spillovers to the local company if the government is weakly enforcing IPR protection. Using the outcome of its R&D activities, the MNE can reduce its marginal cost of producing its output as follows:

$$c^n = d - f(x), \tag{2}$$

where $d > 0$, and we assume $f(0) = 0$, $f' > 0$, and $f'' < 0$. The local company can benefit from the R&D activities of the MNE by reducing its marginal cost when its government is weakly enforcing IPR protection ($\theta \neq 0$) as follows:

$$c^s = d - \theta f(x). \tag{3}$$

We assume that both MNE and the local company have no difference over marginal costs when the MNE conducts no R&D activities ($c^s = c^n = d$, if $x = 0$). This configuration is compatible with previous theories to explain MNEs: MNEs own or can appropriate the assets or their services; they can differ in productivity from comparable assets possessed by competing firms; and hence they can hold legal title (patents, trademarks) of these assets. Based on these findings, we setup the model in a way that a company can be multinational when it has enough potential and capacity to conduct R&D activities. In addition, one can realize that the marginal costs of these two companies are the same when the government has no protection of IPRs ($c^s = c^n = d - f(x)$, if $\theta = 1$).

We solve this game to determine the subgame-perfect equilibrium by finding each firm's best outcome and subsequently working backward to ascertain the optimal choice for the government.

2. Nash Output

The local company's profit function and the optimization problem are given as follows:

$$\max \quad \pi^s(y^s; y^n, x, s, \theta) = R^s(y^s; y^n) - c^s(x, \theta)y^s, \tag{4}$$

where $R^s(y^s; y^n)$ is the revenue function of the local company, implying that $R^s(y^s; y^n) = p(y^s + y^n)y^s$. There would be multiple local companies in the host country, but we assume only a single local company in the host country, for simplicity's sake. The Nash equilibrium output level for the southern firm can be explored via the first-and second-order conditions:

$$\pi^s_{y^s} = R^s_{y^s} - c^s = a - by^n - 2by^s - c^s = 0 \text{ and } \pi^s_{y^s y^s} = R^s_{y^s y^s} = -2b < 0. \tag{5}$$

The MNE's profit function and its optimization problem are given as follows:

$$\max \ \pi^n\left(y^n;y^s,x,s,\theta\right)=R^n\left(y^n;y^s\right)-\left[c^n(x)-s\right]y^n, \tag{6}$$

where $R^n\left(y^n;y^s\right)$ is the revenue function of the MNE, implying $R^n\left(y^n;y^s\right)=p\left(y^s+y^n\right)y^n$. This setup implies that the MNE produces its output (y^n) in the market of the host country by investing its money in this country (c^n). For simplicity, we assume that there is no fixed cost of establishing its factory in the host country, allowing us to focus more on strategic relationships between the MNE and both the local company and the government of the host country. The MNE also faces the marginal cost (c^n) to produce its output in the host country, and we regard this as FDI to the host country. The government provides subsidies (s), or taxes if negative, to attract, or discourage if negative, FDI. Following Kang (2010), we have focused principally on a subsidy per output produced in the host country, because a lump-sum subsidy does not equate to private and social returns to FDI, as demonstrated by Hanson (2001).

The Nash equilibrium output of the MNE can be characterized by the first-and second-order conditions:

$$\pi^n_{y^n}=R^n_{y^n}-\left(c^n-s\right)=a-by^s-2by^n-\left(c^n-s\right)=0 \ \text{ and } \ \pi^n_{y^ny^n}=R^n_{y^ny^n}=-2b<0. \tag{7}$$

Using (5) and (7), one can identify the Nash equilibrium output levels as follows:

$$q^n(x,s,\theta)\equiv y^n=\frac{1}{3b}\left[a+c^s-2\left(c^n-s\right)\right]; \ \text{ and } \ q^s(x,s,\theta)\equiv y^s=\frac{1}{3b}\left[a+\left(c^n-s\right)-2c^s\right]. \tag{8}$$

Totally differentiating the first-order conditions with respect to q^n, q^s, x, s, and θ, we can show the following equation:

$$\begin{bmatrix} R^n_{y^ny^n} & R^n_{y^ny_s} \\ R^s_{y^sy^n} & R^s_{y^sy^s} \end{bmatrix}\begin{bmatrix} dq^n \\ dq^s \end{bmatrix}=-\begin{bmatrix} f' \\ \theta f' \end{bmatrix}dx-\begin{bmatrix} 0 \\ f(x) \end{bmatrix}d\theta-\begin{bmatrix} 1 \\ 0 \end{bmatrix}ds \tag{9}$$

First of all, one can show the slopes of the output reaction functions, which

are negative since $\frac{dq^n}{dq^s} = -\frac{R^n_{y^n y^s}}{R^n_{y^n y^n}} = -\frac{1}{2}$, thereby implying that output levels of the MNE and the local company are strategic substitutes. However, even though these two companies are in a Cournot competition in the market of the host country, R&D activities conducted by the MNE could benefit the local company when the government of the host country is weakly enforcing protection of IPRs:

Proposition 1 (IPR Protection and Knowledge Spillovers)
When the government of the host country weakly enforces protection of IPRs, generating knowledge spillovers, the local company will benefit from R&D activities conducted by the MNE.

Proof: Holding $d\theta = ds = 0$ from (9), we can show that the MNE's output level (q^n) increases with its R&D activities (x) because $\frac{dq^n}{dx} = -\frac{R^s_{y^s y^s} f' - R^n_{y^n y^s}\theta f'}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{(2-\theta)f'}{3b} > 0$. However, the effect of R&D activities, conducted by the MNE, on the output level of the local company (q^s) depends on the host country's enforcement of IPR protection: $\frac{dq^s}{dx} = -\frac{R^n_{y^n y^n}\theta f' - R^s_{y^s y^n} f'}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{(2\theta - 1)f'}{3b} \geq 0$ if $\theta \geq \frac{1}{2}$. Therefore, in a regime of weakly enforced protection of IPRs in the host country, the outcome of R&D activities conducted by the MNE could reduce the marginal cost of the local company, generating knowledge spillovers, and then increases its output level. (Q.E.D.)

From this proposition, it turns out that the government of the host country has an incentive to enforce weakly protection of IPRs in order to generate knowledge spillovers from the MNE to the local company. Additionally, one may identify the effects of IPR protection on each company's output level from (9), according to the following proposition:

Proposition 2 (Effects of IPR Protection on Outputs)
Stronger protection of IPRs increases the MNE's output level, while weaker protection increases the local company's output level.

Proof: Holding $dx = ds = 0$ from (9), we can show that the MNE's output level (q^n) increases with IPR protection of the host country (θ) because $\frac{dq^n}{d\theta} = -\frac{-R^n_{y^n y^s} f(x)}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{-f(x)}{3b} < 0$. Thus, lower θ, that is, stronger protection, increases the MNE's output level. However, we can also show that $\frac{dq^s}{d\theta} = -\frac{R^n_{y^s y^n} f(x)}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{2f(x)}{3b} > 0$, implying that higher θ, that is, weaker protection, increases the local company's output level. (Q.E.D.)

As expected, stronger (weaker) protection of IPRs increases the output level of the MNE (the local company), implying that the host country's IPR protection regime can be a factor that the MNE makes a decision of its FDI destination. In addition, one may identify the effects of FDI subsidies on each company's output level from (9), according to the following proposition:

Proposition 3 (Effects of FDI Subsidies on Outputs)
FDI subsidies increase the MNE's output level, but reduce the local company's output level.

Proof: Holding $dx = d\theta = 0$ from (9), we can show that the MNE's output level (q^n) increases with FDI subsidies provided by the government of the host country (s) because $\frac{dq^n}{ds} = -\frac{R^s_{y^s y^s}}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{2}{3b} > 0$. However, we can also show that $\frac{dq^s}{ds} = -\frac{-R^s_{y^s y^n}}{R^n_{y^n y^n} R^s_{y^s y^s} - R^n_{y^n y^s} R^s_{y^s y^n}} = \frac{-1}{3b} < 0$, implying that subsidies to attract FDI reduce the local company's output level. (Q.E.D.)

Therefore, the MNE will respond *positively* to subsidies of the host country, by increasing output production in the host country. This positive impact of the FDI subsidy on the MNE's production level confirms Moran's (2005) finding that MNEs have become more responsive to FDI incentives from host economies. However, under conditions of Cournot competition, the host country's subsidies to attract FDI will hurt its local company, because its output is a substitute for the MNE's output, as proven before.

3. Nash R&D Level

Now let us consider the optimal R&D of the MNE, which is supposed to maximize its profits in the market of the host country, having the following objective function:

$$\begin{aligned}\pi^n\left(x;q^n(x,s,\theta),q^s(x,s,\theta),s,\theta\right) &= R^n\left(q^n(x,s,\theta),q^s(x,s,\theta),s,\theta\right)-\left(c^n(x)-s\right)q^n(x,s,\theta)\\ &= R^n\left(q^n(x,s,\theta),q^s(x,s,\theta),s,\theta\right)-\left(d-f(x)-s\right)q^n(x,s,\theta).\end{aligned} \tag{10}$$

The first-order and second-order conditions of this optimization problem are given as follows:

$$\frac{2}{3}(2-\theta)f'(x)q^n(x,s,\theta)=0\text{; and} \tag{11}$$

$$\frac{2}{3}(2-\theta)\left[f''(x)q^n(x,s,\theta)+f'(x)q_x^n(x,s,\theta)\right]<0.^2 \tag{12}$$

Solving the first-order condition (11) for x, one can find the optimal level of R&D activities that the MNE maximizes its profits:

$$z(s,\theta)\equiv \arg\left[\frac{2}{3}(2-\theta)f'(x)q^n(x,s,\theta)=0\right]. \tag{13}$$

Even though we need to define a specific function for $f(x)$ in order to find the optimal level, we can provide implications using the first-order and second-order conditions. Totally differentiating the first-order condition with respect to x and θ, we can have the following result:

Proposition 4 (Impact of the IPR Protection Regime on R&D Activities of the MNE)

Stronger protection of IPRs in the host country will increase R&D activities of the MNE.

[2] The second-order condition implies that the absolute value of f'', which is negative from (3), must be big enough in order for the solution(s) to exist.

Proof: Totally differentiating the first-order condition (11) with respect to x and θ, we obtain the following result: $\frac{2}{3}(2-\theta)\left[f''q^n + f'q_x^n\right]dx + \left[-\frac{2}{3}f'q^n + \frac{2}{3}(2-\theta)f'q_\theta^n\right]d\theta = 0$. Since $q_\theta^n = \frac{-f(x)}{3b} < 0$ and $\left[f''q^n + f'q_x^n\right]$ from the second-order condition is also negative, we can prove that $\frac{dx}{d\theta} = \frac{f'q^n - (2-\theta)f'q_\theta^n}{(2-\theta)\left[f''q^n + f'q_x^n\right]} < 0$, implying that lower θ, that is, stronger protection, will lead the MNE to raise its R&D activities. (Q.E.D.)

As expected, stronger protection of IPRs in the host country will increase the MNE's R&D activities as well as the output level as shown in Proposition 2. Totally differentiating the first-order condition with respect to x and s, we can demonstrate the following result:

Proposition 5 (Impact of FDI Subsidies on R&D Activities of the MNE) *Subsidies of the host country to attract more FDI will increase R&D activities of the MNE.*

Proof: Totally differentiating the first-order condition (11) with respect to x and s, we obtain the following result: $\frac{2}{3}(2-\theta)\left[f''q^n + f'q_x^n\right]dx + \left[\frac{2}{3}(2-\theta)f'q_s^n\right]ds = 0$. Since $q_s^n = \frac{2}{3b} > 0$ from Proposition 3, we can prove that $\frac{dx}{ds} = \frac{-f'q_s^n}{f''q^n + f'q_x^n} > 0$, implying that R&D activities increase with FDI subsidies provided by the government of the host country. (Q.E.D.)

Proposition 5 implies that FDI subsidies have a positive impact on the MNE's R&D activities, even though the government of the host country provides subsidies to the MNE's output production, rather than directly to its R&D activities. This is because FDI subsidies would encourage the MNE to produce more outputs as shown in Proposition 3 and then the MNE has a strong incentive to be more efficient by conducting more R&D activities in order to reduce its marginal cost due to outcomes of its R&D activities.

III. Optimal Policy Mix of FDI Subsidies and IPR Protection

1. Possible Sets of Optimal Policy Tools

In this section, we consider the optimal policy mix of FDI subsidies and IPR

protection for the host country, having understood the strategic relationships among companies and the government. The government will select the optimal policy mix to maximize its domestic welfare, which will be discussed in the next subsection, but we can imagine possible sets of optimal policy tools of FDI subsidies and IPR protection using the results of the previous analyses done so far.

First of all, we can check the relationship between FDI subsidies and IPR protection using the previous results. Do they go in the same or opposite directions? In other words, do more FDI subsidies lead the government to enforce IPR protection weakly or strongly? Totally differentiating the first-order condition of the previous optimization problem with respect to s and θ, we can answer to this question:

$$\frac{ds}{d\theta} = \frac{f'q^n - (2-\theta)f'q_\theta^n}{-(2-\theta)f'q_s^n} < 0 . \tag{14}$$

It implies that the government is likely to enforce strongly (weakly) protection of IPRs and simultaneously to provide more (less) subsidies to attract FDI. [Table 1] is an easy way to illustrate possible sets of optimal policy tools. As shown in [Table 1], there are four possible illustrations of optimal policy tools: (Case 1) low FDI subsidies and weak IPR protection; (Case 2) high FDI subsidies and weak IPR protection; (Case 3) low FDI subsidies and strong IPR protection; and (Case 4) high FDI subsidies and strong IPR protection. However, Equation (12) implies that (Case 1) and (Case 4) are plausible to be a solution, but (Case 2) and (Case 3) cannot be an optimal policy mix, because a policy tool is moving in the opposite direction with the other policy tool. Therefore, when the government provides more FDI subsidies, they need to reduce θ, which means stronger enforcement of IPR protection (Case 4). In another case, when they decide to provide less FDI subsidies, they need to raise θ, which means weaker enforcement of IPR protection (Case 1).

Table 1. Illustration of Possible Sets of Optimal Policy Mix

	FDI Subsidies	
IPR Protection	(Case 1) Low FDI Subsidies Weak IPR Protection	(Case 2) High FDI Subsidies Weak IPR Protection
	(Case 3) Low FDI Subsidies Strong IPR Protection	(Case 4) High FDI Subsidies Strong IPR Protection

2. Finding the Optimal Policy Mix

Now we find the optimal policy mix of FDI subsidies and IPR in this subsection.

The government is supposed to select the optimal policy mix of FDI subsidies and the IPR protection level in order to maximize its domestic welfare, the sum of the local company's profits and consumer surplus and less the cost of FDI subsidies as follows:

$$\text{Max} \quad W^s(s,\theta) \equiv \pi^s(s,\theta) + CS(s,\theta) - sq^n(s,\theta), \tag{15}$$

subject to $0 \leq \theta \leq 1$. In this optimization problem, consumer surplus is defined as follows: $CS(q) = \int_0^q p(u)du - p(q)q = \frac{1}{2}(a-p)(q^s+q^n) = \frac{1}{2}b(q^s+q^n)^2$. The Lagrange function of this optimization problem is given as follow:

$$L(s,\theta) \equiv \pi^s(s,\theta) + CS(s,\theta) - sq^n(s,\theta) + \lambda_1\theta + \lambda_2(1-\theta), \tag{16}$$

where λ_1 and λ_2 are Lagrange multipliers. The first-order conditions of this optimization problem with respect to s and θ are given as follows:

$$\pi_s^s + CS_s - q^n - sq_s^n = R_{q^n}^s q_s^n + \theta f' z_s q^s + b(q^n+q^s)(q_s^n+q_s^s) - q^n - sq_s^n = 0; \tag{17}$$

$$\begin{aligned} &\pi_\theta^s + CS_\theta - sq_\theta^n + \lambda_1 - \lambda_2 \\ &= R_{q^n}^s q_\theta^n - (-f - \theta f' z_\theta)q^s + b(q^n+q^s)(q_\theta^n+q_\theta^s) - sq_\theta^n + \lambda_1 - \lambda_2 = 0 \end{aligned} \tag{18}$$

$$\theta \geq 0; \quad \lambda_1 \geq 0; \quad \lambda_1\theta = 0; \tag{19}$$

$$1-\theta \geq 0; \quad \lambda_2 \geq 0; \quad \lambda_2(1-\theta) = 0. \tag{20}$$

Solving the first-order conditions of this optimization problem for each policy tool and checking corner solutions, one can find the optimal policy mix as follows:

Proposition 6 (Optimal Policy Mix of FDI Subsidies and IPR Protection) *To maximize its domestic welfare, the host country's government needs to enforce strongly IPR protection* $\left(0<\theta<\frac{1}{2}\right)$ *and provide FDI subsidies* $(s>0)$.

Proof: As we discussed in the previous section, this model does have a general function of $f(x)$ without any specific functional form, not enabling us to find the optimal R&D activity level in the previous section. This generality, without a specific functional form of $f(x)$, leads inability to find the *accurate* optimal levels of policy tools. However, using the previous findings of this paper, one can identify signs and ranges of optimal levels. First of all, using Proposition 2, 3, 4, and 5, one can show that (18) implies that there is no corner solution ($\lambda_1=\lambda_2=0$) and $\frac{dq^s}{dz}$ must be negative to hold (18), verifying that the host country's government needs to enforce strongly IPR protection $\left(0<\theta<\frac{1}{2}\right)$. Using this result and Proposition 2, 3, 4, and 5, one can show that the optimal FDI subsidies are positive. (Q.E.D.)

This result provides an important implication for the previous discussion of possible sets of optimal policy mix in Section 3.1. As discussed before, (Case 1) and (Case 4) are possible solutions for this optimization problem. Proposition 6 implies that the optimal policy mix is Case 4 with strong IPR protection and high FDI subsidies, eliminating (Case 1) because Proposition 6 calls upon the host country to enforce IPR protection strongly.

Presumably, this result implies that a positive impact on consumer surplus with more consumption at a lower price would be greater than negative impacts on the local company's profit loss and the cost of providing FDI subsidies. More precisely and intuitively, we realized from Proposition 3 that FDI subsidies raise the MNE's output $\left(\frac{dq^n}{ds}>0\right)$, but reduce the local company's output $\left(\frac{dq^s}{ds}<0\right)$. Putting them together, one can realize that the gross impact of FDI subsidies on the total production of these two companies is positive because $\frac{dq^n}{ds}+\frac{dq^s}{ds}=\frac{1}{3b}>0$. Therefore, when the government of the host country provides FDI subsidies to the MNE, consumers consume more at a lower price, making consumers better off.

In addition, when the government strongly, but not perfectly, enforces IPR protection, the local company can partly enjoy the outcome of R&D activities

conducted by the MNE, hurting the MNE's commercial interests in the market. However, the government tries to compensate the MNE's damaged interests, due to imperfect protection of IPRs, by providing FDI subsidies.

IV. Conclusion and Policy Implications

This paper provided a theoretical setup for the analysis of the strategic relationships inherent to activities of the innovative MNE and the local company in the host country. Additionally, we explored the incentives of the host country's government to provide subsidies to attract FDI and to protect outcomes of R&D activities conducted by the MNE. As previously demonstrated, the MNE's commercial interests may collide with local companies in the host country over protection of IPRs. Therefore, the extent of knowledge spillovers from the MNE to the local company and the magnitude of incentives to the MNE perform a crucial function in determining the optimal policy mix of IPR protection and FDI subsidies of the host country's government.

Understanding these results shown in this paper, there are several factors that need to be considered by the host country's government when it plans to provide FDI subsidies to MNEs. When it establishes any incentive scheme for foreign investors, it must consider ways by which technology transfers from MNEs to local companies in the host country can be enhanced. In addition, they need to keep tracking how their regime of protecting IPRs affects both the commercial interests of foreign investors, including their incentives to invest, and knowledge spillovers from MNEs to local companies.

Additionally, there have been continuously attempted efforts by some developed countries to move towards a negotiated investment agreement within an international organization, such as OECD and WTO. The proponents of such an agreement seek multilaterally binding disciplines that would harmonize the terms and domestic regulations on foreign investors entering and operating in host countries, by granting them national treatment. However, most developing countries are reluctant to agree to this because they believe that an investment regime would be of sovereignty to pursue their own development strategy. Therefore, it has been controversial and there have been little research on this subject. The expanded use of incentives to attract more FDI in developing countries implies more intense competition, particularly among geographically proximate countries. It may lead these countries into a prisoners' dilemma, owing to the huge cost-burdens inherent to FDI subsidies. This paper did not consider

the competition of FDI policy and a possibility of any multilateral agreement on investment, but this may be a topic for future studies.

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