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Intellectual Property Rights and North-South Joint Ventures*

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Abstract

We study the effect of the intellectual property rights (IPR) regime of a host country (South) on a multinational's decision between serving a market via greenfield foreign direct investment to avoid the exposure of its technology or a North-South joint venture (JV) with a local firm, which allows R&D spillovers under imperfect IPRs. JV is the equilibrium market structure when R&D intensity is moderate and IPRs strong. The South can gain from increased IPR protection by encouraging a JV, whereas policies to limit foreign ownership in a JV gain importance in technology intensive industries as complementary policies to strong IPRs.

JEL Classifications: O34, F23, O32, F13, L24, O24

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1 Introduction

There is one aspect of globalization over which its advocates and critics agree: the increasingly important role of multinational enterprises (MNEs) in the global economy. The latter group criticizes the expanding market and political power of MNEs while the former is convinced of their contribution to growth and development. The organizational structure of MNEs can be a significant factor in determining whether they simply exploit their market power or truly contribute to the development of the host country. Foreign investment by MNEs can take several forms: one option is to directly set up a wholly owned subsidiary in order to have more control over and closer monitoring of its operations abroad; another is to enter an agreement such as licensing, acquisition, or an North-South joint ventre (JV) with an already existing foreign firm to serve a foreign market. The question comes to mind as to which form of investment MNEs prefer under different circumstances and whether their preferred market structure can be an equilibrium outcome.[1]

Firm-specific assets may be knowledge based and can be protected by a patent. The patent grants the MNE technological superiority, which creates incentives for it to move to a foreign market. When an enforcement mechanism to protect patents is absent in the target country, the firm's desire to protect its knowledge based assets can influence how (if at all) it chooses to enter that foreign market. The IPR regime in the host country is hence likely to have an effect on this decision. If knowledge is valuable but can be copied, a MNE may not wish to reveal its technology to an unrelated Southern firm as it would lose absolute control over its know-how. This leads firms to seek a safer alternative and engage in greenfield foreign direct investment (FDI) in countries with weaker IPRs and contract enforcement mechanisms (Maskus, 1998). Subsequently, as IPR protection in a nation becomes stronger, i.e. Trade-Related Aspects of Intellectual Property (TRIPS) is enforced, firms would not

[1] Dunning (1981) studied different modes of entry by considering three advantages of investing into a foreign market. This is usually referred to as the OLI framework, which stands for ownership, locational and internalization advantage. The ownership advantage occurs as information (technology) can be transferred over border at low cost and can therefore be used in several facilities at no extra costs. Locational advantage comes from motives such as tariffs, transport costs, market size, lower wages and closeness to customers. Internalization advantage involves keeping crucial technology in-house by choosing FDI over licensing or JVs.

need to rely as much on the direct form of FDI and tend to choose more licensing and JV agreements.

The relative R&D intensity of an industry also plays an important role in the decision of firms on how to enter a foreign market. For instance in low tech goods such as textile and apparel, distribution, hotel, etc. FDI depends relatively little on IPRs and more on input costs and market opportunities. Investments with technologies that are too costly to imitate likewise pay little attention to local IPR levels.[2] It is particularly in industries with valuable, but easily copied technologies such as the pharmaceutical, chemical or the software industry where concern over the ability of local IPRs to deter imitation arises when making foreign investment decisions. Mansfield's (1994) survey of intellectual property executives in one hundred major US firms in six industries that had international operations found that JVs or licensing to unrelated firms is seen as riskier than FDI with a wholly owned subsidiary when IPRs are weak. This concern was higher for more R&D intensive sectors.[3] This is because the risk at stake is much higher when technologies require higher amounts of R&D investment, making it more efficient to avoid potential losses by internalizing technology transfer through FDI. As the IPR regime in a developing country improves, i.e. it adopts TRIPS, we expect to see licensing and JVs displace FDI.

As technology transfer has proved to be necessary means of growth, it also has important welfare implications for developing countries that attempt to attract foreign capital. The illegitimate means of technology transfer can be achieved through imitation when MNEs choose the form of entry that is relatively more vulnerable to spillovers. However, it is less likely that a MNE makes such a choice when the IPR regime in the target country is loose. The legitimate (voluntary) form of technology transfer on the other hand can be processed through licensing or JV agreements. This form of transfer only occurs when firms see enough commitment to IPRs in the host country so that excessive leakage of its know-how outside the JV can be prevented. It will be seen that this form of technology transfer can be accelerated by an improvement in the level of IPR protection in the South. Hence the South can induce the Northern firm to undertake voluntary technology

[2] Note that the fact that imitation of complex technologies is getting easier with time gives rising importance to IPRs of the host country in FDI decisions.

[3] The concern was also higher for all sectors when a higher stage of production was under question.

transfer when it sees JVs as the socially preferable form of inward investment. In fact, the TRIPS agreement includes provision such as the article 66.2 that requires Northern governments to provide incentives for their firms to transfer technology to the South in return for the protection of their IPRs.[4] As there has been few signs of such move by the North, governments in the South have sought a mechanism for ensuring this requirement the Doha round.

Policies that limit direct foreign investment in the South have been used as an indirect way to encourage inward technology transfer. Indeed, foreign investment policies that place limits on the direct form of FDI, or on the degree of foreign ownership in a JV are often observed in developing countries. Limitations on foreign investment still persist to a great extent in non-WTO members such as Iran. They can even be observed in several member countries such as China, which after joining the WTO has only raised its limits on foreign ownership of JVs in the telecommunications industry to 49% and in insurance and automobile industries to 50% (Lin and Saggi, 2004). This motivates an investigation to see whether such policies are optimal for the South and if so how they could benefit the latter when technology transfer is taken into account.

The role of JVs have been surprisingly little explored in the IPR literature. Al-Saadon and Das (1996) for instance constructs a model of JVs in which ownership shares are endogenously determined through bargaining between a MNE and a single host firm. Only another handful of papers such as Das (1999) and Lin and Saggi (2004) dealt with different aspects of a JV such as moral hazard problems and Southern policies on foreign ownership. Yet, IPR protection as a determinant of knowledge spillover and a firm's decision on the mode of entry have been absent from the discussion. Mattoo, Olarreaga and Saggi (2004) develop a model that differentiates between FDI and acquisition of existing domestic firms. They show circumstances where the preferences of the MNE and the host country government can be in conflict, justifying policy interventions through restrictions on FDI or JVs to induce the foreign firm to choose the socially optimal mode of entry. While this paper is the closest work to ours that deals with technology transfer and the decision of firms about the mode of entry, it also leaves out matters concerning IPRs and technological spillovers.[5]

[4] See http://www.wto.org/english/tratop_e/trips_e/techtransfer_e.htm.

[5] Saggi (1996) also examines the choice of a MNE between FDI and licensing when there are two firms in the host

Our paper is the first theoretical paper to our knowledge that looks at IPR issues surrounding JVs. First, we focus on JVs and show how they are more likely to occur when the R&D intensity of an industry is at an intermediate range. We then show in line with empirical findings of Mansfield (1994) that an improved IPR regime can encourage JVs. We also analyze investment policies in the South and demonstrate that they are often ineffective from the perspective of the recipient country. From the point of view of Southern welfare, strengthening the IPR regime instead serves as a priority to induce a JV and with it technology transfer. It will be seen that Southern policies on the extent of foreign ownership in a JV only become important as a complementary policy to full IPR protection for sectors with high R&D intensity.

The plan of the rest of the paper is as follows: Section 2 describes the basics of the model and looks into the FDI and JV modes of entry by the MNE. It discusses the production and the innovation stage for each case. Section 3 calculates the equilibrium mode of entry. Section 4 solves the bargaining game between the firms in the first stage. Section 5 studies the welfare implication for the host country and finds the socially optimal form of inward foreign investment. Policy recommendations on inward FDI follow in this section. Section 6 concludes.

2 The Model

2.1 Background

There are two countries: the North and the South. We assume one MNE that belongs to the North and two local firms operating in the South. Firms produce a homogenous good intended for the South and compete in a Cournot manner. For instance these could be thought of as drugs aimed at combating tropical diseases only prevelant in the South. We use an oligopoly model as MNEs are

country with asymmetric costs. He finds that licensing is always chosen when the licensee is legally prevented from using the acquired technology to compete with the MNE in the rest of the world. When opportunism is allowed so that the licensee has the option to defect, FDI can become the preferred form of entry when licensing fees cannot recoup the damages to the MNE caused by the loss of its monopoly power in the rest of the world.

usually found in concentrated industries.[6] In addition, markets in which technology transfer plays an important role are usually not perfectly competitive. For simplicity and because we wish to focus on one industry we adopt a partial equilibrium approach.[7] Firms face an aggregate demand in the South

$$p = A - Q, \tag{1}$$

where A represents the size of the market and Q is the total quantity produced.

It is assumed that the Northern MNE has already decided to establish production in the South due to significantly lower production costs in the South.[8] The MNE must make a decision whether to enter the South through FDI or a JV agreement. It could establish a wholly owned subsidiary to protect its technology from exposure to Southern firms. In this case the MNE remains the only firm that has access to the superior technology generated by its R&D. Alternatively, it could form a JV with an already existing Southern firm in order to carry out its production activities.[9] In this case, a potentially loose IPR policy in the South makes it possible for local firms outside the JV to imitate the Northern technology at no extra cost.

When forming a JV, the firms bargain over their profit share. The outcome of the negotiations depends on the relative bargaining power and the outside option of the firms. Following Lin and Saggi (2004) we focus on the two extreme negotiated outcomes: when either the Northern or Southern partner has all the bargaining power.[10] The firm with full bargaining power leaves itself the maximum

[6] The model can be extended to allow for more Southern firms, but this does not yield significant additional insights; the attractiveness of a JV is simply reduced due to higher competition and a bigger loss from spillovers.

[7] The literature in oligopoly in general equilibrium is very small but growing. See for instance Neary (2003) for recent work on "general oligopolistic equilibrium". In this and in related papers Neary treats firms as large in their own sectors yet small in the economy as a whole.

[8] The trade-off between exporting and FDI in the context of IPRs has been explored in previous literature (see for example Naghavi, 2007) and is not the aim of this paper.

[9] We rule out the possibility of the Northern firm entering a JV with more than one firm. We consider that to be a less realistic case.

[10] Lin and Saggi (2004) actually look at three cases with the third being the share that maximizes their joint profits. As in our models firms produce to maximize joint profits, the shares in the JV does not affect total profits.

rent it can achieve from a JV, while giving its partner just the equivalent of its outside option. A JV contract only goes through if it creates extra rents. Whether or not a JV is formed and thus the equilibrium market structure depends both on the level of IPR protection and the R&D intensity of the industry.

R&D investment takes place in the next stage. The level of this investment determines the potential quality of technology transfer to the South. R&D in this model is aimed at inventing more efficient production technologies and hence takes a cost-reducing form. The Northern MNE is assumed to be the sole firm that can invest in R&D as the South is considered less developed. The mode of entry along with other factors such as the level of IPR protection in the South determine the level of R&D investment. The model looks at a range of industries with different R&D intensities. The paper however leaves out extremely high technology intensive industries discussed in a somewhat similar framework in Chin and Grossman (1991) and Zigic (1998) where the Northern firm may be able to form a constrained or unconstrained monopoly.[11] Such industries are not of interest in our discussion on JVs as they are infeasible and lie beyond the region where sharing ownership is a profitable option for the MNE.[12] The cost functions for the Northern and the Southern firms respectively are

$$C = \alpha - \sqrt{gx} \tag{2}$$

and

$$c = \alpha - \beta\sqrt{gx}, \tag{3}$$

where x is the R&D investment, g is the effectiveness of R&D, α is the pre-innovative production

[11] These models do not look at the possibility of a JV, but extend the analysis to more technology intensive sectors where the Northern firm can engage in strategic predation to deter entry or serve the market as a unconstrained monopoly. While an unconstrained monopoly clearly rules out the possibility of a JV, our model can be easily extended to include strategic predation by the Northern firm or the JV. This would however not bring any new insights into the model.

[12] Both theory (See Mattoo, Olarreaga and Saggi, 2004) and empirics (Javorcik, 2006, Javorcik and Saggi, 2004) prove that joint ventures do not occur for high technology intensive industries. Northern firms in such cases prefer to serve the foreign market through a wholly owned subsidiary abroad even when IPRs are fully protected.

cost, and $x \leq \alpha^2/g$. The level of technological spillovers are captured by

$$\beta = b\iota. \tag{4}$$

The parameter β itself is a product of the absorptive capacity $0 \leq b \leq 1$ and ι, a measure of the weakness of IPR protection in the host country with $\iota = 0$ indicating full IPR protection and $\iota = 1$ the complete lack thereof.

Absorptive capacity b is the ease with which the outsider Southern firm can absorb the knowledge generated by the Northern firm. This will depend on such factors as the complexity of the knowledge generated and the level of development of the Southern firm and country. The larger is b, the greater is the absorptive capacity. Thus when $b = 0$ it is impossible for the outsider Southern firm to learn anything from the JV while when $b = 1$ the firm is fully capable of making use of the available technology. When IPR protection is completely missing in the host country, spillovers amount to the natural level determined by how easy it is to copy the technology ($\beta = b$). In the rest of the paper, we focus the discussion on changes in the level of IPR protection and take b as given. Note that the former is a policy instrument whereas b is exogenous. Finally, $\beta = 0$ always holds under FDI as it is assumed that this form of subsidiary prevents any leakage/spillover of knowledge to competing firms operating in the South.[13]

We also compare the welfare implications of each mode of entry to find the socially optimal form of foreign investment for the host country. This allows us to see whether it is optimal for the South to upgrade its IPR protection regime and/or put restrictions on foreign ownership in a JV.

The timing of the game is as follows. Firms bargain in the first stage over their share in a potential JV and decide the market structure. If both firms are at least as well off with the a JV than competing on their own, the agreement goes through. Otherwise the MNE enters the South through FDI. The MNE then engages in R&D and firms compete in output in the final stage of the game. We now turn to the two modes of entry and look at production and R&D investment for each

[13] Clearly, in practice, there can be some spillovers with FDI, although less than in a JV. For simplicity we just set the spillovers under FDI equal to zero. Results remain qualitatively the same for positive, but lower spillovers under FDI.

case before analyzing the bargaining game in the first stage.

2.2 FDI

When the Northern firm chooses to enter the South through FDI, it simply competes with active local firms in the host country that produce the homogeneous good. It is usually assumed that FDI incurs fixed costs that can be avoided by forming JVs to utilize already existing facilities of a foreign firm. Fixed costs of FDI are however left out of the model for simplicity. Adding them simply increases the attractiveness of JVs proportionally.[14]

A marginal cost asymmetry arises as firms in the South do not have access to the Northern firm's technology attained through its R&D efforts. Given that there are no spillovers with FDI ($c = \alpha$), the profits of the Northern firm and the two Southern firms are respectively

$$\pi_F = (p - C)q_F - x \tag{5}$$

and

$$\pi_{Sj} = (p - \alpha)q_{Sj}, \tag{6}$$

where subscript F represents the Northern firm when it engages in FDI, S denotes a Southern firm and $j = 1, 2$ identifies the latter. In the final stage of the game, firms compete in quantity and find their optimal output using the first order conditions of (5) and (6) with respect to q:

$$q_F = \frac{a + 3\sqrt{gx}}{4}, \tag{7}$$

$$q_{Sj} = \frac{a - \sqrt{gx}}{4}, \tag{8}$$

for $j = 1, 2$. As $A - \alpha$ appears in all the upcoming equations, it is replaced by a to simplify the notation. Replacing the optimal quantities back into the Northern firm's profit function and differentiating the latter with respect to x, we can derive the optimal level of R&D investment:

$$x_F^* = \frac{9a^2 g}{(16 - 9g)^2}. \tag{9}$$

[14] It will be seen that although the model reflects a case with zero FDI fixed costs, a JV results in other advantages for the MNE such as sharing the fixed R&D investment cost.

It can be seen that R&D effort is higher the more technology intensive is an industry (i.e. the higher is g). Finally replacing the optimal output and R&D investment back into (5) and (6), the optimal profits for each firm can be found:

$$\pi_F^* = \frac{a^2}{16 - 9g}, \tag{10}$$

$$\pi_{Sj}^* = \frac{a^2(4 - 3g)^2}{(16 - 9g)^2}. \tag{11}$$

We assume that $g \leq 4/3$ to assure that all firms produce non-negative output and earn non-negative profits. A higher level of g would lead to the Southern firms being driven out of the market. In that case, neither Southern firm finds it profitable to enter the market and compete in technology intensive industries. We rule out this case.

2.3 North-South Joint Venture

Now we look at a situation where the Northern firm enters the South by forming a JV with a local firm to produce output in the host country.[15] We assume a JV maximizes joint profits with a fixed share of profits going to each partner. The joint profits of the Northern firm and the Southern firm in a JV are

$$\pi_J = (p - C)q_J - x \tag{12}$$

with subscript J representing a JV. An agreed share of profits ϕ $(1 - \phi)$ goes to the Northern (Southern) partner where $0 \leq \phi \leq 1$. While the Northern firm continues to perform its own R&D activities, all production by the JV is assumed to take place in the South at marginal cost C. This makes it more likely for the technology to leak out to the outsider Southern firm, which can then gain partial access to the technology developed by the Northern firm. How great a spillover it enjoys depends on the absorptive capacity and the weakness of IPR protection in the South, β. The profit of the outsider Southern firm is therefore

$$\pi_{SO} = (p - c)q_{S2}. \tag{13}$$

[15] Although there is a vast literature on research JVs and R&D spillovers, i.e. d'Aspremont and Jacquemin (1988), Suzumara (1992), Neary and O'Sullivan (1999), and Leahy and Neary (2005), here we are concerned with a JV at the production stage.

where the second subscript O stands for outsider. Solving for the optimal output by each firm yields

$$q_J = \frac{a + (2-\beta)\sqrt{gx}}{3} \tag{14}$$

and

$$q_{SO} = \frac{a - (1-2\beta)\sqrt{gx}}{3} \tag{15}$$

for the JV and the outsider Southern firm respectively.

Subsequently, optimal R&D investment under a JV is

$$x_J^* = \frac{a^2 g(2-\beta)^2}{[9 - g(2-\beta)^2]^2}. \tag{16}$$

Comparing (9) and (16), it can be seen that the equilibrium R&D is higher under FDI than with a JV as long as R&D effectiveness is above the threshold level

$$\tilde{g} = \frac{5 - 16\beta}{3(2-\beta)(1+\beta)}. \tag{17}$$

This value starts at 5/6 for full protection ($\beta = 0$) and is falling in β until it reaches 0 when $\beta = 5/16$. [16] Looser IPR protection reduces R&D incentives of a JV due to higher spillovers, while not affecting that in the case of FDI. Notice that the R&D decision is independent of how profits are divided between the two partners in a JV as joint profits are maximized when solving for the optimal R&D investment.[17]

Substituting the optimal levels of output and R&D investment back into the profit function of each firm, optimal profits turn out to be

$$\pi_J^* = \frac{a^2}{9 - g(2-\beta)^2} \tag{18}$$

and

[16] Note that even with full IPR protection, the level of R&D is higher with FDI than a JV when $g \geq 5/6$. This is because the positive strategic effect of the cost asymmetry on output is stronger in the FDI case due to a higher number of rivals to compete against. When the cost difference is large enough, this effect outweights the negative scale effect that FDI entails due to the smaller size of the MNE.

[17] We can alternatively solve for the R&D investment that maximizes the Northern share of profits in a JV when it chooses to behave on pure self-interest. Our model is robust to such modifications as the nature of our results remain unchanged.

$$\pi^*_{SO} = \frac{a^2[3 - g(1-\beta)(2-\beta)]^2}{[9 - g(2-\beta)^2]^2} \tag{19}$$

for the JV and the outsider Southern firm respectively. The profit of the JV is always decreasing in spillovers, whereas that of the outsider Southern firm is always increasing with it. The advantage of the JV over a third firm decreases with a weaker IPR regime as the cost asummerty that exists between the JV and the outsider firm is reduced.

3 The Equilibrium Mode of Entry

In the first stage, the Northern firm makes a decision on how to enter the Southern market. A JV is the equilibrium market structure when it generates additional rents for the insiders, i.e. $\pi_J \geq \pi_F + \pi_{Sj}$. A JV is not an equilibrium for a low g because total JV profits here are smaller than the sum of profits of the two participants in the absence of a JV, i.e. $\pi_J < \pi_F + \pi_{Sj}$. Also looser IPR protection in the South reduces the relative profitability of the JV inducing the MNE to instead choose FDI to protect itself from exposure to Southern firms. As β increases, the range of g over which a JV occurs is reduced. There is a threshold level of β above which a JV is no longer profitable and hence cannot be an equilibrium. A JV will be formed below this threshold regardless of who holds the bargaining power. This critical level of spillovers can be derived by solving for the β at which $\pi^*_J = \pi^*_F + \pi^*_{Sj}$:

$$\tilde{\beta} = 2 - \sqrt{\frac{32 - 9g}{g(9g^2 - 33g + 32)}}. \tag{20}$$

At $\tilde{\beta}$ there are just zero gains from a JV.

Recall that this threshold determines whether a JV creates additional total profits for the insiders than when they remain on their own ($\pi_J \geq \pi_F + \pi_{Sj}$). A JV can therefore only take place when the IPR regime in the South is strong enough so that $\beta \leq \tilde{\beta}$. When a technology is more complex and harder to copy (low b), the role of IPRs in the decision of the MNE about the mode of entry diminishes. The equilibrium market structure can be seen in figure 1, which depicts $\tilde{\beta}$ for different levels of R&D intensity.

The figure illustrates that JVs are only offered and accepted and hence an outcome when R&D

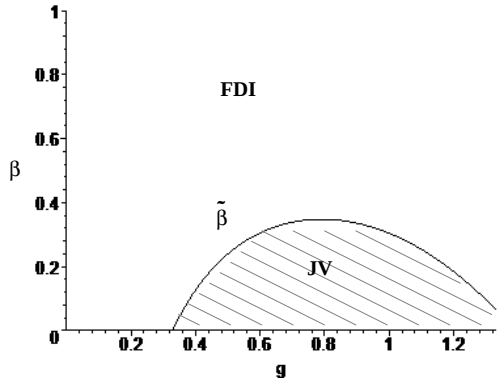

Figure 1: Equilibrium Market Structure

intensity is in an intermediate range. They are not likely to occur when R&D effectiveness is low as the Southern firm has little to gain from forming a JV to get access to knowledge. Here, we are nearer to the simple merger case, in which a two-firm merger with identical firms will not be profitable. Similarly, it is not in the interest of the Northern firm to share ownership and its technology when R&D effectiveness is high, IPR protection low and the technology easy to copy. Under these circumstances it will dominate the market on its own. Also the equilibrium JV share of the Southern firm is tiny in this region causing little change in its market share and hence aggregate profits compared to the FDI case. R&D investment and profits are more convex in g under FDI than in the JV scenario. This means that on one hand JVs are more profitable in intermediate levels of g. Therefore, they can also endure higher spillovers and still be profitable in this range (higher $\tilde{\beta}$). On the other hand at high g, R&D investment x is increasing at a much faster rate for FDI than JV with the relative difference increasing in β. This increases the relative profitability of FDI in high g's causing $\tilde{\beta}$ to eventually fall in g after reaching a maximum. We can conclude that a JV only takes place when the level of IPR protection in the South is sufficiently high so that the insiders can exploit the advantages of merging. The absolute maximum β consistent with a JV is $\bar{\beta} = 0.348$. When the level of IPR protection is not sufficiently stringent, no JV can occur and the Southern firm remains an independent competitor that uses the old technology.

Proposition 1 *Increasing the IPR protection level in the South (lowering β) reduces the losses due*

to imitation of the JV technology by the outsider firm and consequently increases the range of g over which a JV occurs.

4 Bargaining in a Joint Venture

Turning now to the bargaining between the two firms, a deal has to be reached in order to divide the joint profits π_J^* between the two sides. Let the portion of profits that goes to the Northern and the Southern partner be $\phi\pi_J^*$ and $(1-\phi)\pi_J^*$ respectively. We will look at the two extreme cases where either the Northern or the Southern firm holds full bargaining power. When a firm has all the bargaining power, it captures all rents from the JV and leaves its partner the minimum share that is just sufficient to convince the latter to participate.

When it is the Southern firm that has all the bargaining power, the MNE's profits are equal in the JV and FDI cases. Formally, the critical share is the ϕ which solves $\pi_F^* = \phi\pi_J^*$:

$$\phi^S = \frac{9 - g(2-\beta)^2}{16 - 9g}. \tag{21}$$

The superscript indicates which side of the deal enjoys the bargaining power. The share of the Northern firm is an increasing function of g.[18] Meanwhile, the Southern firm would only enter a JV if the share $(1-\phi^S)$ matches its profits in the FDI case, where it uses its old technology to compete with the Northern firm.

We turn now to the case in which the Northern firm has all the bargaining power. It offers a share to the Southern firm that would make the latter indifferent between the JV and FDI. This share is denoted by $(1-\phi^N)$ and is the $(1-\phi)$ that solves $\pi_{Sj}^* = (1-\phi)\pi_J^*$:

$$1 - \phi^N = \frac{(4-3g)^2[9 - g(2-\beta)^2]}{(16-9g)^2}. \tag{22}$$

The profits of the Northern firm when it has full bargaining power in a JV is $\phi^N\pi_J^*$. Similar to the previous case, the Northern firm would clearly only make the offer if $\phi^N\pi_J^* \geq \pi_F^*$. The share of the

[18] Northern share starts at $\phi^S = 9/16$ when $g = 0$ and is increasing in g until it reaches 1, that is when the Northern firm no longer finds it optimal to create a JV and share its technology.

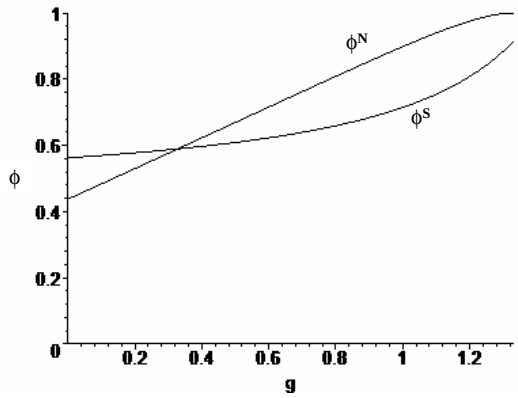

Figure 2: North-South Joint Venture Profit Shares

Northern firm when it has all the bargaining power is also increasing in g until it no longer finds it profitable to form a JV.[19] A JV not being possible when g is above a critical threshold complies with empirical findings of Javorcik (2006) and Javorcik and Saggi (2004), which show that JVs in highly R&D intensive sectors present a lower potential for transfer of technology as Northern firms would be more likely to engage in wholly owned projects than to share ownership.

Figure 2 illustrates the share of profits that remains for the MNE in each case, namely ϕ^S and ϕ^N, for a situation when IPRs are fully protected. It can be seen that the share ϕ^N is concave and always higher than ϕ^S in the relevant range.

Looking at figures 1 and 2 simultaneously gives interesting new insights regarding the division of JV shares and the market equilibrium outcome. It is easy to see that a JV is only formed if condition $\phi^N \geq \phi^S$ is satisfied. Notice that the intersections of ϕ^N and ϕ^S in figure 2 for different values of β sketches the $\tilde{\beta}$ curve in figure 1. As β increases, the range of g for which $\phi^N \geq \phi^S$ holds shrinks until it is never satisfied when the ϕ^S curve moves completely above ϕ^N in figure 2 and β surpasses $\tilde{\beta}$ in figure 1. Note that at $\tilde{\beta}$, the Southern firm is just indifferent between staying out of a JV and getting the maximum possible JV share consistent with the Northern firm taking part, $(1 - \phi^S)$. Likewise, the Northern firm is just as well off without a JV as forming one and getting the maximum share ϕ^N. This implies that the equilibrium form of foreign investment is the same

[19] The Northern share in this case is $\phi^N = 7/16$ when $g = 0$ and rises with g until it reaches 1.

regardless of which side holds the bargaining power as $\tilde{\beta}$ is identical for both cases.[20]

Lemma 1 *The critical level of spillovers $\tilde{\beta}$ under which a JV is the equilibrium market structure is the same regardless of which side of the JV holds the bargaining power as $\phi^N = \phi^S$ always holds at $\tilde{\beta}$.*

JV stability problems do not occur as long as profits of the outsider Southern firm are higher than the one in the JV. This is always the case except for a rare combination of parameter values $g \geq 0.8$ and $\beta \approx 0$. Here, the outsider suffers a disadvantage due to high R&D effectiveness of the JV and very low spillovers. In this case, the Southern firm has to offer the Northern firm a slightly higher share to prevent the outsider from intervening to sway the MNE to switch partners. On the other hand, when profits of the outsider are higher than the insider's, a coordination problem may arise in that the potential Southern partner may be tempted to reject the offer and wait for the third firm to join the JV instead. In other words, no firm may opt to engage in a JV if it believes that another firm will do so. It remains the case that the JV would make Southern firms at least as well off as under FDI, which would be the outcome upon unsuccessful negotiations. Neary (2007) refers to this as the 'after-you' problem and shows how it could be resolved by creating an n-stage bargaining game. Neither the stability nor the coordination problems would arise if we assume that the MNE is randomly matched with one of the Southern firms and that there is only one round of negotiations.

5 Southern Welfare

In this section we examine some policies that could be used by the Southern government to raise welfare. Southern welfare consists of consumer surplus and the profits of the two Southern firms. The welfare function can be written as

$$W^F = CS^F + \pi_{S1} + \pi_{S2} \tag{23}$$

[20] It will be seen that the division of the bargaining power does make a difference in welfare implications as the share of profits by the Southern firm and hence producer surplus are different in the two cases.

and

$$W^J = CS^J + \pi_{SI} + \pi_{SO}, \tag{24}$$

where the second subscripts I and O stand for insider and outsider, and superscripts F and J denote FDI and JV. Initially, we assume that all output is sold on the Southern market and Southern consumer surplus is:

$$CS^i = \frac{Q^{i2}}{2} \quad for\ i = F, J. \tag{25}$$

Solving for consumer surplus under each mode of entry, we obtain

$$CS^F = \frac{(q_F + q_{S1} + q_{S2})^2}{2} = \frac{a^2 18(2-g)^2}{(16-9g)^2} \tag{26}$$

and

$$CS^J = \frac{(q_{JV} + q_{SO})^2}{2} = \frac{a^2[6 - g(1-\beta)(2-\beta)]^2}{2[9 - g(2-\beta)^2]^2} \tag{27}$$

for FDI and JV respectively.

The other constituent of welfare is producer surplus which itself consists of the profits of the outsider and the insider Southern firms. The profits of the outsider firm not considered for the JV can be seen in equations (11) and (19) for FDI and JV respectively. The profit of the Southern firm potentially involved in the JV is given in (11) if the MNE chooses FDI, and is $(1-\phi^S)\pi_J^*$ or $(1-\phi^N)\pi_J^*$ in a JV depending on which side holds the bargaining power. Notice that if it is the Northern firm who has the bargaining power, the insider firm's profit can be dropped from the welfare comparison as it is equal its profits under FDI by the definition of ϕ^N.[21] When the Southern firm holds the bargaining power on the other hand, its profits are

$$(1-\phi^S)\pi_J^* = \frac{a^2[g(\beta^2 - 4\beta - 5) + 7]}{(16-9g)[9 - g(2-\beta)^2]}. \tag{28}$$

We now turn to the IPR and the foreign investment policies in the South and discuss how they can be optimally set to maximize Southern welfare.

[21] Keep in mind that these profits must however be added to both FDI and JV welfare when putting three scenarios in the same context.

5.1 The Political Economy of Intellectual Property Rights

We first analyze the relationship between the level of IPR protection in the South and each component of welfare individually. As no spillovers are assumed under FDI, changing β only affects welfare when JV is the market outcome.

The impact of β on consumer surplus can be found by looking at changes in equation (27). β increases consumer surplus until it reaches a peak, after which the detrimental effect of higher spillovers from lower incentives to innovate dominates and starts to harm consumers in the economy. For high levels of g where R&D is more intensive, consumer surplus is always falling with a higher β. Differentiating (27) with respect to β gives the optimal level of spillovers from the consumers' perspective:

$$\hat{\beta} = 2 - \frac{3\left(1-\sqrt{1-g}\right)}{g}. \tag{29}$$

The β that maximizes consumer surplus approaches $1/2$ as g tends to zero and falls in g until it reachs zero at $g = 3/4$. For higher g's where R&D takes a meaningful role in the industry, consumers prefer full IPR protection ($\beta = 0$) to enjoy higher levels of innovation.

Next we turn to the effect of β on the profits of the two Southern firms. Equation (19) shows that the profits of the outsider firm is always increasing in β due to the benefits brought about by technological spillovers. Equation (28) shows that the profits of the insider firm is always decreasing in β when it has the bargaining power in the JV and is independent of β when the MNE has the bargaining power.[22] Total Southern profits therefore also increases in β when the MNE has the bargaining power. On the other hand, when the Southern firm holds the bargaining power it increases with β at low levels of g, where the gains of the outsider from spillovers dominates the losses it brings to the insider. Total profits are decreasing in β at high g's where the reverse is true.

We can now add up to derive the impact of β on total Southern welfare. When the Northern firm has the bargaining power, $\frac{\partial W^J(\phi^N)}{\partial \beta} > 0$ implies that a higher level of spillovers always increases Southern welfare in the feasible range of g where JV is a possible outcome. While a higher β always

[22] Recall that the profits of the insider Southern firm is equal to its profits under FDI when the MNE has full bargaining power and is hence independent of β.

increases total producer surplus, it also improves consumer surplus up to the point where $\tilde{\beta}$ and $\hat{\beta}$ intersect ($g \approx 1/2$) and reduces it thereafter.

The impact of β on welfare when the Southern firm posesses the bargaining power depends on g, the R&D intensity of the industry. When g is low both consumer surplus and producer surplus are increasing in β, while the opposite holds at high levels of g. Welfare therefore increases in β for low g, decreases in β for high g, and is locally U-shaped around the critical value of $\bar{g} = 1$ with local maxima at $\beta = 0$ and $\beta = 1$. The effect of spillovers is hence ambiguous on total welfare ($\frac{\partial W^J(\phi^S)}{\partial \beta} \gtreqless 0$). It is however possible to draw from the shape of $W^J(\phi^S)$ that maximum welfare is reached at either the highest spillover rate in concurrence with a JV, $\tilde{\beta}$, or at zero spillovers.

When the MNE has full bargaining power so that β always increases welfare, the optimal policy is the ι that gives $\tilde{\beta}$. To achieve this outcome, IPR protection needs to be stronger the easier it is to copy the technology of the MNE. When the Southern firm has the bargaining power, the optimal policy should give $\tilde{\beta}$ for $g \leq \bar{g}$, but is $\iota = \beta = 0$ for $g > \bar{g}$. Recall that at high g's total Southern welfare is at its maximum level with $\beta = 0$ as losses from lower incentives to innovate accompanied by higher spillovers are substantial.

Proposition 2 *If a host country prefers a JV as the mode of inward investment, then subject to the JV constraint ($\beta \leq \tilde{\beta}$) the optimal IPR policy should give $\tilde{\beta}$ for $g \leq \bar{g}$, and for $g > \bar{g}$ when the MNE holds the bargaining power. When production is sufficiently R&D intensive ($g > \bar{g}$) and the Southern firm holds the JV bargaining power, it is in the interest of the South to fully protect IPRs ($\beta = 0$).*

After assessing how β affects Southern welfare in the presence of a JV, we turn to the comparison of welfare under the two market structures (with and without a JV). The South is able to manipulate the decision of the MNE on the mode of entry by choosing an IPR regime that assures the preferred form of inward investment.

Comparing (26) and (27) reveals that consumer surplus with FDI is higher than that under a JV. This is because the JV results in less competition and thus a higher price. Comparing the profits of the outsider firm under the two modes using (11) and (19), it is easy to see that it is always higher

when a JV is formed. This gain comes from two sources: lower competition and spillovers. As for the insider firm, we have seen in the previous sections that its JV profits only differ from that under FDI when it holds the bargaining power. When IPRs are fully protected ($\beta = 0$), the firms prefer a JV except for low levels of R&D intensity. When IPRs are less well protected on the other hand ($\beta > 0$), the relative attractiveness of FDI increases.

Finally, adding up profits of the two Southern firms for each case reveals that total Southern profits are always higher with a JV than with FDI, i.e. $\pi^*_{SI} + \pi^*_{SO} \geq \pi^*_{S1} + \pi^*_{S2}$. It can therefore be concluded that a JV always favors Southern firms and hurts consumers as it increases total profits in the expense of lower consumer surplus.

5.2 Intellectual Property Rights and the FDI Policy

Having calculated all the components of welfare, we can now analyze the optimal mode of inward investment from the point of view of the South and with it the implications for Southern investment policies that limit foreign share in a JV. We will now compare Southern welfare under FDI with the best attainable welfare under a JV. As we saw earlier, the latter reaches a constrained maximum at $\beta = 0$ or $\beta = \tilde{\beta}$ depending on the level of g. Recall also that the parity $\phi^N = \phi^S$ holds when spillovers are at the threshold level $\tilde{\beta}$, making the profits of the insider Southern firm equal under both bargaining power situations. Furthermore, consumer surplus and profits of the outsider firm are independent of the internal division of profits in a JV. Thus, at $\beta = \tilde{\beta}$, total welfare under a JV is independent of bargaining power.

Lemma 2 *Southern welfare under a JV at $\tilde{\beta}$ is equal regardless of whether the Northern or the Southern firm holds the bargaining power, thus independent of JV shares. This makes foreign investment policies irrelevant at this level of β.*

Figure 3 illustrates Southern welfare under FDI and JV for both cases of $\beta = \tilde{\beta}$ and $\beta = 0$. The figure represents only the range of g, over which JVs are an equilibrium for sufficiently tight IPRs. Thus, they correspond to those levels of g in figure 1 where $\tilde{\beta}$ is positive. The figure can be divided into four regions. In the first region on the left, which contains the lowest g's where a JV is

feasible ($g < g'$), the South prefers FDI. Here, spillovers allowed are not large enough to overcome the benefits of FDI.

The second region lies within the range $g\prime \leq g \leq \bar{g}$. Here $\beta = \tilde{\beta}$ induces a JV, which is preferred to FDI regardless of who holds the bargaining power (see lemma 2).[23] Thus in this region it is optimal to strengthen the IPR regime to $\tilde{\beta}$. If it is possible to set IPR at this level then policies aimed at increasing the Southern share in the JV do not affect welfare of recipient countries.[24]

Proposition 3 *For a large mid-range of $g\prime \leq g \leq \bar{g}$, it is optimal for the South to strengthen its IPR regime to the level that just induces a JV over FDI ($\tilde{\beta}$).*

For $g > \bar{g}$, provided the Southern government can use policy to ensure that the Southern firm receives the share $(1 - \phi^S)$ in the JV, the South can increase its welfare further by strengthening IPRs to the maximum level that eliminates spillovers altogether ($\beta = 0$). This also extends the desirability of a JV up to $\hat{g}$ when the Southern firm holds the bargaining power. Hence, in this third region of $\bar{g} < g \leq \hat{g}$ a dual IPR/FDI policy results in higher welfare.[25] The small arrow on the right hand side of figure 3 shows the welfare gains brought about by a dual policy, which represents a jump from $W^J(\tilde{\beta})$ to $W^J(\phi^S, \beta = 0)$.

Proposition 4 *At higher levels of R&D effectiveness ($\bar{g} < g \leq \hat{g}$), the South can attain maximum welfare through a dual policy that limits foreign shares in a JV and fully protects IPRs.*

In the fourth region, where R&D intensity is at its highest level ($g > \hat{g}$), the Southern government prefers FDI as the mode of inward investment because it brings more competition, the share of the JV offered to the Southern firm is negligible, and spillovers are not attractive (discourage innovation).

[23] Also these results are parallel to Smarzynska Javorcik (2000) and Saggi and Smarzynska Javorcik (2004) in which the South tends to favor joint ventures over other forms of FDI believing that local participation made possible by the former is a better way to facilitate absorption of new technologies.

[24] These results are in accordance with those in Mattoo, Olarreaga and Saggi (2004) regarding the interests of the MNE and the Southern government as long as there IPR protection is strong enough in this model. Both government and the firm would prefer JV over FDI in an intermediate range of R&D effectiveness, in their model, cost of technology transfer.

[25] Note that welfare is maximized at $\beta = 0$ for $g > \bar{g}$ when the Southern firm has the bargaining power.

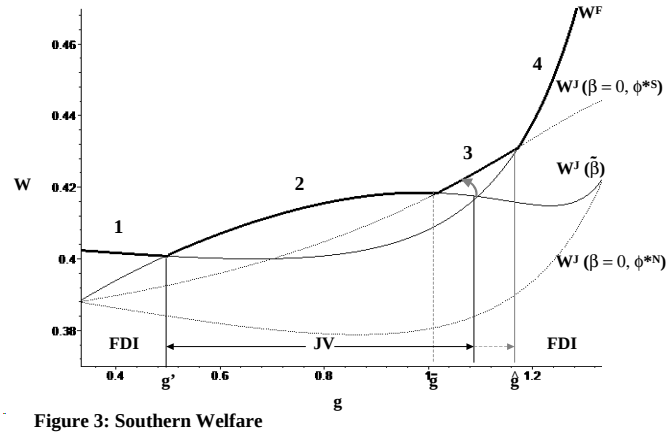

Figure 3: Southern Welfare

Similar to the first region with low g's, interests here are in conflict as the MNE prefers a JV whereas the Southern government favors FDI. Therefore, at very low or very high levels of R&D effectiveness $g < g\prime$ and $g > \hat{g}$, it is optimal for the government to prevent JVs from forming. This could be achieved by a ban or even by loosening IPR protection sufficiently, i.e. to push β beyond $\tilde{\beta}$.

Proposition 5 *For $\tilde{\beta} \geq 0$ and $g < g\prime$ or $g > \hat{g}$ FDI is socially superior to a JV and the Southern government should use measures to deter JVs.*

Finally, it is never optimal for the South to fully protect IPRs and allow a JV, which concedes the entire bargaining power to the incoming MNE. This causes welfare to drop down to the $W^J(\phi^N, \beta = 0)$ curve in all four regions.[26]

6 Conclusion

In this paper we have developed a North South model in which a Northern oligopolistic multinational firm that engages in R&D must decide how to serve a Southern market. We have made the assumption that because production costs in the North are prohibitively high, the good is manufactured in the South. The MNE must choose whether or not to collaborate with a local firm. Initially

[26] Notice that these results resemble those in Mattoo, Olarreaga and Saggi (2004) which show that under no spillovers, the government in the South always prefers FDI when cost of technology transfer (R&D effectiveness in our case) is low. In their model the North has the full bargaining power as in the case being discussed here.

there are two Southern firms already established in the host country market and the multinational can choose whether or not to enter a JV with one of them. The basic ingredients that go into the model are fairly simple, but they nevertheless generate a rich set of results. The principal issue to which we have applied the model is to effects of the Southern IPR regime on a MNE's decision between serving a market via an independent venture type FDI or by setting up a JV with a local firm. We assumed that entering a JV increases the exposure of the multinational firm's technology to imitation by rival firms. To capture this effect we assumed that the local firm that does not enter the JV (the outsider) could benefit from R&D spillovers from the JV when IPRs are imperfectly protected.

We demonstrated a precise set of conditions under which the JV will be established. When firms form a JV and coordinate their production they gain from reduced competition but tend to help their rivals gain market share. This, the well-known merger paradox, implies in our context that without R&D investment the JV is unprofitable. We showed that the level of R&D intensity must be sufficiently high to overcome the combined loss of market share that occurs as a result of the JV. Lower R&D spillovers also work towards JVs and we showed that the threshold spillover, below which it is an equilibrium, increases in the R&D intensity of the Multinational up to a maximum and then declines. It eventually declines because if the multinational has very effective R&D it gains little from sharing its superior technology. Thus we found that JVs are most likely when R&D intensity is at an intermediate level. The strengthening of IPRs reduces the losses due to imitation of the JV's technology by the outsider firm and consequently increases the range of R&D intensities of production over which a JV occurs. This creates the possibility that the Southern policy can alter the way multinationals choose to serve the market. It can do this by joining up to TRIPS agreement of the WTO.

In addition to looking at the positive aspects of IPR protection we also employed our model to look at the effects on welfare in the Southern country and considered possible policy responses of the Southern government. We found that when a JV is viable, the sum of southern firms' profits under a JV always exceed the corresponding levels under direct FDI. However this gain to firms comes at

the expense of the consumer who faces higher prices under the JV.

We found that if the Northern firm has all the bargaining power and IPRs are fully protected then a JV will be inferior to direct FDI from the point of view of Southern welfare. For a JV to dominate from a Southern welfare perspective we need some Southern bargaining power and/or imperfect IPR protection. We showed that for moderately R&D intensive industries the best possible policy is to set IPR protection at the level that will just induce a JV to occur. This result was shown to be independent of the bargaining power of the firms. For highly R&D intensive industries Southern welfare under a JV can be higher with full IPR protection, but only if the Southern bargaining power in the JV is positive. In particular, we demonstrated that this is the case when the Southern firm has all the bargaining power and the level of R&D effectiveness is above a threshold level. We also showed that there is also a higher threshold level of the effectiveness above which a JV always yields lower Southern welfare than direct FDI.

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