Crowding Out and Distributional Effects of FDI Policies

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Abstract: We analyze optimal host country policy toward multinational production in a three country model where oligopolists from two source countries invest in a common host country to take advantage of low costs. A discriminatory output tax on foreign direct investment (FDI) from one source effectively encourages FDI from the favored source country while crowding out FDI from the disfavored source country. Such a tax also shifts rents across firms and alters wages in all countries. When free to discriminate, the host country imposes a higher tax on the country with the stronger natural tendency to conduct FDI. The source country subject to the larger tax gains from a nondiscrimination clause with respect to the host country's FDI policy.

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1 Introduction

Interest in the impact of foreign direct investment (FDI) has grown substantially, in part due to rapidly increasing flows of FDI and the proliferation of investment treaties. FDI issues are expected to figure prominently at the future rounds of the World Trade Organization (WTO) negotiations. However, the FDI literature largely ignores how FDI policies of individual countries alter production location decisions in a multi-country setting.[1]

When the literature does move beyond a two country setting, it focuses on multiple host countries competing for FDI from a source country.[2] This literature on tax competition deals mostly with models of perfect competition and thus fails to address the strategic consequences of FDI policies that may arise in imperfectly competitive markets.[3] This omission is particularly worrisome since the bulk of FDI occurs in highly concentrated industries: see Brainard (1997) and Markusen (1995).[4]

To emphasize the third country repercussions of FDI policies in oligopolistic markets, we develop a model where a host country sets its policy toward FDI from multiple source countries. A model with one host and two source countries is the simplest scenario for considering issues related to third country repercussions and non-discrimination across potential source countries.[5] In our model, all countries have limited supplies of skilled labor required for production by multinational firms. FDI occurs to reduce production costs, but more FDI flowing into a host country reduces the incentive for further FDI.[6]

We characterize the optimal FDI policy profile offered by the host government: the tax or subsidy on the output of multinationals from each source country. Inward FDI raises wages thereby benefitting workers and hurting

[1]See Horstmann and Markusen (1992), Janeba (1996), Markusen and Venables (1998, 1999), and Raff and Srinivisan (1996).

[2]See Haaparanta (1996), for example.

[3]See Janeba (1998) and Motta and Norman (1996) for exceptions.

[4]Hence, FDI policies should have the potential to generate strategic effects similar to the export subsidies in Brander and Spencer (1985).

[5]We generalize Glass and Saggi (1999), where firms from a source country invest in a host country, by adding another source country. Glass and Saggi (1999) builds upon Dixit and Grossman (1986) by including FDI.

[6]FDI occurs from high cost source countries to low cost host countries. Two-way FDI flows are observed but are not the focus of this study: see Rowthorn (1992).

host firms. This tension between the interests of the two groups determines optimal host policy. In particular, we show that the host government levies a higher tax on multinational firms from the smaller source country: due to a higher autarkic wage, firms from the source country with the smaller labor supply per firm have a stronger tendency to conduct FDI, thereby allowing the host country to impose a higher tax.

Since national labor markets are linked by FDI in our model and countries have limited supplies of skilled labor needed for production by multinationals, FDI flows transmit resource conditions across countries and affect both profits and wages. Consequently, the host country's FDI policy toward one country has repercussions not only for the FDI flows from the alternative source country but also for wages in both countries. In particular, we show that discriminatory FDI policies alter the:

- composition of FDI across source countries (*crowding out effect*),
- distribution of rents between firms (*strategic effect*),
- distribution of income between workers and firms (*distributional effect*).

We also explore some of the implications of forcing the host country to treat all multinational firms equally. The host country is harmed by any restriction on its freedom to set policies differentially. But the disfavored source country benefits from equal treatment through a reduction in the tax the host country imposes on its multinational firms and thus has an incentive to push for symmetric FDI policy.

By design, our model abstracts from efficiency considerations. However, such abstraction is useful since it allows us to derive clear results regarding distributional effects both within and across countries. Such distributional conflicts help identify the positions different countries (as well as different groups within each country) may be expected to take regarding both the desirability of FDI as well as the adoption of a non-discrimination clause with respect to FDI policy of the host country.[7]

After establishing the basic setup of the model, we examine the properties of the autarky equilibrium (meaning that FDI is not allowed) and the no intervention equilibrium. These two extremes help establish the distinguishing

[7]See Hoekman and Saggi (1999) for an overview of the arguments for and against a multilateral investment agreement.

properties of source countries. Then we consider FDI policies adopted by the host country that are symmetric versus asymmetric with respect to the source countries involved. We also comment on the case where firms from different countries may have different technologies of production, thereby generating another basis for policy discrimination.

2 Model

The world consists of three countries indexed by i: a host country receiving FDI from two source countries $i = 1, 2$. The host country can be any country with a cost advantage relative to the potential source countries in the absence of FDI. Each country i has n symmetric oligopolistic industries comprised of m_i number of firms that produce good y. The number of industries plays an insignificant role so we set $n = 1$ without loss of generality.[8]

Source firms decide whether to produce each unit of output at home or abroad. Let α_i denote the share of skilled labor demanded in the host country by a representative firm from source country i, which provides a measure of the extent of FDI in the host country from source country i. Figure 1 illustrates the FDI flows considered in our model.

Host country policy alters the incentives for FDI. Suppose that a firm from country i faces an output tax of τ_i for each unit of output produced in the host country.[9] From the perspective of a firm from a source country, the tax increases the marginal cost of producing in the host country.[10] If source firms from split production across countries, $0 < \alpha_i < 1$, the marginal cost of production must be equalized across countries

$$z_i = z_0 + \tau_i, \forall i = 1, 2 \tag{1}$$

where z_i denotes the wage rate in source country i and z_0 denotes the wage rate in the host country. We refer to this pair of equations as the FDI

[8] In what follows, if we reinterpret the aggregate labor endowment as labor endowment per industry, all of our results go through for any number of industries.

[9] We allow for output subsidies as negative taxes. Other policy instruments, such as profit taxes and local content requirements, are common, especially for restricting FDI. See Lahiri and Ono (1998). The host country's tax on its own firms is normalized to zero, as any common output tax on all firms does not affect the extent of FDI.

[10] The labor market is competitive so each firm views the wage in each country as a given.

equilibrium conditions.

Firms behave as Cournot oligopolists. The demand function facing the world industry is given by $P = p(Q)$ where $p'(Q) < 0$ and $p''(Q) \leq 0$.[11] Let y_i denote the output of a firm from country i. Total world output equals $Q \equiv \sum_{i=0}^{2} m_i y_i$. Profit of a firm in country i is $\pi_i = (p - c_i)\, y_i$, where $c_i = \alpha_i (z_0 + \tau_i) + (1 - \alpha_i)\, z_i$ for source firms $i = 1, 2$ and $c_0 = z_0$ for host firms. Profit maximization requires the first order conditions

$$p - y_i \psi = c_i, \, \forall i = 0, 1, 2 \tag{2}$$

where $p \equiv p(Q^*) > 0$ is the price and $\psi \equiv -p'(Q^*) > 0$ is the negative of the slope of the demand function at the equilibrium industry output. Applying the FDI equilibrium conditions to simplify the first order conditions yields $p - y_i \psi = z_i$ as $c_i = z_i$ for any α_i.

We examine an environment where output in each country is constrained by the supply of a scarce factor, such as skilled labor. Denote the skilled labor supply in country i by k_i (with $K \equiv \sum_{i=0}^{2} k_i$ as the total labor supply).[12] One unit of output requires one unit of labor in each country. Since only a fixed supply of workers are available in each country i, wages adjust to clear labor markets. The labor market equilibrium condition for the host country is

$$m_0 y_0 + \sum_{i=1}^{2} \alpha_i m_i y_i = k_0 \tag{3}$$

where labor demand in the host country equals host firm production plus multinational production from both source countries. Similarly, the labor market equilibrium conditions for the two source countries are

$$(1 - \alpha_i) m_i y_i = k_i, \, \forall i = 1, 2 \tag{4}$$

where labor demand in each source country is the share of multinational production kept in the source country. Total output is constrained by the

[11] Adding a second (numeraire) good and a second factor of production used in the production of that good does not affect our conclusions. Quasilinear utility yields our assumed demand structure: see Dixit (1979).

[12] We maintain the notation of Dixit and Grossman (1986), who refer to skilled labor as k. Since we have only one factor, skilled labor, any reference to labor hereafter should be understood to mean skilled labor.

total availability of labor $Q^* = K$ and is hence unresponsive to changes in FDI policies.[13]

Profits of all firms in country i are $\Pi_i = m_i \pi_i$.[14] Define welfare in the host country as the sum of profit and labor earnings plus any tax revenues (or minus any subsidy payments)

$$W_0 = B\Pi_0 + z_0 k_0 + T \tag{5}$$

where $0 \leq B \leq 1$ denotes host country ownership share of host firms and total tax revenues are[15]

$$T = \tau_1 \alpha_1 m_1 y_1 + \tau_2 \alpha_2 m_2 y_2. \tag{6}$$

Define welfare in each source country as the sum of profit and labor earnings.

$$W_i = \beta \Pi_0 + \Pi_i + z_i k_i, \, \forall i = 1, 2 \tag{7}$$

where $0 \leq \beta \leq 1$ denotes source country ownership share of host firms and $B \equiv 1 - 2\beta$ generates full ownership of host firms within these three countries.[16] Define world welfare as the sum of host and source countries welfare $W \equiv W_0 + W_1 + W_2$. We measure welfare net of consumer surplus since consumer surplus does not respond to policy changes due to total output being fixed.[17] In our model, policy intervention cannot improve aggregate welfare of the world economy but only alter the distribution of welfare across countries. This feature is useful in highlighting strategic and distributional effects of FDI policies (the focus of this paper).

[13] Adding together the labor constraints (3) and (4) yields that total output must equal the world labor supply.

[14] Profits, wages, outputs and extents of FDI are understood to depend on $\boldsymbol{\tau} \equiv (\tau_1, \tau_2)$.

[15] Under an alternative (political economy) interpretation, B represents the weight the host government puts on the profits of host firms relative to host labor earnings (and hence $\beta = 0$ in source welfare). The host government may care more about host labor earnings if workers are better organized into lobbying groups, or if workers are poor enough (relative to owners of host firms) that their marginal utility of income is distinctly higher.

[16] We assume source firms are fully owned within the source country (and the source counties own the same share of host firms) for simplicity.

[17] An absence (or lack of importance) of consumer surplus effects may also occur for export-oriented FDI, where sell (primarily) to an external market. As an example, see Barry and Bradley (1997) for details regarding Ireland's experience with FDI where most multinationals cater to the world market.

3 Benchmark Equilibria

To help establish the distinguishing properties of source countries, we examine the properties of the autarky equilibrium (in which FDI is not allowed) and the no intervention equilibrium (in which FDI policies are not allowed). When FDI is infeasible, we show that the source country with the larger labor supply per firm has the lower wage. When FDI is feasible (but policy intervention is prohibited), we show that the source country with the larger labor supply per firm has the smaller extent of FDI. A smaller extent of FDI and a lower autarkic wage both indicate a lesser natural propensity to conduct FDI in the source country.

3.1 Autarky (No FDI) Equilibrium

An autarky equilibrium specifies the output of firms $\{y_0, y_1, y_2\}$ and the wage in each country $\{z_0, z_1, z_2\}$.[18] In this case, the FDI equilibrium conditions (1) are omitted, and the extents of FDI from each source country are set to zero: $\alpha_1 = 0$ and $\alpha_2 = 0$. Let $\{y_i^a, z_i^a\}$ denote the optimal solution to the three first order conditions (2) and the three labor constraints (3, 4) in the absence of FDI.

The autarky equilibrium has a simple form. Each firm in each country produces output reflecting the labor supply per firm in that country

$$y_i^a = \frac{k_i}{m_i}, \forall i = 0, 1, 2. \tag{8}$$

As a result, the wage in each country is

$$z_i^a = p - \psi \frac{k_i}{m_i}, \forall i = 0, 1, 2. \tag{9}$$

The potential host country must have the largest labor supply per firm. Label the source countries so that the first potential source country has a larger labor supply per firm than the second potential source country. We refer to the first source country as the larger source country, meaning it has the larger labor supply per firm

$$\frac{k_0}{m_0} > \frac{k_1}{m_1} \geq \frac{k_2}{m_2} \Rightarrow z_2^a \geq z_1^a > z_0^a. \tag{10a}$$

[18] Autarky refers to absence of FDI: firms still export their output to the world market.

Consequently, by (9), the first country will have a lower wage than the second and the potential host country will have the lowest wage in the absence of FDI.

3.2 No Intervention Equilibrium

An no-intervention equilibrium (allowing FDI) specifies the output of firms $\{y_0, y_1, y_2\}$, the wage in each country $\{z_0, z_1, z_2\}$, and the extent of FDI from each source country $\{\alpha_1, \alpha_2\}$. Let $\{y_i^n, z_i^n, \alpha_i^n\}$ denote the optimal solution to the three first order conditions (2), the three labor constraints (3, 4) and the two FDI equilibrium conditions (1) when $\tau_1 = \tau_2 = 0$.

In the absence of government intervention, the equilibrium extent of FDI from source country i into the host country is

$$\alpha_i^n = 1 - \frac{M}{m_i}\frac{k_i}{K}, \forall i = 1, 2. \tag{11}$$

where $M \equiv \sum_{i=0}^{2} m_i$ the total number of firms in the world. To ensure that FDI does indeed occur from the first potential source country $\alpha_1^n > 0$, we additionally assume that the first source country has fewer resources per firm than the world average:

$$\frac{k_1}{m_1} < \frac{K}{M}. \tag{12}$$

This assumption for the first source country is stronger than the ordering due to the labeling of countries (10a).[19]

In our model, FDI arises due to labor scarcity in the source country relative to the host country (or world). The equilibrium extent of FDI from a source country is smaller the larger the labor supply in the source country relative to the world. The intuition is that a larger labor supply implies a lower autarkic wage and a smaller incentive for FDI. Similarly, the equilibrium extent of FDI from a source country is larger the larger the number of firms in the source country relative to the world.

Define $\delta_i \equiv k_i/k_0$ as the labor supply of source country i relative to the host country. Figure 2 illustrates the FDI patterns in (δ_1, δ_2) space. From

[19]However, an equivalent condition for the second source country is implied by (10a). The second source country has the smallest resources per firm; therefore, it must have fewer resources per firm than the world average.

(11), the line **D1** depicts the boundary for FDI to occur from the first source country

$$\delta_2 > -1 + \left(\frac{M}{m_1} - 1\right)\delta_1 \Longleftrightarrow \alpha_1^n > 0 \tag{13}$$

and the line **D2** depicts the boundary for FDI to occur from the second source country

$$\delta_2 < \frac{1}{\frac{M}{m_2} - 1}\left(1 + \delta_1\right) \Longleftrightarrow \alpha_2^n > 0 \tag{14}$$

The area where firms from both source countries invest in the host country ($\alpha_1^n > 0$ and $\alpha_2^n > 0$) lies between the two lines (below **D2** and above **D1**). In this region, the labor supply in both source countries is small relative to the host country.

In the absence of government intervention, FDI equalizes wages across countries.[20]

$$z_i^n = z^n = p - \frac{\psi K}{M}, \forall i = 0, 1, 2 \tag{15}$$

In equilibrium, the wage in any country decreases with an increase in labor in any country, and increases with an increase in the number of firms in any country. A greater number of firms generates greater labor demand, which elevates the wage; a greater labor supply depresses the wage.

The output of each firm reflects the average labor supply per firm in the world

$$y_i^n = y^n = \frac{K}{M}, \forall i = 0, 1, 2. \tag{16}$$

The output of a firm from any country clearly increases with an increase in the labor supply in any country, and decreases with an increase in the number of firms in any country (as the constant total output must be split across a larger number of firms).[21]

[20]Wages are measured in efficiency units of labor, so observed wages may still differ across countries.

[21]Proofs appear in the Appendix. We hold the world labor supply fixed to keep price constant.

Proposition 1 *Holding the world labor supply fixed, (i) a decrease in the host country labor supply decreases the extent of FDI from both source countries, and (ii) an increase in the labor supply of the first source country decreases the extent of FDI from the first source country and increases the extent of FDI from the second.*

A similar result applies with respect to the number of firms in each country.[22] The driving force behind these results is that any force (a decrease in the labor supply or an increase in the number of firms) that increases the wage in a source country relative to the host country encourages FDI.

The second part of Proposition 1 highlights the interaction between the source countries that occurs through FDI. When resources in the first source country increase, its autarkic wage declines and its firms shift less production abroad. Due to less FDI from the first source country, the host country wage falls, thereby making FDI more attractive to firms from the second source country. The role FDI plays in transmitting resource conditions across countries is at the heart of the crowding out, strategic, and distributional effects highlighted in this paper.

3.3 Welfare Effects of FDI

In autarky, the total profit for the m_i firms in country i is $\Pi_i^a = \psi k_i^2/m_i$. Welfare in each potential source country is

$$W_i^a = pk_i + \beta\psi\left(\frac{k_0^2}{m_0}\right) \tag{17}$$

where the first term reflects revenue of own firms (the sum of firm profits and labor earnings) and the second term reflects profits of firms from the potential host country. Similarly, welfare in the potential host country is

$$W_0^a = pk_0 - (1-B)\,\psi\left(\frac{k_0^2}{m_0}\right). \tag{18}$$

[22]Holding the number of firms in the world industry fixed, (*i*) a decrease in the number of host country firms increases the extent of FDI from both source countries, and (*ii*) an increase in the number of firms in the first source country increases the extent of FDI from the first source country and decreases the extent of FDI from the second.

World welfare is constant and depends only on the total world labor supply $W^a = pK$. The price p depends on total output Q, which equals the world labor supply K.

Aggregate welfare in the potential host country under FDI is

$$W_0^n = Bm_0\psi\left(\frac{K}{M}\right)^2 + k_0\left(p - \psi\frac{K}{M}\right) \tag{19}$$

The move from autarky to FDI has two effects on host welfare.[23] Host wage earnings rise due to the heightened demand for labor and profits from host firms decline due to the higher wage.[24] The tension between these two effects lies at the heart of our policy analysis. Allowing FDI changes host welfare according to

$$\triangle W_0^{na} \equiv W_0^n - W_0^a = \psi\left(\frac{k_0}{m_0} - \frac{K}{M}\right)\left[k_0 - B\left(k_0 + m_0\frac{K}{M}\right)\right] \tag{20}$$

Since the host country must have more resources per firm than the world average, welfare in the host country improves due to FDI iff

$$B < \overline{B}_0 \equiv \frac{1}{1 + \frac{m_0}{k_0}\frac{K}{M}} \tag{21}$$

Thus, the host country benefits more from FDI when its labor supply is large, its number of firms is small, and its weight on host firm profit is small.

Aggregate welfare in each source country is

$$W_i^n = (m_i + \beta m_0)\,\psi\left(\frac{K}{M}\right)^2 + k_i\left(p - \psi\frac{K}{M}\right),\ \forall i = 1, 2 \tag{22}$$

where the first term equals the sum of profit of own source firms and profit of firms from the potential host country, and the second term reflects wage earnings. FDI benefits the profits of firms from both source countries but harms their wage earnings. Source countries also bear the negative effect on the profit of host firms, although with a different weight than the host country.[25]

[23] If the host country were to own any share of source firms, a third effect would be present.

[24] Calculations supporting these claims are in the Appendix.

[25] Countries generally own significantly more of their own firms than of firms from other countries.

Let $\triangle W_i^{na} \equiv W_i^n - W_i^a$ be the extent that welfare in country i is higher under nonintervention than autarky. For the same number of firms $m_i = m$, the first source country gains less than the second due to its larger labor supply

$$\triangle W_{12}^{na} \equiv \triangle W_1^{na} - \triangle W_2^{na} = -\frac{\psi K}{M}(k_1 - k_2) < 0. \tag{23}$$

The first source country has the lower wage in autarky and consequently its firms enjoy a smaller cost reduction from FDI. If the host country opens up to FDI by choice, it must gain from FDI by revealed preference. Since world welfare is fixed, the first source country, which has a smaller extent of FDI, would then have to lose from FDI to offset the host country's gains.[26]

4 Discriminatory FDI Policies

Consider the scenario where the host government can set FDI policies that differ across firms from different countries. We describe equilibrium under such policy intervention and then investigate optimal policies.

4.1 Equilibrium

Let $\{y_i^*, z_i^*, \alpha_i^*\}$ denote the optimal solution to the three first order conditions (2), the three labor constraints (3, 4) and the two FDI equilibrium conditions (1). The equilibrium extent of FDI from each source country is

$$\alpha_i^* = \frac{m_j\tau_j + \psi\left[K - \frac{M}{m_i}k_i\right] - \tau_i(M - m_i)}{m_j\tau_j + \psi K - \tau_i(M - m_i)}, \forall i, j = 1, 2; i \neq j \tag{24}$$

The extent of FDI from the first source country decreases with its own FDI tax and increases with its rival's FDI tax; the extent of FDI from the second source country has identical properties.

Equilibrium wages in the host country equal

$$z_0^* = p - \frac{\psi K + m_1\tau_1 + m_2\tau_2}{M} \tag{25}$$

[26]The second source country might gain or lose.

and equilibrium wages in each source country equal

$$z_i^* = p - \frac{\psi K - (M - m_i)\,\tau_i + m_j \tau_j}{M},\ \forall i, j = 1, 2; i \neq j. \tag{26}$$

As is clear, wages decrease in each country with an increase in the world labor supply. The host country wage decreases with either FDI tax; the wage in each source country rises with its own FDI tax and falls with its rival's FDI tax. This latter effect is interesting as it indicates that a tax on FDI from source country i impacts wages in rival source country j.

Lastly, equilibrium output of a local firm in the host country is

$$y_0^* = \frac{K}{M} + \frac{m_1 \tau_1 + m_2 \tau_2}{M\psi} \tag{27}$$

while equilibrium output of a multinational firm from each source country is

$$y_i^* = \frac{K}{M} + \frac{m_j \tau_j - \tau_i\,(M - m_i)}{M\psi},\ \forall i, j = 1, 2; i \neq j. \tag{28}$$

Equilibrium output of a multinational firm falls with its own FDI tax and rises with its rival's FDI tax. Equilibrium host firm output increases with the tax on FDI from either source country.

Proposition 2 *A discriminatory FDI tax discourages FDI from the source country whose firms are subject to the tax while encouraging FDI from the other source country, increases wages in the disfavored source country while decreasing wages both in the other source country and in the host country, and expands output (and profits) for firms from the favored source country while contracting output (and profits) for firms from the other source country and host firms.*

The above proposition is one of the central results of this paper; it demonstrates the third country effects of FDI policies. Since national labor markets are linked by FDI in our model, the host country's FDI policy has repercussions not only for the FDI flows from the alternative source country but also for the wages (and therefore the output levels and profits of firms) in both countries. We examine the welfare consequences of these FDI policies next.

4.2 Policy

We can explicitly calculate welfare in each country by substituting the equilibrium values of the endogenous variables from the previous subsection. An increase in the FDI tax on the output of firms from the first source country affects the host country's welfare according to $dW_0/d\tau_i$. Setting $dW_0/d\tau_1 = 0$ and $dW_0/d\tau_2 = 0$ determines the optimal FDI policy schedule

$$\tau_i = \frac{\psi}{2}\left[\frac{K+k_0}{\frac{M}{B}-m_i-m_j} - \frac{k_i}{m_i}\right], \forall i,j = 1,2; i \neq j \tag{29}$$

Firms from both source countries are subject to FDI taxes ($\tau_1^* > 0$ and $\tau_2^* > 0$) provided world labor supply (host labor supply) and host country ownership of host firms are not too small.[27]

Figure 3 illustrates the range of relative labor supplies $\delta_i \equiv k_i/k_0$, $i = 1, 2$ where firms from both source countries suffer FDI taxes from the host government. For each source country, its relative labor supply must be sufficiently small to suffer a tax. The boundary lines are the line **D3** for firms from the first host country to suffer a tax on their FDI

$$\delta_2 > -2 + \left(\frac{2m_1 + m_2 - \frac{M}{B}}{m_1}\right)\delta_1 \Longleftrightarrow \tau_1^* > 0 \tag{30}$$

and the line **D4** for firms from the second host country to suffer a tax on their FDI

$$\delta_2 < \left(\frac{m_2}{\frac{M}{B} - (m_1 + 2m_2)}\right)(2 + \delta_1) \Longleftrightarrow \tau_2^* > 0 \tag{31}$$

Thus, firms from both countries suffer taxes ($\tau_1^* > 0$ and $\tau_2^* > 0$) when the relative labor supplies of both countries are sufficiently small. There also exist ranges where FDI from only one of the source countries is taxed (from the other is subsidized) and where FDI from both source countries is subsidized.

Examining the optimal tax on FDI by firms from the first source country, we can see how the parameters of the model affect this tax level. Increases in the labor supply in either source country decrease the tax level.[28] Thus, if

[27] If the host country government cares strongly about local wages (B is small), it may subsidize inward FDI. This result suggests that the use of incentives to attract FDI may stem from the desire to improve the welfare of workers in host countries.

[28] Increases in a source county's own labor supply lowers the optimal tax for its firms by more than an increase in the rival source country's labor supply.

the one source country experiences an expansion in its labor supply, the host country will respond by lowering the tax on FDI from *both* countries. Also, an increase in world labor supply (host country labor supply) increases the optimal tax level.

Proposition 3 *Holding the world labor supply fixed, (i) an increase in the labor supply of either source country decreases the FDI tax for firms from both source countries, and (ii) an increase in the labor supply of the first source country decreases the first FDI tax and increases the second.*

A similar result holds with respect to the number of firms in each country.[29] An increase in the number of firms from the second source country increases the FDI tax on firms from the first source country. On the other hand, an increase in the number of firms from the host country decreases the FDI tax on firms from either source country.

Comparing the taxes on firms from the two countries, the optimal tax schedule implies the difference

$$\triangle\tau = \tau_1^* - \tau_2^* = \frac{\psi}{2}\left[\frac{k_2}{m_2} - \frac{k_1}{m_1}\right] \tag{32}$$

The above equation implies that the optimal tax is lower for the first source country than the second $\tau_1^* < \tau_2^*$ because the first source country has a larger labor supply per firm than the second (10a) and thus a lower autarkic wage, making the firms from the first country more sensitive to taxes on FDI.

Corollary 1 *Firms from the source country with the larger labor supply per firm face a smaller tax on multinational production.*

4.3 Discriminatory Treatment versus Nonintervention

Let $\triangle W_i^{*n} \equiv W_i^* - W_i^n$ be the extent that welfare in country i is higher under discriminatory FDI policies than no intervention. For the same number of firms $m_i = m$, the first source country gains more from discriminatory FDI

[29]Holding constant the total number of firms in the world industry, (*i*) a decrease in the host country decreases the asymmetric FDI subsidy for both source countries and (*ii*) an increase in the number of firms in the first source country decreases the first FDI subsidy and increases the second.

policies relative to nonintervention than the second source country due to its larger labor supply

$$\triangle W_{12}^{*n} \equiv \triangle W_1^{*n} - \triangle W_2^{*n} = \frac{\psi K}{4M}(k_1 - k_2)\left(1 + 3\frac{k_0}{K}\right) > 0. \tag{33}$$

The host country must gain: it can always set the FDI taxes to zero so it can do no worse being able to set its FDI policy. World welfare is fixed, so one source country must lose. We find that the second source country necessarily loses from asymmetric intervention while the first source country might gain or lose.

5 Symmetric Intervention

Now we consider host country intervention to attract FDI, but where the tax on FDI is constrained to be the same across firms from different source countries $\tau_1 = \tau_2 = \tau$.

5.1 Equilibrium

Let $\{y_i^s, z_i^s, \alpha_i^s\}$ denote the optimal solution to the three first order conditions (2), the three labor constraints (3, 4) and the two FDI equilibrium conditions (1) when $\tau_1 = \tau_2 = \tau$. The equilibrium can be derived as under the symmetric case (expressions for various endogenous variables are in the appendix).

Proposition 4 *A symmetric tax on multinational production decreases FDI as well as the output (and profits) of firms from both source countries, increases profit and output of host firms, and raises wages in both source countries while lowering wages in the host country.*

The above proposition highlights the strategic as well as distributional consequences of FDI policies. A tax on FDI reduces the wage in the host country and thus decreases the marginal cost of host firms thereby increasing their profits at the expense of source firms.

5.2 Policy

We can explicitly calculate welfare in each country by substituting the equilibrium values of the endogenous variables from the previous subsection. An increase in the symmetric FDI tax affects the host country's welfare according to $dW_0/d\tau$. Setting $dW_0/d\tau = 0$ determines the optimal FDI tax

$$\tau^s = \frac{\psi}{2}\left[\frac{K+k_0}{\frac{M}{B}-(M-m_0)} - \frac{K-k_0}{M-m_0}\right] \tag{34}$$

Increases in the labor supply (or decreases in the number of firms) in either source country lower the tax level.

Proposition 5 *Holding the world labor supply and the number of firms in the world industry fixed, a decrease in the host country labor supply or an increase in the number of host firms lowers the symmetric FDI tax.*

The FDI tax is positive provided the world labor supply (implicitly the host labor supply) and weight on host firm profits are not too small.

$$\frac{dW_0}{d\tau} > 0 \Leftrightarrow \frac{k_1+k_2}{m_1+m_2} < 2B\frac{K}{M} \tag{35}$$

This expression is the counterpart to **D3** (see equation 30) and **D4** (see equation 31) but for symmetric FDI policy.

5.3 Symmetric Policy versus Nonintervention

As in the case of asymmetric taxes, the symmetric tax clearly increases the profits of host firms relative to nonintervention. Meanwhile, the profits of source firms fall. Lastly, labor earnings increase in both source countries and fall in the host country.[30] Thus, each country has a conflict between labor earnings and profits in overall welfare.

As in the case of asymmetric policies, it can be shown that the host country necessarily gains from FDI when it can select an optimal subsidy/tax. Since world welfare is fixed, this improvement in host welfare must come at the expense of one or both source countries. Thus, it is quite possible that the

[30]Calculations supporting these claims are in the Appendix.

source country firms actually receive an FDI subsidy and one of the source countries loses nevertheless.

Let $\triangle W_i^{sn} \equiv W_i^s - W_i^n$ be the extent that welfare in country i is higher under a symmetric policy than no intervention. For the same number of firms $m_i = m$, the first source country gains more from symmetric host FDI policy relative to nonintervention than the second source country due to its larger labor supply.

$$\triangle W_{12}^{sn} \equiv \triangle W_1^{sn} - \triangle W_2^{sn} = \frac{\tau m}{M}(k_1 - k_2) > 0. \tag{36}$$

While the second source country must lose from symmetric intervention by the host country, the fate of the first source country is ambiguous.

5.4 Asymmetric versus Symmetric Treatment

A comparison of the symmetric tax with the asymmetric taxes indicates how the subsidies adjust under mandated equal treatment.

Proposition 6 *If forced to treat the two source country firms symmetrically, the host country increases the FDI tax on firms from the larger country and decreases the FDI tax on firms from the smaller country:* $\tau_1^* < \tau^s < \tau_2^*$.

The consequences of this policy change are clear: FDI from the larger country is squeezed out if asymmetric treatment is replaced by a symmetric policy. Such a policy change also has distributional consequences because firms from the first country obviously lose (and its workers gain) when their tax increases whereas firms from the second country gain (and its workers lose). Thus firms from the source country with the lesser extent of FDI in the absence of intervention would object to any move toward equal treatment of multinational firms.

Let $\triangle W_i^{s*} \equiv W_i^s - W_i^*$ be the extent that welfare in country i is higher under symmetric FDI policy than asymmetric policy. For the same number of firms $m_i = m$, the first source country gains less from symmetric host FDI policy relative to asymmetric policy than the second source country due to its larger labor supply

$$\triangle W_{12}^{s*} \equiv \triangle W_1^{s*} - \triangle W_2^{s*} = -\frac{\psi}{4M}(k_1 - k_2)\left(K + 3k_0 - 4\frac{\tau m}{\psi}\right) < 0. \tag{37}$$

The host country must be hurt by the restriction on its freedom to set FDI policy differentially. Since world welfare if fixed, the second source country must gain from the requirement that FDI policy treat all multinational firms symmetrically whereas the first source country may gain or lose.

6 Another Basis for Discrimination

Our model points out that the optimal host policy differs across the two source countries due to differences in labor supplies in the two source countries that generate different incentives for FDI on the part of firms. An alternative rationale for such discrimination might stem from firms from one country having a more efficient technology of production. How do our results change under this scenario?

To highlight the role of technology, assume that labor supplies and number of firms are symmetric across countries $k_i = k$ and $m_i = m$. Furthermore, let firms in one of the source countries (say the second country) have a less efficient technology of production: they require $\theta \geq 1$ units of labor to produce one unit of output.

Equilibrium under autarky can be derived as before. Nothing changes for the host and the first source country. However, the first order condition of firms from the second source country is given by

$$p - y_2\psi = \theta z_2 \tag{38}$$

Furthermore, the labor market constraint for the second source country also needs to be rewritten as

$$\theta m y_2 = k \tag{39}$$

When FDI is allowed, the equilibrium can also be derived as before, except that the labor constraint in the host country must be rewritten as

$$m y_0 + \alpha_1 m y_1 + \theta \alpha_2 m y_2 = k \tag{40}$$

and the labor constraint in the second source country must be rewritten as

$$\theta(1 - \alpha_2) m y_2 = k \tag{41}$$

We can derive results similar to those derived under the basic model. The main motivation for introducing technology differences is to examine the

rationale for discrimination. In this regard, results similar to Propositions 3 through 6 can be derived in this alternative model: firms from the country with the lower autarkic wage face a smaller tax and the symmetric tax is bound by the two asymmetric taxes. Not only do the various effects discussed in this paper continue to exist, but the consequences of non-discrimination are analogous.[31]

7 Conclusion

This paper constructs a three country model of FDI to gain insight into cross-country repercussions of FDI policies and whether FDI policies should be restricted to treating multinational firms symmetrically. Our contribution lies mainly in stressing the distributional consequences, both within as well as across countries.

A discriminatory tax reduction promotes FDI from the favored source country while discouraging FDI from the other source country (crowding out effect), lowers wages in the favored source country while raising wages in the other source country and in the host country (distributional effect), and expands output for multinationals from the favored source country while contracting output for multinationals from the other source country and local firms in the host country (strategic effect).

A multilateral agreement requiring non-discriminatory treatment of multinational firms forces the host country to increase the tax on firms from source country with a larger labor supply per firm and lower the tax on firms from the other source country. Our findings help us better understand the different positions interest groups in different countries can be expected to take on the issue of non-discrimination with respect to multinational firms.

Last, we mention a few caveats. Since total output is fixed in our model by design, we do not address issues of efficiency. Also, we model FDI as production shifting but substantial FDI occurs for market access reasons. Clearly, a different model is needed to capture such concerns. Future research should, no doubt, analyze the aspects not considered here.

[31] Although the analysis becomes rather cumbersome, intuition suggests that if countries differ both in terms of resources as well as technologies, firms from the country with the stronger natural tendency toward FDI (lower autarkic wage) would face a higher tax.

A Appendix

Define $k_0 \equiv (1-\kappa)\,K$, $k_1 \equiv \eta\kappa K$, and $k_2 \equiv (1-\eta)\,\kappa K$ so that an increase in κ increases labor in the source countries while decreasing it in the host country. Similarly, η increases labor in the first source country while decreasing it in the second. Define $m_0 \equiv (1-\mu)\,M$, $m_1 \equiv \nu\mu M$, and $m_2 \equiv (1-\nu)\,\mu M$ and interpret parameters μ and ν similarly.

A.1 Proof of Proposition 1

Increasing labor in the source countries while decreasing it in the host country reduces both extents of FDI

$$\frac{\partial \alpha_1^n}{\partial \kappa} = -\frac{\eta}{\nu\mu} < 0$$

$$\frac{\partial \alpha_2^n}{\partial \kappa} = -\frac{1-\eta}{(1-\nu)\,\mu} < 0$$

Increasing labor into the first source country while lowering it in the second reduces the first extent of FDI and raises the second

$$\frac{\partial \alpha_1^n}{\partial \eta} = -\frac{\kappa}{\nu\mu} < 0$$

$$\frac{\partial \alpha_2^n}{\partial \eta} = \frac{\kappa}{(1-\nu)\,\mu} > 0$$

Increasing the number of firms in the source countries while decreasing the number in the host country raises both extents of FDI

$$\frac{\partial \alpha_1^n}{\partial \mu} = \frac{\eta\kappa}{\nu\mu^2} > 0$$

$$\frac{\partial \alpha_2^n}{\partial \mu} = \frac{(1-\eta)\,\kappa}{(1-\nu)\,\mu^2} > 0$$

Lastly, increasing the number of firms into the first source while decreasing the number in the second raises the first extent of FDI and reduces the second

$$\frac{\partial \alpha_1^n}{\partial \nu} = \frac{\eta\kappa}{\nu^2\mu} > 0$$

$$\frac{\partial \alpha_2^n}{\partial \nu} = -\frac{(1-\eta)\,\kappa}{(1-\nu)^2\,\mu} < 0$$

WELFARE: Comparing nonintervention to autarky, host wage earnings rise due to the heightened demand for labor

$$(z_0^n - z_0^a)\,k_0 = k_0\psi\left(\frac{k_0}{m_0} - \frac{K}{M}\right) > 0$$

Profit from host firms declines due to the higher wage

$$\Pi_0^n - \Pi_0^a = -\psi m_0\left[\left(\frac{k_0}{m_0}\right)^2 - \left(\frac{K}{M}\right)^2\right] < 0$$

Source countries enjoy the positive effect of FDI on the profit of source firms

$$\Pi_i^n - \Pi_i^a = \psi m_i\left[\left(\frac{K}{M}\right)^2 - \left(\frac{k_i}{m_i}\right)^2\right] > 0,\ \forall i = 1,2$$

Source countries bear a negative effect of FDI on their wage earnings

$$(z_i^n - z_i^a)\,k_i = -k_i\psi\left(\frac{K}{M} - \frac{k_i}{m_i}\right) < 0,\ \forall i = 1,2$$

A.2 Proof of Proposition 2

The extent of FDI from the first source country increases with its own tax

$$\frac{\partial \alpha_1^*}{\partial \tau_1} = \frac{-\left(\frac{M}{m_1} - 1\right) M\psi k_1}{\left[(M-m_1)\,\sigma_1 - m_2\sigma_2 + \psi K\right]^2} < 0$$

and decreases with its rival's tax

$$\frac{\partial \alpha_1^*}{\partial \tau_2} = \frac{m_2\frac{M}{m_1}\psi k_1}{\left[(M-m_1)\,\sigma_1 - m_2\sigma_2 + \psi K\right]^2} > 0.$$

The wage in the host country increases with either tax

$$\frac{\partial z_0^*}{\partial \tau_1} = -\frac{m_1}{M} < 0$$

The wage in the first source country decreases with its own tax

$$\frac{\partial z_1^*}{\partial \tau_1} = \left(1 - \frac{m_1}{M}\right) > 0$$

and increases with its rival's tax

$$\frac{\partial z_1^*}{\partial \tau_2} = -\frac{m_2}{M} < 0.$$

Output by a firm from the host country decreases with either tax

$$\frac{\partial y_0^*}{\partial \tau_1} = \frac{1}{\psi}\frac{m_1}{M} > 0$$

Output by a firm from the first source country increases with its own tax

$$\frac{\partial y_1^*}{\partial \tau_1} = -\frac{1}{\psi}\left(1 - \frac{m_1}{M}\right) < 0$$

and decreases with its rival's FDI tax

$$\frac{\partial y_1^*}{\partial \tau_2} = \frac{1}{\psi}\frac{m_2}{M} > 0.$$

A.3 Proof of Proposition 3

Shifting labor into the source countries from the host country lowers both asymmetric FDI taxes

$$\frac{\partial \tau_1^*}{\partial \kappa} = -\frac{\psi K\left[\eta\left(1-\mu B\right)+\nu\mu B\right]}{2\nu\mu M\left(1-\mu B\right)} < 0$$

$$\frac{\partial \tau_2^*}{\partial \kappa} = -\frac{\psi K\left[\left(1-\eta\right)\left(1-\mu B\right)+\left(1-\nu\right)\mu B\right]}{2\left(1-\nu\right)\mu M\left(1-\mu B\right)} < 0$$

Shifting labor into the first source country from the second lowers the first tax and increases the second

$$\frac{\partial \tau_1^*}{\partial \eta} = -\frac{\kappa\psi K}{2\nu\mu M} < 0$$

$$\frac{\partial \tau_2^*}{\partial \eta} = \frac{\kappa\psi K}{2\left(1-\nu\right)\mu M} > 0$$

Shifting firms into the source countries from the host country increases both taxes

$$\frac{\partial \tau_1^*}{\partial \mu} = \frac{\psi K \left[\mu^2 B^2 \nu (2-\kappa) + \eta\kappa (1-\mu B)^2\right]}{2\nu\mu^2 M (1-\mu B)^2} > 0$$

$$\frac{\partial \tau_2^*}{\partial \mu} = \frac{\psi K \left[\mu^2 B^2 (1-\nu)(2-\kappa) + (1-\eta)\kappa (1-\mu B)^2\right]}{2(1-\nu)\mu^2 M (1-\mu B)^2} > 0$$

Shifting firms into the first source country from the second increases the first tax and reduces the second

$$\frac{\partial \tau_1^*}{\partial \nu} = \frac{\eta\kappa\psi K}{2\nu^2\mu M} > 0$$

$$\frac{\partial \tau_2^*}{\partial \nu} = -\frac{(1-\eta)\kappa\psi K}{2(1-\nu)^2\mu M} < 0$$

Shifting ownership of host firms to the host country decreases both asymmetric FDI subsidies

$$\frac{\partial \tau_1^*}{\partial B} = \frac{\partial \tau_2^*}{\partial B} = \frac{\psi K (2-\kappa)}{2M(1-\mu B)^2} > 0$$

A.4 Proof of Proposition 4

The extent of FDI from source country i is

$$\alpha_i^s = \frac{\psi\left[K - \frac{M}{m_i}k_i\right] - m_0\tau}{\psi K - m_0\tau}, \forall i = 1,2$$

and similarly for the second source country. Equilibrium wages in the host country equal

$$z_0^s = p - \frac{\psi K + \tau(m_1+m_2)}{M}$$

and equilibrium wages in each source country equal

$$z_i^s = z^s = p - \frac{\psi K - \tau m_0}{M}, \forall i = 1,2$$

Lastly, equilibrium output of a local firm in the host country is

$$y_0^s = \frac{K}{M} + \frac{\tau\left(m_1 + m_2\right)}{M\psi}$$

while equilibrium output of a multinational firm from source country i is

$$y_i^s = y^s = \frac{K}{M} - \frac{\tau m_0}{M\psi}, \forall i = 1, 2$$

The extent of FDI from either source country decreases with the tax

$$\frac{\partial \alpha_1^s}{\partial \tau} = -\frac{\frac{m_0}{m_1} M\psi k_1}{\left[m_0\sigma + \psi K\right]^2} < 0$$

The wage in the host country decreases with the tax

$$\frac{\partial z_0^s}{\partial \tau} = -\frac{m_1 + m_2}{M} < 0$$

The wage in either source country increases with the tax

$$\frac{\partial z_1^s}{\partial \tau} = \frac{m_0}{M} > 0$$

Output by a firm from the host country increases with the tax

$$\frac{\partial y_0^s}{\partial \tau} = \frac{m_1 + m_2}{\psi M} > 0$$

Output by a firm from either source country decreases with the tax

$$\frac{\partial y_1^s}{\partial \tau} = -\frac{m_0}{\psi M} < 0$$

A.5 Proof of Proposition 5

Shifting labor into the source countries from the host country lowers the symmetric tax

$$\frac{\partial \tau^s}{\partial \kappa} = -\frac{\psi K}{2\mu M\left(1 - \mu B\right)} < 0$$

whereas shifting labor into the first source country from the second has no effect

$$\frac{\partial \tau^s}{\partial \eta} = 0$$

Further, shifting firms into the source countries from the host country increases the symmetric FDI tax

$$\frac{\partial \tau^s}{\partial \mu} = \frac{\psi K \left[\mu B \left(\frac{2\mu B - \kappa}{1-\mu B}\right) + \kappa\right]}{2\mu^2 M (1-\mu B)} > 0, \text{ as } \mu > \kappa \text{ and } 2B > 1$$

whereas shifting firms into the first source country from the second has no effect

$$\frac{\partial \tau^s}{\partial \nu} = 0$$

Lastly, shifting ownership of host firms to the host country increases the symmetric tax

$$\frac{\partial \tau^s}{\partial B} = -\frac{\psi K (2-\kappa)}{2M (1-\mu B)^2} < 0$$

WELFARE: Comparing symmetric FDI policy to nonintervention, the profits of host firms fall due to higher costs and lower output

$$\Pi_0^s - \Pi_0^n = -\tau m_0 \left(1 - \frac{m_0}{M}\right) \left[2\frac{K}{M} + \frac{\tau}{\psi}\left(1 - \frac{m_0}{M}\right)\right] < 0$$

Meanwhile, the profits of source firms fall

$$\Pi_i^s - \Pi_i^n = -\frac{\tau m_0 m_i}{M^2}\left(2K - \frac{\tau m_0}{\psi}\right) < 0, \, \forall i = 1, 2$$

Also, labor earnings increase in both source countries

$$(z_i^s - z_i^n) k_i = \frac{\tau m_0 k_i}{M} > 0, \, \forall i = 1, 2$$

and fall in the host country.

$$(z_0^s - z_0^n) k_0 = -\tau \left(1 - \frac{m_0}{M}\right) k_0 < 0$$

A.6 Proof of Proposition 6

Recall that the symmetric tax is

$$\tau^s = \frac{\psi}{2}\left[\frac{K+k_0}{\frac{M}{B}-(M-m_0)} - \frac{K-k_0}{M-m_0}\right]$$

whereas the asymmetric FDI taxes are

$$\tau_i = \frac{\psi}{2}\left[\frac{K+k_0}{\frac{M}{B}-m_i-m_j} - \frac{k_i}{m_i}\right], \forall i = 1,2$$

Subtracting τ^s from τ_i and using the property that

$$\frac{k_0}{m_0} > \frac{K}{M} > \frac{k_1}{m_1} > \frac{k_2}{m_2}$$

delivers the result.

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Figure 1: FDI Pattern
with Two Source Countries

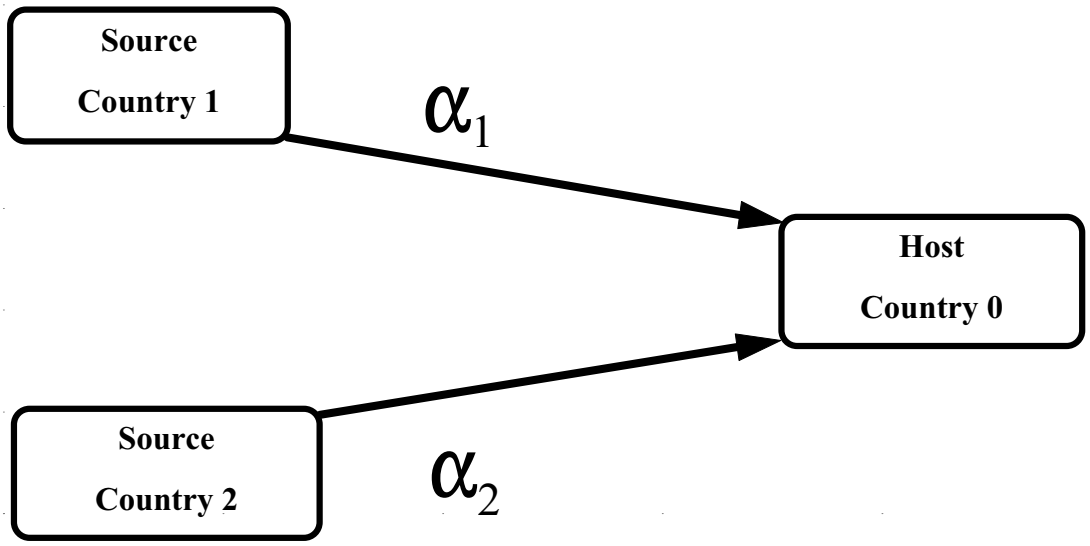

Figure 2: Equilibrium FDI Patterns
with Two Source Countries

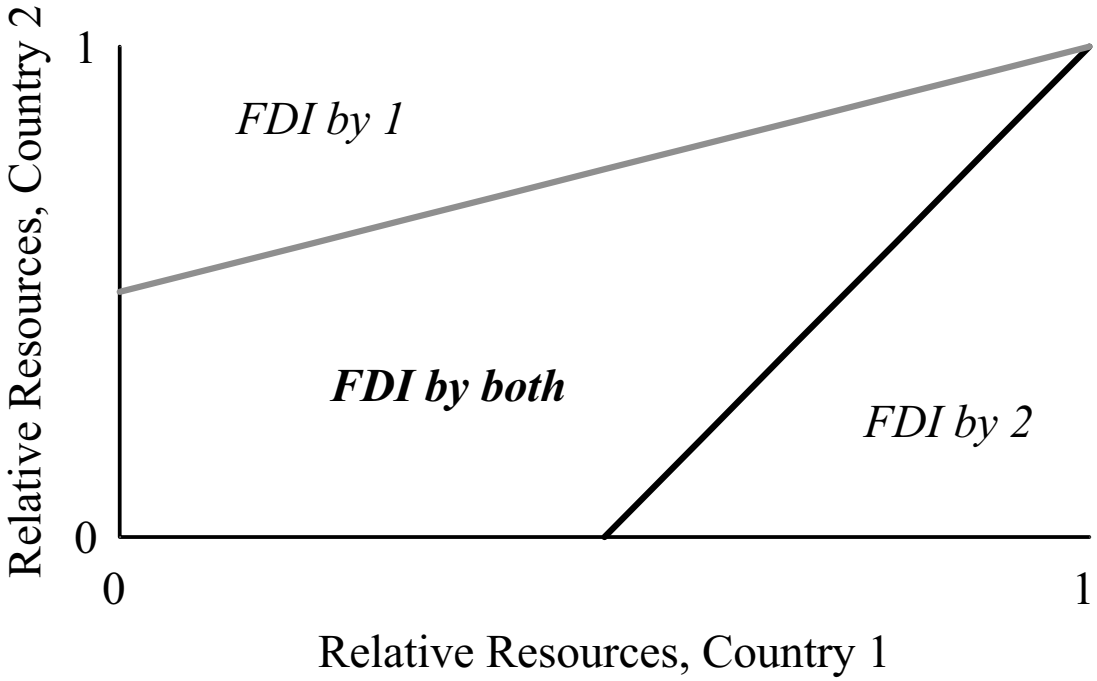

Figure 3: Equilibrium FDI Policies
with Two Source Countries