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FDI policies under shared factor markets

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Abstract

We examine the consequences of foreign direct investment (FDI) policies in a general equilibrium setting with several oligopolistic industries. By shifting labor demand across countries, FDI raises the wage in the host country and lowers the wage in the source country, thereby raising profits of source country firms at the expense of host country firms. The extent of cross-ownership of firms, the relative number of firms and the relative supply of skilled labor alter the impact of FDI policy on national welfare. The tension between profits and wages determines whether the optimal policy is designed to encourage FDI. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

The global sales by foreign affiliates of multinational firms now exceed worldwide exports of goods and services (see the United Nations *World Investment Report* 1995 and 1996 (United Nations, 1995 United Nations, 1996)). Many firms are choosing to serve foreign markets through establishing foreign production subsidiaries rather than producing domestically and exporting. In addition, many

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potential host countries actively pursue multinationals, offering incentives to establish production subsidiaries, while many source countries seem to fear the erosion of their production base as production is shifted abroad. How does FDI affect profits and factor earnings in host and source countries? What is the optimal policy toward FDI for host and source countries?

Despite the increasing importance of FDI, the impact of FDI policies on the countries involved has received relatively little attention in the trade literature. Most of the existing literature examining the welfare impact of capital flows assumes perfectly competitive markets (see Ruffin, 1984 for survey) even though multinational firms operate mostly in oligopolistic industries (Markusen, 1995; Brainard, 1997). Furthermore, we are interested more in the consequences of production shifting involved under FDI.

Our paper shares with Levinsohn (1989) a view of FDI as moving production abroad and also shares the point that introducing FDI into strategic trade models can lead to fundamentally new conclusions. Levinsohn (1989) showed that if FDI by foreign firms is possible, a tariff and a quota are equivalent instruments even in a model of imperfect competition. This equivalence arises as the possibility of FDI eliminates the asymmetric foreign supply response under the two policy instruments obtained in the absence of FDI. We demonstrate that a strategic rationale for FDI policies arises from the production shifting effects of FDI in the presence of oligopolistic competition.¹

In this paper, we explore the welfare consequences of FDI where firms operate in oligopolistic markets. These firms establish production facilities abroad due to lower costs there (inclusive of any tax or subsidy to FDI). Factor prices and the extent of FDI are determined in general equilibrium. As in Dixit and Grossman (1986), many high technology industries use a factor (skilled labor) available in fixed supply and firms compete in quantities. We add FDI, so firms shift production to the low wage country until wage equalization (net of any tax or subsidy) removes further incentives for FDI.² We derive the optimal policies (tax or subsidy) toward FDI from both the host and the source country perspective.

Our model captures the tension that FDI creates between the interests of the workers and local firms. Inward FDI generates increased labor demand, which benefits workers through raising wages in the host country but consequently damages the profits of host firms. The reverse implications hold for the source

¹Rodríguez-Clare (1996) argues that multinationals benefit the host country when they generate linkage effects beyond those generated by the local firms that they displace. Multinationals may even benefit local producers by expanding the set of intermediate goods. Haddad and Harrison (1993) reject the hypothesis of spillovers from FDI to the productivity of local firms in Morocco. In our paper, multinationals and local firms always have opposing interests since the presence of multinationals raises rather than lowers the costs of local firms.

²Lucas (1993) shows high costs in the source country create a push while Coughlin et al. (1991) shows lower wages in the host country (state) create a pull in generating incentives for FDI.

country: profits rise but wages fall. This tension between wages and profits implies that government policies toward FDI benefit one group at the expense of the other.

The view that shifting production abroad raises host wages at the expense of source wages is widely held. To mention a few examples, in March 1996, General Motors employees in Dayton, Ohio went on strike to protest G.M. shifting production to low wage countries. In October 1995, Boeing employees in Kansas, Washington, and Oregon went on strike to protest Boeing shifting production to China. More formal empirical evidence supports the view that the entry of multinationals raises wages in host countries (see Harrison, 1994 and Aitken et al., 1996).³

This detrimental effect of FDI on the source wage is countered by the increased profitability of source firms (hence G.M. and Boeing's desire to shift production abroad). In oligopolistic markets, the increased profitability of source firms comes at the expense of host firms. Thus host firms are hurt due to FDI not only because competition increases (partial equilibrium effect) but also due to higher factor prices (general equilibrium effect).

Brander and Spencer (1985) demonstrated that trade policies can shift profits across countries under imperfect competition. We confirm that policies designed to influence FDI have the ability to shift profits across countries as well. FDI raises the costs of host firms and simultaneously lowers the costs of source firms by transferring demand for the fixed factor across countries. While the rationale for export subsidies is sensitive to a number of assumptions, we demonstrate that the rationale for strategic FDI subsidies is robust.

Dixit and Grossman (1986) argued that if several symmetric oligopolies all use a factor in fixed supply, uniform export subsidies may fail to improve source welfare. Instead of promoting source firms, export subsidies bid up the wage of the factor in fixed supply, offsetting the effect of export subsidies on market shares and thus profits. We show, however, that the problem Dixit and Grossman describe does not arise when subsidizing FDI. *The increase in output that results from a subsidy raises costs at home under exporting whereas it raises costs abroad under FDI.*

Even if a source country were to subsidize exports, as long as firms have the option of FDI, the original Brander-Spencer argument survives the Dixit-Grossman criticism. The point is that a subsidy which causes firms to expand their output raises the source wage thereby creating an incentive for FDI. The increased labor demand in the host country raises the costs of host firms thereby shifting rents to host firms. Thus, the important point is not that policies explicitly target FDI but rather that firms have the option of undertaking FDI in response to wage conditions.

³In what follows, for the sake of brevity, we refer to the source country as just source and the host country as just host.

The Brander and Spencer result is also sensitive to firm behavior, the number of firms, and cross-ownership of firms. Eaton and Grossman (1986) argued that export taxes are required if firms behave as Bertrand/price-setting rather than Cournot/quantity-setting oligopolists. Dixit (1984) argued that export taxes are required if the number of firms is large. Lee (1990); Miyagiwa (1992) and Dick (1993) argued international cross shareholding reduces the magnitude of optimal export subsidies substantially.⁴ We also consider more than one firm in each country (in the base model), cross-ownership of firms (in an extension) and Bertrand behavior (in the appendix). We find that the basic nature of our argument is robust to these preceding criticisms of the Brander-Spencer argument.

As mentioned above, a subsidy to FDI raises wages abroad while lowering wages at home. The adjustment in wages lowers the costs of source firms and consequently shifts profits in their direction. Given the trade-off between wages and profits, the optimal source policy depends upon the parameters in an intuitive fashion. When the ratio of domestic to host firms is not large relative to the ratio of domestic to host skilled labor supply, the optimal source policy is a subsidy to outward FDI. Under this scenario, the extent of outward FDI is small (since autarkic wages are approximately the same in the two countries), so the subsidy payments needed to achieve a gain in source profits at the expense of host firms are relatively small. However, when the extent of FDI is large because the autarkic source wage is high (due to high demand for and low supply of skilled labor), the total subsidy payments required will exceed the benefits obtained by shifting profits from rivals. The optimal source policy is then a tax on outward FDI.

Our investigation of the optimal host country policy toward FDI in the base model reveals that the host can raise welfare by taxing FDI. Government policies in many countries such as Japan, South Korea, and Brazil (historically or currently), have actively discriminated against FDI to encourage the development of local firms. Many emerging markets in South-East Asia (Malaysia, Philippines and Thailand) and India still do not allow free entry of multinational firms in order to protect local firms. FDI in Japan is negligible, with McDonalds and General Electric the key exceptions; Japan maintains practices that discourage foreign investors (*The Economist* March 1, 1997). The policies adopted may not literally be taxes but such policies act like taxes in discouraging FDI.

On the other hand, many less developed countries (LDCs) now appear eager to attract FDI (although historically many of them did shut out FDI).⁵ Economic reform in many formerly communist countries has added to the list of countries vying for FDI (United Nations *World Investment Report*, (United Nations, 1995)).

⁴See also Markusen and Venables (1988); Harris (1989) and Qiu (1994, 1995) for entry, retaliation, asymmetric information, uncertainty and related concerns.

⁵Incidentally, tax treatment of multinationals also varies within an economy. For an analysis of the impact of inter-state variation in tax treatment of multinationals and flows of FDI within the U.S., see Hines (1996).

Frank (1997) provides details of recent policy changes in favor of FDI in the Eastern European countries. Ford, enticed by tax incentives, recently opened an assembly plant in Belarus; the picture accompanying one article (*The Economist* July 26, 1997) is quite telling: a farmer hauling a wagon-load of hay with two horses is labelled “Ford’s competition takes a test drive”. Even Japan, known as a hostile environment for FDI, is contemplating encouraging FDI in Okinawa, a southern island with little local manufacturing (*The Economist* July 19, 1997). The Belarus and Okinawa (and other LDC-like) scenarios involve *government objectives that are more concerned with improving local factor earnings than the negative impact higher factor prices would have on local producers*.

We believe the explanation for this cross-country variation in FDI policies involves variation in the state of development of the local industries or in the extent of foreign ownership of local firms. LDCs usually have small or non-existent local firms in industries that are dominated by multinationals since brand names, R&D, and reputation are of central importance in such industries (Markusen, 1995 Brainard, 1997). Furthermore, in many small open economies, a substantial fraction of the ownership of firms may belong to other countries. China illustrates the dividing line nicely as its local industries are developing to the point where they are pressuring the Chinese government to remove its FDI incentives (*The Economist* March 1, 1997).

If the economic environment of a country is such that profits of local firms are unimportant either (because local industries are extremely underdeveloped so that national income comprises mostly of wage earnings or because local profits do not accrue to domestic agents), the country has an incentive to subsidize inward FDI. The loss in profits incurred due to the increased entry of multinationals is small relative to the gain accruing to workers. We demonstrate that if the host country owns a small enough share of local oligopolists, subsidies to inward FDI by the host country do indeed raise host country welfare. Such subsidies may also benefit the source if part of the ownership of host country firms lies with a third country. Of course, such policies improve source and host welfare at the expense of the third country.

Since substantial cross-ownership of firms exists across developed countries, we extend our model to consider the consequences of cross-ownership of firms. The presence of cross-ownership lowers the optimal outward FDI subsidy. As in the case of substantial third country ownership of its firms, under sufficient cross-ownership, the host country can raise its welfare (net of subsidy payments) by subsidizing inward FDI. However, the presence of cross-ownership reduces the profit-shifting effects: the damage to host firms is partially offset by the benefit to source firms. The key difference from the case of third country ownership of host firms is that with cross-ownership, the interests of the source and the host must conflict.

Section 2 finds a Cournot oligopoly equilibrium when a common factor is available in fixed supply and examines the impact of various FDI policies on the

key endogenous variables. Section 3 determines the welfare effects of FDI policies for each country. Section 4 presents extensions of our base model involving cross-ownership and third country ownership of firms. Section 5 concludes. The Appendix provides the details for Bertrand behavior.

2. Model

Our model closely parallels the model developed in Dixit and Grossman (1986) but introduces the potential for FDI. All goods are produced using only skilled labor, which is available in fixed supply in each country. The economy is composed of $n \geq 1$ industries indexed by $j = 1, 2, \dots, n$.⁶ One unit of good j is produced using one unit of skilled labor. The market for skilled labor is competitive; enough different industries hire skilled labor that each firm views the wage as given.

Dixit and Grossman (1986) include a low-technology sector where a numeraire good is produced by unskilled workers in a perfectly competitive market. The unit labor requirement for unskilled workers in the low-technology industry is normalized to one. Since the price of the low-technology good is normalized to one, the wage for unskilled workers is one, regardless of export subsidies. Any identical unit labor requirement for unskilled workers across high-technology industries, combined with otherwise symmetric industries, makes uniform export subsidies ineffective in raising domestic welfare. We set the unit labor requirement for unskilled workers in high-technology industries to zero, but a positive value that is identical across industries would not alter our results.

For the bulk of their model, Dixit and Grossman (1986) assume the host wage is exogenous: the host does not face a common factor market in the high-technology sector.⁷ However, since we consider shifting labor demand abroad through FDI, we consider the general equilibrium consequences on the host as well. Adding a host resource constraint causes the host wage to rise as the source wage falls in response to FDI from the source to the host.

We expand the Cournot duopoly case to consider the implications of the number of firms in the industry along the lines of Dixit (1984). Since the allocation of labor demand across countries plays an important role, not only the total number of firms in each industry but the number that are source and the number that are host play important roles as well. In each industry, m identical source firms and M identical host firms produce a homogeneous good for sale to consumers in another

⁶The number of industries plays no important role but n being large does help to justify the assumption that firms take the wage as given.

⁷They do perform an extension introducing a foreign skilled labor constraint that appears to further weaken the profit-shifting role for export subsidies.

location. In a symmetric equilibrium with FDI, each of the m source firms in each industry will be a multinational producing in both countries.

2.1. Output market

Let y_j denote the output of a representative source firm in industry j (so total industry output of source firms is my_j). Let capital letters denote the host analogues of each variable: in particular, the output of a representative host firm in industry j is Y_j (so total industry output of host firms is MY_j). Total output in industry j is $Q_j \equiv my_j + MY_j$, the sum of source and host production by firms in industry j . Let the demand function in some third country be given by $P_j = p_j(Q_j)$ where $p'_j(Q_j) < 0$ and $p''_j(Q_j) \leq 0$.⁸

Each source firm decides whether to produce each unit at home or abroad. Let α_j denote the share of skilled labor demanded abroad by a source firm in industry j , which provides a measure of the extent of FDI. Host firms do not undertake FDI in the source country. FDI seeks lower production costs, so in equilibrium FDI occurs in only one direction.⁹

Suppose source firms in industry j are offered a subsidy σ_j for each unit of output that they produce in the host country.¹⁰ If $\sigma_j > 0$, the subsidy acts like a reduction in the host wage for skilled labor hired by source firms. Note that we do not require $\sigma_j > 0$; negative values are taxes.

The wage for skilled labor in the source country is z and in the host country is Z . The net marginal cost of a source firm in industry j is $c_j \equiv (1 - \alpha_j)z + \alpha_j(Z - \sigma_j)$ and the marginal cost of a host firm is $C \equiv Z$. All firms take the source and host wage for skilled labor as given.

If the source wage is less than the host wage minus the subsidy $z < Z - \sigma_j$, then all production by source firms remains in the source $\alpha_j = 0$. If the source wage is greater than the host wage minus the subsidy $z > Z - \sigma_j$, then all production by source firms occurs in the host $\alpha_j = 1$. Hence, the source wage must equal the host wage minus the subsidy

$$z = Z - \sigma_j \tag{1}$$

for production by source firms to be split across countries $0 < \alpha_j < 1$. The FDI

⁸For the symmetric case and under quasilinear preferences (the standard assumption in this literature), the location of consumption is irrelevant since the resource constraint fixes the price by fixing output in each industry. In the presence of local consumption, welfare would be our welfare measures plus some constant consumer surplus.

⁹Two-way FDI is commonly observed but not addressed in our model, which explains the net flow of FDI.

¹⁰At the moment, who pays the subsidy is immaterial; we address this issue later.

subsidy places a wedge between the source and host wages.¹¹ We are interested in how FDI subsidies encourage a greater extent of FDI, which shifts production across countries. We focus on the case where some but not all production is shifted abroad in equilibrium.

As Cournot oligopolists, each firm picks its quantity to maximize its profits, given the quantity chosen by the other firms. The profits of a source firm equal $\pi_j = [p_j - c_j]y_j$ while the profits of a host firm equal $\Pi_j = [p_j - Z]Y_j$. The first order conditions (simplified using $z = Z - \sigma_j$) are¹²

$$\frac{\partial \pi_j}{\partial y_j} = p_j + y_j p_j' - c_j = p_j + y_j p_j' - z = 0 \quad (2)$$

$$\frac{\partial \Pi_j}{\partial Y_j} = p_j + Y_j p_j' - Z = 0 \quad (3)$$

To completely describe an equilibrium, we also need to specify how the wage in each country is determined. In what follows, we restrict attention to a symmetric equilibrium where all industries are identical and thus source firms split production across countries to the same extent regardless of industry. We examine how FDI policies affect that split.¹³

2.2. Labor market

Only a fixed supply k of skilled labor per industry is available in the source country, so the wage must adjust to equate the demand for skilled labor with the supply of skilled labor.¹⁴ The source labor constraint is

$$(1 - \alpha)my = k \quad (4)$$

The source labor constraint relates production of each source firm to the extent of FDI and implicitly the source wage. Similarly, only a fixed supply K of skilled labor per industry is available in the host country. The host labor constraint is

$$\alpha my + MY = K \quad (5)$$

¹¹Skilled labor is measured in efficiency units (one skilled worker produces one unit of high-technology output), so the model can be consistent with higher observed source wages (in the absence of any FDI policy) if observed wages are not measured in efficiency units and host skilled labor is less productive than source skilled labor.

¹²All second order conditions are easily verified.

¹³Industries do differ substantially in their extent of FDI. The industries here should be viewed as all being high-tech industries, the kind of industries where FDI is prevalent. Thus, our analysis should capture the impact on a representative high-tech firm.

¹⁴We keep the number of industries n fixed throughout our analysis so there is no loss of generality in working with the supply of skilled labor per industry.

Adding the source and host labor constraints dictates that the total production of each industry is constant.

$$Q \equiv my + MY = k + K \tag{6}$$

With symmetric industries, the fixed availability of skilled labor in each country fixes total output in each industry. This aspect of the model greatly simplifies the analysis since, in equilibrium, price and total output in each industry are unaffected by government policy – only FDI responds to policy and thus FDI affects the equilibrium through the changes in wages induced by FDI.

2.3. General equilibrium

An equilibrium must specify the output of a representative source firm y , the output of a representative host firm Y , the source wage z , the host wage Z , and the extent of FDI α of a representative source firm. Let $\{y^*, Y^*, z^*, Z^*, \alpha^*\}$ denote the solution to the system of equations: the FDI equilibrium condition Eq. (1), the first order conditions Eqs. (2) and (3), and the labor constraints Eqs. (4) and (5). The key parameters are the source skilled labor supply per industry k , the host skilled labor supply per industry K , the number of source firms in each industry m , and the number of host firms in each industry M .

Let $f \equiv m/M$ denote the ratio of source firms to host firms in each industry and $r \equiv k/K$ denote the ratio of skilled labor in the source relative to the host. Abbreviate p for $p(Q^*)$ and p' for the slope of the demand function at the equilibrium industry output Q^* given by Eq. (6), where $p' < 0$. Further let $\psi \equiv -p' > 0$.

Solving the system of equations gives the equilibrium extent of FDI

$$\alpha^* = \frac{\psi K(f - r) + \sigma f M}{[\sigma M + \psi K(r + 1)]f} \tag{7}$$

source wage

$$z^* = \frac{[(f + 1)pM - (r + 1)\psi K] - \sigma M}{(f + 1)M} \tag{8}$$

host wage

$$Z^* = \frac{[(f + 1)pM - (r + 1)\psi K] + \sigma f M}{(f + 1)M} \tag{9}$$

representative source firm output

$$y^* = \frac{\psi K(r + 1) + \sigma M}{\psi(f + 1)M} \tag{10}$$

and representative host firm output.

$$Y^* = \frac{\psi K(r+1) - \sigma f M}{\psi(f+1)M} \quad (11)$$

Next we investigate the properties of the above equilibrium and then the welfare consequences of FDI policies.

2.4. Equilibrium analysis

FDI exists between asymmetric countries even in the absence of subsidies since autarkic wages would differ, providing the firms facing higher wages an incentive to shift production to the low wage country. Substituting $\sigma=0$ in Eq. (7) gives the initial equilibrium extent of FDI

$$\alpha_0^* = \frac{f-r}{f(r+1)} > 0 \Leftrightarrow f > r \quad (12)$$

Therefore, in the absence of any subsidy to FDI, FDI occurs $\alpha_0^* > 0$ iff $f > r$, when host skilled labor (measured in efficiency units) per firm is higher abroad than at home.

Since we are interested in equilibria in which FDI occurs from the source to the host, we assume $f > r$ (satisfied trivially by labeling the countries accordingly). In the absence of FDI, the host wage would be lower than the source wage due to lower demand for skilled labor relative to the fixed supply. Since an incentive for FDI exists as long as wages abroad are lower, FDI equalizes wages across the two countries in the absence of any taxes or subsidies to FDI.

The extent of FDI, Eq. (7), increases with the number of source firms relative to host firms. The greater source labor demand due to the increased number of source firms puts upward pressure on the source wage, which encourages source firms to engage in more FDI. Since part of the increase in labor demand is shifted abroad through FDI, host wages increase. Thus source wages Eq. (8) as well as host wages Eq. (9) increase with the relative number of source firms. An increase in the relative number of source firms reduces the output of each firm, Eqs. (10) and (11). As noted in Eq. (6), total production of each country is fixed by the world supply of skilled labor per industry, regardless of the number of firms in each industry. Thus, as the number of firms expands, industry output must be spread across more firms. The impact of relative source resources is exactly opposite that of the relative number of source firms.

Proposition 1. *An increase in the number of source relative to host firms increases both the source and the host wage, decreases both source and host output of each firm, and increases the extent of FDI. An increase in source relative to host skilled labor supply decreases both the source and the host wage, increases both source and host output of each firm, and decreases the extent of FDI.*

What are the consequences of FDI subsidies? A subsidy to FDI directly increases the incentive for source firms to shift production to the host country. This production shifting transfers labor demand from the source to the host thereby raising host wages and lowering source wages. This movement of wages implies that the source firms enjoy a lower cost of production relative to host firms and therefore gain market share and enjoy higher profits.

Proposition 2. *A subsidy to FDI leads to a greater extent of FDI, a lower source wage, a higher host wage, larger output by each source firm and smaller output by each host firm.*

The effect of a subsidy to FDI on the equilibrium follows immediately from simple differentiation of the equilibrium values. A wage differential arises between the two countries (host wage exceeds source wage) that exactly equals the magnitude of the subsidy. According to Eq. (6), the increase in the source output exactly offsets the decrease in the host output, leaving total output of each industry unchanged.

Note that the subsidy cannot become too large or else host firm output would fall to zero.

$$\sigma \leq \bar{\sigma} \equiv \frac{\psi K(1+r)}{fM} \Leftrightarrow Y^* \geq 0 \tag{13}$$

Also, the subsidy cannot become too low (the tax cannot become too large) or else the extent of FDI would fall to zero.

$$\sigma \geq \underline{\sigma} \equiv -\frac{\psi K(f-r)}{fM} \Leftrightarrow \alpha^* \geq 0 \tag{14}$$

We determine the optimal FDI policies within this interval $\sigma[\underline{\sigma}, \bar{\sigma}]$.

3. FDI policies with complete ownership

We have established that a subsidy to FDI increases the extent of FDI and increases the share of source firm production in total production. FDI subsidies lower the costs of source firms and effectively promote these firms, even if all industries are identical and share a common factor available in fixed supply. Under what circumstances are such subsidies optimal?

3.1. Optimal source policy

Define source welfare as the sum of the profits of source firms and the earnings of source skilled labor minus any subsidy payments $s \equiv \sigma \alpha m y$.

$$w \equiv m\pi + zk - s \quad (15)$$

For a subsidy to raise source welfare, the profits of source firms net of the subsidy must rise by more than the reduction in the earnings of source skilled labor. Differentiating total source welfare with respect to the subsidy level

$$\frac{dw}{d\sigma} = \frac{f[\psi K(2r - (1 - f)) - 2\sigma Mf]}{\psi(f + 1)^2} \quad (16)$$

Solving the first order condition yields the optimal subsidy

$$\sigma^* \equiv \frac{\psi K(2r + 1 - f)}{2fM} > 0 \Leftrightarrow f < 1 + 2r \quad (17)$$

The source subsidizes FDI iff $\sigma^* > 0$. In particular, if the two countries have the same number of firms $M = m$, then $f = 1$ and $\sigma^* > 0$. The optimal policy remains a subsidy even when the number of source firms is somewhat greater than the number of host firms, provided $f < 1 + 2r$. The properties of the optimal policy follow from simple differentiation of Eq. (17).

Proposition 3. *The optimal source policy toward outward FDI is a subsidy iff the relative number of source firms is sufficiently small $f < 2r + 1$. The optimal subsidy decreases in the number of source relative to host firms and increases in the source relative to host skilled labor supply.*

When $f < 2r + 1$, the ratio of domestic firms to host firms is not that large relative to the ratio of domestic to host supply of skilled labor. From Eq. (7), under this scenario, the extent of outward FDI is small, so, the subsidy payments that have to be made to achieve a gain in profits at the expense of the host rivals are relatively small. However, when $f > 2r + 1$, the extent of FDI is large since autarkic source wage is high (due to high demand and limited supply of skilled labor) so that the total subsidy payment required exceeds the benefits obtained by shifting profits from rivals. Subsidy payments are high because both the number of firms and the extent of FDI are large. Alternatively, when the relative number of firms f is big compared to relative skilled labor supply r , a small tax on FDI can lead to a large increase in labor demand at home so that the losses incurred through reduced firm profits are dominated by increase in wage earnings, making a tax on outward FDI an optimal policy.

A subsidy to outward FDI depresses the source wage and shifts profits toward the source firm in each industry, but increased outward FDI also increases the wage abroad. How does the source subsidy to outward FDI affect aggregate host welfare? Define host welfare as the sum of the profits of host firms and the earnings of host skilled labor.

$$W \equiv M\Pi + ZK \quad (18)$$

Profits shifted toward source firms due to a FDI subsidy come at the expense of the profits of host firms. However, host wages rise due the increased demand for host skilled labor.

For a subsidy paid by the source to reduce host welfare, the profits of host firms must fall by more than the improvement in host skilled labor earnings. As might be expected, the benefits to source welfare are achieved at the expense of host welfare. Differentiating host welfare with respect to the level of the subsidy, host welfare falls by the magnitude that source welfare rises $(dW/d\sigma) = -(dw/d\sigma)$. Host welfare is minimized at the optimal FDI policy chosen by the source. Intuitively, whenever the source prefers a subsidy, the host prefers to restrict FDI because FDI raises the host wage and shifts profits away from host firms. Total world welfare $w + W = (r + 1)Kp = Qp$ is independent of any taxes or subsidies to FDI. Thus, an outward FDI subsidy by the source country increases source welfare at the expense of host welfare. We turn next the optimal host policy toward inward FDI.

3.2. Optimal host policy

Let $\tilde{\sigma}$ now denote the subsidy implemented by the host, given that the source institutes no policy toward outward FDI. The trade-off facing the host government is clear: inward FDI benefits workers at the expense of firms. Can the host government intervene to raise host welfare? Welfare in the host equals

$$\tilde{W} = MII + ZK - S \tag{19}$$

where $S \equiv \sigma am y$ denotes the magnitude of any subsidy payments. Differentiating host welfare with respect to the subsidy level gives

$$\frac{d\tilde{W}}{d\tilde{\sigma}} = - \frac{\psi K(2f + rf - r) + 2\tilde{\sigma}fM}{\psi(f + 1)^2} < 0 \tag{20}$$

which is negative since $f > r$ (by labeling of countries). Thus host welfare is strictly decreasing in the host subsidy to inward FDI: the host can increase its welfare by *taxing* inward FDI.

Such a tax discourages the inflow of FDI. Therefore, the optimal host policy must respect the constraint that the extent of FDI be non-negative as in Eq. (14).¹⁵

$$\tilde{\sigma}^* = \underline{\sigma} \equiv - \frac{\psi K(f - r)}{fM} < 0 \tag{21}$$

The minimum subsidy is negative since $f > r$ by labeling of the host and source countries so the optimal policy is a tax on inward FDI.

¹⁵The value of the tax that solves the first order condition is greater than the value defined in Eq. (14), so the constraint always binds.

Proposition 4. *The optimal host policy toward inward FDI is the prohibitive tax. The optimal tax increases with the relative number of source firms and decreases with the relative source skilled labor supply.*

The above result illustrates that when the host values profits as well as wages, it taxes inward FDI. Properties of the optimal tax Eq. (21) are easily established by differentiation. Intuition for these properties is simple: as the number of source firms increases, the wage in the source country increases making FDI more attractive, which forces the host to increase its tax to continue blocking FDI. Similarly, a high source labor supply implies a low relative wage in the source country. This low wage makes FDI less attractive so that a smaller tax can prohibit FDI.

4. FDI policies with incomplete ownership

Many countries do implement measures to attract FDI yet our base model suggests potential host countries should only discourage FDI. How can our model explain FDI promotion policies? Next, we discuss two different extensions that accomplish this objective.

The first variant assumes that the host weighs profits less than wages because a substantial portion of the ownership of its firms lies with a third country. This scenario provides some insight into whether small less developed economies that have few local firms of their own have an incentive to subsidize inward FDI.

The second extension introduces cross-ownership of firms among the two countries (portfolio investment). Since substantial cross-ownership of firms exists among developed countries, this second model applies to FDI between two developed economies. Both these models are capable of generating subsidies to inward FDI as optimal host policies.

4.1. Optimal host policy with external ownership

Suppose the host firms are not fully host-owned but partially owned by some third country. Let $1 - \beta$ represent the host country's ownership share of host firms where β belongs to the rest of the world (ROW) with $0 \leq \beta \leq 1$. Host welfare with some external ownership of source firms is

$$W_e = (1 - \beta)M\Pi + ZK - S \quad (22)$$

which differs from Eq. (18) by weighting source firm profits by $1 - \beta$ instead of one. What is the optimal host policy toward FDI? Maximizing host welfare with respect to the subsidy yields the optimal host subsidy

$$\sigma_e^* \equiv \frac{\psi K[2\beta f(r+1) - r(f-1) - 2f]}{2fM(\beta f + 1)} \tag{23}$$

Above a critical threshold level of external ownership of host firms,

$$\beta > \bar{\beta}_e \equiv \frac{2f + r(f-1)}{2f(1+r)} \Leftrightarrow \sigma_e^* > 0 \tag{24}$$

the host chooses to subsidize inward FDI.¹⁶ Differentiating Eq. (23) with respect to β reveals that the optimal host subsidy is increasing in the external ownership of host firms.

Proposition 5. *The host subsidizes inward FDI iff a sufficiently large share of host firms are owned by some third country $\beta > \bar{\beta}_e$. The optimal host subsidy increases in the share of host firms owned by other countries.*

How does the subsidy to inward FDI affect source welfare? Unlike the base model where the host and source country’s interests were always in conflict, subsidizing inward FDI here can raise source as well as host welfare. In the absence of a source FDI policy, source welfare Eq. (15) simplifies to

$$w_e = m\pi + zk \tag{25}$$

Differentiating source welfare over the FDI subsidy (implemented by the host country) gives

$$\frac{dw_e}{d\sigma_e} = \frac{\psi K(2f + rf - r) + 2\sigma_e fM}{\psi(f+1)^2} > 0 \tag{26}$$

Thus, source welfare is strictly increasing in the inward FDI subsidy offered by the host: source profits rise more than source wage earnings fall. The FDI policy adopted by the host improves source welfare whenever the host FDI policy is a subsidy $\beta > \bar{\beta}_e \Leftrightarrow \sigma_e^* > 0$.

Proposition 6. *The optimal host policy improves welfare in both countries when it subsidizes inward FDI, whereas it improves only host welfare when it taxes inward FDI.*

How can welfare improve in both countries? Recall that some third country owns some share of host firms. Whenever, the extent of this ownership is large, interests of the source and the host coincide. In fact, the source and the host can

¹⁶This result applies even when ownership of host firms lies with the source country; however, the results regarding the impact on source welfare in this section are derived based on the external ownership of host firms belonging to some third country.

cooperate to increase joint welfare at the expense of the third country; cooperating would entail implementing a subsidy even higher than the one chosen by the host alone since, when acting alone, the host ignores the benefits that accrue to the source as a result of its policy.

4.2. Optimal source policy with cross-ownership

Suppose now that some share of firms in each country are owned by the other country. Let β represent the source ownership share of host firms and γ represent the source ownership share of source firms with $0 \leq \gamma \leq 1$. When all firms are owned within the source and host, strategic FDI subsidies have a beggar-thy-neighbor character since total world welfare is independent of such policies. This trait holds in the base model where $\beta=0$ and $\gamma=1$ and continues to hold under general cross-ownership here.

We examine how the presence of cross-ownership alters the incentives for governments to offer subsidies to FDI. From the viewpoint of the source country, not all of the increased profits of source firms due to a subsidy to outward FDI accrue to the source country under cross-ownership. Additionally, some of the decreased profits of host firms now accrue to the source. Thus, cross-ownership weakens the incentive for subsidizing outward FDI.

Source welfare with cross-ownership is

$$w_c = \gamma m \pi + \beta M \Pi + z k - s \tag{27}$$

Under $\beta=0$ and $\gamma=1$, source welfare reduces to Eq. (15). Differentiating source welfare with respect to the subsidy level and solving for the optimal outward FDI subsidy yields

$$\sigma_c^* = \frac{\psi K [2(r+1)(\gamma - \beta) - (f+1)]}{2M [1 - \gamma + (1 - \beta)f]} > 0 \Leftrightarrow \gamma - \beta > \frac{1}{2} \left(\frac{f+1}{r+1} \right) \tag{28}$$

In a fully symmetric model, $r=f=1$ so the above inequality requires that $\gamma - \beta > 1/2$. The source government wants to subsidize outward FDI iff the source share of its own profits exceeds its share of host profits by a wide enough margin. Subsidizing FDI increases profitability of source firms at the expense of host firms; if a large share of the profits of host profits are owned by the source, such a subsidy to FDI would be counterproductive.

Furthermore, when $\gamma = \beta$, the optimal source policy is a tax: when the source has equal ownership in the profits of all firms, it prefers to discourage outward FDI because it can gain from the increased host profits from restricting FDI, but it receives no benefit from raising wages abroad. The outputs of all firms remain positive under the policy σ_c^* iff $\beta < \bar{\beta}_c \equiv (2r+1)/(2r+2)$ where $\bar{\beta}_c$ is found by substituting $\tilde{\sigma}_c^*$ from Eq. (28) into y^* from Eq. (10) and solving $y^* > 0$ for β .

Cross-ownership shares are typically not that large: Dick (1993) provides measures of cross-ownership for the U.S. that correspond to $\beta=3.36\%$ and

$\gamma=86\%$. Note well that $3.36\% \ll \bar{\beta}_c$ as $\beta < 1/2$ is sufficient for any $0 < r < \infty$ and only $\beta < 3/4$ is required for $r=1$. Thus we proceed under the assumption that $\beta < \bar{\beta}_c$.

How does the existence of cross-ownership affect the optimal source subsidy to outward FDI? From Eqs. (17) and (28), the optimal source subsidy under cross-ownership is lower than the optimal subsidy under no cross-ownership.

$$\sigma_c^* - \sigma^* = - \frac{\psi K(f+1)[(2r+1)(1-\gamma) + \beta f]}{2fM[1-\gamma + (1-\beta)f]} < 0 \tag{29}$$

Therefore, cross-ownership shrinks the level of the optimal outward FDI subsidy.

How does the optimal subsidy vary with the extent of cross-ownership? As the source share of source firms rises, the optimal subsidy increases

$$\frac{\partial \sigma_c^*}{\partial \gamma} = \frac{\psi K(f+1)[2r+1-2\beta(r+1)]}{2M[1-\gamma + (1-\beta)f]^2} > 0 \tag{30}$$

as the last term in the numerator is positive due to the assumption that source ownership of host firms is not too large $\beta < \bar{\beta}_c$. Thus a source subsidy to outward FDI increases in the source share of source profits. Similarly, as the source share of host profits rises, the optimal subsidy decreases

$$\frac{\partial \sigma_c^*}{\partial \beta} = - \frac{\psi K(f+1)[2(r+1)(1-\gamma) + f]}{2M[1-\gamma + (1-\beta)f]^2} < 0 \tag{31}$$

Since a source subsidy to FDI shifts profits away from host firms, the incentive for such a subsidy declines as source ownership of host firms increases.

Proposition 7. *The optimal source subsidy to outward FDI under cross-ownership is smaller than the optimal subsidy under no cross-ownership. The optimal source subsidy increases with the source share of source profits (γ) and decreases with source share of host profits (β).*

4.3. Optimal host policy with cross-ownership

Suppose the source government does not subsidize outward FDI, and the host government considers whether subsidizing inward FDI would improve host welfare. Foreign welfare with cross-ownership is

$$\tilde{W}_c = (1-\beta)M\Pi + (1-\gamma)m\pi + ZK - S \tag{32}$$

Under $\beta=0$ and $\gamma=1$, host welfare reduces to Eq. (19). How is the analysis altered relative to the case of no cross-ownership? Differentiating host welfare with respect to the subsidy level and solving for the optimal inward FDI subsidy gives

$$\begin{aligned} \tilde{\sigma}_c^* &\equiv \frac{\psi K[2f(\beta - \gamma)(r + 1) + r(f + 1)]}{2fM(\gamma + \beta f)} > 0 \Leftrightarrow \gamma - \beta \\ &< \frac{1}{2} \left(\frac{r}{f}\right) \left(\frac{f + 1}{r + 1}\right) \end{aligned} \quad (33)$$

Under what conditions is the above inequality satisfied? The host has an incentive to subsidize inward FDI whenever β is not too small relative to γ (whenever source ownership of host firms is not too small relative to source ownership of source firms). If β is not too small, then the losses incurred by host firms due to inward FDI subsidies do not affect host welfare substantially whereas all of the increase in labor earnings are captured by the host. When $\beta = \gamma$ (so that the source has equal ownership in both countries), the above condition clearly holds and the host prefers to subsidize inward FDI.

The optimal subsidy $\tilde{\sigma}_c^*$ is consistent with positive output levels of all firms iff $\gamma > \underline{\gamma}_c \equiv (1/2)(r/(r + 1))$ where $\underline{\gamma}_c$ is found by solving $\tilde{\sigma}_c^* < \bar{\sigma}$ from Eqs. (33) and (13) for γ (equivalent to substituting $\tilde{\sigma}_c^*$ into Y^* and solving $Y^* > 0$ for γ). As before, we impose this assumption. In this case, γ being sufficiently large is the range where host ownership of source firms is sufficiently small, consistent with extents of cross-ownership that are not too large.

We next explore the properties of the optimal inward FDI subsidy under cross-ownership. The optimal inward subsidy increases with the source share of host firms

$$\frac{\partial \tilde{\sigma}_c^*}{\partial \beta} = \frac{\psi K(f + 1)[(2\gamma(r + 1) - r)]}{2M(\gamma + f\beta)^2} > 0 \quad (34)$$

since $\gamma > \underline{\gamma}_c$. This finding accords well with intuition: a bigger β means that profits of host firms matter less to the host. Thus, the bigger β is, the stronger the incentive for the host to increase labor earnings by promoting FDI. Further, the optimal inward subsidy decreases with the source share of source firms.

$$\frac{\partial \tilde{\sigma}_c^*}{\partial \gamma} = - \frac{\psi K(f + 1)[(2f\beta(r + 1) + r)]}{2fM(\gamma + f\beta)^2} < 0$$

The larger the source ownership in source firms, the smaller the benefit of increasing source profits to the host.

Proposition 8. *Under cross-ownership, the host can increase welfare by subsidizing inward FDI. The optimal subsidy to inward FDI decreases with source ownership of source firms (γ) and increases with the source ownership of host firms (β).*

Just as in the no cross-ownership case, world welfare is independent of subsidy levels so the root of the mutual conflict is clear: a subsidy by the host government

always hurts source welfare. From Eqs. (28) and (33), if $r=f$, then the region over which the source country prefers a subsidy is exactly the region over which the host country prefers a tax to inward FDI.

5. Conclusion

We construct a model that examines the welfare consequences of FDI across countries. We argue that by shifting labor demand across countries and raising the wage in the host at the expense of the wage in the source, FDI not only benefits host workers at the expense of source workers, it also reduces profits of host firms by raising wages abroad. Thus, a tension arises between worker interests and firm profits in the two countries. In the base model, the source subsidy to outward FDI always hurts host welfare. Similarly, the host tax on inward FDI always hurts source welfare.

However, if a substantial share of the ownership of host firms lies with a third country, a subsidy to inward FDI by the host may also benefit the source since increased FDI lowers the costs of source firms (both due to the subsidy and due to the reduction in source wage that results from shifting production abroad). Further, since part of the ownership of host firms now lies with the third country, such policies improve host welfare at the expense of the third country.

We also examine the case of cross-ownership of firms. In the presence of cross-ownership of firms, subsidies to inward FDI can raise host welfare. By encouraging the shifting production into its economy, the host government raises host wages while hurting host profits. However, cross-ownership reduces the loss in profits thereby allowing the wage effect to dominate.

Ultimately, this paper has provided *an argument for strategic FDI policies* that persists in situations where shared factor markets impinge on the effectiveness of export subsidies. While shared factor markets work against the efforts of export subsidies designed to make source oligopolists more aggressive in competing against host firms, shared factor markets facilitate the effects of FDI subsidies.

Ever since Eaton and Grossman (1986), it is widely recognized that the nature of the optimal policy is quite sensitive to the assumptions related to market conduct. How would our results change if firms competed in prices rather than quantities? In the presence of resource constraints, our FDI policies function under Bertrand behavior (with imperfect substitutes to maintain profits) in essentially the same manner as for Cournot behavior. Thus our results regarding strategic FDI policy are not only robust to the presence of multiple symmetric industries that share a common factor but also to the behavior of firms.

In companion papers, we pursue the interrelations between multiple country groupings. This work emphasizes the crowding out effects of FDI from one source on FDI from another source into the same host and also the effects of FDI into one host contracting FDI from the same source into another host. This analysis

provides insights into the competition between similar countries for FDI, a prevalent phenomenon.

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Appendix 1

Our key results go through even when firms behave as Bertrand competitors.

Bertrand equilibrium analysis

To ease exposition, we derive our results for the case of n duopolies, each facing the demand functions

$$p_S = a - q_S - sq_H$$

$$p_H = a - sq_S - q_H$$

where q_i is the output and p_i the price of firm i , $i \in \{S, H\}$ for source and host respectively. The parameter $s \in [0, 1]$ represents the substitutability of the products: the two products are homogeneous if $s=1$ and completely unrelated if $s=0$. As noted in Dixit (1979), the above demand system can be derived from utility maximization when the representative consumer's utility is given by

$$U = a(q_H + q_S) - \frac{q_H^2 + q_S^2 + sq_Hq_S}{2} + x$$

where x is some numeraire good. Rewrite the demand system in terms of quantities as

$$q_S = \frac{a}{1+s} - \frac{1}{1-s^2} p_S + \frac{s}{1-s^2} p_H$$

$$q_H = \frac{a}{1+s} + \frac{s}{1-s^2} p_S - \frac{1}{1-s^2} p_H$$

According to the Bertrand assumption, each firm i chooses its price p_i to maximize its profits

$$\pi_i = [p_i - c_i] \left[\frac{a}{1+s} - \frac{1}{1-s^2} p_i + \frac{s}{1-s^2} p_j \right]$$

given the price of the other firm p_j , where the marginal costs of production are $c_S \equiv \alpha z + (1-\alpha)(Z-\sigma) = z$ and $c_H \equiv Z$. Solving the above problem yields the following first order condition:

$$p_i = \frac{a(1-s) + c_i + sp_j}{2}$$

Solving for the equilibrium prices yields

$$p_i = \frac{a(1-s) + c_i}{2-s}$$

As in the Cournot case, imposing the resource constraints (in per industry terms) $(1-\alpha)y_S = k$ and $\alpha y_S + y_H = K$ and the FDI equilibrium condition $z = Z - \sigma$ gives the equilibrium extent of FDI

$$\alpha^* = \frac{K(1-r)(1-s)(2+s) + \sigma}{K(1+r)(1-s)(2+s) + \sigma}$$

the source wage

$$z^* = a - \frac{1}{2} [K(1+r)(2-s)(1+s) + \sigma]$$

and the host wage

$$Z^* = a - \frac{1}{2} [K(1+r)(2-s)(1+s) - \sigma]$$

In the absence of any subsidies to FDI, $\alpha_0 = (1-r)/(1+r)$ so we require $r < 1$ by the labeling of the countries as host and source. This condition is the same as required for the Cournot case (but $f=1$ here so $f > r \Leftrightarrow r < 1$). Now we can consider optimal FDI policies: we discuss each scenario in turn, pointing out the underlying similarity between the two cases.

Optimal source policy

Maximizing source welfare yields the optimal source policy

$$\sigma^* = \frac{K(1-s)(2+s)(sr+r-1)}{3+s}$$

The source subsidizes outward FDI iff

$$r > \frac{1}{1+s}$$

Recall that $0 < r < 1$ and $0 < s < 1$. When s is small, each producer is essentially a monopolist since the products are highly differentiated. Consequently, the incentive for profit shifting is slight so that the incentive to raise domestic wages by taxing outward FDI dominates. The price level is now affected by the subsidy so world welfare is not exogenous. Hence, source welfare gains do not arise entirely from host welfare losses.

Optimal host policy

Maximizing host welfare yields the optimal host policy

$$\tau^* = \frac{Ks(1-s)(2+s)(1-r+s)}{s+3} > 0$$

As under the Cournot case, the host taxes inward FDI. The difference is that now the host may impose its optimal tax since the tax that shuts down FDI completely may be bigger than τ^* . It is easy to show that this maximum tax is $\tau_{\max} = K(1-s)(2+s)(1-r) > 0$.

Optimal host policy with external ownership

The optimal host policy when β of its profits belong to a third country is

$$\sigma_E = - \frac{K(1-s)(2+s)[1+s-r-\beta(1+r)(1+s)]}{2+(1+\beta)(1+s)}$$

The host chooses to subsidize inward FDI iff a substantial enough share of its firms are owned by the third country.

$$\beta > \beta_E \equiv \frac{1+s-r}{(1+r)(1+s)}$$

For s small, the host subsidizes inward FDI even when β is small. When s is small, profit shifting incentive disappears (firms are almost monopolies) and the wage incentive dominates.

Optimal source policy with cross-ownership

The optimal source policy with cross-ownership is

$$\sigma_C^* = \frac{K(1-s)(2+s)[2+s+(1+r)(1+s)(\beta-\gamma)]}{(\beta+\gamma)(1+s)-2(2+s)}$$

The source country subsidizes outward FDI iff source ownership of host firms is sufficiently slight

$$\beta < \beta_c \equiv \gamma - \frac{2 + s}{(1 + r)(1 + s)}$$

Once again we obtain a condition quite analogous to the one obtained for the Cournot case. The properties of the optimal policy with respect to the extent of cross-ownership remain the same $(d\sigma_c^*)/(d\gamma) > 0$ and $(d\sigma_c^*)(d\beta) < 0$.

Optimal source policy with cross-ownership

The optimal host policy with cross-ownership is

$$\tilde{\sigma}_c = \frac{K(1 - s)(2 + s)[r(2 + s) + (1 + r)(1 + s)(\beta - \gamma)]}{2 + (\gamma + \beta)(1 + s)}$$

The host subsidizes inward FDI iff source ownership of host firms is substantial enough

$$\beta > \tilde{\beta}_c \equiv \gamma - \frac{r(2 + s)}{(1 + r)(1 + s)}$$

Again the result corresponds quite well to the Cournot case. The optimal policy has the same sensible properties with respect to the extent of cross-ownership: $(d\tilde{\sigma}_c^*)/(d\gamma) < 0$ and $(d\tilde{\sigma}_c^*)(d\beta) > 0$.

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