

Exporting versus Direct Investment under Local Sourcing

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Abstract: This paper examines a setting where foreign direct investment (FDI) shifts demand for an intermediate good from the source to the host country. A domestic and a foreign firm choose between exports or FDI, always sourcing the intermediate locally. We show that by increasing the price of the intermediate, outward FDI can act as a *cost-raising strategy* for a firm and that attracting FDI can raise host country welfare. Two-way FDI is the equilibrium when the countries have similar market sizes. However, such FDI reduces global welfare relative to two-way exporting since it eliminates indirect competition between suppliers. JEL no. F12, F13, F23, L13

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1 Introduction

This paper develops a model of intraindustry trade and investment that focuses on the interaction between oligopolistic producers of intermediate and final goods. We determine the effects of FDI in the downstream market on the prices of intermediate and final goods, the profits of producers of these goods, and welfare. The model sheds light on several important questions: Is welfare highest when downstream markets are served through FDI? Do countries have an incentive to induce FDI (such as through a subsidy to

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inward FDI) in order to generate local sourcing? If so, how do such policies affect world welfare?

Many oligopolistic industries are vertically linked to other oligopolistic industries (Roy and Viaene 1998). Most modern manufacturing relies on services such as telecommunications and accounting. Explicitly modeling the vertical aspects of production helps shed light on the causes and effects of FDI in such industries.

Our model is built on the central idea that the decision to export or engage in FDI by producers of final goods alters the demand conditions facing suppliers of intermediates. Due to the increase in the price of the intermediate, outward FDI can act as a *cost-raising strategy* (Salop and Scheffman 1983). If its foreign rival opts for exports, FDI by a firm imposes a greater disadvantage on the rival since the rival sources its intermediate entirely from its local supplier. Inward FDI may induce the local firm to invest abroad in order to escape the increase in the price of the local intermediate. That such a strategic link may exist between inward and outward FDI is a novel insight provided by our model.

Chen et al. (2004) have made a related point about strategic outsourcing. They show that a domestic firm facing competition from a foreign firm might opt to purchase an intermediate from abroad at a higher price than the cost at which it can produce the intermediate itself. A key difference between our models is that we consider competition in both the domestic and foreign markets and can therefore show that outward FDI by the domestic firm can lead the foreign firm to invest into the domestic market (two-way FDI). Also, our focus is on the role of relative market size of the two countries rather than on the magnitude of tariffs.

Our model exhibits the empirically supported property that two-way FDI is the equilibrium when the two countries have similar market sizes (Brainard 1997 and Markusen 1995). We provide an alternative explanation for two-way FDI that does not rely on fixed costs. In our model, the attraction of FDI is not monotone in the size of the foreign market, unlike conventional models of horizontal FDI. On the one hand, FDI into a bigger market is attractive because total trade costs increase with the magnitude of exports. On the other hand, the increase in the relative price of the host country intermediate that occurs due to FDI depends positively on the relative size of the host country market and works against the lure of a bigger market size.

Another interesting feature of our model is that two-way FDI between countries effectively *ends indirect competition* between suppliers of intermediates. As a result, two-way FDI reduces world welfare relative to two-way

exporting. Finally, while inward FDI raises domestic welfare, such gains are always at the expense of welfare in the source country.

The paper is organized as follows. Section 2 describes our model. Section 3 provides an analysis of two-way exporting. Sections 4 and 5 analyze one-way and two-way FDI. Section 6 considers robustness and compares our model to existing work. Section 7 concludes.

2 Model

Consider two segmented markets: home (h) and foreign (f). A domestic firm and a foreign firm produce a final good y . Producing one unit of the final good y requires one unit of an intermediate good (or service) z . Let the per unit trade cost of good y be given by τ . Clearly, this trade cost creates a force in favor of FDI relative to exporting. The (inverse) demand curve for the final good y in country j is $p_j = \alpha_j - x_j$. The intermediate z is also produced by a monopolist in each country. The price of the intermediate in country j is w_j . We refer to the intermediate producers as *suppliers* and the final good producers as *downstream firms* or just firms.

We study a three-stage game. In the first stage, firms simultaneously decide how to serve the market abroad: each can sell abroad either through exporting or by producing the good abroad through FDI. Next, the domestic and foreign suppliers choose their prices simultaneously. Finally, firms choose their quantities and consumption occurs.

We assume that firms source the intermediate z locally—while exporting, a firm buys the intermediate from the supplier in its own country, whereas under FDI, it sources from the supplier abroad. This *local sourcing* assumption captures the idea that inward FDI in the production of the final good creates demand for the local supplier. This demand effect may be one reason why many countries impose domestic content requirements on multinationals.

Most manufactured goods require multiple intermediates for production, many of which are tradable to some degree. What is important for the logic underlying our model is that producers source *some* intermediates locally due to policy measures or constraints imposed by the nature of production technologies. Production almost always requires some nontradable inputs. As long as tradable intermediates are complementary to those sourced locally, the effects our model captures will persist (Section 6.1 has more on this issue). More generally, for the effects captured by our model

to be relevant, suppliers of intermediates must have some degree of market power and the final good under question needs to be an important source of demand for the intermediates.

We consider market competition under two-way exporting, one-way FDI, and two-way FDI in turn. Let the output supplied by firm i in market j be x_{ij}^k , where $i \in \{h, f\}$ denotes the domestic and the foreign firm and $j \in \{h, f\}$ denotes the home or the foreign market. The superscript k where $k \in \{\varepsilon\varepsilon, \phi\phi, \varepsilon\phi, \phi\varepsilon\}$ denotes the mode through which the two firms serve the two markets. Under $\varepsilon\varepsilon$, both firms export; under $\phi\phi$ both do FDI; under $\varepsilon\phi$ ($\phi\varepsilon$) the home (foreign) firm exports whereas the foreign (home) firm conducts FDI. While often observed in practice, no firm chooses to simultaneously export and engage in FDI in our model. We now derive equilibrium modes of supply. All derivations not reported below are provided in the Appendix.

3 Two-Way Exporting

Under intraindustry trade, both firms export to each other's markets (as in Brander and Krugman 1983) and source the intermediate from suppliers in their own country. Cournot competition in the downstream market implies that the derived demand curves facing the home and foreign suppliers are $x_i^{\varepsilon\varepsilon} \equiv \sum_j x_{ij}^{\varepsilon\varepsilon}$, where

$$x_{ij}^{\varepsilon\varepsilon} = \frac{\alpha_j - w_j - w_{-j} - \tau}{3}. \quad (1)$$

Since one unit of the final good requires one unit of the intermediate and all downstream production is locally sourced, the quantity produced by suppliers equals that produced by downstream firms. The two suppliers simultaneously choose their prices to maximize their respective profits: $v_j = w_j x_j^{\varepsilon\varepsilon}$. The first order condition for supplier j is $8w_j = \alpha_w + 2w_{-j} - \tau$, where $\alpha_w = \alpha_h + \alpha_f$ is a measure of the world market size.

This condition highlights an important property of our model. While suppliers do not directly compete with one another, they nevertheless are in *indirect* competition with each other. Each supplier's price directly affects the cost of any firm that sources from it, and therefore affects its market share. For example, if the domestic supplier increases its price, the domestic firm's cost increases and it loses market share to the foreign firm. As a result, the demand curve facing the foreign supplier shifts outward, and the foreign

supplier increases its price (although it does not match the domestic firm's price increase).

Simultaneously solving the first-order conditions of the two suppliers yields the equilibrium price of the intermediate:

$$w_j^{\varepsilon\varepsilon} = \frac{\alpha_w - \tau}{6}. \quad (2)$$

Despite the fact that intermediates are nontraded and sourced locally and market sizes may differ across countries, under two-way exporting the equilibrium price of the intermediate is the *same* in the two countries. Downstream firms sell in both markets so the derived demand curve facing suppliers is the same in both markets.

The equilibrium profit of the domestic firm is found by making appropriate substitutions into:

$$\pi_h^{\varepsilon\varepsilon} \equiv (p_h - w_h^{\varepsilon\varepsilon})x_{hh}^{\varepsilon\varepsilon} + (p_f - w_h^{\varepsilon\varepsilon} - \tau)x_{hf}^{\varepsilon\varepsilon}. \quad (3)$$

An analogous expression applies for the foreign firm's profits under two-way exporting $\pi_f^{\varepsilon\varepsilon}$.

4 One-Way FDI

We now examine the first stage of the game where both firms choose their mode of supply. We begin with the scenario where both firms are exporting and consider whether one of the firms has an incentive to switch to direct investment. We focus on the case where the domestic firm considers FDI in the foreign market.

4.1 Unilateral FDI Incentive

Define the home firm's *unilateral incentive for FDI* as the difference between its profits from FDI versus exporting when its rival is exporting:

$$u_h \equiv \pi_h^{\phi\varepsilon} - \pi_h^{\varepsilon\varepsilon}. \quad (4)$$

Similarly, the foreign firm's unilateral incentive for FDI is $u_f \equiv \pi_f^{\varepsilon\phi} - \pi_f^{\varepsilon\varepsilon}$. Recall that under FDI, the home firm sources the intermediate from the foreign supplier. Thus, the derived demand facing the domestic supplier is

obtained from the output produced by the domestic firm in the domestic market

$$x_h^{\phi\varepsilon} \equiv x_{hh}^{\phi\varepsilon} = \frac{\alpha_h - 2w_h + w_f + \tau}{3}, \quad (5)$$

whereas the derived demand curve facing the foreign supplier is obtained from the output produced by the foreign firm (for both markets) as well as the output produced by the domestic firm under FDI (in the foreign market) $x_f^{\phi\varepsilon} \equiv x_{hf}^{\phi\varepsilon} + x_{ff}^{\phi\varepsilon} + x_{fh}^{\phi\varepsilon}$, where

$$x_{hf}^{\phi\varepsilon} + x_{ff}^{\phi\varepsilon} = \frac{2(\alpha_f - w_f)}{3}, \quad x_{fh}^{\phi\varepsilon} = \frac{\alpha_h + w_h - 2(w_f + \tau)}{3}. \quad (6)$$

Suppliers choose their prices to maximize own profits and the first-order condition for the home supplier is $4w_h = \alpha_h + w_f + \tau$, whereas that for the foreign supplier is $8w_f = 2\alpha_f + \alpha_h + w_h - 2\tau$. Once again, the first-order conditions imply upward sloping reaction functions: an increase in the price charged by one supplier causes the other to raise its price. These first-order conditions are easily solved for the equilibrium prices of the intermediate good:

$$w_h^{\phi\varepsilon} = \frac{9\alpha_h + 2\alpha_f + 6\tau}{31}, \quad w_f^{\phi\varepsilon} = \frac{5\alpha_h + 8\alpha_f - 7\tau}{31}. \quad (7)$$

The equilibrium profits of suppliers and downstream firms, and the unilateral incentive for FDI (4) can then be calculated.

PROPOSITION 1. *Suppose markets are symmetric ($\alpha_h = \alpha_f = \alpha$). Outward FDI by the domestic firm raises the price of the intermediate in both markets. Profits of the foreign supplier rise due to FDI by the domestic firm while those of the domestic supplier may rise or fall. Profits of the foreign firm fall.*

FDI creates a divergence in the price of the intermediate in the two markets. The domestic firm's decision to move production abroad shifts out the demand curve facing the foreign supplier while shifting in the demand curve facing the domestic supplier. The change in demand conditions facing suppliers suggests that the price of the intermediate in the domestic market should fall, so why does it rise instead? In addition to the *demand effect* described above, FDI also has a *strategic effect* that works as follows. The demand effect shifts the foreign supplier's reaction function outwards, causing the foreign supplier to raise its price. But since the domestic supplier's

price is an increasing function of the foreign supplier's price, the domestic supplier raises its price too, despite a reduction in demand for its product.

The foreign supplier is better off due to increased demand and the higher equilibrium price. Whether or not the domestic supplier loses from outward FDI depends upon whether the demand effect dominates the strategic effect. The increase in the price of the intermediate makes the foreign firm worse off by raising its cost.

The domestic firm anticipates the impact of its FDI decision on the price of the intermediate in both markets and takes this impact into account when making that decision. As the foreign market size increases, the price of the foreign intermediate increases *faster* than that of the domestic intermediate thereby weakening the unilateral incentive for FDI. Let

$$w^{\phi\epsilon} \equiv \frac{w_f^{\phi\epsilon}}{w_h^{\phi\epsilon}} = \frac{5\alpha_h - 7\tau + 8\alpha_f}{9\alpha_h + 6\tau + 2\alpha_f} \quad (8)$$

describe the foreign relative to the domestic price of the intermediate. Under one-way FDI, the relative price of the foreign intermediate is strictly increasing in the foreign market size

$$\frac{\partial w^{\phi\epsilon}}{\partial \alpha_f} = \frac{62(\alpha_h + \tau)}{(9\alpha_h + 6\tau + 2\alpha_f)^2} > 0. \quad (9)$$

The demand-shifting effects of FDI drive this property, which is central to the model. Demand for the foreign intermediate comes from the foreign firm's sales in both markets and the domestic firm's sales in the foreign market, whereas demand for the domestic intermediate comes from only the domestic firm's sales in the domestic market. So as the size of the foreign market increases, demand for the foreign intermediate rises relative to demand for the domestic intermediate. The resulting increase in the relative price of the foreign intermediate affects the incentives for FDI of *both* firms.

PROPOSITION 2. *The firm from the country with the smaller market has the stronger unilateral incentive for FDI: $u_h \geq u_f$ iff $\alpha_f \geq \alpha_h$.*

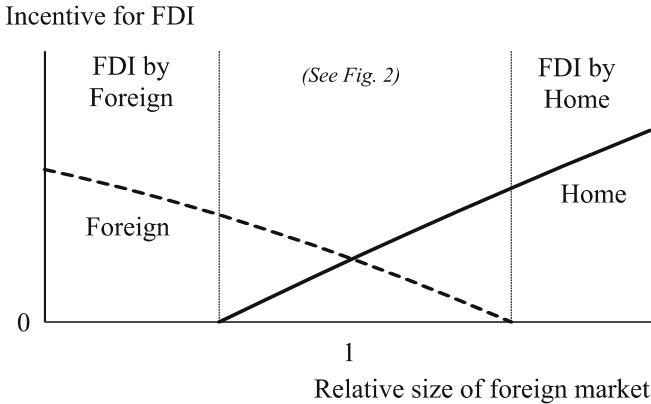
$$u_h - u_f = \frac{2(\alpha_f - \alpha_h)(98\alpha_w + 2911\tau)}{8649} > 0 \text{ iff } \alpha_f \geq \alpha_h.$$

Comparing α_f to α_h indicates relative market size because for a given price, quantity demanded will be greater in the foreign market than in the domestic market iff $\alpha_f \geq \alpha_h$.

FDI can be in the interest of a firm for two reasons. First, FDI economizes on trade costs. Second, since the foreign intermediate becomes relatively more expensive (9), FDI by the home firm causes a larger cost increase for the foreign firm, whose exports to the home market decline as a result. In other words, *outward FDI can help a firm defend its home turf by acting as a cost raising strategy*. The firm exporting to the bigger market has a stronger incentive to economize on trade costs and also gains more from the cost raising effect of FDI so that it has a stronger unilateral incentive for FDI.

Figure 1 plots the unilateral incentives for FDI of the two firms as a function of the relative size of the foreign market $r \equiv \alpha_f/\alpha_h$. The downward sloping curve **Foreign** plots the unilateral incentive of the foreign firm whereas the upward sloping curve **Home** plots the unilateral incentive of the domestic firm. When the foreign market is similar in size to the domestic market, unilateral incentives for FDI are positive for both firms. When the markets are of the same size $r = 1$, the incentives are equal $u_h = u_f$ due to symmetry.

Figure 1: *Unilateral FDI Incentives*



4.2 Welfare Effects

How does outward FDI impact consumers and domestic welfare in both countries? Define country j 's welfare $\omega_j^{\phi\varepsilon}$ (under mode $\phi\varepsilon$) as the sum of the profits of the domestic firm, the profits of the domestic supplier, and consumer surplus:

$$\omega_j^{\phi\varepsilon} \equiv \pi_j^{\phi\varepsilon} + v_j^{\phi\varepsilon} + cs_j^{\phi\varepsilon}. \tag{10}$$

Domestic consumers are hurt by outward FDI due to the strategic effect in the supplier market—as both suppliers increase their prices, downstream firms decrease output and price of the final good increases.

PROPOSITION 3. Suppose markets are symmetric ($\alpha_h = \alpha_f = \alpha$). FDI by the domestic firm raises the downstream price in the domestic market and also raises the price abroad iff the market is large enough $\alpha > \underline{\alpha}$. Domestic welfare declines but foreign welfare rises. Furthermore, world welfare declines relative to two-way exporting.

Why does foreign welfare increase? Proposition 1 indicates that part of the increase in profits of the foreign supplier comes at the expense of the foreign firm, which suffers from an increase in the price of the intermediate. However, the increase in the foreign supplier's profits that comes due to an increase in demand (at the expense of the domestic supplier) is a pure gain for the foreign country.

Given the effects of FDI, a natural question is whether there is any rationale for FDI inducing policies when FDI results in local sourcing. Suppose that the domestic firm is just unwilling to do FDI into the foreign market. If the foreign government makes a transfer to the domestic firm (such as a subsidy conditional on FDI), then both the foreign country and the domestic firm can be made better off. Thus, the model suggests that the favorable treatment being offered to multinationals in many countries may stem from the desire to raise welfare by benefiting suppliers of intermediates. However, global welfare suffers: while host country welfare improves, source country welfare and world welfare declines.

5 Two-Way FDI

We next analyze the situation where both firms conduct FDI. The following analysis considers the scenario where one of the firms chooses direct investment and determines whether the other firm has an incentive to switch to direct investment in response.

5.1 Competitive FDI Incentive

Suppose both firms do FDI in each other's markets. Then, the output sold in the domestic market by each firm is

$$x_{hh}^{\phi\phi} = x_{fh}^{\phi\phi} = \frac{\alpha_h - w_h}{3}, \quad (11)$$

and similarly for the foreign market

$$x_{ff}^{\phi\phi} = x_{hf}^{\phi\phi} = \frac{\alpha_f - w_f}{3}. \quad (12)$$

Demand facing the suppliers is then $x_h^{\phi\phi} \equiv x_{hh}^{\phi\phi} + x_{fh}^{\phi\phi}$ and $x_f^{\phi\phi} \equiv x_{ff}^{\phi\phi} + x_{hf}^{\phi\phi}$. The equilibrium upstream prices in the two markets are:

$$w_j^{\phi\phi} = \frac{\alpha_j}{2}. \quad (13)$$

Using these prices, profits of both suppliers and firms can be calculated. It is easy to show that at these prices, no firm has an incentive to simultaneously engage in exporting and FDI due to the presence of trade costs.

We now move back to the first stage of the game where the two firms choose their mode of serving the foreign market. Both firms choose between exporting and FDI simultaneously. We have already considered the home firm's unilateral incentive for FDI. Now define the foreign firm's *competitive incentive for FDI* as the difference between its profits from FDI versus exporting when its rival opts for FDI:

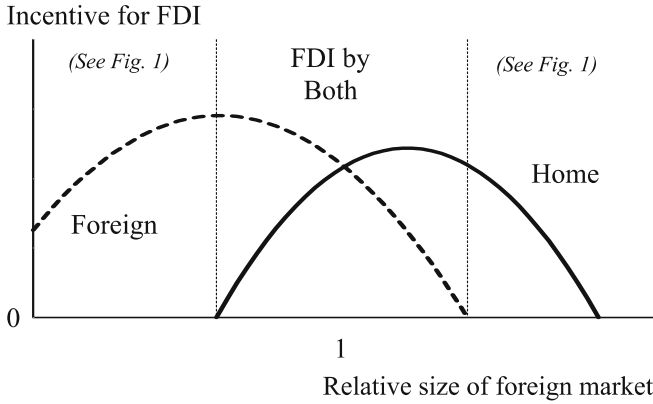
$$\Lambda_f \equiv \pi_f^{\phi\phi} - \pi_f^{\phi\varepsilon}. \quad (14)$$

Similarly, the home firm's competitive incentive for FDI is $\Lambda_h \equiv \pi_h^{\phi\phi} - \pi_h^{\varepsilon\phi}$. Two-way FDI is the equilibrium if neither firm has an incentive to switch to exporting given that the other firm has opted for FDI: $\Lambda_i > 0$ for $i = h, f$.

Figure 2 plots the competitive incentives for FDI against the relative size of the foreign market $r \equiv \alpha_f/\alpha_h$. The competitive incentive function Λ_h is denoted by **Home** and Λ_f by **Foreign**. Only when both curves are above zero is two-way FDI the equilibrium. Two-way FDI occurs when the market sizes in the two countries are sufficiently similar. Once again, the incentives are equal due to symmetry when $r = 1$.

To derive equilibrium FDI patterns, we need to combine our analysis of the unilateral and competitive incentives for FDI. When the foreign market is small relative to the domestic market, the domestic firm exports and the foreign firm choose FDI; when the two market sizes are similar, both firms do FDI, and when the domestic market is small relative to the foreign market, the domestic firm conducts FDI whereas the foreign firm exports.

Figure 2: *Competitive FDI Incentives*



PROPOSITION 4. *If trade costs are small relative to size of the world market, the firm from the country with the bigger market size has the stronger competitive incentive for FDI.*

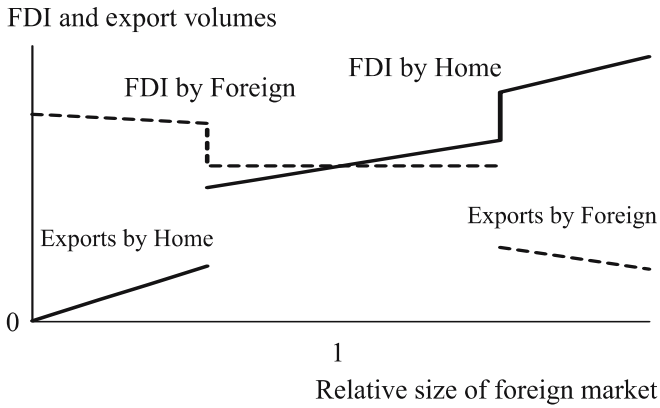
$$\Lambda_h - \Lambda_f = \frac{8(\alpha_h - \alpha_f)(25\alpha_w - 511\tau)}{8649}. \tag{15}$$

If $511\tau < 25\alpha_w$, then $\Lambda_h > \Lambda_f$ iff $\alpha_h > \alpha_f$.

Recall that the firm from the country with the smaller market size has a stronger unilateral incentive. The intuition for the difference is that FDI into the bigger country results into a sharp increase in the price of the intermediate produced there, thereby making production abroad more attractive. Thus, *inward FDI into the bigger country is more likely to force the firm from that country to do FDI into the smaller country.* Finally, the reason trade costs must be small for this result to hold is that if not, the firm exporting to the bigger market would have a stronger incentive to economize on trade costs and this incentive would dominate the cost-raising effect of FDI.

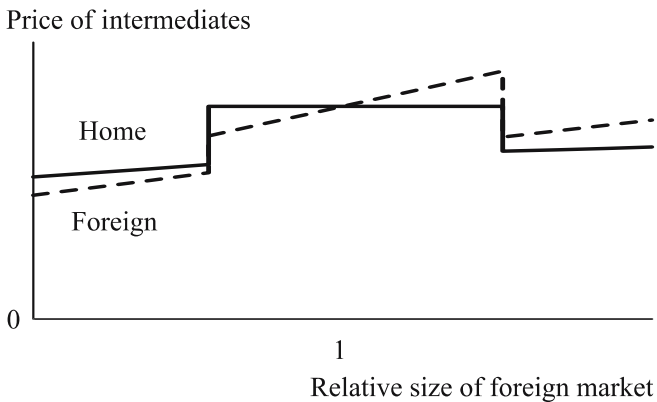
Figure 3 displays equilibrium exports and FDI sales of the two firms as a function of the relative size of the foreign market. The upward sloping line shows the sales of the home firm in the foreign market while the downward sloping line plots the sales of the foreign firm in the domestic market. These lines are discontinuous because the underlying mode of supply chosen by firms change with the relative size of the foreign market (Figures 1 and 2).

Figure 3: *FDI and Export Sales Volumes*



Initially, when the foreign market is relatively small (i.e., $r < 1$), the foreign firm chooses FDI while the home firm exports (i.e., the mode is $\varepsilon\phi$). Under this mode, as r increases, home exports increase whereas FDI sales of the foreign firm decrease: higher home exports lead to an increase in the price of the intermediate at home thereby penalizing the foreign firm's FDI sales since it sources the intermediate locally (see Figure 4 for the behavior of intermediate prices in the two markets). Once the foreign market size is of sufficient size (even though $r < 1$), the home firm switches to FDI and at the critical market size at which this mode switch occurs, the foreign firm's FDI sales in the domestic market drop by a discrete amount

Figure 4: *Price of Intermediates*



whereas the domestic firm's FDI sales jump up relative to its exports due to no longer having to pay the trade cost. The drop in FDI sales of the foreign firm obtains because the domestic firm's FDI has a strong cost-raising effect on the foreign firm due to the sharp increase in the price of the domestic intermediate (Figure 4) which occurs because the domestic firm's FDI causes a discrete increase in the price of the foreign intermediate and the prices of the two intermediates are strategic complements. Why does the upward jump in FDI sales of the domestic firm occur? To see why, first note that the domestic intermediate price is higher than the foreign intermediate under the regime $\varepsilon\phi$ and the regime $\phi\phi$ as long as $r < 1$. Given that, outward FDI by the domestic firm allows it to access the intermediate good at lower cost thereby causing a discrete upward jump from its exports to FDI sales. Finally, if the relative size of the foreign market continues to increase, we hit the range where the foreign firm prefers exporting and the domestic firm FDI. In this range, further increases in the relative size of the foreign market imply a decrease in foreign exports and an increase in domestic FDI sales abroad—once again foreign exports fall because the cost-raising effect of domestic FDI increases with the relative size of the foreign market.

5.2 Welfare Effects

Intuition suggests that two-way FDI increases competition between firms relative to one-way FDI since all trade costs are avoided. Such increased competition might then be expected to promote welfare. This intuition turns out to be incomplete since FDI increases competition in product market but *decreases* competition in the intermediate market. Two-way FDI *shields* suppliers in both countries from competition with each other since the two firms source the output intended for each market from the supplier in that market. In contrast, under exporting, suppliers of intermediates are forced to compete indirectly with each other since their choices impact competition between sellers.

PROPOSITION 5. *Relative to one-way FDI by the home firm, two-way FDI increases welfare at home, decreases welfare abroad, and decreases world welfare. Furthermore, relative to two-way exporting, welfare is lower under two-way FDI in both countries and hence also in the world.*

Domestic welfare improves because FDI by the foreign firm restores the demand curve facing the domestic supplier, whose profits increase. The for-

eign country suffers for the same reason: part of the surplus collected by the foreign supplier is transferred to the domestic supplier. Two-way FDI allows suppliers in both markets to exercise unbridled monopoly power whereas under exporting they are forced to compete indirectly. As a result, both countries are strictly worse off under two-way FDI than under two-way exporting.

6 Discussion

First, we comment on the scenario where production requires multiple intermediates, one of which can be sourced from either country (and is perfectly tradable) whereas the other must be sourced locally. Then we discuss the degree that our results might apply more generally. Finally, we further clarify the differences in our model relative to existing work.

6.1 *Traded Intermediates and Generality*

Suppose production of good y requires two intermediates: z_1 and z_2 , where the latter can be traded at zero cost whereas the former must be sourced locally. The first intermediate may be a service and the second a good. Such a scenario is probably more natural than a world of perfect or zero tradability of all intermediates. Suppose one unit of good z_1 and θ units of good z_2 are required to produce one unit of good y , where $\theta \geq 0$. When $\theta = 0$, this scenario reduces to our main model. Our results do not require that all intermediates be sourced locally, only that *one* must be. However, we do require that the two intermediates be complements: if they are substitutes, competition among suppliers of the tradable intermediate (z_2) in the two countries will indirectly imply competition in the market for intermediate z_1 . The implication of this indirect competition is that the price of intermediate z_1 will not respond as much as to FDI as it does in our main model.

Consider the decision of suppliers, given the modes of supply chosen by the two firms. Price competition implies that the equilibrium price of intermediate z_2 equals zero in both markets due to the zero marginal costs. The equilibrium prices of intermediate z_1 under alternative scenarios will be exactly those obtained in our main model. Consequently, all of our results go through without modification.

Clearly, our model is quite stylized and its logic rests on several key assumptions, at least two of which deserve further discussion. First, we do not allow for multiple firms at either stage of production in the absence of

trade or FDI. Second, we rule out vertical integration between firms and suppliers and only restrict attention to market interaction between them. Of course, the two assumptions are related: if market structure were nearly competitive at both stages of production, marginal cost pricing would prevail and vertical integration would offer no efficiency gains. However, in our duopoly setup, suppliers and firms set prices above their marginal costs and the market equilibrium suffers from the double marginalization problem. As is well known, this problem can be resolved by vertical integration, which ensures marginal cost pricing of the intermediate good. However, vertical integration has costs of its own and for simplicity we have kept the choice between vertical integration and market interaction between suppliers and firms outside the model.

We should note that the assumption of duopoly at the final good stage is rather reasonable since multinationals frequently operate in oligopolistic environments, and strategic considerations are best highlighted under duopoly. But the assumption that there is only one supplier in each market is on weaker grounds. What if the intermediate market was also oligopolistic? If so, for the logic of our model to go through, we would need to assume that suppliers compete in quantities as opposed to prices and that they not be excessively large in number. Under price competition, multiple suppliers would end up pricing at marginal cost, and inward or outward FDI would have no impact on prices of the intermediate good in the two markets. By contrast, under quantity competition, the forces captured by our model would remain relevant although the price response of the intermediate good to inward FDI would decrease with the number of suppliers.

One final point is worth noting: the key mechanism underlying our model is that FDI shifts derived demand for a nontraded intermediate across countries and this mechanism does not depend upon market structure. Thus, we argue that this insight should apply under a variety of conditions even though all of the effects highlighted by the model would not hold under a broad range of market structures.

6.2 Contrast to Related Literature

We extend the traditional exporting versus FDI models by allowing the prices of intermediates to respond to FDI. FDI models for oligopolistic industries include Horstmann and Markusen (1987, 1992) and Rowthorn (1992), and FDI with vertical linkages is addressed by Venables (1996),

Rodriguez-Clare (1996), and Markusen and Venables (1998). But these models do not consider FDI in vertically related oligopolistic industries; models with monopolistic competition in intermediates lack strategic interaction. Our model also helps merge the literature on FDI in oligopolistic markets with the literature on trade policy in vertically related industries, such as Sleuwaegen et al. (1998), Ishikawa and Lee (1997), Ishikawa and Spencer (1999), and Spencer and Jones (1991, 1992).

Our model shares some base assumptions with Roy and Viaene (1998): both models have oligopolistic upstream and downstream markets, CRS in production at both levels, and linear demand for the downstream good. Roy and Viaene examine the incentives to undertake FDI in the *upstream* market when downstream firms always buy the intermediate from abroad. By contrast, we examine the incentives to undertake FDI in the *downstream* market when downstream firms always buy the intermediate locally. Also, our FDI is *horizontal* in nature, whereas Roy and Viaene have *vertical* FDI, in which a downstream firm buys the intermediate from its upstream subsidiary abroad. Another important difference between our work and theirs is that our model addresses how firms choose to serve each other's markets.

Chen et al. (2004) emphasize the anticompetitive effects of outsourcing (buying an intermediate from abroad) in a model with differentiated final goods and sales only in the domestic market. There, the foreign supplier is an integrated firm and has an efficiency advantage in producing the intermediate. The domestic firm chooses whether to import the intermediate or produce it itself. The firms pick prices for the final goods. Also, outsourcing the intermediate involves transport costs, whereas FDI in the downstream market (with local sourcing) avoids them.

Rowthorn (1992) generates cross-investment between countries in an oligopoly without intermediates; the causes and consequences of FDI in our model are therefore fuller in nature as the effects on suppliers through the price of intermediates are addressed. Markusen and Venables (1998) also generate two-way FDI without intermediates. The mechanisms at work in our model bear some similarity to the literature on FDI and unionization, such as Lommerud et al. (2003), Straume (2003), Collie and Vandebussche (2005), Naylor (1998, 1999), Bughin and Vannini (1995), and Zhao (1995). Unions have market power, similar to the suppliers of intermediates, and both might be expected to capture some profits from forces that benefit producers of final goods, such as increases in the price of final goods (Ries 1993).

While our work shares some features with Collie and Vandenbussche (2005) and Zhao (1995), there are some important differences. For example, relative to Collie and Vandenbussche (2005), prices of intermediates in both countries are endogenous in our model and we derive equilibrium FDI regimes. Relative to Zhao (1995), in our model intermediate goods producers (unions in their context) choose prices *after* firms choose between exporting and FDI. Our model captures the view that FDI often carries a high degree of irreversibility and increases demand for local intermediates whereas the work of Zhao (1995) and of Bughin and Vannini (1995) captures the notion that FDI improves the bargaining position of firms with respect to unions.

Haaland and Wooton (1999) also examine the justification for attracting FDI when FDI generates demand for intermediates. Their model features agglomeration forces that can induce further entry, whereas in our model FDI makes any further FDI into the same country less attractive. Fosfuri and Motta (1999) argue that firms need not have preexisting advantages to become multinationals since firms may gain advantages through FDI. Wes (2000) considers a bilateral monopoly with trade but no FDI. Ekholm and Forslid (2001) construct a model in which congestion effects lead to the geographic dispersion of plants.

7 Conclusion

This paper develops a model in which the price of intermediates plays a crucial role in determining the incentives for FDI. Past analyses of the choice of exporting versus FDI have typically ignored the fact that multinationals source some intermediates locally (due to policy constraints or technological advantages) and that the prices of such intermediates respond to FDI.

Extending the scope of the traditional exporting versus FDI model by adding vertical structure yields several new insights. The switch from exporting to FDI can act as a cost-raising strategy. That FDI can confer such a strategic advantage is a unique aspect of our model. Also novel is the strategic link between inward and outward FDI: when one firm does FDI into another market, the increase in the intermediate's price can force the local firm to also opt for FDI over exporting.

The welfare implications of FDI in our framework are striking. While FDI improves welfare in the host country, welfare in the source country declines. Such a result nicely highlights the tension between host and source

countries. Our model provides an explanation for a policy of attracting FDI through incentives but warns that two-way FDI effectively ends competition between suppliers of intermediates and can be welfare-reducing relative to two-way exporting. The implication of these results is that a host country's chosen FDI policies (for example the use of domestic content requirements and incentives for FDI) may have deleterious consequences for source countries and for world welfare. The industrial organization of FDI, and in particular vertical interactions between firms and their suppliers, provides interesting new insights and deserves further study.

Appendix

Proof of Proposition 1

Imposing $\alpha_f = \alpha_h = \alpha$,

$$w_h^{\phi\epsilon} - w_h^{\epsilon\epsilon} = \frac{4\alpha + 67\tau}{186} > 0 \tag{16}$$

$$w_f^{\phi\epsilon} - w_f^{\epsilon\epsilon} = \frac{16\alpha - 11\tau}{186} > 0 \tag{17}$$

$$v_f^{\phi\epsilon} - v_f^{\epsilon\epsilon} = \frac{(140\alpha - 73\tau)(16\alpha - 11\tau)}{25947} > 0 \tag{18}$$

$$v_h^{\phi\epsilon} - v_h^{\epsilon\epsilon} = -\frac{1666\alpha^2 - 6220\alpha\tau + 313\tau^2}{25947} \text{ of ambiguous sign} \tag{19}$$

$$\pi_f^{\phi\epsilon} - \pi_f^{\epsilon\epsilon} = -\frac{4936\alpha^2 + 4280\alpha\tau + 49051\tau^2}{155682} < 0. \tag{20}$$

Proof of Proposition 3

Imposing $\alpha_f = \alpha_h = \alpha$,

$$p_h^{\phi\epsilon} - p_h^{\epsilon\epsilon} = \frac{10\alpha + 28\tau}{279} > 0 \tag{21}$$

$$p_f^{\phi\epsilon} - p_f^{\epsilon\epsilon} = \frac{16\alpha - 104\tau}{279} > 0 \text{ iff } \alpha > 6.5\tau \tag{22}$$

$$\omega_f^{\phi\epsilon} - \omega_f^{\epsilon\epsilon} = \frac{2396\alpha^2 + 1960\alpha\tau - 92626\tau^2}{77841} > 0 \tag{23}$$

$$\omega_h^{\phi\epsilon} - \omega_h^{\epsilon\epsilon} = \frac{-19706\alpha^2 + 71852\alpha\tau - 79883\tau^2}{77841} < 0. \tag{24}$$

Lastly, world welfare declines as a result of one-way FDI

$$\omega_f^{\phi\varepsilon} - \omega_f^{\varepsilon\varepsilon} + \omega_h^{\phi\varepsilon} - \omega_h^{\varepsilon\varepsilon} = \frac{-7457\alpha^2 + 37886\alpha\tau - 63098\tau^2}{77841} < 0. \quad (25)$$

Proof of Proposition 5

Imposing $\alpha_f = \alpha_h = \alpha$,

$$\omega_h^{\phi\phi} - \omega_h^{\phi\varepsilon} = \frac{1015\alpha^2 - 4980\alpha\tau - 1268\tau^2}{17298} > 0 \quad (26)$$

$$\omega_f^{\phi\phi} - \omega_f^{\phi\varepsilon} = \frac{-569\alpha^2 + 1848\alpha\tau - 1666\tau^2}{5766} < 0 \quad (27)$$

$$\omega_h^{\phi\phi} - \omega_h^{\phi\varepsilon} + \omega_f^{\phi\phi} - \omega_f^{\phi\varepsilon} = \frac{-346\alpha^2 + 1770\alpha\tau - 3133\tau^2}{8649} < 0 \quad (28)$$

$$\omega_f^{\phi\phi} - \omega_f^{\varepsilon\varepsilon} = \omega_h^{\phi\phi} - \omega_h^{\varepsilon\varepsilon} = -\frac{11\alpha^2 - 28\alpha\tau + 95\tau^2}{162} < 0. \quad (29)$$

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