

Multinationals

1 Alternatives

- A firm has three main choices of how to serve another market: 1) export, 2) license a firm there to produce, or 3) form a subsidiary there to produce.
- With FDI and licensing, production shifted abroad.
- With FDI the subsidiary is part of the multinational firm, whereas with licensing the licensee is a separate firm.
- Interests of licensee and licensor often clash: Opportunistic behavior occurs when a licensee takes an action that raises its own profits but lowers the profits of the licensor.

2 OLI Framework

- For FDI to be more attractive than licensing or exporting, a firm needs to have three advantages:
 1. Ownership advantage exists when the firm has patent or exclusive ability to do something well, so that the firm should sell to markets abroad.
 2. Locational advantage exists when tariffs, transportation costs or comparative advantage make exporting unattractive.
 3. Internalization advantage exists when imperfect contracts and opportunistic behavior make licensing unattractive, so all activities should occur within the firm.
- If only ownership and locational advantages exist, a firm licenses its technology to a local firm.
- If only ownership and internalization advantages exist, a firm exports.

3 Internalization

- Transactions are internalized due to complications of exchanging information between firms.
- With arms-length use of markets, one firm has to tell another firm its production secrets.
- Once the second firm has the knowledge necessary to produce the product, it may become a competitor.
- The licensee might not renew the contract at its conclusion and yet continue to sell, or might sell output in another market not permitted in the contract.
- How can a contract be constructed to extract the full profits from selling in the foreign market?

- Firms experience difficulty in writing complete contracts specifying actions and payoffs for all states of nature due to the vast number of states of nature.
- Even if it were possible to write complete contracts, then firms find it especially difficult to enforce contracts in an international arena.
- Other countries (especially developing countries) often do not enforce intellectual property rights as well as the United States and other developed countries.
- Most countries favor their own firms and thus imperfectly protect the interests of foreign licensors.
- An inherent conflict between firms' profits occurs unless profits are all in one firm.
- These informational and enforcement issues are central to modeling the formation of multinational firms.

4 Markusen JEP 1995

- FDI has grown rapidly, with a large share of world trade (30%) occurring within firms.
- Most FDI (70%) has developed countries as both the host and source countries, and much of this FDI is two-way.
- FDI is mostly horizontal, where multinationals create local production facilities in each country and sell most of their output within each country.
- This structure contrasts with vertical FDI, where multinationals allocate production processes across countries in accordance with factor intensity or other sources of comparative advantage.

- Multinational firms tend to arise in industries with large R&D expenditures relative to sales and substantial product differentiation.
- Thus multinational firms have substantial intangible assets (including brand recognition/reputation).
- Trade barriers and transport costs generate a substitution effect toward FDI while decreasing the overall level of both investment and trade.

5 Ethier QJE 1986

- Two countries: home and foreign (*)
- Two goods: wheat (W) and manufactures (M)
- Two factors: land (T) and labor (L), internationally immobile
- Land is specific to wheat production, while labor is used to produce both goods, earning the wage (w).

5.1 Wheat Production

- Land (T) and labor (L) produce wheat (W) according to the production function for wheat

$$W = F(L_W, T)$$

where L_W is labor allocated to the wheat sector.

5.2 Manufacturing Stages

- Manufacturing occurs in three stages:
 1. research,
 2. upstream production,
 3. downstream production.

5.3 Timing

- The timing is:
 1. Labor allocated between research and production.
 2. Research outcome realized.
 3. Quality levels chosen.

5.4 Research Stage

- Research determines variable costs for upstream production, the unit labor requirement a .
- Research outcome dictates whether costs will be high (a_H) or low (a_L), with $a_L < a_H$.
- Labor devoted to research R increases probability $p(R)$ that costs low $a = a_L$. Assume $p' > 0$ and $p'' < 0$.
- Cost of research is paying wage w to R units of labor hired: wR .
- Technology for producing manufactures (at high or low cost) provides an ownership advantage.
- That this ownership advantage is private information contributes to internalization advantage.

5.5 Upstream Stage

- Upstream varieties produced in different quality levels Q , where $0 \leq Q \leq \bar{Q}$ and \bar{Q} is the maximum quality.
- Given the wage w , the variable cost of producing one unit of manufactures of quality Q and any variety is aQw , which increases with quality Q based on research outcome $a \in \{a_L, a_H\}$.
- Given the research outcome a , the firm chooses its optimal quality choice as $Q_H = Q(a_H)$ when costs are high or $Q_L = Q(a_L)$ when costs are low ($Q_L > Q_H$).
- The expected cost of upstream production is thus

$$p(R)a_LQ_Lw + [1 - p(R)]a_HQ_Hw$$

where the first term represents the possibility that costs will be low and the second term the possibility that costs will be high.

5.6 Downstream Stage

- Nontraded downstream output creates locational advantage: production must be located where consumption is.
- Labor requirement q in downstream production is invariant to variety, quality and location.
- Consumers tastes identical across countries.
- One unit of each variety consumed worldwide: Domestic consumption fraction of manufactures μ , foreign fraction $1 - \mu$.
- Consumers view a unit of manufactures of quality Q as a perfect substitute for Q units of wheat.
- The cost of downstream production is qw_0 , where $w_0 \equiv \mu w + (1 - \mu)w^*$ is the average world wage (wages weighted by consumption shares).

5.7 Integrated Equilibrium

- Assume relative efficiency of labor across activities is the same across countries.
- Suppose firms are risk neutral and take the wage as given.
- We examine what happens when all activities are concentrated in one (multinational) firm.
- Denote the wage of an efficiency unit of foreign labor w^* and suppose the domestic wage is lower than the foreign wage $w < w^*$.
- A firm's expected revenue (prior to realization of the research outcome) is

$$p(R)Q_L + [1 - p(R)]Q_H \quad (1)$$

where the first term is revenue if low costs and the second term is revenue if high costs.

- $P_W = 1$ by normalization and $P_M(Q) = Q$ due to perfect substitutability.
- The firm's problem to pick labor allocated to research and qualities conditional on high or low cost research outcome $\{R, Q_H, Q_L\}$ to maximize expected profits

$$E\pi = p(R)Q_L(1 - a_L w) + [1 - p(R)]Q_H(1 - a_H w) - (wR + qw_0) \quad (2)$$

- The first two terms are revenues minus upstream costs (under low and high cost outcomes) and the last two terms are research costs and downstream costs. The parameters are $\{a_L, a_H, w, w^*, \mu, q\}$.
- The firm's optimal decision depends on wages and potential research outcomes.
- A firm may decide to never enter, always enter, or enter only if enjoy the good research outcome (low cost).

1. STATE INDEPENDENT NONENTRY (NEVER ENTER). If the wage exceeds even the highest possible marginal product

$$w > \frac{1}{a_L} > \frac{1}{a_H}$$

then profits would be negative even if the firm realized the best research outcome. Thus, the firm will never want to produce and will never conduct any research.

$$R = Q_L = Q_H = 0$$

2. STATE DEPENDENT ENTRY. If the wage exceeds the lower marginal product but not the higher marginal product,

$$\frac{1}{a_L} > w > \frac{1}{a_H}$$

then profits will be positive only if the firm realizes the best research outcome. Here research expenditure depends on the wage, and the firm produces only if it enjoys low costs as a result of its research.

$$R > 0, Q_H = 0, Q_L = \bar{Q} > 0$$

3. STATE INDEPENDENT ENTRY. If even the lower marginal product exceeds the wage,

$$\frac{1}{a_L} > \frac{1}{a_H} > w$$

then profits will be positive regardless of the research outcome. Here research expenditure does not depend on the wage.

$$R > 0, Q_H = Q_L = \bar{Q} > 0$$

Whether entry is state dependent generates reason to form multinational firms

5.8 Manufacturing Equilibrium

- Expected profits (2) must equal zero due to free entry.

- With state dependent entry ($Q_H = 0$) must have expected profits from low cost production be zero

$$E\pi = p(R)\bar{Q}(1 - a_L w) - (wR + qw_0) = 0$$

- With state independent entry must have expected profits from both types of production be zero

$$E\pi = \bar{Q} \{p(R)(1 - a_L w) + [1 - p(R)](1 - a_H w)\} - (wR + qw_0) = 0$$

$$E\pi = \bar{Q} \{1 - p(R)a_L w - [1 - p(R)]a_H w\} - (wR + qw_0) = 0$$

- Zero profit conditions give relationship between w and w^* through w_0 . Similarly, require zero foreign profits if research and upstream production more profitable there.

5.9 General Equilibrium

- Let n denote the number of (domestic) firms with research and upstream production at home and let n^* denote the number of (foreign) firms with research and upstream production abroad.
- Labor market equilibrium has domestic labor paid its value of marginal product in terms of wheat (note $P_W = 1$) $w = F_L(L_W, T)$, and similarly for foreign labor $w^* = F_L^*(L_W^*, T^*)$.
- These equations give relation between the domestic and foreign wages $\{w, w^*\}$ and either n^* (as $n = 0$ when $w > w^*$) or n (as $n^* = 0$ when $w < w^*$).
- Determines the domestic and foreign wage and the number of domestic or foreign firms.

5.10 International Equilibrium

- Both labor market equilibrium and manufacturing equilibrium must hold, creating three possibilities:
 1. $w < w^*$: all research and upstream production takes place at home $n > 0$ and $n^* = 0$
 2. $w > w^*$: all research and upstream production takes place abroad $n = 0$ and $n^* > 0$
 3. $w = w^*$: research and upstream production occur both at home and abroad $n \geq 0$, $n^* \geq 0$ and $n + n^* > 0$
- R&D and upstream production are located wherever costs are lower.
- The production process is vertically split across countries – called vertical FDI.

5.11 Arms-Length Contracting

- Now consider an arm's length contract between a research/upstream firm and two downstream firms (home, foreign).
- Contract replicates $\{R, Q_H, Q_L\}$ choices made by fully integrated firm.
- Downstream firms pay P per unit such that downstream firms earn zero profit.
- How much downstream firm can pay depends on success of research effort.
- Pays P_H for $a = a_H$ but P_L for $a = a_L$ where

$$P = p(R)P_L + [1 - p(R)]P_H$$

- The downstream firm cannot observe research expenditure R or success.
- Any contract must be incentive compatible to ensure upstream firm keeps its side of the deal. Payments

$$P_L = P + [1 - p(R)]Q_L$$

in the event of low cost research outcome and

$$P_H = P - p(R)Q_H$$

in the event of the high cost research outcome are incentive compatible.

5.12 Role of Multinationals

- State contingent contracts may be difficult to implement.
- Suppose arms length contracts cannot be state contingent.
- Forming a multinational firm is a way to avoid writing state contingent contracts.
- Joining firms brings their profit objectives in line, removing opportunistic temptations.
- Direct investment substitute for interindustry trade, compliment to intraindustry trade.
- Similar factor endowments gives rise to direct investment, possibly two-way.

6 Glass and Saggi JIE 1999

- Constructs a model that examines the consequences of FDI across countries.
- FDI shifts labor demand across countries.
- FDI raises wage in the host country and lowers the wage in the source country.
- FDI benefits host workers at the expense of source workers.
- FDI reduces profits of host firms by raising wages abroad.
- Thus, a tension arises between worker interests and firm profits in the two countries.

6.1 Model

The key assumptions of the model are (note symmetry):

- One factor, skilled labor, available in fixed supply in each country.
- $n \geq 1$ industries with homogeneous goods. All demand in a third country.
- One unit of each good is produced using one unit of skilled labor.
- m identical source firms and M identical host firms in each industry.
- Market for skilled labor is competitive. Firms take wage as given. The wage for skilled labor in the source country is z and in the host country is Z .

6.2 Output market

- Let y_j denote output of a representative source firm in industry j .
- Total industry output of source firms is my_j .
- Let capital letters denote the host.
- Output of a representative host firm in industry j is Y_j .
- 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 demand function in some third country be $P_j = p_j(Q_j)$ where $p'_j(Q_j) < 0$ and $p''_j(Q_j) \leq 0$.

6.2.1 FDI decision

- 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.

6.2.2 FDI subsidy

- Suppose source firms are offered a subsidy σ_j for each unit of output produced in host country.
- If $\sigma_j > 0$, subsidy acts like reduction in host wage for source firms.
- Negative values of subsidies are taxes.
- Net marginal cost of a source firm is $c_j \equiv (1 - \alpha_j) z + \alpha_j (Z - \sigma_j)$.
- Marginal cost of a host firm is $C \equiv Z$.
- All firms take source and host wages as given.

- Source wage must equal host wage minus subsidy

$$z = Z - \sigma_j \quad (3)$$

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

- FDI subsidy places a wedge between source and host wages.

6.2.3 Output choice

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

$$\frac{\partial \pi_j}{\partial y_j} = p_j + y_j p'_j - c_j = p_j + y_j p'_j - z = 0 \quad (4)$$

$$\frac{\partial \Pi_j}{\partial Y_j} = p_j + Y_j p'_j - Z = 0 \quad (5)$$

- In a symmetric equilibrium, all industries are identical and thus source firms split production across countries to the same extent regardless of industry.

6.3 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.
- The source labor constraint is

$$(1 - \alpha) my = k \quad (6)$$

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

$$\alpha my + MY = K \quad (7)$$

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

$$Q \equiv my + MY = k + K \quad (8)$$

- 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.

6.4 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 (3), the first order conditions (4, 5), and the labor constraints (6, 7).
- 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 (8), where $p' < 0$.
- Further let $\psi \equiv -p' > 0$.

- Solving the system of equations gives the equilibrium extent of FDI

$$\alpha^* = \frac{\psi K(f - r) + \sigma f M}{(\sigma M + \psi K(r + 1)) f} \quad (9)$$

source wage

$$z^* = \frac{[(f + 1)pM - (r + 1)\psi K] - \sigma M}{(f + 1)M} \quad (10)$$

host wage

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

representative source firm output

$$y^* = \frac{\psi K(r + 1) + \sigma M}{\psi(f + 1)M} \quad (12)$$

and representative host firm output.

$$Y^* = \frac{\psi K(r + 1) - \sigma f M}{\psi(f + 1)M} \quad (13)$$

6.5 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 (9) gives the initial equilibrium extent of FDI

$$\alpha_0^* = \frac{f - r}{f(r + 1)} > 0 \iff f > r \quad (14)$$

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.

- 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 incentive for FDI exists whenever wages abroad are lower, FDI equalizes wages across the countries in absence of any taxes or subsidies to FDI.
- The extent of FDI (9) 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 (10) as well as host wages (11) increase with the relative number of source firms.

- An increase in the relative number of source firms reduces the output of each firm, (12) and (13).
- As noted in (8), 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.*