Intellectual Property Protection and International Technology Diffusion

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Spillovers: Effects and Issues

- How do technology spillovers affect a foreign firm's decision whether to produce in a host country?
- How does foreign direct investment (FDI) affect the host country?
- Can stronger intellectual property (IP) protection attract FDI?
- Does the host country benefit?
- Is IP protection a good way to attract FDI?

Empirical Evidence

- Support for FDI generating technology spillovers:
  - Haddad and Harrison (1993), Kokko (1994).
- Support for IP protection affecting FDI:
  - Lee and Mansfield (1996), Smith (2001), Javoncik (2001), Nunnenkamp and Spatz (2004).

Existing Models

- Technology spillovers influence FDI decisions:
  - Siotis (1999), Petit and Sanna-Randaccio (2000).
- Multinational firms control technology spillovers through labor mobility by paying high wages:
  - Markusen (2001), Fosfuri, Motta, and Ronde (2001), Glass and Saggi (2002).

Theory of the Multinational Firm

- For multinational firms to arise, there must be a reason:
  - To serve the host country - something done better than other firms (ownership advantage).
  - To produce there (location advantage).
  - To keep transactions within the firm (internalization advantage).

Core Elements

- Here, multinational firms possess (preexisting) superior technology.
- Producing in the host country lowers production costs.
- Domestic firms learn about better techniques when multinationals enter (demonstration effect).
- Laws protecting IP limit ability of domestic firms to benefit from spillovers.

Model of Technology Spillovers

- One source and one host firm (*n* host firms later).
- Source firm has superior process technology.
- Source firm chooses exports or FDI.
- FDI lowers cost of source firm: marginal cost 1 with FDI, $\Omega > 1$ without.
- FDI also lowers cost of host firm due to technology spillovers: marginal cost θ with FDI, $\Theta > \theta$ without.

Spillovers & Host Firm's Costs

- Host country's IP protection sets fraction μ of technology that may be legally imitated.
- Technology spillovers generate knowledge flows to host firm, fraction σ_j.
  - Spillovers larger under FDI than exports $\sigma_X < \sigma_F$, $\sigma_X = \sigma_F/\Psi$, $\Psi > 1$
- Host firms able to absorb fraction α.

Host Firm's Costs

- Host firm's technology (unit labor requirement) is weighted average of source firm's superior technology of 1 and existing technology $\Gamma > 1$.
- Weights are $\alpha\sigma_j\mu$ and 1 - $\alpha\sigma_j\mu$.
  - $\theta = \alpha\sigma_F\mu + (1 - \alpha\sigma_F\mu)\,\Gamma$, when FDI.
  - $\Theta = \alpha\sigma_X\mu + (1 - \alpha\sigma_X\mu)\,\Gamma$, when exports.

Timing

- Host country sets its IP protection.
- Source firm chooses FDI or exports.
- Spillovers and absorption occurs.
- Host and source firm pick quantities.
- Resulting prices, profits, consumer surplus, and welfare determined.

Standard Cournot Duopoly

- Linear demand (with slope one) $P = A - Q$
- Total output $Q = q_H + q_S$
- Equilibrium profits

$$\pi_i = \frac{(A + c_j - 2c_i)^2}{9}$$

- Constant marginal costs $c_S < c_H$

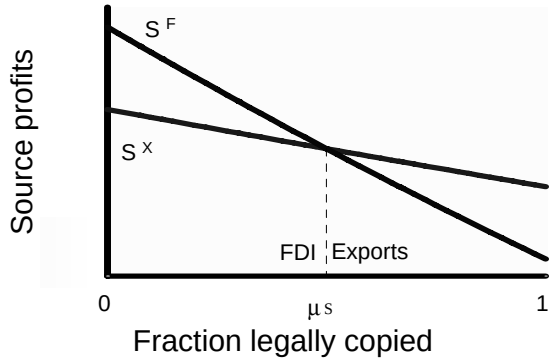
Source Profits

- IP protection limits degree that host rival can use technology spillovers.
- Stronger IP protection raises cost of host rival more under FDI than exports due to greater degree of technology spillovers.

$$\sigma_F > \sigma_X \rightarrow \left|\frac{\partial \theta}{\partial \mu}\right| > \left|\frac{\partial \Theta}{\partial \mu}\right|$$

- Source profits increase with IP protection (decrease with imitation) more under FDI than exports.

Source: Exports or FDI?



Source Imitation Threshold

- Source imitation threshold μ_S is level of IP protection such that source profits under FDI equal source profits under exports.

  $$\pi_S^F(\mu_S) = \pi_S^X(\mu_S)$$

- It is minimum level of IP protection required for source firm to choose FDI.
- When IP protection sufficiently strong, source firm chooses FDI (otherwise exports).

Proposition 1

- IP protection can be used to attract FDI.
- FDI occurs when imitation is sufficiently low $\mu < \mu_S$.

$$\mu_S = \left(1+\frac{1}{n}\right)\frac{\Omega - 1}{\alpha\sigma\left(1-\frac{1}{\Psi}\right)(\Gamma - 1)}$$

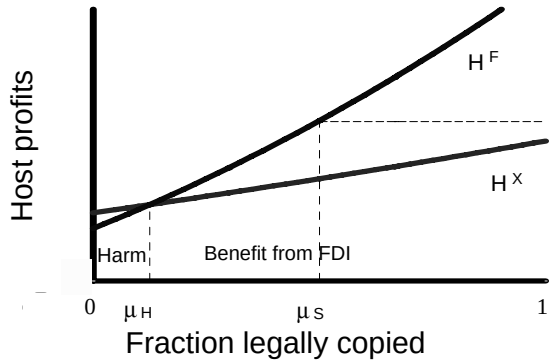
Proposition 2

- The source threshold decreases with
  - Larger technology gap Γ.
  - Larger technology spillovers under FDI relative to exports Ψ.
  - Larger absorption ability α.
  - Larger number of host firms *n*.
  - Smaller cost reduction Ω.

Host Profits

- Recall that IP protection limits degree that host firm can use technology spillovers.
- Stronger IP protection raises cost of host firm more under FDI than exports.
- Host profits decrease with IP protection (increase with imitation) more under FDI than exports.

Host: Exports or FDI Better?



Host Imitation Threshold

- Host imitation threshold μ_H is level of IP protection such that host profits under FDI equal host profits under exports.

$$\pi_H^F(\mu_H) = \pi_H^X(\mu_H)$$

- It is maximum level of IP protection such that host firm benefits from FDI by source firm.
- When IP protection is sufficiently weak, host firm prefers FDI (otherwise exports).

Proposition 3

- The host country can benefit from using IP protection to attract FDI.
- The host firm benefits from FDI by the source firm provided IP protection is sufficiently weak $\mu > \mu_H$.

$$\mu_H = \frac{\Omega - 1}{2\alpha\sigma\left(1 - \frac{1}{\Psi}\right)(\Gamma - 1)}$$

Host versus Source Threshold

- Host threshold lower than source threshold. $\mu_H = \mu_S / 4$
- At source imitation threshold, FDI benefits host country: host profits and consumer surplus rise (lower price & higher quantity).
- Possible for host country to benefit by strengthening IP protection to attract FDI.
- Does host country always benefit? No.

Host Country IP Protection

- Host profits may fall if start from weak IP protection.
- FDI adversely selected in industries with least benefits for host.
- With multiple industries, gain in one industry can be offset by losses in other industries due to higher costs for host firms.

Conclusions

- Raising IP protection *can* attract FDI, provided FDI generates larger technology spillovers than exports.
- Doing so need not benefit host country.
  - Handicaps local firms.
  - Adversely selects FDI with least benefits for host country.
  - Applied equally across industries.

Conclusions

- IP protection not best policy instrument for attracting FDI.
- Use targeted financial incentives
- Make country more attractive in other ways.