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:

• Support for IP protection affecting FDI:
  – Lee and Mansfield (1996), Smith (2001),

Existing Models

• Technology spillovers influence FDI decisions:

• Multinational firms control technology spillovers through labor mobility by paying high wages:
Core Elements

• Multinationals possess superior process technology.
• Producing in 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 $\theta$ with FDI, $\Theta > \theta$ without.
Spillovers & Host Firm’s Costs

• Host country’s IP protection sets fraction $\mu$ of technology that may be legally imitated.
• Technology spillovers generate knowledge flows to host firm, fraction $\sigma_j$.
  – Spillovers larger under FDI than exports $\sigma_X < \sigma_F$,
    $\sigma_X = \sigma_F/\Psi$, $\Psi > 1$
• Host firms able to absorb fraction $\alpha$.

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 (standard asymmetric Cournot duopoly/oligopoly).
- Resulting prices, profits, consumer surplus, and welfare determined.

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 $\mu_S$ is level of IP protection such that source profits under FDI equal source profits under exports.
  \[ \pi^F_S(\mu_S) = \pi^X_S(\mu_S) \]
- 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 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 $\Gamma$.
  – Larger technology spillovers under FDI relative to exports $\Psi$.
  – Larger absorption ability $\alpha$.
  – Larger number of host firms $n$.
  – Smaller cost reduction $\Omega$. 
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 $\mu_H$ is level of IP protection such that host profits under FDI equal host profits under exports.
  \[ \pi^F_H(\mu_H) = \pi^X_H(\mu_H) \]
- 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 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.
  \[ \mu_H = \frac{\mu_S}{4} \]
- 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.