Multinationals and the Globalization of Production

Internalization: Licensing

Penn State // Fall 2016

Administrative things

- Please sign in to Arkaive.com
- Final exam
  - Tuesday December 13, 2:30PM–4:20PM
  - Willard 073
  - Will discuss format, cumulative stuff 12/6
- Materials coming your way…
  - Ungraded problem set #5 (covers holdup, licensing)
  - Practice final exam

Roadmap

- Past: Where do firms locate?
  - FDI for market access (Horizontal/Export platform)
  - FDI for factor cost savings (Vertical)
  - FDI for tax motives
- Present: Why do firms own affiliates?
  - Why not purchase from another firm?
  - Why not license to another firm?
  - Today: Technology diffusion and licensing

OLI framework

- Being a multinational comes with costs
- What are the benefits?
- For a firm we ask what *advantage* comes from
  - ownership? [Patents, brands, good ideas…]
  - location? [HFDI, VDFI, tax FDI]
  - internalization?

What is the benefit from **owning** the foreign producer?

Technology transfer

- Problem with outsourcing
  - Downstream firm was residual claimant [earned $(1-\beta)R$]
  - Distorts incentives of the supplier firm
- A possible solution is to license the final-good technology
  - Supplier (licensee) pays final-good firm a license fee
  - Final-good firm (licensor) gives licensee its technology
  - Supplier is now the residual claimant $\rightarrow$ incentive aligned
- Nice! What could go wrong?

Technology diffusion

- Licensee works with the new technology
- Over time, learns how the technology works
- Licensee tempted to break contract, produce on its own

- How easy can the technology be transferred?
- How easy can the technology be "stolen?"
- These tend to be bigger problems in developing countries

Petrochemicals in China

- China is a large and important market for MNEs
- MNEs often enter through joint ventures (sometimes mandatory)
- Swiss Ineos & Chinese Sinopec
- Ineos claims that Sinopec uses Ineos trade secrets to build acrylonitrile plants throughout China

Barriers to MNE entry?

"China is a major market for synthetic rubber, but no international producer has built facilities there for solution-polymerized styrene-butadiene, an advanced rubber used in tires."

– Chemical and Engineering News (3/31/2014)

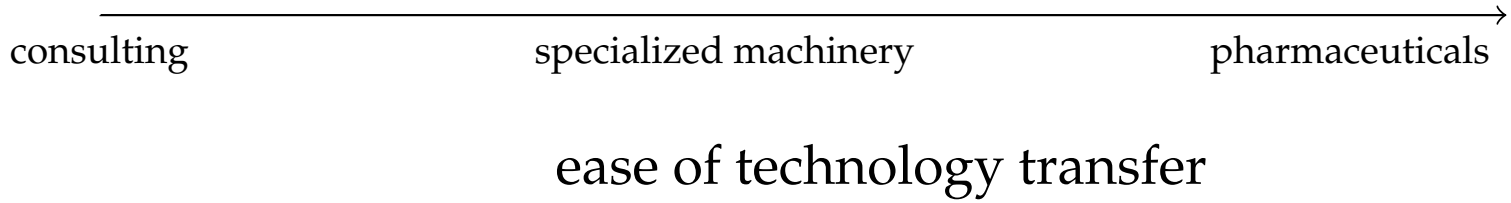
Underlying problems

- Not only China: Brazil, India, Russia…
- Problems often due to country-level factors

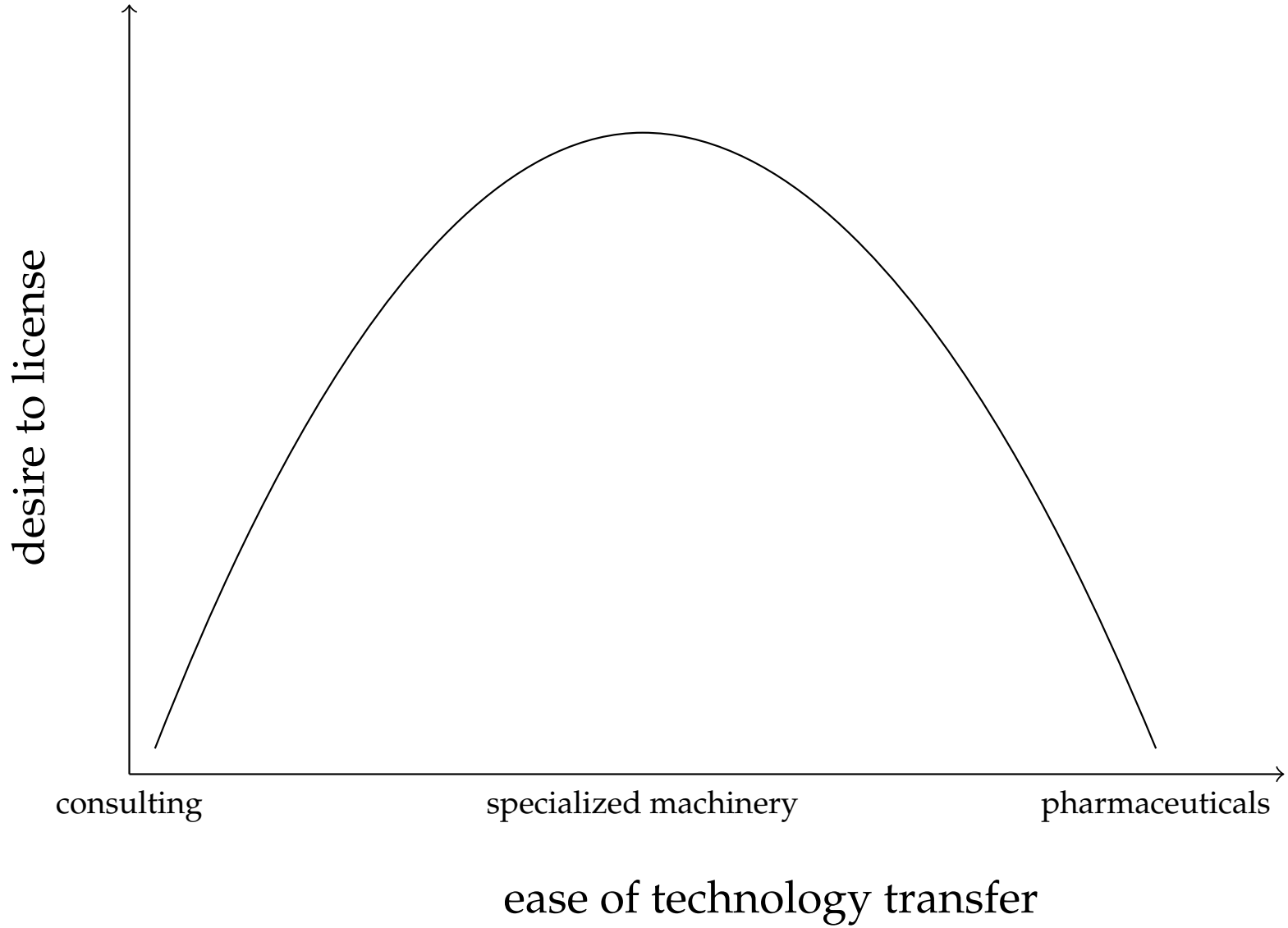
"Many issues are the same: poor legal environments for IPR [intellectual property rights], protectionist industrial policies, and a sense that IP [intellectual property] theft is justified by a playing field that benefits developed countries."

– IP Commission Report

Ease of technology transfer



Desire to license



A model of licensing

- When should a firm license? Integrate?
- How should the license agreement look?
- Model similar to hold up model in some ways
  - Final good firm; potential licensee (supplier)
  - Need supplier to produce an intermediate
  - Final good firm owns the final good technology
  - **Contracts are still not enforceable**
- Model differences
  - Dynamic: Two periods, t and $t+1$
  - Need exactly one unit of m to produce (simplification)
  - One unit of m generates revenues R

Integrated firm

- Final good firm produces $m = 1$ and the final good
- Costs γp_m per unit of m
- Cost to "support" final good technology is f
- Final good firm profit when integrated

$$\pi_F^I = (R - \gamma p_m - f) + \frac{(R - \gamma p_m - f)}{1 + r}$$

- Prices, revenues, and costs same in t and $t + 1$
- Firm discounts the future at rate $1 + r$

Aside: Discounting

- The one-period interest rate is r
- To have \$100 in $t+1$, I invest $x = 100/(1+r)$ in t
- So \$100 in $t+1$ is worth the same as $100/(1+r)$ at t
- Dividing future values at the appropriate interest rate makes them comparable to present values
- Example $r = 0.05$
  - \$100 in $t+1$ is worth $100/1.05 = \$95.24$ at t
- The greater is the interest rate, the less I care about the future
  - $r = 0.2 \rightarrow \$100/1.2 = \$83.3$

Licensing: Final good firm

- Licensee pays the final-good firm L_t and L_{t+1}
- Final-good firm still pays tech support f
- Final-good firm pays cost of transferring tech T
- Final-good firm profit when licensing

$$\pi_F = (L_t - f - T) + \frac{(L_{t+1} - f - T)}{1 + r}$$

- License fees may differ in t and $t + 1$

- Final-good firm no longer produces

Licensing: Licensee

- Is the *residual claimant* of final-good revenue
- Profit of licensee if licenses for both periods

$$\pi_S = (R - p_m - L_t) + \frac{(R - p_m - L_{t+1})}{1 + r_S}$$

- Licensee may have different interest rate

Licensing: Licensee defection

- Contracts / IPR not enforceable
- After t, licensee learns how to use the final-good tech...
- ...but not as well. Pays $f^S > f$ to support tech
  - f^S vs. f is the ease of "stealing" the tech
- Profit of a one-period licensee (D for defect)

$$\pi_S^D = (R - p_m - L_t) + \frac{\left(R - p_m - f^S\right)}{1 + r_S}$$

Incentive compatibility

- Since the license contract is not enforceable, it must be structured in a way that makes the licensee not want to defect
- We say the contract must satisfy the licensee's *incentive compatibility constraint*
- It must be better for the licensee to stay in the contract than to defect

$$\pi_S \geq \pi_S^D$$

- From the definition of the two profit functions

$$L_{t+1} \leq f^D$$

- The best choice for the final-good firm is $L_{t+1} = f^D$

Licensee profit

- In the incentive compatible contract

$$\pi_S = (R - p_m - L_t) + \frac{\left(R - p_m - f^S\right)}{1 + r_S}$$

- What is L_t?

License fee in t

- Many ways to sell license
- Our assumption: Many potential licensees
- Final-good firm takes bids from potential licensees
- Drives value of contract for licensee to zero

$$\begin{aligned} \pi_S &= (R - p_m - L_t) + \frac{\left(R - p_m - f^S\right)}{1 + r_S} = 0 \\ L_t &= (R - p_m) + \frac{\left(R - p_m - f^S\right)}{1 + r_S} \end{aligned}$$

Integrate or license?

- Our usual discrete choice: Which provides higher profits?

$$\pi_F^I \geq \pi_F$$

$$(R - \gamma p_m - f) + \frac{(R - \gamma p_m - f)}{1 + r} \geq (L_t - f - T) + \frac{(L_{t+1} - f - T)}{1 + r}$$

$$(R - \gamma p_m - f) + \frac{(R - \gamma p_m - f)}{1 + r} \geq \left((R - p_m) + \frac{\left(R - p_m - f^S\right)}{1 + r_S} - f - T \right) + \frac{\left(f^S - f - T\right)}{1 + r}$$

In-class example I

- Take 5 minutes, work with neighbors
- $R = 5, p_m = 1, f = 1.1, f^S = 1.2, T = 0.2, r = 0.03, r^S = 0.03, \gamma = 1.4$
- Compute L_t, L_{t+1}, and $V_F = L_t + L_{t+1}/(1 + r)$
- Compute the license agreement surplus = $(R - p_m) + (R - p_m)/(1 + r)$
- Compute π_F^I and π_F, should the firm integrate, or license?

Identical discount rates

- When $r = r^S$ both firms value the future the same
- The final-good firm can extract the entire surplus from the licensee
  - Need $r = r^S$ and $\pi_S = 0$
- Can now simplify the $\pi_F^I \geq \pi_F$ expression

$$T \geq p_m(\gamma - 1)$$

- Integrate when the costs of licensing are greater than the gains from having the supplier produce
- When $T = 0$ the firm always licenses (because the final-good firm extracts all the surplus)

In-class example II

- Take 5 minutes, work with neighbors
- $R = 5, p_m = 1, f = 1.1, f^S = 1.2, T = 0.2, r = 0.03, r^S = 0.25, \gamma = 1.4$
- Compute L_t, L_{t+1}, and $V_F = L_t + L_{t+1}/(1+r)$
- Compute the lic. agreement surplus = $(R - p_m) + (R - p_m)/(1+r)$
- Compute π_F^I and π_F, should the firm integrate, or license?
- Compare V_F to the V_F from the last example. Why are they different?