

International Intellectual Property Rights Protection and the Rate of Product Innovation

Edwin L.C. Lai

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Product Cycle Models Lacked FDI

- In standard product cycles models, for production to be shifted to the South, Southern firms must expend effort to imitate production technologies.
- Why don't Northern firm shift their production to the South instead?
 - Build a plant in the South to reap cost savings.

FDI Important

- Greater and greater shares of world output are being produced and traded by multinational firms.
- Need some product cycle models with foreign direct investment (FDI) to understand the role of multinational in innovation, international technology transfer, and imitation.
- Possible that results found in standard product cycle models might be differ if FDI occurs.

FDI in Product Cycle (Helpman 1993)

- First effort to add FDI to a product cycle model less than satisfying.
- Purpose of model was to examine effects of IPRs on Southern welfare.
 - Stronger Southern IPR protection captured as an exogenous reduction in imitation intensity.
- Two models: one with endogenous innovation but no FDI, and the other with FDI but innovation exogenous.

FDI with Endogenous Innovation

- Lai saw need for a model with FDI and endogenous innovation to properly assess effects of IPRs.
- What Helpman should have done was add FDI keeping innovation endogenous, but likely that welfare analysis (including transitional dynamics) would have been too complex.
- If willing to stick to steady-state analysis, FDI with endogenous innovation can be done, as Lai shows.

IPRs Matter

- Helpman found that reducing the imitation intensity:
 - Reduced rate of innovation in the base case without FDI,
 - Reduced FDI in the version with exogenous FDI.
- Remained unknown what reducing imitation intensity would do to FDI and innovation in a model with FDI and endogenous innovation.
 - Lai finds FDI and innovation both fall.

FDI Matters

- Comparing the case with FDI to that without, having FDI occur leads to a reversal of the effect of reducing the imitation intensity on innovation.
 - Without FDI, less imitation leads to less innovation.
 - With FDI (and no imitation prior to becoming a multinational), less imitation leads to more innovation.
 - When FDI and imitation coexist as channels of international technology transfer, all depends on which channel is predominate.

IPRs Encourage FDI

- That stronger IPR protection in the South encourages FDI seems to make intuitive sense.
 - Less imitation makes profit stream last longer (in expected value), which encourages innovation.
- Less obvious that there is an effect related to labor constraints.
 - Without FDI, more demand for Northern labor due to longer monopolies pushes up the Northern wage and makes innovation more expensive.
 - But with FDI, demand for labor rises in the South rather than the North, so this effect discouraging innovation is avoided.

Modifications Needed to Add FDI

- Helpman's base model was just Grossman and Helpman's product cycle model but with exogenous imitation (no imitation valuation condition).
- Helpman's model with FDI had already tackled how to put FDI into product cycle model.
- Lai's model is a mixture of Helpman's two models, which is Grossman and Helpman's product cycle model plus FDI minus endogenous imitation.

Lai's Model

- Consumer side is same as GH, as it is in most variety-based product cycle models.
- In terms of market structures, need to add one more: multinational production.
 - Measures of products produced by Southern imitators, Northern firms producing in the North, and multinational firms producing in the South must sum to one.

Profit Maximization by MNCs

- Lai normalizes the unit labor requirement in production to one $a_x = 1$.
- Multinationals, like Northern firms, price at a fixed markup over marginal cost.
- Multinationals enjoy lower costs producing in the South due to lower wage there, so they charge lower prices than Northern firms. (p_F is p_m in article).

$$p_F = \frac{w_S}{\alpha} < \frac{w_N}{\alpha} = p_N$$

Exogenous Imitation

- Innovation modeled the same as in GH but imitation is exogenous here.
- M ($i\delta$ in the article) is the exogenous hazard rate, the probability that a multinationalized product will be imitated in the next instant.
- There is no imitation targeting products produced in the North in the base model.
- Imitation is costless.

Profit Maximization by Southern firms

- Once a product has been imitated, the Southern firm prices at marginal cost $p_S = w_S$.
 - Bertrand competition against the multinational producing that variety.
 - MNCs have same cost as Southern firms.
- Adding FDI gets rid of large gap versus small gap.
 - Like always small gap as price at rival's marginal cost.
 - Here wage gap across countries irrelevant since rival producing in same country.

IPRs and Imitation

- As in Helpman, a strengthening of Southern IPR protection is captured as an exogenous reduction in the imitation hazard rate.
 - Can be thought of as better enforcement of patent laws.
 - If all imitation illegal (patent not expired), better enforcement means more copiers are caught so fewer successfully compete in the marketplace.

MNCs More Profitable

- The pricing expressions for MNCs and Northern producers and the standard demand function lead to:

$$\frac{\pi_F}{\pi_N} = \left(\frac{w_S}{w_N} \right)^{1-\varepsilon}$$

- Profits for MNC exceed those for Northern producer due to lower wage in the South.
 - Wage is per efficiency unit of labor since unit labor requirement in production normalized to one.

Profit Streams

- Expected present discounted value (PDV) of profits for a MNC (Π_m in article):

$$V_F = \frac{\pi_F}{r + M}$$

- Expected PDV of profits for a Northern firm (Π_N in article):

$$V_N = \frac{\pi_N}{r}$$

Valuation Conditions

- Valuation (free entry) condition for innovation: cost of innovation must equal reward.

$$\frac{a_N w_N}{n} = V_N = \frac{\pi_N}{r}$$

- Valuation condition for multinationalization: Northern firms indifferent to becoming MNC.

$$V_N = V_F = \frac{\pi_F}{r + M}$$

MNCs and Imitation Risk

- Putting the two conditions together, MNC profits must exceed profits as a Northern firm to offset imitation hazard.

$$\frac{\pi_N}{r} = \frac{\pi_F}{r + M} \Rightarrow \frac{\pi_N}{\pi_F} = \frac{r}{r + M} < 1$$

- Putting together with relative wage version:

$$\left(\frac{w_S}{w_N} \right)^{1-\varepsilon} = \frac{\pi_N}{\pi_F} = \frac{r}{r + M}$$

Profit Expressions

- Recall
 - Unit labor requirement in production normalized to one.
 - Price is constant markup over marginal cost.

- Profit of Northern firm

$$\pi_N = (p_N - w_N)x_N = \left(\frac{1-\alpha}{\alpha}\right)w_N x_N$$

- Profit of MNC

$$\pi_F = (p_F - w_S)x_F = \left(\frac{1-\alpha}{\alpha}\right)w_S x_F$$

Labor Constraints

- Northern labor constraint: demand for innovation and Northern production cannot exceed Northern labor supply.

$$a_N \dot{n} / n + n_N x_N = L_N$$

- Southern labor constraint: demand for production by MNCs and Southern firms cannot exceed Southern labor supply.

$$n_F x_F + n_S x_S = L_S$$

System of Equations

- Main equations are valuation conditions for innovation and multinationalization, and Northern and Southern labor constraints.
- Find expressions for market measures based on endogenous arrival rate of innovations (g) and hazard rate of multinationalization (ω), and exogenous imitation.
- Boil down to two equations in g and ω .

Relative Wages

- Effects on relative wages across countries indicate consequences for income distribution.
- Using $r = \rho + \phi g$ and the expression for profits of MNC relative to Northern firm gives an expression for the Southern wage relative to the Northern wage:

$$\frac{w_S}{w_N} = \left(\frac{\pi_N}{\pi_F} \right)^{\frac{1}{\varepsilon-1}} = \left(\frac{\rho + \phi g}{\rho + \phi g + M} \right)^{\frac{1}{\varepsilon-1}}$$

- Decrease in M leads to increase in g , which both increase the Southern relative wage.

Main results

- If multinationalization is the channel of international production transfer, stronger IPRs in the South lead to:
 - higher rate of innovation,
 - higher rate of production transfer from the North to the South, and
 - higher wage of South relative to North.
- Opposite happens if imitation is the channel.

Effects of Southern IPR Protection

	Channel of Production Transfer	
	Multinationalization	Imitation
Rate of innovation	+	-
Rate of production transfer	+	-
Relative wage of South	+	-