

Intellectual Property Rights and Quality Improvement

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Mixed Conclusions in Literature

	Nature of Innovation	Stronger IPR	Results		
			FDI	Innovation	
				w/ FDI	w/o FDI
Helpman	Exogenous w/FDI	Imitation intensity ↓	↑	–	↓
Lai	New varieties	Imitation intensity ↓	↑	↑	↓
Glass & Saggi	Higher qualities	Imitation cost ↑	↓	↓	↓

Why Do Results Differ?

- Different models of the effect of IPR protection on FDI and innovation give different results but not clear why.
- Comparing Glass and Saggi (2002) to Lai (1998), there are two main differences in setup of models:
 - Innovations are to develop new varieties in Lai, but higher quality levels in Glass and Saggi.
 - Strengthening Southern IPR protection is an exogenous reduction in imitation intensity in Lai, but endogenous reduction in imitation rate in Glass and Saggi.
- Which of these two differences in setup causes the difference in results?
 - Need quality ladders model with FDI and exogenous imitation.

How Our Model Compares to GH

- Both quality ladders product cycle models.
- Same consumers problem and solution.
- Endogenous innovation modeled the same.
- Imitation endogenous in GH but exogenous here: imitation intensity M .
 - Imitation does not target Northern production.
- FDI added here: Northern firms can shift production to the South where costs lower.
- For quality ladders model with endogenous imitation and FDI, see Glass and Saggi *JIE* 2001.

Multinational Production

- At each time interval dt , the FDI intensity φ_F indicates how likely a Northern firm is to become a multinational.
- The cost of going multinational is zero.
- When FDI occurs in equilibrium, Northern firms are indifferent between producing in the North and producing in the South through FDI, so that $v_F = v_N$.

Profits

- Price: Firms producing only in the North (Northern firms) and multinationals set price equal to the quality increment.

$$p_N = p_F = \lambda$$

- Output: Northern firms and multinationals make same amount of sales since charge same price.

$$x_N = x_F = E / \lambda$$

- Cost: FDI lowers costs compared to Northern production since labor cheaper in the South.

$$c_N = w > 1, c_F = 1$$

Profit Comparison

- FDI raises profits compared to Northern production due to cost reduction:

$$\pi_N = E\left(1 - \frac{w}{\lambda}\right), \pi_F = E\left(1 - \frac{1}{\lambda}\right)$$

$$\frac{\pi_F}{\pi_N} = \frac{\lambda - 1}{\lambda - w} > 1$$

Valuations

- Values of innovation and multinational production are discounted profits.

$$v_N = \frac{\pi_N}{\rho}, v_F = \frac{\pi_F}{\rho + M}$$

$$v_N = v_F \Rightarrow \frac{\pi_F}{\pi_N} = \frac{\rho + M}{\rho} > 1$$

Valuation Comparison

- Multinationals face added risk of imitation.
- Imitation terminates the profit stream.
- For FDI to occur, cost reduction must be sufficient to compensate for (increased) imitation risk.

$$v_N = v_F \Rightarrow \frac{\lambda - 1}{\lambda - w} = \frac{\pi_F}{\pi_N} = \frac{\rho + M}{\rho} > 1$$

Valuation Conditions

- Innovation valuation condition must hold whenever innovation occurs in equilibrium:

$$\begin{aligned} v_N &= wa_N, \pi_N = \rho v_N \\ \Rightarrow E(1 - w\delta) &= wa_N \rho, \quad \delta = 1/\lambda \end{aligned}$$

- FDI valuation condition must hold whenever FDI occurs in equilibrium :

$$\begin{aligned} v_F &= v_N, \pi_F = (\rho + M)v_F \\ \Rightarrow E(1 - \delta) &= wa_N (\rho + M) \end{aligned}$$

Aggregation

- Measures of production (Northern, multinational, and Southern) sum to one:

$$n_N + n_F + n_S = 1$$

- Aggregate rate of innovation equals innovation intensity times measure of Southern production:

$$\iota = \iota_N n_S$$

- Aggregate flow/extent of FDI:

$$\phi = \phi_F n_N$$

Steady-State Conditions

- Flows in must equal flows out of each type of market structure:

$$\phi_F n_N = M n_F = \iota_N n_S$$

- Implies that rate of innovation ι equals rate of imitation $M n_F$, but not imitation intensity M :
 - n_F endogenous, so ι and M need not be positively related.

Resource Constraints

- Northern labor constraint requires labor demand for innovation and production to not exceed Northern labor supply:

$$a_N \iota + \left(1 - \frac{\iota}{M} - n_S\right) E \delta = L_N$$

- Southern labor constraint requires labor demand for production to not exceed Southern labor supply:

$$\frac{\iota}{M} E \delta + n_S E = L_S$$

Comparative Statics

- The four main equations are the FDI and innovation valuation conditions and the Northern and Southern labor constraints.
- The main endogenous variables are the rate of innovation ι , aggregate expenditure E , Northern relative wage w , and measure off multinational production n_F .
- The base model can be solved for all variables and derivatives of variables taken with respect to M .

Main Results

- In presence of FDI, stronger Southern IPR protection encourages FDI and innovation if innovations are new varieties. But, if innovations are higher quality levels, FDI and innovation both fall.
- Hence, stronger Southern IPR protection may shift composition of innovation away from quality improvements in existing products toward development of new varieties. Overall effect on innovation and FDI unclear.

More Results

- However, when there is no FDI, an exogenous decrease in imitation due to stronger Southern IPR protection always shifts production from the South to the North and hence takes Northern labor away from innovation. Thus, innovation falls regardless of its type.
- Imitation increases the relative wage if there is FDI but otherwise decreases the relative wage. Effects on the relative wage are important as they lead to reallocation of income across countries.

Innovation by followers

- In the base model, innovation is done by leaders (previous innovators) and thus only targets Southern production.
- If innovation is done by followers and thus targets all markets, will results be the same?
- No. Signs of effects on innovation and FDI (and other market measures) are reversed for case with FDI.

Effects of Increased Imitation Intensity

Variable	Inefficient followers		Efficient followers	
	FDI	No FDI	FDI	No FDI
ι	+	+	-	+
w	+	-	+	-
E	+	-	+	-
n_S	-	+	+	+
n_F	+	NA	-	NA
n_N	-	-	+	-



Conclusion

- Effect of IPR on innovation (and FDI) depends on whether:
 - Innovation enhances variety or quality
 - FDI occurs or not
 - Innovation by leaders or followers
 - Imitation endogenous or exogenous