

# The dual role of IPRs under Imitation and Innovation Driven Development

Monique Newiak

LMU Munich

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# Do stronger IPRs benefit or hurt developing countries?

1. How do IPRs affect the knowledge transfer and accumulation in developing countries?
2. When can IPRs stimulate R&D and welfare in developing countries?

Why important?

- Trade-Related Aspects of Intellectual Property Rights (TRIPS, 1994)
- no consent about effect of IPRs on welfare in developing countries

# Literature: IPRs in North-South models

## 1. **"if anyone benefits, it is not the South", Helpman (1993)**

- no R&D in developing countries

→ IPRs cannot stimulate R&D by construction

## 2. **"IPRs can stimulate southern innovation"**

- phases of innovation and imitation (Currie et al., 1999)
- threshold effects (Lorenczik & Newiak, 2011)

## 3. **"Imitation is helpful to stimulate own R&D"**

- imitation as prerequisite for innovation (Glass, 2010)
- imitation as stepping stone, but role diminishing when the R&D sector develops (this presentation)

# Main findings in this presentation

## Intellectual property rights

- stimulate R&D, product variety and welfare if southern R&D sector is large
- dampen R&D, product variety and welfare in both, developed and developing countries if southern R&D sector is small

## For South with high research costs there is

- imitation equilibrium: high copying, large wage difference to North, low R&D, small variety of goods
- innovation equilibrium: low copying, low wage differences, high R&D activity, large variety of goods

# The basic setup

## Firms in the North

- innovate
- produce own non-copied goods

$$\bullet \ell^* = \ell_R^* + \ell_Y^*$$

## Firms in the South

- imitate northern firms
- innovate
- produce southern inventions and copied goods

$$\bullet \ell = \ell_R + \ell_C + \ell_Y$$

$$n = n_R^* + n_C + n_R$$

Other Assumptions: costless trade, no migration, financial autarky, no capital, perfectly mobile labor within each region

# Households

max. life time utility

$$U(t) = \int_t^{\infty} e^{-(\rho - g_L)t} \ln u(t) dt, \quad u(t) = \left[ \int_0^n x_j^{\alpha} dj \right]^{\frac{1}{\alpha}}$$

s.t.  $\dot{a}^{(*)} = (r^{(*)} - g_L)a^{(*)} + w^{(*)} - c^{(*)}$

# Northern innovators

- hire researchers  $\ell_R^*$ , use knowledge capital  $n^\theta$

$$\dot{n}_R^* + \dot{n}_C = \frac{\ell_R^* n^\theta}{a_R^*}$$

knowledge spillovers  $0 < \theta < 1$

- if not copied, supply monopolistically to the world market

# Southern innovators

- hire researchers  $\ell_R$ , use knowledge capital  $n^\theta$

$$\dot{n}_R = \frac{\ell_R n^\theta}{\beta a_R}$$

$1/\beta$  is southern research efficiency.

- supply monopolistically to the world market



# Southern research efficiency

- Research is easier ( $1/\beta$  is larger) the more has been innovated and copied in the past

$$\dot{n}_R = \frac{\ell_R n^\theta}{\beta a_R} \quad \text{with} \quad \frac{1}{\beta} = \frac{n_R + \phi n_C}{n}$$

- Own R&D benefits efficiency more than copying  $\phi < 1$

# Southern imitators

- hire workers  $\ell_C$  who develop the imitation blueprint
- use knowledge capital  $(n_R^*)^\theta$

$$\dot{n}_C = \frac{\ell_C (n_R^*)^\theta}{a_C \beta}$$

$a_C$  – imitation costs, measure of IPRs

- supply monopolistically to the world market

# Financial markets in North and South

Discounted profits = firm value = cost of blueprint

- Northern labor market

$$\frac{\pi_R^*}{r^* - \frac{\dot{v}_{R_t}^*}{v_{R_t}^*} + \iota} = v_R^* = \frac{w^* a}{n^\theta}$$

- Southern labor market

$$\frac{\pi_C}{r - \frac{\dot{v}_C}{v_C}} = v_C = \frac{w a_C \beta}{(n_R^*)^\theta} \quad \frac{\pi_R}{r - \frac{\dot{v}_R}{v_R}} = v_R = \frac{w a_R \beta}{n^\theta}$$

# Equilibrium

Wages, interest rates, prices  $(w^*, w), (r^*, r), (p_R^*, p_C, p_R)$

such that the allocation of

- labor in North and South  $(\ell_R^*, \ell_Y^*), (\ell_R, \ell_C, \ell_Y)$
- varieties and their supply  $(n_R^*, n_C, n_R), (x_R^*, x_C, x_R)$
- consumption exp.  $(c^*, c)$
- asset holdings  $(a^*, a)$

1. solves

- household's utility maximization problem
- firms' profit maximization problem

2. there is free entry to R&D and imitation and

3. goods, labor and financial markets clear

# Product Variety & Southern Research Share

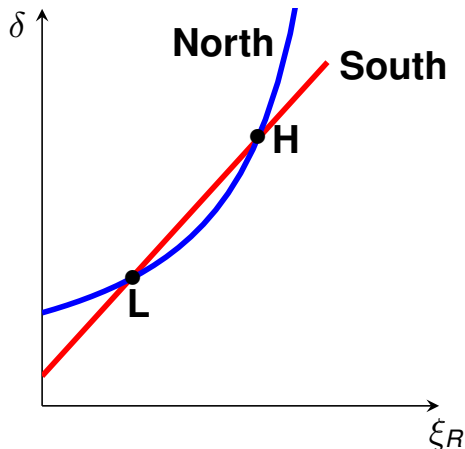
$$\text{North:} \quad \delta \equiv \frac{n^{1-\theta}}{\ell^*} = \frac{1-\alpha}{a\left(g(1-\xi_R) + \alpha R(\rho - g_L)\right)}$$

$$\text{South:} \quad \delta \equiv \frac{n^{1-\theta}}{\ell^*} = \frac{(1-\alpha)}{\Delta} \frac{\ell}{\ell^*} \frac{(1-\phi)\xi_R + \phi(1-R)}{a_R(1-R)}$$

$$R = \left(\frac{a_C}{a_R}\right)^{\frac{1}{\theta}}$$

$\xi_R = \frac{n_R}{n}$ ,  $R$  is measure of IPR strength

# Product variety and southern research activity



southern research share:  $\xi_R = \frac{n_R}{n}$ , product variety:  $\delta = \frac{n^{1-\theta}}{\ell^*}$

# Existence of imitation equilibrium

$$\frac{\frac{a_R}{a_R^*} \Delta \frac{\ell_t^*}{\ell_t}}{g + \alpha \left( \frac{a_C}{a_R} \right)^{\frac{1}{\theta}} (\rho - g_L)} > \phi.$$

**Result 1:** imitation equilibrium (L) does not exist if

- southern labor force  $\ell$  is large
- southern research costs  $a_R$  are low
- spillovers from imitation  $\phi$  are large
- IPRs are strong ( $a_C$  is large)
- northern research is relatively costly ( $a_R^*$  is large)

# Comparing imitation and innovation equilibrium

**Result 2:** The innovation equilibrium there is

(a) Higher innovative activity

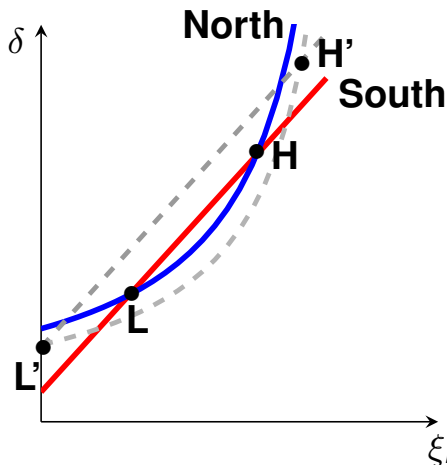
- higher southern research efficiency  $1/\beta$
- larger southern R&D share  $\xi_R$ , higher number of southern inventions  $n_R$
- higher total number of varieties, higher number of noncopied goods
- smaller imitation rate  $\iota$

(b) better welfare outcomes

- lower wage gap between North and South
- higher northern consumption
- higher southern consumption
- higher southern welfare



Increases in IPRs ( $R \uparrow$ )



southern research share:  $\xi_R = \frac{n_R}{n}$ , product variety:  $\delta = \frac{n^{1-\theta}}{\ell^*}$

# Increases in IPRs

**Result 3:** An increase in IPRs leads to

## Innovation Eqm.

- southern research efficiency  $\uparrow$
- number of varieties  $\uparrow$
- southern inventions & research share  $\uparrow$

## Imitation Eqm.

- southern research efficiency  $\downarrow$
- number of varieties  $\downarrow$
- southern inventions & research share  $\downarrow$

Why?

- If  $\xi_R$  large  $\rightarrow \frac{1}{\beta} \uparrow \rightarrow n_S \uparrow \rightarrow \xi_R \uparrow \rightarrow n \uparrow$
- If  $\xi_R$  small  $\rightarrow \frac{1}{\beta} \downarrow \rightarrow n_S \downarrow \rightarrow \xi_R \downarrow \rightarrow n \downarrow$

# Conclusion

## Model

- decision of a developing country to imitate or innovate
- R&D efficiency can be innovation or imitation driven

## Results

- imitation equilibrium possible if initial research costs high or initial IPRs low
- IPR effects depend on R&D development
  - imitation equilibrium: IPRs *decrease* R&D activity and welfare
  - innovation equilibrium: IPRs *increase* R&D activity and welfare
  - results are in line with U-shaped relation between income and IPRs (Maskus (2000), Chen and Puttitanun (2005))