

Patent protection and Southern innovation: a strategic analysis

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Patent is the **legal right** granted by the government to an innovator to exploit a particular innovation for a given number of years.

It gives **temporary monopoly right to exclude others from making, using, or selling any product embodying the patent.**

According to US constitution, intellectual property rights are granted in order to “**promote the Progress of Science and useful Arts**”.

Patent plays a minor role in encouraging innovation in some industries such as computers, semiconductors, information and communication technologies and software.

Bessen and Maskin (2000): When the innovation is sequential and complementary the competition can increase firms future profit. They did not find evidence of any significant increase in R&D intensity and productivity in these industries when patent protection was extended to software in the 1980's in US.

The empirical evidence shows that the **incentive effect of patent is very small or negligible** and that the firms would have a substantial incentive to innovate even **in the absence of intellectual property rights**.

The purpose of patent protection in developing countries (Southern) is to ensure proper returns from the innovation mainly done by the firms located in developed (Northern) countries.

In the Southern countries (e.g., India), the governments typically practised process patents and that too with varying degrees of enforcements under their laws. The North always insisted on the patent protection in the South as practised in the North.

Purpose: To analyse the issue of extending patent protection in the South and its welfare implications. More specifically, in an intra-industry trade framework we ask whether there is any merit of weak patent protection in the South.

Under the current WTO (World Trade Organization) regime, one important issue is the standardization (and strengthening) of patent systems across countries. The relevant question is whether the North **always prefers patent** protection in the South.

The argument for extending patent protection in the South is for **more innovation** in the North by increasing the returns from their innovations.

This is based on the premise that **South does not innovate**.

Many Asian countries such as **South Korea, India and Taiwan** are **inventing new products** those are competing with the existing products of the developed countries' firms.

For example, India, Singapore, Taiwan and a number of Latin American countries are showing significant participation **in software** and also in **hardware** industries.

Significant R&D efforts are also evidenced in **Indian pharmaceutical industry**. Ranbaxy Laboratories topped the list of companies from developing nations in filing patents. The company filed patents for 240 products (2004 data).

According to the Patent Cooperation Treaty (PCT) database, **Indian drug companies** have filed around 4,200 applications. Of these, 55% are for **pharmaceutical innovations** (Rajesh Unnikrishnan, The Financial Express, December 13, 2004).

Tsai and Wang (2004) provide evidence of significant R&D activities in **Taiwan's electronics** industry.

Wei et al. (2008) provide the evidence of innovation by Chinese motorcycle companies. The importance of innovation in the less developed countries is also acknowledged in Muniagurria and Singh (1997), Zhou et al. (2002) and Chen and Puttitanun (2005).

Also, some recent case studies on Chinese firms indicate that foreign and local firms **learn and imitate from each other** (Wei et al., 2008).

There is a **common skepticism** that while patent protection in the South helps the Northern firms, it may **adversely affect** the Southern countries by eliminating imitation in the Southern market.

For example, India, who was issuing process patents under its 'Patent Act 1970', had to amend its patent law in order to comply with its TRIPs agreement in the beginning of 2005 and put the patent protection regime in place.

Under this backdrop, we show that there can be a simple argument, which **does not justify the ‘blanket’ approach** of WTO for extending product patent regime in the South.

We show that **patent protection** in the South also increases the Southern firm’s incentive for innovating new products. Hence, patent protection in the South **not necessarily reduces competition** faced by the Northern firms. The switch from no patent protection to patent protection in the South may only **shift the market** where the Northern firms face competition from the Southern firms.

Under **no patent protection**, the Southern firm has two options: i) to do **innovation** of new products; ii) can **undertake imitation** of the existing product of the Northern firm. In this situation, the Northern firm can also **undertake imitation** of the Southern firm’s new product and sell the product in the South.

North is assumed to have patent protection regime. Thus, the Southern firm can enter the Northern market only with a **different** (new) product.

Once the possibilities of **innovation by the Southern firm and imitation by the Northern firm** are considered, some of the conventional wisdom might go wrong.

Literature:

There exists a large theoretical literature, which does not support the universal patent protection:

Helpman (1993), Grossman and Helpman (1991), Segerstrom et al. (1990), Lai (1998), Deardorff (1990), Chin and Grossman (1988), Diwan and Rodrik (1991), Taylor (1993), Glass and Saggi (2002).

They consider **technology diffusion** from North to South **through imitation**.

Diwan and Rodrik (1991) argued that when the North and South have **different technological needs and tastes**, and the **R&D resources are limited**, then the Southern patent protection might have a role in promoting the development of technologies appropriate to the South. They have also shown that increased patent protection in the South might not be good for the North, as more R&D resources would be deployed to suit Southern tastes.

Another resource based argument against stronger patent protection is provided by Glass and Saggi (2002). In their product cycle model with endogenous innovation, imitation and foreign direct investment, Glass and Saggi (2002) argue that stronger IPRs protection leads to **more resources used** (or reduced incentive) **for imitation**, which in turn **reduces FDI** and consequently **contracts innovation**.

In the context of technology transfer:

Vishwasrao (1994): Weaker patent protection in the South may be offset by the northern firm opting for subsidiary or export production rather than licensing the technology.

Markusen (2001): If tighter patent protection leads to mode switch from exports to subsidiary production then welfare of North and South improves. On the other hand if subsidiary is chosen then tightening patent protection may lead to a fall in the host country welfare.

Fosfuri (2000) argued that both strong and weak patent protection might be better than an intermediate level of patent protection.

Sinha (2006) considered **exports, FDI and licensing** as separate mode of transferring technology to the South. I focused on impact of patent protection on the innovation rate in the North and welfare in the South. The result is that the Southern governments can strategically choose a **weaker patent enforcement** for maximization of welfare for the South, which would also **maximise the innovation** in the North.

Literature on Product patent:

Marjit and Beladi (1998) argued that given the **significant dispersions** in the international distribution of income, **granting product patent** in the South may lead to a situation where the markets in the developing countries **are not served**.

Contrary to the existing literature we allow **innovation by the Southern** firms and **imitation by the Northern** firms.

We **challenge the basic view of standardizing the patent system** across the globe.

First, we argue that under certain conditions the maximization of world welfare is attained under a **differential patent regime** i.e., patent protection in the North and no patent protection in the South.

Second, the conventional argument for imposing patent protection in the South for helping the Northern firms or Northern country may not hold when **Southern firm can also innovate**. In other words, the conventional argument in favor of the North typically ignores the **competition effect** from the South under a stronger Southern patent regime.

Third, under certain conditions, the **absence of Southern patent protection may serve the interests of all parties concerned**.

Fourth, we provide important insights on the **possible outcome of international negotiations** in the context of patent enforcement in the southern countries.

2. The basic model

Consider two countries, called North and South, with separated markets.

Assume one firm in each country and call these firms as firm N and firm S respectively.

The firms can invest in research and development (R&D) for inventing a new product and they can also do imitative R&D.

There is patent protection in the North thus only the original innovator can sell its product in the North market.

In case South follows **no patent protection**, these firms are allowed to sell the same product by doing imitation of the technology of the other firm.

Game:

Innovation Stage: Each firm decides on R&D for inventing technology for a new product. Assume that **firm N chooses** to invent the technology for a **product x**, while **firm S** chooses to invent the technology for a product y. We consider that the products x and y are **imperfect substitutes**.

Imitation Stage: Both firms decide on imitation.

Competition Stage: They compete in the product market like Cournot duopolists.

We assume that the investment of the Northern firm for innovative R&D is F_N and the cost of the Southern firm for doing innovative R&D is $F_S = F_N + F$, where $F > 0$. For simplicity, assume $F_N = 0$. So $F_S = F$.

Also, for simplicity, we assume that for both firms the **cost of imitation is 0**.

Two firms are symmetric in all respects except their capability of doing innovative R&D.

Demand structure:

The representative consumer's utility is a function of consumption x , y and the numeraire good m is given by $U(x, y) + m$ with

$U(x, y) = a(x + y) - \frac{x^2}{2} - \frac{y^2}{2} - \gamma xy$, where the term γ shows the degree of product differentiation and we assume that $\gamma \in (0, 1)$.

If $\gamma = 0$, this implies that the products of these firms are **isolated** but for $\gamma = 1$, the products are **perfect** substitutes.

Demand functions for x and y

$$P_x = a - x_N - x_S - \gamma y_N - \gamma y_S, \quad (1)$$

$$P_y = a - y_N - y_S - \gamma x_N - \gamma x_S, \quad (2)$$

where p_x and p_y are prices of goods x and y and a is positive constant.

Assume constant average cost of production for x and y , given by c , which is the same for both firms and $c < a$.

3.1 Implication for the firms' profits

3.1.1. Patent protection in South

These firms compete like Cournot duopolists in both North and South market.

Hence, in this situation the output of x and y in each country is $\frac{(a-c)}{(2+\gamma)}$. Thus,

profits of these firms are

$$\pi_N^P = \frac{2(a-c)^2}{(2+\gamma)^2} \text{ and } \pi_S^P = \frac{2(a-c)^2}{(2+\gamma)^2} - F_s. \quad (3)$$

3.1.2. No patent protection in South

In stage 2, each firm will find it optimal to imitate.

Note that firm N will always innovate x.

Firm S has two options: (i) to innovate y (and imitate x in stage 2) (IR) or, (ii) not to innovate y (and imitate x in stage 2) (OI).

Product Market:

IR: North (x, y) , South (x_N, x_S, y_N, y_S)

OI: North (x) , South (x_N, x_S)

Under IR:

The amount of x and y sold in the North is $\frac{(a-c)}{(2+\gamma)}$ and each firm supplies

$\frac{(a-c)}{3(1+\gamma)}$ units of each good in the South.

Therefore, profits of these firms, conditional on IR, are

$$\pi_N^{IR} = \frac{2(a-c)^2}{9(1+\gamma)} + \frac{(a-c)^2}{(2+\gamma)^2} \quad \text{and} \quad \pi_S^{IR} = \frac{2(a-c)^2}{9(1+\gamma)} + \frac{(a-c)^2}{(2+\gamma)^2} - F_s. \quad (4)$$

Under OI:

Firm N has monopoly in the North. However, in the South both firms sell the product x and compete à la Cournot. Therefore, profits of these firms, conditional on OI, are

$$\pi_N^{OI} = \frac{(a-c)^2}{9} + \frac{(a-c)^2}{4} \quad \text{and} \quad \pi_S^{OI} = \frac{(a-c)^2}{9}. \quad (5)$$

However, firm S will do OI instead of IR provided

$$F > (a-c)^2 \left[\frac{(1-\gamma)}{9(1+\gamma)} + \frac{1}{(2+\gamma)^2} \right] = G. \quad (6)$$

3.1.3 Comparing the profits under patent protection and no patent protection regimes

Proposition 1: (i) If costs of doing R&D are sufficiently small, i.e., $F_s < G$, both firms always prefer patent protection in the South.

(ii) If the costs of doing R&D are moderate, i.e., $F_s \in (G, H)$, firm S always prefers patent protection in South. For these costs of doing R&D, firm N prefers no patent (patent) in the South for $\gamma > (<) \gamma^c$.

(iii) If the costs of doing R&D are sufficiently large, i.e., $F_s \in (H, \pi_s^p = 0)$, firm S always prefers no patent protection in South. For these costs of doing R&D, firm N prefers no patent (patent) in the South for $\gamma > (<) \gamma^c$.

Firm N	Patent	No patent (if $\gamma > \gamma^c$)	No patent (if $\gamma > \gamma^c$)
		Patent otherwise	Patent otherwise
		G	H
<hr/>			
Firm S	Patent	Patent	No patent

$F_s \rightarrow$

Figure 1: Northern and Southern firms' preferences over patent protection regimes

3.2 Welfare implications

3.2.1 Patent protection in South

Welfare of the North and the South are respectively

$$W_N^P = \frac{(a-c)^2(3+\gamma)}{(2+\gamma)^2} \quad \text{and} \quad W_S^P = \frac{(a-c)^2(3+\gamma)}{(2+\gamma)^2} - F_s. \quad (9)$$

The world welfare is

$$W_W^P = W_N^P + W_S^P = \frac{(a-c)^2(3+\gamma)}{(2+\gamma)^2} + \frac{(a-c)^2(3+\gamma)}{(2+\gamma)^2} - F_S$$

3.2.2. *No patent protection in South*

When $F_S < G$, welfare of the North and the South are respectively

$$W_N^{NP} = \frac{(a-c)^2}{(2+\gamma)} + \frac{2(a-c)^2}{9(1+\gamma)^2} \quad \text{and} \quad W_S^{NP} = \frac{(a-c)^2}{(2+\gamma)^2} + \frac{2(a-c)^2}{3(1+\gamma)} - F_S.$$

World welfare in this situation is

$$W_W^{NP} = W_N^{NP} + W_S^{NP} = \frac{(a-c)^2}{(2+\gamma)} + \frac{2(a-c)^2}{9(1+\gamma)} + \frac{(a-c)^2}{(2+\gamma)^2} + \frac{2(a-c)^2}{3(1+\gamma)} - F_S. \quad (10)$$

If $F_S > G$, welfare of the North and the South are respectively

$$W_N^{NP} = \frac{35(a-c)^2}{72} \quad \text{and} \quad W_S^{NP} = \frac{(a-c)^2}{3}. \quad (11)$$

World welfare in this situation is

$$W_W^{NP} = W_N^{NP} + W_S^{NP} = \frac{35(a-c)^2}{72} + \frac{(a-c)^2}{3}. \quad (12)$$

3.2.3 *Comparing welfare under patent protection and no patent protection regimes*

Proposition 2: (i) Assume that $F_s < G$.

(a) *Welfare of the North is always higher under patent protection in the South compared to no patent protection in the South.*

(b) *Welfare of the South is always higher under no patent protection in the South compared to patent protection in the South.*

(ii) Suppose $F_s > G$.

(a) *Welfare of the North is higher under no patent (patent) in the South compared to patent (no patent) in the South provided the degree of product*

differentiation is sufficiently (not sufficiently) small, i.e., $\gamma > (<) \gamma^$.*

(b) Welfare of the South is higher (lower) under no patent protection in the South compared to patent protection in the South provided $F_s > D$ ($F_s \in (G, D)$).

North	Patent		No patent (if $\gamma > \gamma^*$)		No patent (if $\gamma > \gamma^*$)	
			Patent otherwise		Patent otherwise	
			G		D	$F_S \rightarrow$
<hr/>						
South	No patent		Patent		No patent	

Figure 2: Higher welfare to North and South under patent and no patent regimes

Firm N	Patent		No patent (if $\gamma > \gamma^c$)		No patent (if $\gamma > \gamma^c$)	
			Patent otherwise		Patent otherwise	
			G		H	
<hr/>						
Firm S	Patent		Patent		No patent	

$F_S \rightarrow$

Figure 1: Northern and Southern firms' preferences over patent protection regimes

$$\gamma^c < \gamma < \gamma^* \quad D > H$$

$$F_S \in [G, H) \text{ and } \gamma > \gamma^*$$

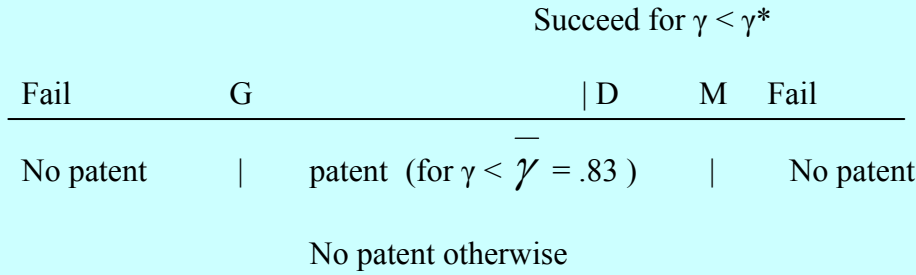
Implications for world welfare

Proposition 3: (i) If $F_s < G$, world welfare is higher under no patent protection than under patent protection in the South.

(ii) Consider $F_s \geq G$. World welfare is higher under patent protection than under no patent protection in the South if $\gamma < \bar{\gamma}(=.83, \text{approx.})$ and $F_s < M$, where

$$M = \frac{2(a-c)^2(3+\gamma)}{(2+\gamma)^2} - \frac{59(a-c)^2}{72}.$$

In terms of diagram



$F_S \rightarrow$

Figure 3. World welfare under different patent regimes.

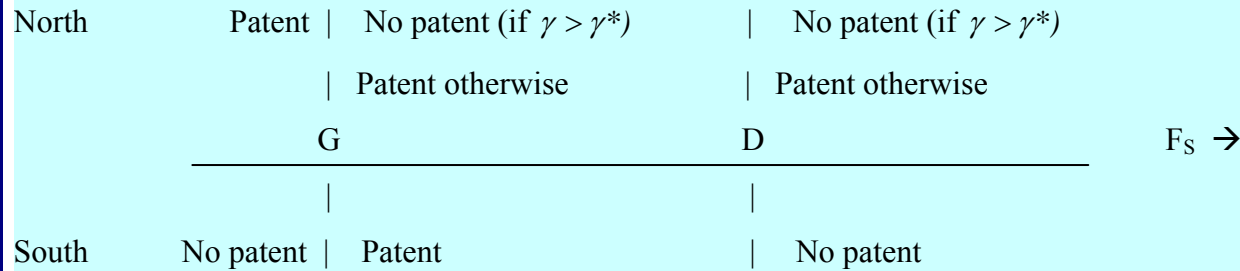


Figure 2: Higher welfare to North and South under patent and no patent regimes

$$\gamma^c < \gamma^* < \bar{\gamma} \quad M > D > H$$

Results: 1. Under certain parameter configurations **Northern firm might like the no patent** protection in the South to continue.

2. **Conflict of interest:** Northern **government would favour patent** protection in the South although the Northern **firm would prefer no patent** protection in the South.

3. It is also possible that the Southern firm may be better off **under patent** protection regime in the South whereas the Southern **government prefers the opposite**.

Most interestingly, we show that if the costs of doing Southern R&D are **sufficiently high and the goods are close substitutes**, the Northern and the Southern governments, and the Northern and the Southern firms are **all better off under no patent** protection regime in the South.

We also show that there are situations where the **Southern firm and the government prefer patent** protection regime in the South but the **Northern firm and the Northern government prefer no patent** protection regime in the South.

4. The paper also sheds light on the possible **outcomes of international negotiations** for implementing patent protection in the South. We show situations where Northern country may or may not be able to compensate the South for its welfare loss following the imposition of Southern patent protection.