Competition Policy and Innovation

Industrial Economics II

Jos Jansen

Max Planck Institute, Bonn

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Intellectual Property Rights

Often we have taken static view of industry: allocative efficiency.
Today issues related to **innovation**: productive and dynamic efficiency

Trade-off between dynamic efficiency (*ex ante*, incentives to innovate) and productive efficiency (*ex post*, incentives to diffuse technology)...
Time-consistency problem of policy maker for process innovation:

- Given innovation, productive efficiency would require full diffusion of new knowledge (reduce all costs, and thereby reduce prices)
- Given full diffusion of knowledge, no incentive to create new knowledge (free-rider incentives)

Patent protection and property right laws are ways of policy maker to commit not to expropriate innovator ex post.

IPR protection balancing act: Create market power for innovator (sacrifice *allocative efficiency*), in exchange for disclosure by innovator (to create diffusion after expiration of patent, *productive efficiency*) to give incentives to innovate (*dynamic efficiency*)

Antitrust and Innovation

Distinguish two activities in industries where innovation matters:

- **Creation of knowledge:** research and development [upstream mkt]
- **Usage of knowledge:** production [downstream market]

Firms can abuse IPRs for created knowledge to increase market power in product market.

Today analysis of some antitrust issues related to:

- **Diffusion of knowledge:**
  - Licensing of Innovation
  - Patent Pools

Licensing

Innovator who holds patent can delegate implementation of patented technology by signing a licensing agreement with third party.

Patent holder licenses technology, because it can lead to **efficient use** of intellectual property (pro-competitive), since:

- other is able to use your IP more efficiently
- other can use your IP as input to different or further innovations
- it can save transaction costs for developing complementary technologies, and resolve blocking rights

First, focus on first reason. Second, look at resolution of blocking rights.

Licensing

Licensing Contract

Firm holds patent for process innovation: reduction of marginal production cost. Patent holder offers a license contract to technology adopter for usage of patented technology.

Often such contract contains fixed fee F, and per-unit royalty, r. Royalties are based on use, for example, price per unit sold (or fraction of revenue).

- **Royalty** can be used to:
  - control market price — royalty adds to marginal cost of adopter
  - share risk — if adopter makes no sales, no royalty payment
- **Fixed fee** can be used to shift profit from adopter to patent holder

Today: focus on royalty rate to control market price.

Licensing

Competition

Consider Bertrand duopoly where existing technology gives unit cost c
Firm 1 (innovator) makes innovation, $c' < c$, but not drastic, $p^m(c') > c$.
Firm 2 (potential adopter) has no innovation.

- **No license:** Production by innovator at price $p^* = c - \varepsilon$.
- **License:** rate $r = c - \varepsilon - c'$ gives cost $c' + r = c - \varepsilon$ to adoptor. Production by adopter at same price, $p^* = c - \varepsilon$. Royalty rate extracts all profit from cost-reduction to innovator.

Both innovator and adopter are indifferent between licensing and not licensing. Here only effect of licensing is to shift production from innovator (no license) to adopter (license).

Can innovator do better?

Licensing

Cartelization (1)

Royalty $r' = p^m(c') - c'$ is acceptable too, and gives innovator $\pi^m(c')$...

- **Without license:** non-innovative firm earns zero profit, since innovator sets price slightly below c.
- **With license:** adopter has cost $c' + r' = p^m(c')$, and earns zero profit.

So license with $r' = p^m(c') - c'$ is acceptable, gives price $p^m(c')$ and monopoly profits to the innovator.

Patent holder can abuse license contract to cartelize market!

Licensing

Cartelization (2)

Crucial assumptions that make scheme work:

- **Royalty must be paid for any output of adopter.** If adopter can avoid paying royalties by sticking to old technology, c, it could undercut p^m, and undermine scheme. However, such contingent contracts need not be feasible (incentive compatible) when innovator or court cannot observe the usage of technology. Maybe problematic for antitrust authority to mandate contingent contracts.
- **No entry of new firms with old technology.** Entrant with cost c could undercut p^m and undermine scheme.

Authority should investigate markets where all potential entrants licensed.

Patent Pools

Potential Benefits

So far, we considered licensing of single innovation to users. For complex products (e.g. mobile phones) access to more than one technology is required to produce. **Coordination of supply** of required technologies, by pooling of patents and offering them as package, may increase welfare...

- Avoid delays in adoption of technologies due to coordination problems
- Reduce transaction costs of negotiation with individual rights holders
- Stimulate investments in promotion of adopting technologies in package
- Obtain offer for lower price....

Patent Pools

Complementary Patents

Consider n manufacturers of homogeneous good that need **both** of 2 complementary patented technologies (A and B) to get produced. Firm i owns patents i, and licenses at per unit royalty rate r_i for $i = A, B$.

1. Patent holders or pool choose royalty rates r_A and r_B
2. Manufacturers use patents to produce and compete in prices (at cost $r_A + r_B$) at demand $P(Q) = 60 - Q$

Comparison: pool that makes coordinated choice of royalties, versus individual patent holders who make non-cooperative choices

Solve game backwards:
Stage 2: equilibrium price equals marginal cost: $p^* = r_A + r_B$ and demand $Q^* = 60 - r_A - r_B$

Patent Pools

Cooperative Rate Choice: complements

Stage 1: Equilibrium choices of manufacturers (i.e. $Q^* = 60 - r_A - r_B$) are anticipated, when pool sets royalty rates...

- **Pool:** Patent holders assign right to exploit patents A and B to patent pool. Pool sets both royalty rates:

$$\begin{aligned} \pi_A(r_A, r_B) + \pi_B(r_A, r_B) &= (r_A + r_B)Q^* \\ &= (r_A + r_B)[60 - (r_A + r_B)] \end{aligned}$$

Maximization gives:

$$\begin{aligned} r_A^P + r_B^P &= 30 \text{ or, say, } r_A^P = r_B^P = 15 \\ \pi_i^P &= 15 \times 30 = 450 \\ p^P &= r_A^P + r_B^P = 30 \end{aligned}$$

Patent Pools

Non-Cooperative Rate Choice: complements

Stage 1: Equilibrium choices of manufacturers (i.e. $Q^* = 60 - r_A - r_B$) are anticipated, when individual patent holders set royalty rates...

- **No Pool:** Each patent holder chooses royalty rate independently. Is it equilibrium for individual firms to choose $r_A = r_B = 15$ again? Suppose competitor (firm B) does. Then firm A maximizes profit:

$$\pi_A(r_A, r_B) = r_A Q^*(r_A, 15) = r_A(45 - r_A)$$

Firm A chooses higher royalty rate, i.e. $r_A = 45/2 > 15$.
In equilibrium:

$$\begin{aligned} r_i^* &= 20 \text{ and } \pi_i^* = 400 \\ & p^* = r_A^* + r_B^* = 40 \end{aligned}$$

In pool final prices [and royalties] are lower (consumers better off), and patent holders profits are higher

Patent Pools

Demand Externality

Royalty rate increase by patent holder B imposes **negative externality** on patent holder A. It reduces demand from manufacturers, which hurts both firms. Patent holder B receives extra revenue from price increase, but patent holder A does not benefit. Therefore, patent holders have **excessive incentive** to increase royalty rates.

Patent pool management internalizes negative (demand) externality, and chooses lower royalty.

Patent Pools

Substitutable Patents

Consider n manufacturers of homogeneous good that need **one** of 2 patented technologies (A or B) to get produced. Firm i owns patents i, and licences at per unit royalty rate r_i for $i = A, B$.

1. Patent holders simultaneously choose royalty rate r_i
2. Manufacturers use patents to produce and compete in prices (at cost $\min\{r_A, r_B\}$) at inverse demand $P(Q) = 60 - Q$

Solve game backwards:
Stage 2: equilibrium price equals marginal cost: $p^* = \min\{r_A, r_B\}$ and demand

$$Q_i^*(r_i, r_j) = \begin{cases} 60 - r_i, & \text{if } r_i < r_j \\ \frac{1}{2}(60 - r_i), & \text{if } r_i = r_j \\ 0, & \text{otherwise} \end{cases}$$

Patent Pools

Royalty Rates: substitutes

Stage 1: Equilibrium choices of manufacturers ($Q_i^*(r_i, r_j)$ for $i = A, B$) are anticipated, when royalty rates are set...

- **Pool:** pool sets royalty rates to maximize:

$$\pi_A(r_A, r_B) + \pi_B(r_B, r_A) = r_A Q_A^*(r_A, r_B) + r_B Q_B^*(r_B, r_A)$$

  which gives $r_i^* = 30$, $\pi_i^* = 450$, $p^* = 30$

- **No pool:** each patent holder chooses royalty rate to maximize:

$$\pi_i(r_i, r_j) = r_i Q_i^*(r_i, r_j)$$

  which gives: $r_i^* = 0$, $\pi_i^* = 0$, $p^* = 0$

With substitutable technologies, patent pool increases final good price (consumers worse off)

Patent Pools

Potential Dangers

- **Problem:** Antitrust authority may not be able to verify whether all patents in pool are essential, i.e. their absence would block development of new product. Also firms with substitutable patents may have incentive to form pool and collude. Higher prices harm consumers.

- **Remedy:** Allow pool members to license patents individually. Anti-competitive pools tend not to be robust to independent licensing (provided that pool members set individual royalty rates non-cooperatively)

- **Potential drawbacks of remedy:**
  - Firms may get excessive incentives to invent around individual patents in pool
  - Firms may get lower incentive to form patent pool in first place

Summary

- **Licensing**
  - Benefit of licensing: it creates market for diffusion of knowledge
  - Potential danger of licensing: royalty rates can be used to cartelize market
- **Patent Pools**
  - Complements: Pool internalizes externality and reduces excessive royalty rates to manufacturers
  - Substitutes: Pool increases rates to manufacturers if it pools sufficiently substitutable technologies

Further Readings

- Gilbert (2008) "Competition Policy for Intellectual Property," in Paolo Buccirossi (ed.) *Handbook of Antitrust Economics*, MIT Press
- Scotchmer (2004) *Innovation and Incentives*, MIT Press, Chapter 6
- Shapiro (2001) "Navigating the Patent Thicket: Cross licenses, patent pools, and standard setting," in Jaffe, Lerner and Stern (ed.) *Innovation Policy and the Economy*, vol. 1, NBER/MIT Press