Law And Economics

Intellectual Property Law

Francisco Poggi

University of Mannheim - Fall 2021

Introduction

Intellectual Property: intangible assets.

- Takes many forms:
  - Patents (exclusive rights)
  - Copyrights (literary and artistic work)
  - Trademarks (way to distinguish goods of service from a specific provider)
  - Geographical Denomination.

- Why do we have intellectual property rights? Production of ideas.

Why is innovation an interesting economic problem?

- Innovation is the production of information.
- In the absence of legal protection, owner cannot simply sell it to a market.
  - Any purchaser destroys the monopoly at little or no cost.
- Two important externalities:
  - Appropriability effect. Private benefit from innovation might not capture consumer surplus, or follow-up innovations.
  - Business stealing effect. Firm does not internalize the loss of profit by rivals.
- Competition generates inefficiencies:
  - Duplication of efforts (treasure hunt).
  - Race effect.

Benefits of Intellectual Property Law

- Encourages innovation via *appropriability*.
- Generates more transparency.
  - Secrecy might be socially costly.
  - Helping disseminating the innovation.
  - (Although less dissemination that would be efficient.)

Patents

- Two systems:
  - First to invent (US until 2011).
  - First to file (international standard).

- Pros and Cons:
  - First to invent is seen as more *fair*.
  - First to file might benefit large companies.
  - First to file is easier to enforce.
  - First to file encourages filing fast. Higher dissemination.

Alternative Mechanisms

- **Award System**: Designating a well-defined project and then granting a fixed sum of money as the prize for the first firm that completes the project.
  - Government should he highly knowledgeable.
  - If prize is determined after innovation takes place, there is a hold-up problem.
  - Competition at the research level, no reason why should be better.

- **Procurement or Contractual Mechanism**: Designating a well-defined project and then granting it to a single firm to produce the innovation.
  - Prevents excessive duplication of research costs.
  - Government must know the value of the innovation.

Breadth and Duration

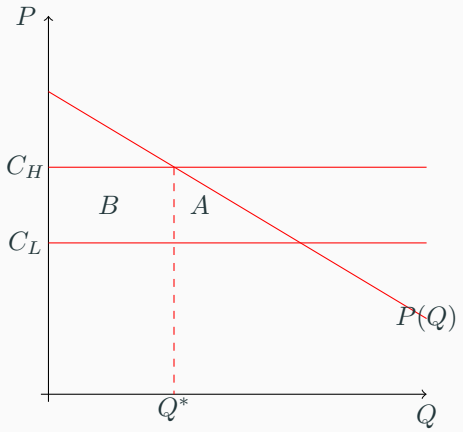
- Novel and screen adaptation:
  - Narrow copyrights give the novelist ownership over the novel and the adapter rights over screenplay.
  - Broad copyrights give the novels ownership over both.
- Duration:
  - Usually 20 years for patents.
  - Higher for *orphan drugs*, that also get *market exclusivity* in the EU and the US.
- Trade-off:
  - Narrow and short IPR better ex post more competitive/efficient market outcome.
  - Broad and long IPR encourages more innovation.

Bertrand model with Innovator

- Model:
  - Perfect substitutes. Inverse demand $P(Q)$.
  - Incumbent's marginal cost of production: c_H.
  - If innovation is successful, marginal cost $c_L < c_H$.
  - Probability of success p (choice variable).
  - Cost of innovation development $C(p)$ (increasing and convex $C(0) = C'(0) = 0$).

- Timing:
  - Innovator decides probability of success.
  - If innovation is successful, Bertrand competition.

Bertrand Model with Innovator



Market

Bertrand Model with Innovator

- Let $Q^* = P^{-1}(c_H)$.
- Bertrand equilibrium if innovation happens: (c_H, c_H) and the innovator sells Q^*.
- Private Value of Innovation:

$$B = (c_H - c_L) \cdot Q^*$$

- The innovator captures all the value from innovation GIVEN the inefficiencies in the market if the innovation happens.

Optimal Duration of a Patent

Consider a dynamic version of the model.

The firm that innovates gets a 'flow' B for a period of T. Discounted benefit:

$$\int_0^T e^{-rt} B \, dt = [1 - e^{rT}] \frac{B}{r}$$

Total welfare is the flow B for period T and $B + A$ after that point. Discounted welfare:

$$\int_0^T e^{-rt} B \, dt + \int_T^\infty e^{-rt} (B + A) \, dt = \frac{B}{r} + e^{-rT} \frac{A}{r}$$

Optimal Duration of Patent

- Designer's problem:

$$\max_{T} \qquad p(T)\left[\frac{B}{r} + e^{-rT}\frac{A}{r}\right] - C(p(T))$$

- Solution for $C(p) = \frac{c}{2}p^2$

$$e^{-rT^*} = \frac{A}{2A+B}$$

  - For quadratic cost, the result is independent of c.
  - Depends only on B/A (elasticity of demand) and r.
  - When $A = 0$, $T^* = \infty$.
  - When B approaches 0, $T^* = \log(2)/r$.
  - $\log(2)/r$ is a lower bound of T^*, for $r = 3.5\%$, this is about 20 years.

Copyrights

- Why are copyrights protected?
  - Incentives for creation.
  - Incentives for maintenance.
  - Congestion.

- Fair use doctrine is usually justified via transaction costs argument.
  - Parodies (dumb starbucks).
  - Critic's privilege.

Duration

- Trademarks and Trade Secrets don't have a duration (like physical property).
- **Trademark**:
  - Role is informative.
  - Competitors are not harmed, as long the trademark does not increase their cost of communication.
  - (Trademarks do loose protection when they become generic: yo-yo, thermos, aspirin)
- **Trade Secrets**:
  - Only protect against unlawful appropriation of confidential information (e.g.theft, breach of contract).
  - Competitors are free to appropriate via reverse engineering or independent discovery.
  - Firms are responsible of keeping their secrets secret.

Secrecy vs Patent

- With a patent,
  - Developer enjoys market exclusivity for a fixed time period T. This is valued at B.
  - After T, anyone can copy. Profit zero.
- With Secrecy,
  - Anyone that develops can copy. Assume that development happens with probability p independent across periods.
  - Cost of keeping things secret c.

Patent Payoff

$$\begin{aligned}\pi^P &= B + \delta B + \delta^2 B + ... + \delta^T B \\ &= \frac{(1-\delta^{T+1})B}{1-\delta}\end{aligned}$$

Secrecy Payoff

Given that someone develops at time t,

$$\begin{aligned}\pi^S(t) &= (B-c) + \delta(B-c) + \delta^2(B-c) + ... + \delta^t(B-c) \\ &= \frac{(1-\delta^{t+1}) \cdot (B-c)}{1-\delta}\end{aligned}$$

Probability that someone develops at time t is: $p(1-p)^t$.

$$\begin{aligned}\pi^S &= E[\pi^S(t)] = \sum_{t=0}^{\infty} p(1-p)^t \pi^S(t) \\ &= \frac{(B-c)}{1-\delta(1-p)}\end{aligned}$$

Patent vs Secrecy

Secrecy iff

$$B[\delta^{T+1}(1-\delta) - p\delta(1-\delta^{T+1})] > c(1-\delta)(1-p)$$

In other words, iff $\frac{B-c}{1-\delta(1-p)} \geq \frac{(1-\delta^{T+1})B}{1-\delta}$

$$p < \frac{\delta^T - \delta^{T+1}}{1-\delta^{T+1}}$$

AND B/c is high enough.

Patent Races

- Patents feature *winner-takes-it-all* characteristics.
- This generates a 'race effect' that distorts the innovation process.
- Bryan, K. A. and Lemus, J. (2017). The direction of innovation. ***Journal of Economic Theory*, 172:247–272**

Patent Races

- Two potential innovations, A and B.
- Two firms that can allocate an indivisible unit of research to either innovation.
- These inventions are perfect substitutes: once one is discovered, the marginal value of the other one falls to zero.
- A is relatively easy to invent: If one firm researches A and the other firm researches B, A is discovered first with probability $3/4$.
- A is worth \$12. B is worth \$16.
- Firms that innovate perfectly capture the value created.

Patent Races

- **Efficient allocation**:
  - Firms should work on project B.

- **Equilibrium allocation**:
  - If other firm works on B,
    - Work on B gives \$16 with probability 1/2. \$8.
    - Work on A gives \$12 with probability 3/4. \$9.
  - If other firm works on A,
    - Work on B gives \$16 with probability 1/4. \$4.
    - Work on A gives \$12 with probability 1/2. \$6.

Imperfect Appropriation: Follow-up Inventions

- Two potential innovations, A and B.
- Two firms that can allocate an indivisible unit of research to either innovation.
- Once A is invented, it becomes possible for each firm to work on a third invention, C.
- These inventions are perfect substitutes: once A is discovered, the marginal value of B is zero. Once B is discovered, the value of A and C is zero.
- All innovations are equally difficult to develop.
- A is worth \$4 and C adds \$8. B is worth \$10.
- Firms that innovate perfectly capture the value created.

Follow-up Inventions

- **Efficient allocation**:
  - Firms should work on project A first and C once it opens up.
- **Equilibrium allocation**:
  - Other firm works on B,
    - Work on B gives \$10 with probability $1/2$. \$5.
    - Work on A gives \$4 with probability $1/2$, and opens C, so the firm gets \$8 with probability $1/2 \cdot 1/2$. \$4.
  - Other firm works on A,
    - Work on B gives \$10 with probability $1/2$. C is going to be opened with probability $1/2$, in which case the firm gets 8 with probability $1/2$. \$7.
    - Work on A gives \$4 with probability $1/2$. C is going to be opened, so the firm gets \$8 with probability $1/2$. \$6.

Bryan, K. A. and Lemus, J. (2017). The direction of innovation. *Journal of Economic Theory*, 172:247–272.