

Law and Economics

(Intellectual) Property Law

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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.
 - protection helps disseminating the innovation.
 - (Although less dissemination that would be efficient.)

- 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 be highly knowledgeable.
 - If prize is determined after innovation takes place, there is a hold-up problem.
 - With race at the research level, no reason why this should be better than a patent.
- **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

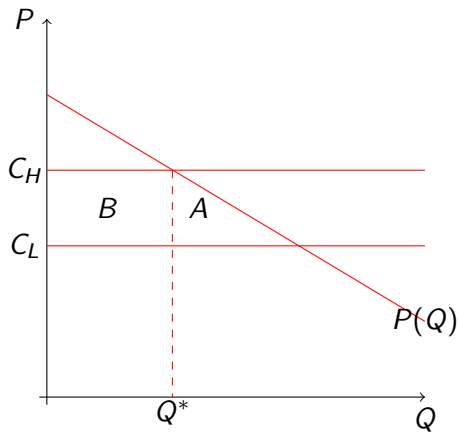
- **Breadth:** how narrow or broad are the rights defined.
 - Example: novel and screen adaptation.
 - Narrow copyrights give the novelist ownership over the novel and the adapter rights over screenplay.
 - Broad copyrights give the novels ownership over both.
- **Duration:** how long do these rights last.
 - 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 R&D: $C(p)$ increasing and convex with $C(0) = C'(0) = 0$.

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

Bertrand Model with Innovator



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:

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

- 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.

- 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

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

Secrecy Payoff

Given that someone develops at time t ,

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

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

$$\frac{B - c}{1 - \delta(1 - p)} \geq \frac{(1 - \delta^{T+1})B}{1 - \delta}$$

In other words, if

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

AND B/c is high enough.

- Patents feature *winner-takes-it-all* characteristics.
- This generates a 'race effect' that distorts the innovation process.
- Bryan and Lemus "*The direction of innovation*" (JET, 2017).

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.

- **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.

