Lecture 4 - Patents and Intellectual Property Rights

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Patents and IPRs

IPRs: economic problem

> **i** Object of analysis
>
> IPRs make a non-rival good partially excludable, creating private incentives for costly innovation.

- ▶ Knowledge is (partly) **non-rival** and often **hard to exclude**
- ▶ Without protection, imitation can dissipate rents ⇒ weak private incentive to incur fixed R&D cost
- ▶ **Policy objective**
  - ▶ Provide incentives for invention while limiting static distortions in product markets

IPRs: instruments

- ▶ Main IPR types:
  - ▶ Patents
  - ▶ Trademarks
  - ▶ Copyrights
  - ▶ Design rights

Scotchmer: ideas model

Ideas model (Scotchmer): primitives

Following Scotchmer (2006)

▶ An "idea" is a pair (ν, F)
▶ ν: per-period consumer surplus under competitive supply (value parameter)
▶ F: fixed cost to develop the idea into an innovation (R&D cost)
▶ **Interpretation**
  ▶ ν captures the size of social gains from making the idea usable
  ▶ F is the up-front resource cost required for development

Ideas model (Scotchmer): social value under discounting

Assume social value lasts forever and the product is competitively supplied.

▶ Per-period social value: ν
▶ Discounted social value:

$$\sum_{t=1}^{\infty} \frac{1}{(1+r)^t} \nu = \frac{\nu}{r}$$

Breadth: product space

Patent breadth: product space (definition)

▶ Breadth determines how close a substitute can be without infringing

▶ Reduced-form implication:
  ▶ Narrower breadth ⇒ more close substitutes enter
  ▶ Broader breadth ⇒ fewer close substitutes enter

▶ **Interpretation**
  ▶ Allowing close substitutes increases the elasticity of demand faced by the patent holder

Breadth and demand elasticity (intuition)

▶ If close substitutes are allowed:
  ▶ residual demand becomes **more elastic**
  ▶ equilibrium price is lower (all else equal)

▶ If substitutes are excluded (broader patent):
  ▶ residual demand is **less elastic**
  ▶ equilibrium price is higher (all else equal)

Breadth–length trade-off (given a target value)

Assume the "correct" expected private value of protection is fixed

Optimal patent length with endogenous R&D (Shy)

Shy (1995) model: setup

▶ Demand: $P(Q) = a - Q$

▶ Process innovation reduces marginal cost from c to $c - x$

▶ R&D effort x costs $R(x)$

▶ Two-stage game:
  1. Regulator chooses patent duration τ
  2. Firm chooses x to maximise discounted profit

▶ **Objects**
  ▶ Choice variables: x (firm), τ (regulator)
  ▶ Parameters: a, c, r

Shy model: firm's choice of x given τ

Firm solves:

$$\max_x \ \Pi(x; \tau) = \sum_{t=1}^{\tau} \rho^{t-1} \pi(x) - R(x), \quad \rho = \frac{1}{1+r}$$

Assume:

▶ per-period profit: $\pi(x) = (a - c)\,x$

▶ cost: $R(x) = \dfrac{x^2}{}$

Patent races
Symmetric patent race: setup

▶ Two symmetric firms may incur a fixed cost f to establish a research division
▶ Success probability: p (per firm)
▶ Payoffs:
   ▶ monopoly profit if sole innovator: π^m
   ▶ duopoly profit if both succeed: π^d
▶ Welfare benchmarks (post-innovation welfare):
   ▶ one research division: $W^m = \pi^m + CS^m$
   ▶ two research divisions: $W^d = 2\pi^d + CS^d$
▶ Assumption (for the comparison):
   ▶ $CS^d > CS^m$ (more competition in the product market raises consumer surplus)

Patent race: Nash equilibrium condition

⚠️ Duplication incentive

"Winner-takes-all" payoffs can create privately excessive entry
into R&D when firms ignore duplication costs.

Summary and next week

Summary

▶ Patents trade off dynamic incentives against static distortions (deadweight loss during protection)

▶ In the ideas model, investment requires $\pi\nu T \geq F$, while welfare accounts for $\frac{\nu}{r}$ and the DWL term $\ell\nu T$

▶ Breadth and length can be substitutes in delivering a given private incentive level (broad–short vs narrow–long)

▶ Patent races can generate socially excessive duplication when private entry incentives exceed social benefits

Next week: multi-stage games

▶ Commitment and first-mover advantage (Stackelberg)

▶ Subgame perfect equilibrium and backward induction

▶ Strategic delegation (Vickers)

References

Scotchmer, Suzanne. 2006. *Innovation and Incentives*. MIT Press.