

Lecture 4 - Patents and Intellectual Property Rights

Gerhard Riener

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 \Rightarrow 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:

$$\sum_{t=0}^{\infty} \frac{1}{(1+r)^t} \nu = \frac{\nu}{r}$$

Breadth: product space

Patent breadth: product space (definition)

- ▶ Breadth determines how close a substitute can be without infringing
- ▶ Reduced-form implication:
 - ▶ Narrower breadth \Rightarrow more close substitutes enter
 - ▶ Broader breadth \Rightarrow 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: $R(x) = x^2$

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.