Are Intellectual Property Rights really needed for more and better innovations?

Some boring views from the "dismal science" (i.e. economics)

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"The protection of intellectual property is important not only for promoting innovation and creativity, but also for developing employment and improving competitiveness"

European Directive 2004/48/EC

"If one wants to induce firms to undertake R&D one must accept the creation of monopolies as a necessary evil"

J.A. Schumpeter, *Capitalism, Socialism and Democracy*, 1943

The dilemma

- ▶ Monopoly power decreases social welfare: higher prices, lower quantities, lower incetives to innovate
- ▶ In principle we fight against monopolies (antitrust laws and authorities)
- ▶ But we also create artificial monopolies through IPRs, patents in particular
- ▶ Such IPRs based monopolies are becoming more and more important (and an important source of inequality)

The rationale

- Patents and IPRs are a necessary evil: they create monopolies but without them innovation would decline for lack of economic incentives
- If innovators invest resources in producing new knowledge they want to get the economic returns it generates
- If imitation is legal and as long as imitation costs are considerably lower than innovation costs imitators will have a competive advantage over innovators
- If innovators anticipate this they will not invest in innovation in the first place

Is society solving this incentive problem in the right way?

- ▶ I want to briefly discuss two issues:
    1. Solving this problem by (intellectual) property rights is not correct from an economic point of view: exclusion rights should not be there
    2. In particular in complex technologies exclusion rights produce a relevant net loss of social welfare and innovation

The economic rationale for property is only half there!

- ▶ Property rights can solve two problems:
    1. A problem of excess exploitation: if a resource is under common property is everyone's incentive to exploit it as much as possible
    2. A problem of insufficient investment: if I invest in a common property I will share the benefit with everybody else, so I have little incentive to invest
- ▶ property confers "exclusion rights" to prevent the former
- ▶ but excess exploitation DOES NOT happen with knowledge, which IS NOT an exhaustible resource, quite on the contrary it improves and increases with use

An NK-like model of complex technologies

Main features:

- product innovation, where products are complex systems of interdependent components (complex product space);
- innovation can generate new products weakly (or not at all) competing with existing ones if enough differentiated in the product space (sub-markets)
- imitation is costly and problematic (complex /interdependent systems cannot be usually imitated "piecewise")

Products

- **products** are made of many component: $\{x_1, x_3, \ldots, x_n\}$.
- each component can take one out of a countable set of values $x_j = \{0, 1, \ldots\}$, i.e. progressively better components
- a product's technological performance is a function $f : X \mapsto R^+$, possibly non-linear and/or non-monotonic: a complex product space
- products diversity may be measured horizontally (number of diverse components) and vertically (distance between components)

Firms

- single product firms
- **prices**: at each time step innovators and a few randomly chosen firms can set prices at profit maximizing level, under the assumption that competitors do not react
- **R&D investment** is a boundedly rational routinized decision subject to adaptive learning (cf. models of Schumpeterian competition *à la* Nelson and Winter)
- firms decide the amount of innovative R&D and imitative R&D and scope of R&D as a share of profits.
- **innovation**: random draw of new components in the neighborhood of the current product. R&D investment determines how many different components can be modified and the size of steps. Firm can be specialized (search only on few components) or generalists (broad search on all components).

Consumers

Maximize utility, which depends upon

- product price
- product technological performance
- product characteristics: each consumer has idiosyncratic preferences for a specific product profile

At each time step only a share of consumers can modify choice, all the others repeat previous purchasing decision

Patents

Patent regimes are defined by:

- patentability standards (required to get a patent)
- patent amplitude (required to sell a product)

Patentability standards

- patent life
- vertical breadth: required minimum distance on single components
- horizontal breadth: minimum number of components which must differ
- patent "coarseness": can we patent whole products, modules or single components?

Patent amplitude

- vertical amplitude: required minimum distance on single components
- horizontal amplitude: minimum number of components which must differ
- patent "coarseness": on how many components do we measure vertical and horizontal amplitudes?

Some results

- **product complexity**:
  - If product complexity is low strong patent regime increases social welfare: higher prices and concentration is more than compensated by higher innovation and product quality.
  - If product complexity is high, a strong patent system, in addition to leading to higher prices and concentration, is also a cause of lower rates of innovation and product quality growth.
 - *de jure* vs. *de facto* amplitude of patents
- **patent coarseness**:
  - if patents are granted on single components they generate long run inefficiencies even in environments characterized by low complexity
  - granting finer patents selects firms with excess R&D specialization. In complex product spaces this determines early lock-in into suboptimal products.

Simple product space
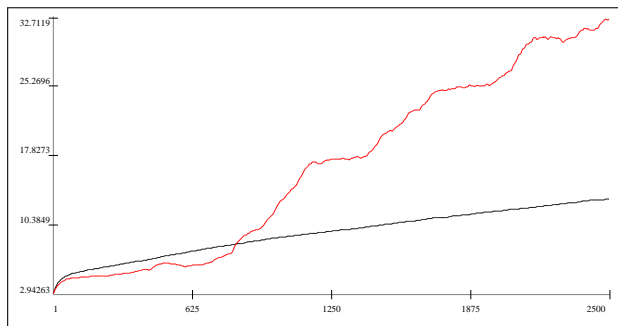
Consumers' welfare, with patents (red) and without patents (black). (N=10, no interdependencies)
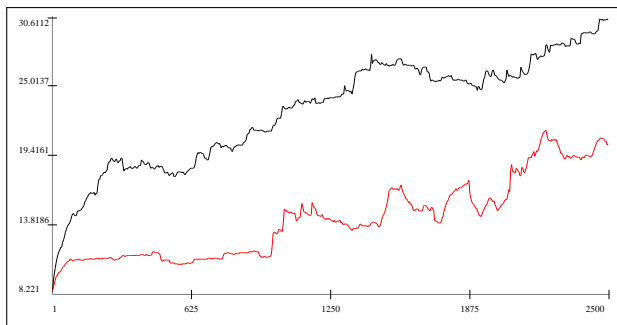
Complex product space
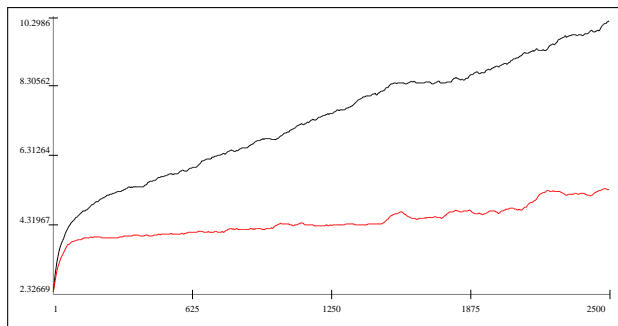
Consumers' welfare, with patents (red) and without patents (black). (N=10, high interdependencies)
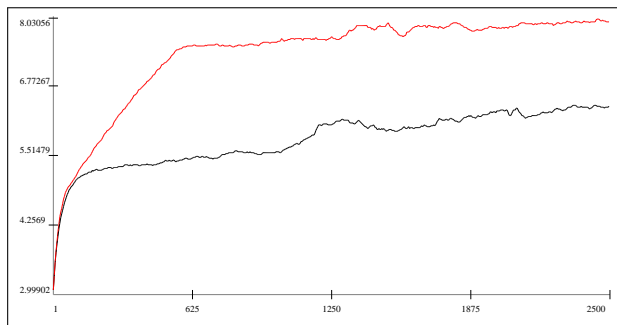
Innovativeness

Average product quality, with patents (red) and without patents (black). (N=10, high interdependencies)

Coarse vs. fine patents

Consumers' welfare, with coarse patents (red) and fine patents (black). (N=10, low interdependencies)