Use of Patents in Different Industries

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Questions

* the role and effects of patents vary considerably across industries.

* can we document systematically this heterogeneity and can we provide a conceptual framework for explaining this diversity?

* how should the patent system deal with these differences? Should patent laws be tailored to industry specificities or should they be kept as homogeneous as possible?
Functions of patents

- Patents are a tool for protecting innovation from imitation, thereby providing supra-normal profits and thus incentives to costly innovative activities which would not otherwise have been undertaken.

- Patents play a fundamental role in disclosing information about innovations which might have been otherwise kept secret, thereby fostering further technological progress.

- Patents support the development of markets for technologies and encourage the development and commercialization of inventions and they may avoid a wasteful duplication of efforts.
the ways inventors use patents is likely to vary as a function of a host of sector-specific variables which define the relative role of these functions.

For example, patents are likely to be applied for in industries
- where the R&D cost is high but imitation is cheap;
- when the information disclosed by the patent does not provide competitors with substantial new innovative opportunities
- when innovation is cumulative or requires the access to multiple fragments of knowledge controlled (through patents) by other agents and exchange of technology becomes critical;
- where the development of an invention made by a small independent inventor requires substantial costs, so that the patent can be licensed to a larger firm; etc.
Interactions

- These variables are themselves determined by complex interactions between fundamental factors like the ways in which technological change is organised and proceeds, the modes of competition, etc...

- Nordhaus 1969: optimal patent length is a (negative) function of demand elasticity, of the productivity of research and of the economic impact of innovation (and of course of the difficulty of imitation).

- But the relationships defining the efficacy and efficiency of patent protection are often non-linear. Thus, understanding how and why patents are used in heterogeneous ways in different industries turns out to be a much more difficult issue. Even more so, at it concerns the welfare effects of alternative patenting regimes in specific sectors.

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New developments

* over the past 30 years or so the use of patents has been dramatically increasing.
* the “knowledge economy”: growing importance of intangibles
* establishment (first in the USA and then throughout the world) of a strong intellectual property regime: the “pro-patent era”
Changes in the use of patents

the use of patents has deeply changed in the last few decades, far beyond the sheer protection from imitation and the exchange of knowledge

strategic behaviour:

companies pay bonuses to staff whose inventions are patented

patents are now routinely used to rank companies

increasing importance of market (i.e. trade of technologies), defensive (cross-licensing) and reputation strategies (to signal assets and competencies)

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new actors and new patenting strategies

- "patent trolls"
- aggressive IPR exploitation by universities and other public research organisations
  - patent pledges and patent commons.
- New markets for patents are emerging: an increasing number of new companies and investment groups has begun to buy, sell, broker, license and auction patents. In this way, small, independent inventors can avoid costly negotiations and court cases, leaving to the market to determine the value of their patents.

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Effectiveness of patents

- a) the effectiveness of patents as a mechanism for appropriating the return from R&D varies across firms and industries,
- b) patents are more effective for product innovations than for process innovations, and
- c) are more often used for radical innovations than for incremental (marginal) inventions

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Mechanisms of appropriability

- different mechanisms to appropriate returns from their innovation:
  - trade secrets
  - lead times
  - Learning curves
  - complementary assets

- The relative importance of these mechanisms contributes to define the role of patents in each industry and even business-line.

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Mansfield, the Yale Survey, etc..

firms do not consider patents as very important for protecting the competitive advantage stemming from their innovations, especially for process innovations.

the effectiveness of patents differs across industries

Patents are effective only in certain industries such as chemicals, pharma, biotechnologies, petroleum, refining

Robust results across countries

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Why are patents more important in some industries than in others?

- The effectiveness of patents is linked to the specific characteristics of the technology and of the R&D process as well as on the nature of the market and on the patterns of competition.

- Technological regimes:
  - Opportunities to innovate,
  - The ways in which profits are extracted from innovation,
  - Cumulativeness of technical progress,
  - Nature of the knowledge base.
Table 2: Main factors affecting the role and effectiveness of patents in different technological regimes

| Appropriability conditions | 1. Costs of imitation  
|                           |   • Degree of substitutability of patented technologies  
|                           |   • Effectiveness of alternative appropriation strategies  
|                           |   • Nature of the production process  |
| Nature of the R&D process | a) Structure of R&D costs  
|                           |   • Capital intensity of the R&D process  
|                           |   • Uncertainty of the innovation process  
|                           |   • Pace of innovation  
|                           |   • R&D organisation  |
| Nature of technology      | • Technological complexity  
|                           | • Cumulativeness  
|                           | • Relevance of technological standardization  |
| Nature of the knowledge base | • Distance between fundamental knowledge and its application  
|                           | • Observability  
|                           | • Tacitness  |
| Nature of the market      | • Size of the market  
|                           | • Market structure  
|                           | • Nature of competition (e.g. price vs. being cutting-edge  |

Source: Adapted from Pammolli and Rossi (2006)
### Table 1 Patent premium estimates

<table>
<thead>
<tr>
<th>Category</th>
<th>Expected patent premium</th>
<th>Conditional p. premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical instruments</td>
<td>1.11</td>
<td>1.62</td>
</tr>
<tr>
<td>Biotech</td>
<td>0.99</td>
<td>1.58</td>
</tr>
<tr>
<td>Drugs and medicines</td>
<td>0.96</td>
<td>1.57</td>
</tr>
<tr>
<td>Office and computing equipment</td>
<td>0.73</td>
<td>1.49</td>
</tr>
<tr>
<td>Machinery</td>
<td>0.72</td>
<td>1.49</td>
</tr>
<tr>
<td>Industrial chemicals</td>
<td>0.66</td>
<td>1.48</td>
</tr>
<tr>
<td>Other electrical equipment</td>
<td>0.58</td>
<td>1.46</td>
</tr>
<tr>
<td>Other chemicals</td>
<td>0.57</td>
<td>1.46</td>
</tr>
<tr>
<td>Communication equipment</td>
<td>0.56</td>
<td>1.45</td>
</tr>
<tr>
<td>Semiconductors</td>
<td>0.55</td>
<td>1.45</td>
</tr>
<tr>
<td>Metals</td>
<td>0.54</td>
<td>1.44</td>
</tr>
<tr>
<td>Petroleum refining and extraction</td>
<td>0.50</td>
<td>1.44</td>
</tr>
<tr>
<td>Other manufacturing industries</td>
<td>0.49</td>
<td>1.43</td>
</tr>
<tr>
<td>Instruments, exc. Medical</td>
<td>0.47</td>
<td>1.43</td>
</tr>
<tr>
<td>Aircraft and missiles</td>
<td>0.46</td>
<td>1.42</td>
</tr>
<tr>
<td>Transportation, exc. Aircrafts</td>
<td>0.46</td>
<td>1.43</td>
</tr>
<tr>
<td>Rubber products</td>
<td>0.42</td>
<td>1.42</td>
</tr>
<tr>
<td>Electronic components, exc. Semicond</td>
<td>0.40</td>
<td>1.41</td>
</tr>
<tr>
<td>Food, kindred, and tobacco products</td>
<td>0.28</td>
<td>1.38</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.60</strong></td>
<td><strong>1.47</strong></td>
</tr>
</tbody>
</table>

Source: Arora et al. (2008)
complex vs. discrete technologies

- complex vs. discrete technologies
- A new product or process is composed of numerous separately patentable elements or relatively few
- Sectors characterized by discrete product technologies are typically drugs, chemicals, steel, and metal products
- Examples of complex product technologies are electronics, software and semiconductors.

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differences in the use of patents

* ease of obtaining a valid patent, that is the lack of patentability or the difficulty in demonstrating the novelty of an invention
* ability of competitors to “invent around”
* danger of disclosing too much information to potential competitors.
Why do firms patent if patents are ineffective means of appropriation?

- Reasons for patenting:
  - to avoid being copied (patent pre-emption)
  - to block rival patents on related innovations

- Strategic considerations:
  - prevention of suits,
  - possibility to use them in negotiations
  - to build “reputation”.

It is now widely recognized that patents are largely (and increasingly) used for transactional, strategic, and signaling motivations, i.e., as instruments to obtain access to externally developed technologies, as defensive tools, as revenue-raising licensing strategies, and as mechanisms for conveying information about their technological capabilities (and hence in facilitating the access to funding).

- Blocking patents typically may be used either to extract licensing revenue or to force inclusion in cross-licensing negotiations.

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Patent pools and cross-licensing:
- critical when product development implies significant standardisation issues, as in telecommunications and computers
- stronger in highly concentrated industries (e.g. semiconductors) where only few players compete and it might therefore be easier to agree upon effective cross-licensing strategies.

Defensive patenting:
- cross-licensing, negotiations purposes and to prevent hold-up ("patent fences"
- "patent thickets"
- protecting brand names and forming an industry standard
- restraining the power of suppliers
- ‘freezing’ a technology
- creating a smoke screen’
- raising entry barriers

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signalling

- attracting venture capital funds and securing financing for startups
- particularly important in new, uncertain and fast growing technologies (biotechnology, nanotechnology, etc.).
- disseminating information about promising research trajectories and their own specific capabilities
- patents strengthen the relationship between inventors and investors by regulating the disclosure of knowledge and reducing the risk of misappropriation by the investor

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Should patent laws explicitly recognise sectoral differences?

* So far both conceptual and practical considerations have prevented the introduction of sector-specific rules.

* The prevailing legal doctrine was - and still is, to a significant extent - that patent laws should be in principle uniform.

* the United States Supreme Court has held that patent standards in the United States are designed to adapt flexibly to both old and new technologies, encompassing "anything under the sun that is made by man."
On the practical side

- how an industry can and should be defined is intrinsically difficult and controversial

- differentiated legal regimes would inevitably lead to strategic behaviour on the part of patent applicants, seeking protection in more favourable statutes (e.g., drugs).

- how many different statutes should be written? How fast would judges learn and develop the law supporting the cases? The result would probably be high uncertainty and soaring administrative costs and litigation

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On the other hand

- the idea that overly homogenous patent laws may be detrimental to is gaining support in other areas.
- The debate on TRIPs highlights the need to differentiate patent regimes across sectors.
- Indeed, one of the main legal arguments against industry-specific patent statutes is that they would conflict with the TRIPs Agreements.
- But, when excessive uniformity on these grounds is criticized, why not adopting the same line in the domain of industries and technologies?
- And if the risk is leveraging the political power of certain industrial lobbies at the expense of others, isn’t this already a feature of the current homogeneous patent system?

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the economics of innovation provides useful conceptual categories on which differentiated statutes could be designed:
- discrete vs. complex technologies,
- cumulative technologies,
- technological regimes, etc.

Many of these notions are actually already applied in the practice of patent laws.
policy levers

Burk and Lemley (2003): patent law gives the courts substantial freedom to do this by means of flexible legal standards, called "policy levers."

Some of these levers operate at an industry-wide or "macro" level, treating different industries differently as a whole.

Other levers work at a case-by-case "micro" level, treating some kinds of inventions differently than others without explicit regard to industry, but in a way that has disproportionate effects on certain industries.

The question becomes then if these flexibilities should left implicit or should they become explicit and intentional.
Personal belief

- Patent laws and their interpretations should incorporate more explicitly and consciously the suggestions provided by the economics and history of innovation.

- In primis, the notion that there is no such thing as "technology", but many different technologies.

- But ....
Thank you for your attention