Lecture # 8 -- How Firms Use Intellectual Property Protection

I. Options for Protecting Intellectual Property

- Options for protecting intellectual property include:
  - Patents
    - Provide firms with temporary monopolies for their inventions, with the tradeoff is that the inventor makes the information public.
  - Lead time
    - Being the first to bring a product to market at least provides a temporary monopoly.
  - Learning curve advantages
    - Similar to lead time. If firms use knowledge more effectively as they gain experience, the first firm to come up with an idea will be the most effective user.
  - Secrecy
    - Firms can keep new ideas secret.
    - More likely to be successful for process innovations than product innovations. How do you keep a new product secret?
  - Sales or marketing efforts

II. Intellectual Property or Secrecy

- Even among firms that do innovation, many firms do not use patents
  - Thus, understanding when firms will or won't use patents is important to understanding patent policy
    - What are the perceived strengths and weaknesses of patents to firms?
- Patents vs. secrecy: Theory
  - Firms may choose one or the other, or may pursue a mixed strategy, as outlined in Table 4 of Hall et al.
  - Patents
    - What are costs of filing a patent?
      - Financial costs
        - Direct filing costs
        - Legal expenditures
        - Maintenance fees to keep in force
      - Requires full disclosure of information
      - Enforcement costs
        - Patent must be valid to have value
          - Ability to enforce in court is uncertain
        - Must monitor for infringement
        - If infringement found, legal action necessary. This is costly

            - Note that application costs are low (£3,500-£9,000), but litigation costs may be several million dollars.
            - Costs are higher in more crowded fields
            - Researchers have not established whether these high costs effect patenting behavior, or whether they occur because of it.
        - High litigation costs give large firms an advantage.
        - However, large firms also face greater risk, as the damages from enforcement could be large for large firms (Polaroid v. Kodak, where Polaroid won $1 billion damages, is a good example)
    - Note that the process itself is uncertain.
        - An application may reveal information and be denied, so that no benefits are obtained from the disclosure
- What are the benefits of a patent?
    - Ability to exclude others from using the technology
        - Could be to have monopoly rights, or simply to keep out competitors
    - Potential licensing royalties
    - Signal quality of invention to investors
    - Signal technological leadership
    - Ability to participate in patent pools
        - Licensing partnerships can help avoid duplication of research efforts
    - Note that being first is important
        - If a competitor may have a similar invention, need to patent it before the competitor
    - To measure performance of R&D employees
        - Difficult, because often involved in team production.
        - However, legal standards for recognizing an inventor on a patent are rigorous.
    - To gain access to certain foreign markets
        - Some developing countries require US firms to license technology to a host-country firm.

o Secrecy
- What are the benefits of secrecy?
    - Can potentially protect invention indefinitely (e.g. Coca-Cola)
    - Can protect work in progress
    - Applicable to a wider range of inventions
- What are the costs of secrecy?
    - Costs of protecting knowledge, including legal costs of confidentiality agreements
        - Examples include splitting R&D into multiple components so that no one team can fully understand the full project

            - Enforcement costs
                - May be harder to enforce in court
            - Mobility of key personnel may threaten secrecy
            - Will secrecy even work? Is the technology easy to reverse engineer
                - Secrecy cannot protect imitation.
            - If a competitor may invent something similar, secrecy will be useless if the competitor patents first
            - Lead time and secrecy are substitutes
            - Can lead to duplicative research efforts
                - Multiple firms doing the same thing and keeping it secret
                - Costly if invention is cumulative
    - Examples of mixed strategies
        - Use patents to protect codified elements of technology, and secrecy to protect the remainder (e.g. the process to produce)
        - Example:
            - Early chemical industry used secrecy to protect new compounds that required tacit knowledge, and patents to protect codified knowledge.
        - As such, firms may wish to keep a new idea secret until the product is ready
            - However, need to file patent early to establish priority
            - Publishing applications makes this tradeoff more important
    - Examples of using disclosure
        - Used to influence the state of the prior art to limit competitor's potential patents
        - Raises the threshold others need to meet to claim a novel invention
- Even among firms that do innovation, many firms do not use patents:
    - Survey data from the UK (Table 2 in Hall *et al*.):
        - Only 30% of firms introduced a new product or process within a 3-year period
        - Not surprisingly, these firms are more likely to use IP
        - However, even roughly ½ of these firms make no use of formal IP
            - Formal IP less likely to be used for process innovations
        - Few say importance is "high"
    - Similar results found in US (Table 3 in Hall *et al*.):
        - 60% of firms doing R&D made no use of utility patents.
        - Only 26% use patents very frequently.
        - Trade secrets are used most often.
- Patents vs. secrecy: Other empirical evidence
    - Key papers are Levin *et al*. (1987) and Cohen et al. (2000)
    - Both surveyed firms about their use of IP and other strategies
        - The sample of Levin *et al*.:
            - Used lines of business as defined by Federal Trade Commission (FTC)

        - R&D data is available at the same level of detail.
        - Received responses from 650 individuals representing 130 lines of business.
            - 18 industries had 10 or more respondents.
        - Excludes firms without publicly traded securities.
            - Thus, small startups, which are often innovative, underrepresented.
- Both surveys find similar results:
    - Secrecy and lead time generally more important than patents
        - Lead time useful for new products
        - Secrecy useful for processes
    - Patents most important for:
        - Product innovations
        - In industries with discrete products, such as chemicals
    - Key results from Levin et al:
        - Used 7-point Likert scale
        - Range from “not at all effective” to “very effective”
        - Effectiveness of various methods of appropriation
            - Patents ranked as least effective
                - Patents less effective for process innovations than for product innovations.
                - Secrecy worse than patents for products –hard to keep a product secret!
                    - New products aren’t advantageous unless people know about them.
            - Patents are more effective for preventing duplication than for securing royalty income.
            - Lead time and learning curve are the most important.
                - That is, gaining short term profits is important.
        - Industry detail
            - Only 3 of 130 industries rated process patents > 5: concrete, primary copper, and one with only one respondent (unnamed to protect privacy).
            - Only 5 of 130 industries ranked product patents > 6: two singletons, drugs, pesticides, industrial organic chemicals.
            - 20 other rated product patents between 5 and 6.
                - Mostly chemical products.
            - No industries rated patents as the most effective means, although in drugs and petroleum, patents were ranked as effective as other means.
    - Why are patents likely effective for chemicals?
        - Clear standards to assess validity and infringement.
        - Easy to see uniqueness of a molecule.
        - Note that industries with simple products rank next after chemicals.

        - As complexity increases, harder to detect infringement.
    - Cohen *et al*. find more use of patents for strategic reasons, rather than for protecting IP
        - Blocking competitors
        - Bargaining power
    - Variations by firm type
        - Larger firms can spread fixed legal costs across more patents
        - Smaller firms specializing in new knowledge use patents as their assets
            - Think of smaller firms that sell their ideas to large biotech companies
            - In contrast, Graham et al. (2010) find that small software firms avoid patenting
            - Patents may improve access to financing
        - Small firms tend to favor getting to market
    - Differences across countries
        - Secrecy perceived as less useful in Japan
            - 26 % of firms surveyed use secrecy to protect new products, compared to 51% for the U.S.
        - Why the difference?
            - First-to-file rule in Japan encourages inventors to apply early
            - Pre-grant opposition in Japan means that granted patents perceived as stronger
                - Potential challenges already have been raised
            - Because of pre-grant challenges and publication of applications, patents are also more likely to be used as sources of information about competitors in Japan
- Empirical evidence on the value of IPR
    - Market value studies suggest that successful IPR raises the value of firms
        - These studies ask whether the stock market values a firm higher when it receives a patent
        - These studies assume rational expectations
        - Model:
            - Value = $q(K + gA)^s$
                - K = book value of tangible assets
                - A = stock of intangible assets (not on balance sheet e.g. patents)
                - q = current market valuation coefficient
                - s = returns to scale
            - Taking logs approximates:
                - $\ln V = \ln q + s\ln K + sgA/K$
        - Results:
            - Hall *et al*. (2005) use citation-weighted patents

            - They find that firm valuation goes up when firms get highly cited patents.
            - Note that the citations *are not known until after the fact*.
            - Thus, investors are correctly anticipating which patents will be most valuable.
        - Other papers find that patents are more valuable than trademarks.
    - Variability of returns
        - These studies focus on average values. However, these values are highly skewed.
        - Patent renewal data provides evidence
            - UK/France (Schankerman & Pakes 1986)
                - 60% of patents survive for 5 years
                - 25% of patents survive past 13 years
                - Thus, most patents have little to no value at the end of their life.
        - Haroff *et al*. (1997, 1999)
            - The 5% most valuable German patents account for 50% of total patent value
            - In the US, the most valuable 8.5% of patents account for 80% of total patent value

III. Strategic Uses of Patents

- There has been a sharp increase in U.S. patenting activity in recent years.
- One explanation is that firms use patents for strategic purposes.
    - Patent fences
        - Used in discrete product industries (e.g. chemicals, pharmaceuticals)
        - Patent close substitutes (e.g. similar drugs) to prevent others from entering that technological area
        - We'll discuss these in greater detail in our next class, in the lecture on biotech
    - Patent thickets
        - Occur in complex industries, such as semiconductors and electronics
        - A single product requires many patents, held by several firms
        - Firms establish a portfolio of patents so that they can trade with each other
        - Also leads to legal costs
            - Number of patent lawsuits filed in US tripled over past 20 years
        - In 2011, Google purchased Motorola for $12.5 billion because of Motorola's patent portfolio

        - Google had just 317 mobile phone patents. Its rivals had thousands.
- The *Economist* article “Patently absurd” refers to patent thickets as the “Tragedy of the ‘Anti-Commons.’”
    - With so many patents existing, they are underused because the danger of infringing on an existing patent is too high.