



The Use and Value of Patents

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Overview

- Economics and policy towards IP
- How are patents used?
- How are patents valued?
- Some open policy-related research questions

Introduction

- The patent bargain – trade off short term “monopoly” right for invention and disclosure
 - **Reality** – system is used strategically in ways that depart considerably from this tradeoff.
 - Benefits of disclosure may be limited by careful drafting of the patent or by omission of essential (tacit) know-how.
 - Sleeping patents - disadvantage a competitor and preserve a (temporary) monopoly in a particular market
 - Etc.
- Traditional model – one invention or product, one patent
 - **Reality** - cumulative invention and complex products with hundreds of patents

[Patent policy]

- Property view of patents can be helpful, but.....

Understanding that intellectual property rights are not the same as ordinary property rights on physical assets is key to understanding that policy can and should be different in this area.

Two differences:

- Non-rivalry
- Provide insufficient notice, lack of clarity about the boundaries of the property (relative to tangible property) - [Bessen and Meurer \(2008\)](#)

Hysteresis in patent policy

- “If national patent laws did not exist, it would be difficult to make a conclusive case for introducing them; but the fact that they do exist shifts the burden of proof and it is equally difficult to make a really conclusive case for abolishing them.” [Edith Penrose \(1951\)](#)
- My interpretation: firms adapt to the systems in which they are and industrial structure evolves from that adaptation.
 - Example - the rise of firms specializing in knowledge creation following the strengthening of the U. S. patent system in the early 1980s (Hall and Ziedonis 2001; Arora et al. 2001).
 - Path dependence in industry structure, which makes it difficult to compare the performance of a system that is in place with one that may involve radical change in the way things are done.
 - Existing systems create rents for some firms and individuals, who then resist strongly any changes that might destroy these rents.

A decorative graphic consisting of a teal circle on the left side, partially overlapping a horizontal bar with a teal-to-white gradient. The bar contains the text "How are patents used?". The bar is framed by a dark brown bracket on the left and a teal bracket on the right.

How are patents used?

How do firms actually use patents?

- Firm level surveys (RD managers and others) – how do they secure returns to innovative activity?
 - US: Levin et al. 1987 and Cohen et al. 2002
 - Individual country surveys (Switzerland, France, Japan, etc.)
 - CIS since late-1990s
- Inventor surveys – How are patents used by firm?
 - PATVAL for inventors (Giuri et al. 2007, Gambardella et al. 2007)
 - New wave of inventor surveys in U. S., Japan, and Korea
 - Successor European surveys

Appropriating the Returns to Product Innovation

Ranking of means across all industries

<i>Survey</i>	<i>Year</i>	<i>Country</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Yale	1982	US	sales & service	lead time	patents	secrecy
Harabi	1988	Switzerland	sales & service	lead time	secrecy	patents
Dutch CIS	1992	Netherlands	lead time	retaining employees	secrecy	patents
Carnegie-Mellon	1993	US	lead time	secrecy/mfg	sales & service	patents
Japan C-M	1993	Japan	lead time	patents	sales & service/ mfg	secrecy
SESSI/INSEE EFA	1993	France	lead time	patents	secrecy	complexity
StatCan Innovation	1999	Canada	confidentiality agreement	trademarks	patents	secrecy
CIS 3 2000*	2000	EU12	lead time	secrecy	trademarks	complexity

*Patents not shown in table, Eurostat 2004, KS-NS-04-001, Theme 9

Similar questions asked for process innovations: patents rank even lower and secrecy higher.

Appropriating the Returns to Product Innovation by Sector

Appropriating the Returns to Product Innovation

Industries preferring patents in descending order of preference

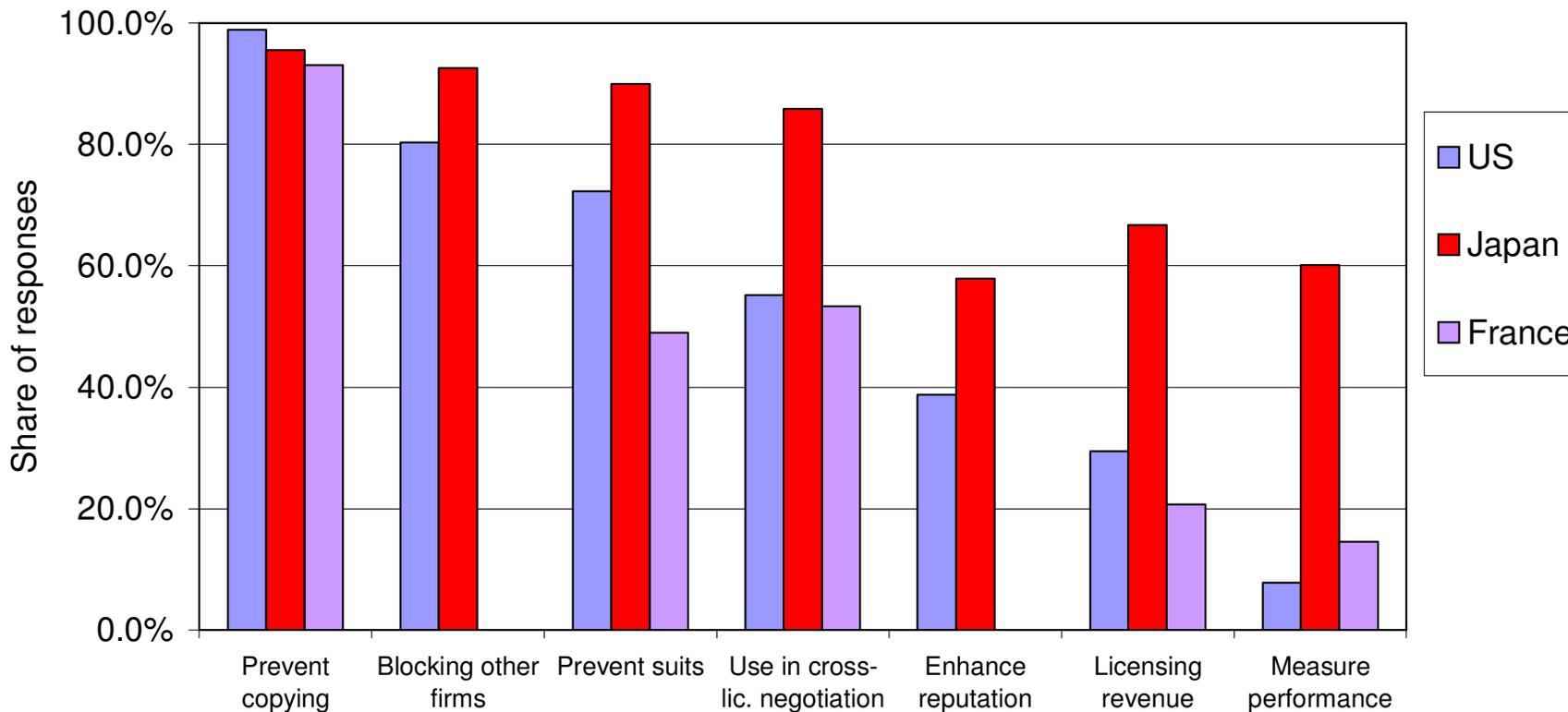
<i>Survey</i>	<i>Year</i>	<i>Country</i>	
Yale	1982	US	pharmaceuticals; plastics; chemicals; steel; oil
Harabi	1988	Switzerland	research labs; machinery; chemicals; watches; paper*
Dutch CIS	1992	Netherlands	pharmaceuticals, chemicals, instruments, rubber&plastics, oil
Carnegie-Mellon	1993	US	pharmaceuticals, medical inst; special machinery; computers; chemicals
Japan C-M	1993	Japan	
SESSI/INSEE EFA	1993	France	pharmaceuticals, instruments; transport equip.; chemicals; machinery; paper
StatCan Innovation	1999	Canada	machinery; elec equip.; pharmaceuticals; comm eq; instruments; chemicals; motor vehicles
CIS 3 2000*	2000	EU12	transport equip.; instruments; chemicals*

* Pharmaceuticals not broken out from chemicals

Summary: pharmaceutical industry ranks at or near the top, followed by specialized machinery and instruments, other chemicals, and occasionally transport equipment especially motor vehicles and parts – discrete product technologies

How are patents used?

How are patents used? 1993 Surveys



Cohen et al. 2002 – use varies by discrete/complex technology product

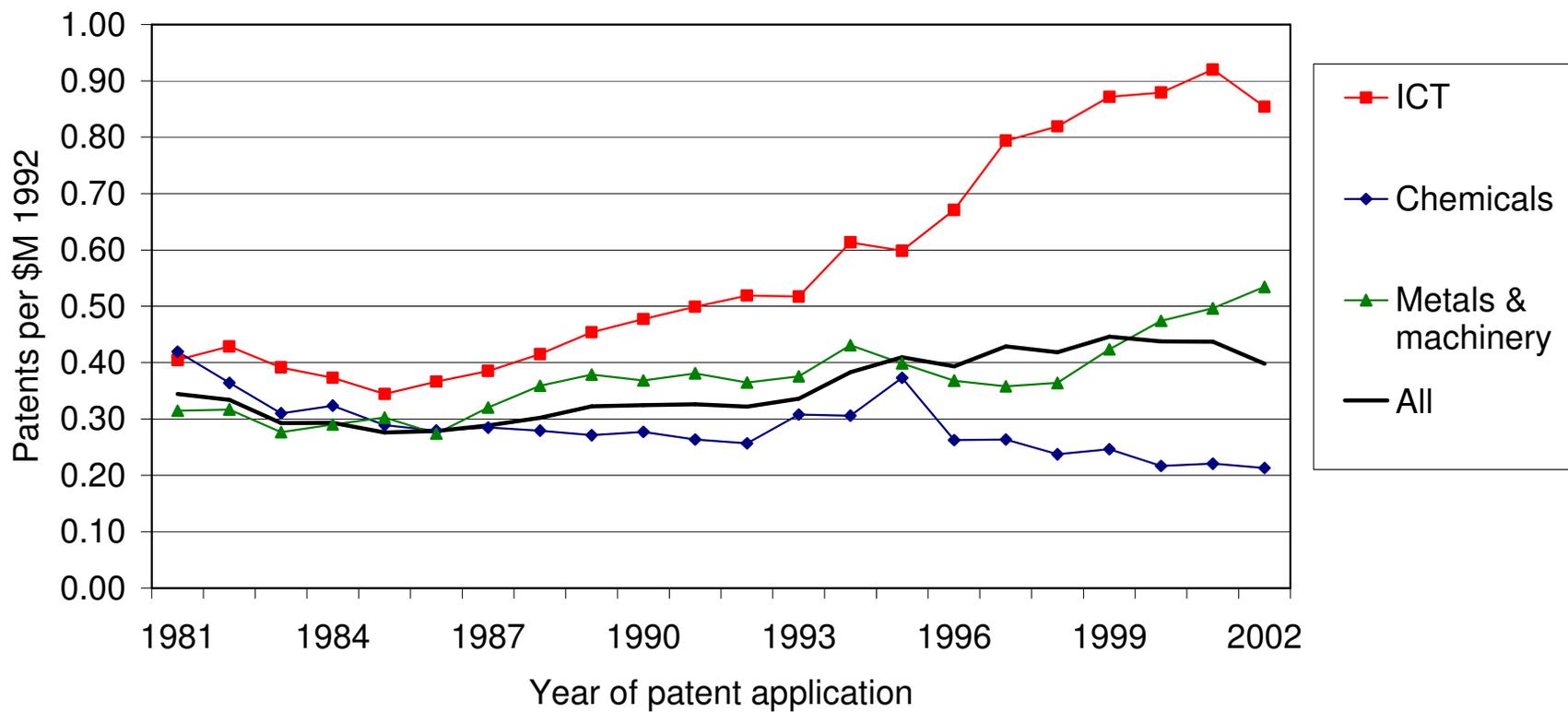
Complex vs. discrete technologies

- **Discrete technology** - the typical product is covered by one or a few patents, usually held by a single firm.
 - patents used to exclude, and sometimes for licensing; also to prevent litigation
- **Complex technology** - a product is covered by many patents, usually held by several firms.
 - patents used in negotiations (cross licensing and other), and to prevent litigation
- Some industries contain both.
- Patent floods associated with complex technology industries

Cohen et al. 2002; Hall 2005, 2009b; von Graevenitz, Wagner, and Harhoff 2008

US patenting rates by sector

USPTO patents-R&D ratio for Compustat sectors

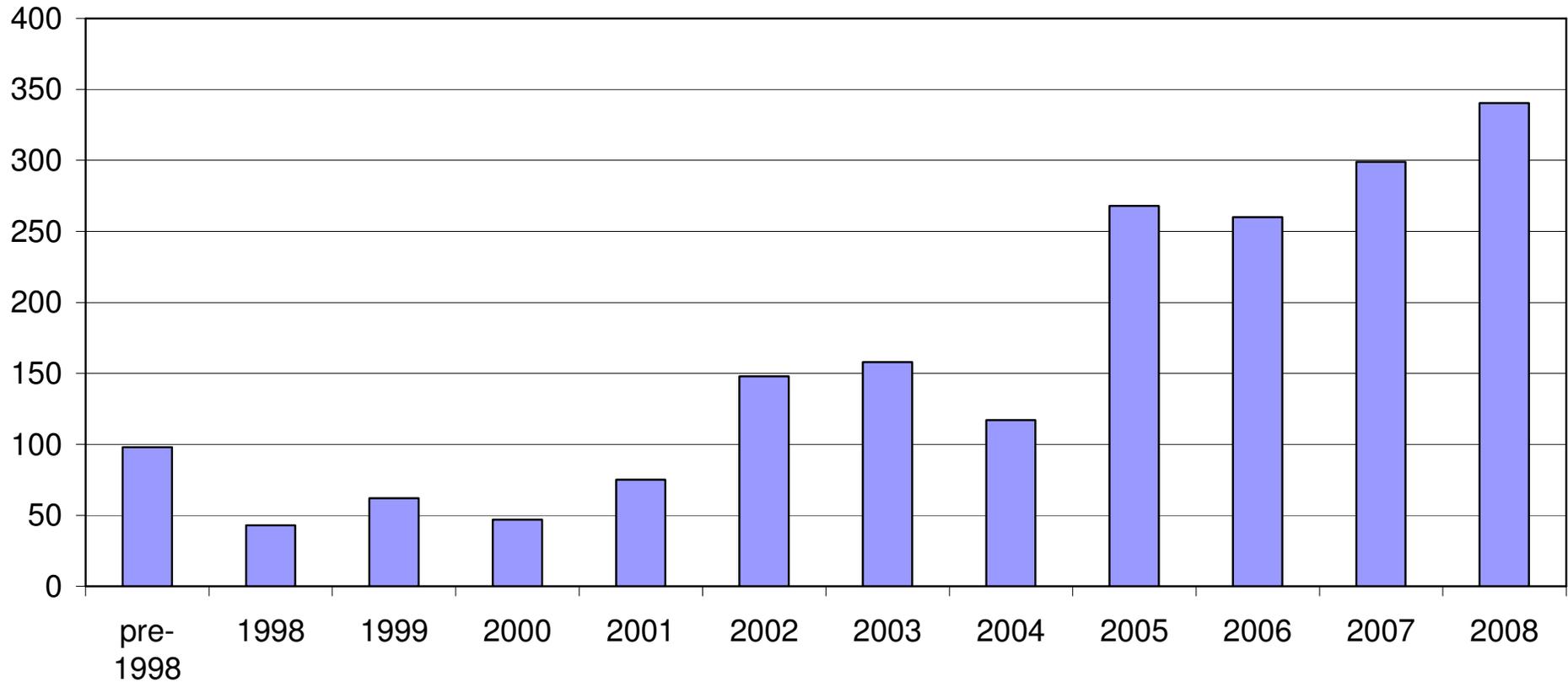


Strategic use of patents in complex technologies

- Observation: patenting behavior of ICT firms has changed
 - Several well-known disputes during the past 25 years
 - Patent portfolio race response - rapid increase in patents/R&D in this sector
 - New equilibrium established
- Non-producing entities or trolls, often in the ICT sector
 - Patent portfolio defense useless when litigant has no production
 - Not worthwhile fighting such suits even when the patent being asserted is weak (Shapiro 2007)
 - Threat of preliminary injunction increases the bargaining threat point of the plaintiff disproportionately relative to his contribution to the product (Reitzig et al. 2007)
 - Inadvertent infringement common (Lemley & Cotropia find only a small number of cases that allege copying, most in pharma)
- **However**, non-producing entities may also play an important role in encouraging entry into innovation
 - secondary market for IP assets ensures that some value is retrieved from the failure - lowers the initial cost of entry.

Number of new patent case filings by non-practicing entities (NPEs)

Source: Patent Freedom Copyright 2008



Data for US - preliminary work by Hall and Ziedonis (2007) confirms this pattern in semi-conductors. Lerner (2006) finds very high litigation rates for small entities in financial methods patenting

Use of patents to secure financing - evidence

- Evidence from US and Germany on VC financing and startup patenting
 - More money
 - Faster progress
 - More likely to be successful
- Heterogeneity across sectors and within sectors

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○ Software vs biotech



What is the value of patents?

[The value of patents]

- What do we mean by value?
 1. value of the underlying invention that the patent protects
 - private - the present discounted profits or licensing fees received by the inventor
 - social - including any unpriced spillovers and some of the value of inventions that build on this one, as well as any consumer surplus not captured by the firm via markup pricing
 2. value of the patent right, the private incremental value of taking out a patent, above and beyond any profits that might be earned on the invention without patent protection
- (2) is the incentive effect of patenting
- (1) is what interests us from a welfare perspective, or when we use patents as indicators of innovative activity.

How to measure value?

Two broad strategies for measuring the value of patents:

1. Valuing the patent portfolio held by a firm by relating firm market value to various firm characteristics (tangible assets, R&D spending, etc.) that include a measure of the patents owned by a firm.
2. Valuing a single patent using two different methodologies:
 - a. Observe the owner's willingness to pay renewal fees on the patent
 - b. Survey its owner or inventor and attempt to elicit an estimate of its value.

(1) includes any interaction effects among patents (if they are complements or substitutes), measures invention value above R&D cost plus patent right value.

(2a) measures the value of the patent right (as opposed to the underlying invention).

(2b) measures the combined value of the invention and the property right on that invention.

Market value results - summary

- Evidence for Anglo-Saxon economies (US, UK, Australia, Canada) plus Japan.
- Patents generally valued above and beyond the R&D done by the firm.
- Value higher in pharmaceutical firms, and possibly in chemicals, computers, and machinery (Hall et al. 2005; Bessen 2006).
- Example - an additional patent per million (1992) dollars of R&D increases a firm's market value by 3 per cent. (Hall et al. 2005)
- Measures of the quality of the portfolio (number of citations received) even more strongly associated with market value.
 - No additional value for U. S. patents unless they received more than the median cites per patent
 - Firm in the top 5 per cent of the cites per patent distribution- market value is 50 per cent higher, other things (including R&D & patents) equal.

Inventor survey results

- “If at the time the patent issued you knew what you now know about the profit history of the invention abstracted here, what is the smallest amount for which you would have been willing to sell this patent to an independent third party, assuming that you had a bona fide offer to purchase and that the buyer would subsequently exercise its full patent rights? (Harhoff et al. 1999, page 512).”
- Results:
 - Confirms earlier work by Grabowski and Vernon, Scherer, etc.
 - distribution of individual patent value is extremely skew, generally more skew than a log-normal distribution.
 - Average numbers are not inconsistent with market value results
 - Mean of 3 million euros (in mid-1990s euros) with a median that is one tenth that value (Gambardella et al. 2008)
 - Detailed comparisons difficult to interval questions, differences in time periods, sectors, controls, etc.

Renewal data

- Fees for renewing patent rise over time –estimate the distribution of value of patent coverage by looking at how many patents are renewed at different lifetimes.
- Pioneered by Schankerman and Pakes (1986); applied to European patents (Schankerman 1998; Lanjouw 1993), Finnish patents (Groenquist 2007), and U.S. patents (Bessen 2007), among others. Results:
 - distribution of patent rights value is skewed;
 - chemical and pharmaceutical patents are worth more, followed by ICT
 - most learning by the patentee about the value of his patent takes place in the first 5 years.
- **Advantage:** measures value of the patent right as opposed to the innovation
- **Disadvantage:** cannot examine the valuable tail of the distribution (above about \$20-30K) except parametrically

Priorities for research

- Modern empirical research in economics largely adheres to a version of the scientific method:
 - Focus on testing particular hypotheses
 - Not on measurement of magnitudes
 - Not on the integration of results on a single topic or question
 - Example: market value of patents
- Policy depends on a set of tradeoffs of costs and benefits.
 - => knowing magnitudes is important.
- First priority
 - review studies in somewhat more detail and to try to produce a best practice summary of their results (augmented with new analysis as needed).
- E.g., “By how much is the patent system subsidizing R&D and innovative activities?”,
 - Renewal studies
 - Combining inventor surveys with other information as in Arora et al.
 - Are these approaches consistent?



Research questions

[Research question (1)]

- How to accommodate different technologies in a unitary system
 - Tailoring difficult – strategic behavior; new technologies; legislative response too slow
 - Courts may help adapt system (Burk & Lemley 2009)
 - Other solutions?
 - Use renewal fees to elicit value from owners?

Research questions (2)

- How to move to a better equilibrium in complex technology areas?
 - Increase filing, renewal costs?
 - Limit rewards to suit (see below)
- How to modify damage computation – *ex ante* licensing costs (inventing around) vs *ex post* (holdup after costs are sunk)?
 - E.g., MercExchange v. eBay decision – 4 factor test for injunctions from SCOTUS in May 2006 – patent owner must show
 - it has suffered irreparable injury;
 - monetary damages are inadequate compensation;
 - a remedy in equity is warranted;
 - the public interest would not be disserved.
- Allow independent invention or prior use defense?
 - relevant for obviousness determination?
 - relevant for injunction?

[Research question (3)]

- What are the full administrative costs of operating a patent system?
 - including the costs borne by the firms that participate or are impacted by it (legal, opportunity, fees, etc.)
 - Necessary in order to perform a true welfare computation.
 - Patent premium research can tell us the additional R&D which is elicited by the existence of patent protection.
 - Evaluating the societal benefit also requires knowing how much it costs to operate.