Rigorous empirical research on intellectual property

Patents in our societies innovation, markets, and new firms

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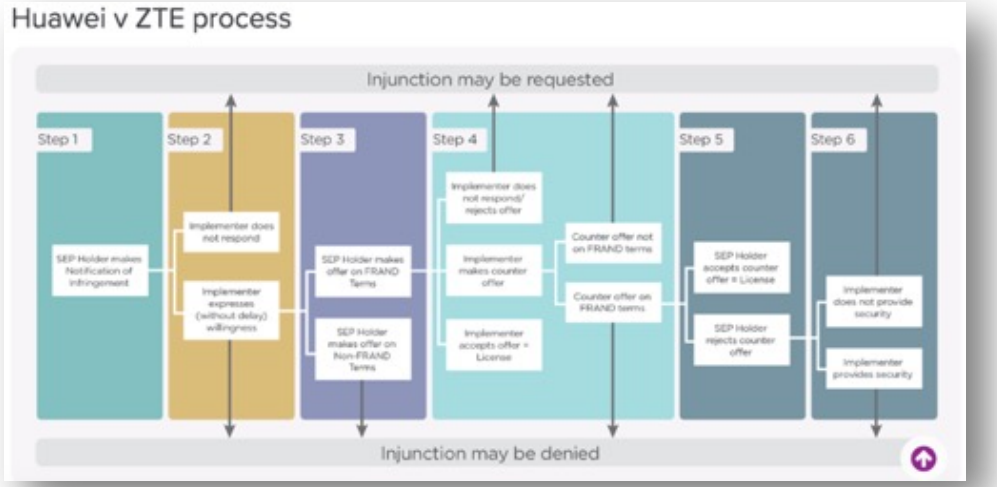

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Patents in our societies: innovation, markets, and new firms

Prof. Alfonso Gambardella

Head of the Department of Management & Technology of Bocconi University, Milan and Fellow of the Strategic Management Society and a member of the Center for Economic and Policy Research (CEPR), London.

Background

This webinar focuses on the role of patents in our societies

Not an exhaustive discussion, but highlights a few broad high-level issues from economic and managerial literature

Key takeaways

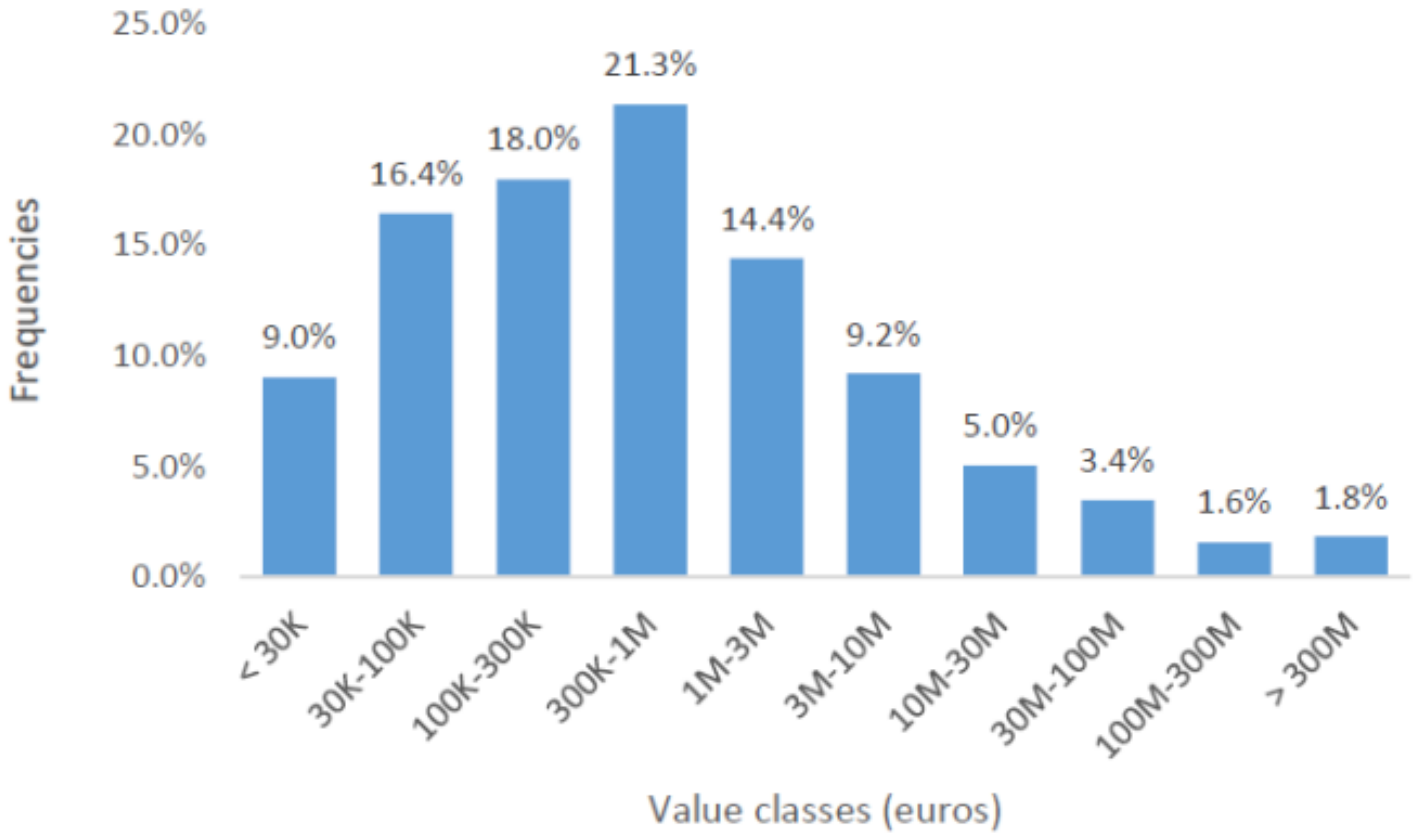
— Dual function of patents: restrict diffusion, but increasingly serve functions that increase diffusion
  - patents as informative signals (especially for new firms)
  - patents disclose information used for subsequent inventions
  - patents help transactions in markets for technology
— We need to understand better the different functions of patents. This calls for
  - more detailed analysis of the many relevant issues, uncovering causal effects to better inform policy and firm actions
  - more widely available data to conduct experiments by a vibrant and competent scientific community on this topic

Agenda

- Value of patent rights (across industries, types of firms)
- Uses of patents (across types of firms)
- Social functions of patents
  - signals
  - disclosure
  - markets for technology
- How and why we can build and make use of better data to address important questions about patents to inform policies and the actions of firms

- *Note: full references of citations in these slides are in* https://www.4ipcouncil.com/research/the-functions-of-patents-in-our-societies-innovation-markets-and-new-firms or you can see *Gambardella, A. (2021), CEPR DP 16045 www.cepr.org*

Value of patent rights



- Very skewed
- Similar results in an earlier survey (PatVal-EU)

Based on 15,311 EU patent applications from the InnoS&T survey with available answers to the following question: ***"if the owner of this patent sold it on the day of grant, what would be the minimum price at which they will sell all technically related patents for this innovation?"*** *Inventors indicate one of the 10 value classes. InnoS&T patents have priority dates 2003-2005, and inventors are located in 20 European countries, Israel, Japan and the US. See Torrisi et al. (2016) for details about the survey*

Estimated values of patent rights

	InnoS&T		PatVal-EU
	Value of portfolio (15311 obs.)	***Average value of patent in portfolio (11760 obs.)***	***Single patent (8217 obs.)***
Mean	10473.4	4598.03	3138.6
Median	591.2	338.34	397.4
Mode	1.9	1.8	6.4

In 000 euros. Portfolio = set of technically interconnected patents. See Gambardella (2021) for methodology

Estimated values of patent rights
(by macro-industries)

	Electrical Engineering (3663 obs.)	Instruments (2501 obs.)	Chemicals (3004 obs.) (*)	Process Engineering (2110 obs.)	Mechanical Engineering (2944 obs.)	Consumption & Construction (1089 obs.)
Mean	9163.0	11263.9	28448.2 (37205.9)	7878.8	4446.8	5888.5
Median	477.1	662.9	1179.3 (1299.2)	543.8	409.5	441.5
Mode	1.3	2.3	2.0 (1.6)	2.6	3.5	2.5

In 000 euros. (*) Values of Biotechnology and Pharmaceuticals & Cosmetics in parenthesis (804 obs.)

Value of patent rights

Estimates consistent with extant literature

- Kogan et al. (2017) study the financial returns from news about patents by US firms 1926-2010. **They find a higher median value of 3.2 million 1982 US dollars.** This reflects selection on better patents and possibly incorporation of value of invention. Not just patent rights. At any rate the bottom line is that returns to patents are high
- Arora et al. (2008) find a 60% return premium on patents. Again, returns to patents seem to be high (on average)

In addition, growing attention to distribution of these returns ...

- Kline et al. (2019) uses the estimated returns by Kogan et al. (2017) to show that workers capture 30% of the value of patent rights in the form of higher wages. More senior and reputed workers capture more (60%). The paper also shows that the main reason is that these people are harder to replace, which is why they capture these rents. A larger supply of talented workers would then be a natural offsetting factor of this potential inequality

Share of EU patents by applicant

Most patents come from large firms

Type of applicant	Shares
SME (≤ 250 employees)	22.9%
Large Firms (> 250 employees) (Firms with ≥ 5,000 employees)	68.8% (52.1%)
Government Research Organizations	2.6%
Universities and Higher Education	3.9%
Others (Hospital, Foundations, Private Organizations, Others)	1.8%
Total	100.0%

Based on 20,325 EU patent applications from the InnoS&T survey with available information on ultimate parent applicant

Uses of patents

Source: 8144 InnoS&T patents with available information, see Torrisi et al. (2016)

- Small firms are more active users of patents
- However, Bloom et al. (2013) estimate that large firms produce most technological spillovers from patents

	Commercial Use (%)			Strategic non-use (%)	Sleeping (%)
	Type of commercial use	%	Total		
Small firm (< 100 empl.)	Internal use	66.0	76.5	14.5	9.0
	Licensing	16.7			
	Sale	12.2			
	Start-up	17.9			
Medium firm (100-250 empl.)	Internal use	73.9	77.0	15.5	7.4
	Licensing	8.6			
	Sale	4.3			
	Start-up	5.6			
Large firm (> 250empl.)	Internal use	54.8	56.2	29.5	14.3
	Licensing	2.7			
	Sale	4.2			
	Start-up	1.0			
Total	Internal use	57.6	60.6	26.3	13.1
	Licensing	6.4			
	Sale	4.3			
	Start-up	4.0			

Value of internally used vs licensed/sold patents

	Average value of patents in the portfolio (000 euros)		Total citations	
	Internal use	**Licensed or sold**	**Internal use**	**Licensed or sold**
Small firm (< 100 empl.)	Mean = 9873 Median = 650 Obs. = 874	Mean = 9057 Median = 650 Obs. = 473	Mean = 0.86 Median = 0 Obs. = 1062	Mean = 1.46 Median = 1 Obs. = 548
Medium firm (100-250 empl.)	Mean = 8115 Median = 267 Obs. = 361	Mean = 4475 Median = 650 Obs. =74	Mean = 0.83 Median = 0 Obs. = 460	Mean = 1.38 Median = 0 Obs. = 95
Large firm (> 250empl.)	Mean = 6607 Median = 260 Obs. = 3494	Mean = 5513 Median = 333 Obs. = 537	Mean = 1.15 Median = 0 Obs. = 5033	Mean = 1.33 Median = 1 Obs. = 716

Estimated from InnoS&T survey, see Gambardella (2021)

- *Small firms: value of licensed patents comparable to internally used, and on average small firms hold valuable patents.*
- *Small firms are valuable suppliers in markets for technology*

Social function of patents: *signals of value*

Hsu and Ziedonis (2013) use data on 370 venture backed start-ups in the semiconductor industry

- Find that early-stage not reputed firms are more likley to gain VC support if they have patents than older more reputed firms
- This is important in that it is the reputational function of patents that matters
- Patents solve information asymmetries when they are relevant
- Consistently, InnoS&T finds that small firms are more likely to seek patents to increase their reputation

Farre-Mensa et al. (2020) confirm this result using data on 34215 applications by first-time US start-ups

- Uncover causal relation between patents and the performance of these firms
- Increases chances of getting funded especially in early periods
- Patents seem to be crucial in the kick-off face when firms are less known

Social function of patents: *disclosure*

Patents protect the inventors, and disclose information about the invention. Systematic research has then tried to understand whether this disclosure function has social benefits

- Gross (2019) uses data on 11,000 US patent applications subject to a secrecy program during World War II that prevented inventors from disclosing their filings. Finds that the program reduced follow-on invention
- Furman et al. (2021) uses data on the opening of US patent libraries since the 1980s and find that the # of patents produced within 15 miles of the library increased between 8-20%
- Hegde et al. (2020) exploit the introduction of the American invention Protection Act (AIPA) in 1999 that required publication of the content of patents 18 months after filing. They show that disclosure of these patents increase citations and research that builds on these patents
- There are still open questions, particularly on the effects of patents on follow-on inventions. Galasso and Schankerman (2015) find that randomly invalidated patents, which preserve disclosure, but not patent rights, are more likely to generate follow-on inventions, but Sampat and Williams (2019) do not find limitations to follow-on inventions in human gene patents. Galasso and Schankerman (2015) find heterogeneity across industries, which suggests that the question is still wide open

Social function of patents: *mkts for technology*

Contracts for intangibles are hard to write because the object of contract is hard to write. Patents define the object of transaction, thereby facilitating technology trade

Moreover, the effect is ***stronger for smaller firms*** because large firms can protect inventions through downstream assets in any case

- Arora et al. (2001) and Arora and Ceccagnoli (2006) find that patent protection is more likely to encourage licensing by smaller rather than larger firms
- Arora et al. (2021) test that science-based inventions are easier to codify and then to transact, but they need patents to restore the incentives to trade. They find that patents that cite science are more likely to be transacted especially by smaller firms that have a higher propensity to trade technology
- Conti et al (2019) find that patents encourage smaller firms that own general-purpose technologies to specialize in supplying the technology rather than integrating downstream in product markets. This encourages an efficient division of labor between specialized suppliers and buyers of technology

Evidence-based management and policy

There are still many open questions about patents and their implications for encouraging or discouraging individual or systems of inventions

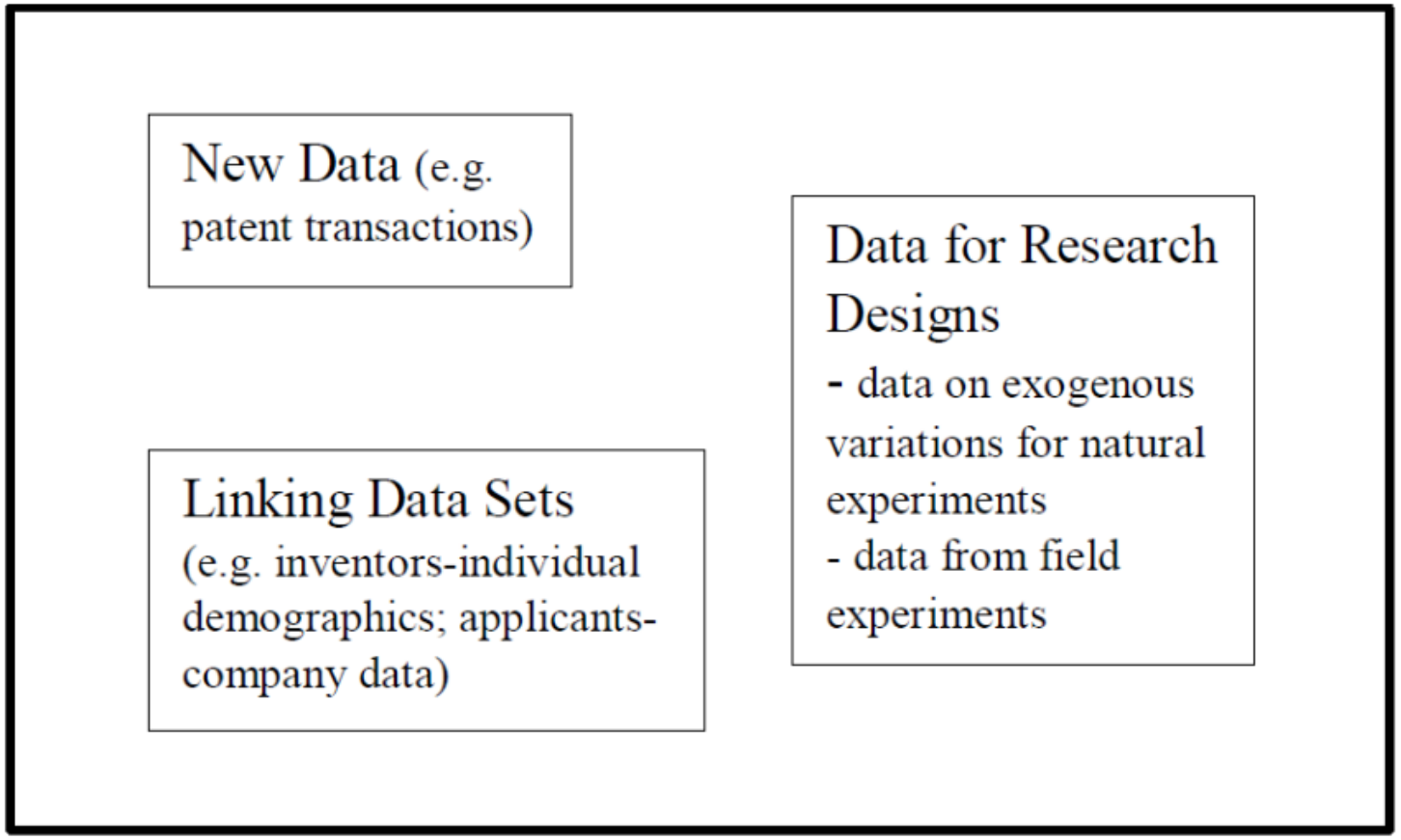
The relevant questions are not whether patents encourage or discourage follow-on inventions, or can be used as signal of values, or encourage markets for technology

It is rather under what conditions they encourage rather than discourage follow-on inventions, act as signals of value, or encourage markets for technology

In order to do so however

- Not only is it crucial to collect new and more extensive data, but also to find the right conditions to run experiments in which we identify causal effects
- This calls for new policies that collect these data and create the conditions to design these experiments
- The collaboration between patent offices, policy-makers, applicants and the scientific community is central to achieve this goal, address many open questions and move beyond studies that establish mere correlations between patents and relevant factors

Evidence-based management and policy



Thank You!
Q&A

Forthcoming Webinar:

Date	Title	Summary
12-10-2021	EC new framework for Standard-Essential Patents	Join Bowman Heiden and Justus Alexander Baron on this discussion about the framework for SEP licensing.

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