

How do patent laws influence innovation?

Evidence from nineteenth-century World's Fairs

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Contributions

- Patent law \Rightarrow the profit incentive \Rightarrow innovation
 - Pre: levels
 - Moser: directions
- Previous studies:
 - Griliches (1957); Schmookler (1966); Sokoloff (1988)
 - Focused on effects to levels of innovative activities: Nordhaus (1969); Klemperer (1990); Sakakibara & Branstetter (2001)

Basic story

- i) Monopoly rights for successful innovations create the incentives for innovations.
- ii) In countries without patent laws, alternative mechanisms create incentives to invent. (e.g. Secrecy)
- iii) In such countries, innovations will concentrate in few industries that alternative mechanisms work well.
- iv) Patents serve to expand the set of industries where innovation is attractive to inventors.

The data

-The Crystal Palace exhibition of 1851 and the American Centennial exhibition in 1876

-Brief descriptions, its industry of use, exhibitor's location, patent status, award

TABLE 1—STATISTICS ON THE WORLD'S FAIRS OF 1851 AND 1876

| | Exhibition | |
|-----------------|----------------|--------------|
| | Crystal Palace | Centennial |
| Location | London | Philadelphia |
| Year | 1851 | 1876 |
| Countries | | |
| Total | 40 | 35 |
| N. Europe | 12 | 10 |
| Exhibitors | | |
| Total | 17,062 | 30,864 |
| N. Europe | 11,610 | 6,482 |
| Visitors | 6,039,195 | 9,892,625 |
| Area (in acres) | 25.7 | 71.4 |

Sources: *Bericht III* (1853) and Kretschmer (1999).

The advantage and potential problems of the data

- Advantages over patent data:
 - Not rely on specific patent systems
 - Available in countries without patent law
 - Classified by industries
- Potential weaknesses:
 - Bias based on space restriction and transportation
 - Underreport innovations that are easy to copy

Endogeneity

- Domestic & foreign interest groups from specific industries may influence patent law.
- It's not a severe problem for 19th century:
 - Lerner (2000): legal traditions and political systems seemed to be critical.
 - Penrose (1951): without considerations for effects on specific industries.
 - Robustness checks.

Propensity to patent across industries and countries

TABLE 2—PATENTING RATES ACROSS INDUSTRIES IN 1851

| Industry of use | Patenting rate | |
|------------------------|----------------|-------|
| | Britain | US |
| Mining | 5.0% | 5.8% |
| Chemicals | 5.1% | 4.0% |
| Food processing | 7.9% | 4.3% |
| Machinery | 20.4% | 36.4% |
| Scientific instruments | 9.7% | 14.9% |
| Textiles | 6.9% | 6.0% |
| Manufactures | 10.1% | 13.5% |
| Total | 11.1% | 14.2% |

- Different patent laws, similar patenting behaviors

Two cases of alternative mechanisms: secrecy

- Jaquet & Chapius (1945): Swiss watchmakers
- Schiff (1977): Margarine production processing

⇒ Hypothesis: the effectiveness of patent protection varies across industries .

⇒ Patentless inventors should focus on industries with low patenting rate and strong alternative mechanisms.

Test for equality of distribution

TABLE 4—CHI-SQUARE TEST OF THE HOMOGENEITY OF DISTRIBUTIONS

| Industry categories | 1851 | | 1876 | |
|-----------------------------------|-----------------|-----------------|----------------|----------------|
| | Seven | Ten | Seven | Ten |
| No patent protection | 18.22 (6) | 23.46 (9) | 68.15 (6) | 78.51 (9) |
| Short and medium patent lives | 89.16 (12) | 91.09 (18) | 55.70 (12) | 67.59 (18) |
| Patent length exceeds 12 years | 768.83 (54) | 802.68 (36) | 237.27 (24) | 265.91 (36) |
| All countries | 1349.99 (66) | 1395.22 (99) | 639.72 (54) | 693.50 (81) |

Discrete-choice regressions

- Patent law \implies Inventors' choices across industries. (Multinomial logit regression).
(control for country size, GDPP, education)
- Results: patent laws have a strong influence on an inventor's choice of industry
 - No patent law: Textile \uparrow Food \uparrow Instruments \uparrow
 - No patent law: Machinery \downarrow Manufactures \downarrow

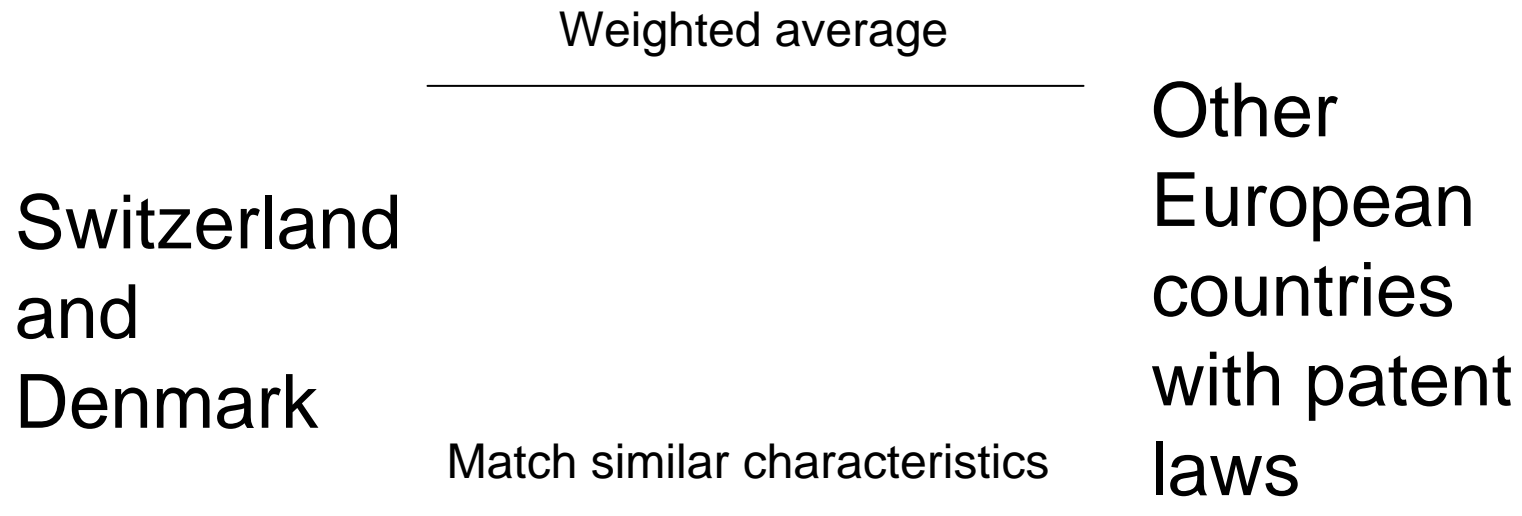
Evolving process

| industry | | No patent | With patent | | No patent | With patent |
|------------------------|------|-----------|-------------|------|-----------|-------------|
| Food processing | 1851 | 2.45% | 4.06% | 1876 | 24.25% | 15.53% |
| Scientific instruments | 1851 | 27.39% | 7.3% | 1876 | 18.49% | 6.11% |

Further evidence: The Netherlands' abolition of patent laws in 1869

- A natural experiment
- Changes:
 - Food processing: 11% to 37%
 - Textile: 37% to 20%
 - Manufactures: 26% to 12%
 - Scientific instruments: stay 8%

Robustness check: a synthetic Switzerland with patent laws



Similar results

Conclusions:

- The absence of patent laws guided innovation toward industries where mechanisms other than patent laws protected intellectual property.
 - Patent law influences demand as well as supply of knowledge
 - Patent law has impact on international patterns of comparative advantages.(e.g. the case of the U.S.A.)

Comments:

- Omitted variables: do initial comparative advantages matter? How to control them? May Switzerland and Denmark be really special not only in the aspect of patent law?
- Selection biases: Machinery manufacturers in Switzerland may not be willing to attend the exhibitions because of lack of patent law. So the result may underestimate the machinery innovation in these countries.

Further questions:

- Is patent law enough to explain the directions of technical changes?

Previous studies: market size, profit, demand;
potential extensions: openness, financial system.

- How do patent law influence the comparative advantages of developing countries?

Thanks
Q & A