Patents and Innovation in Economic History

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Many resources on historical patents

• NBER Patent Citation Database after 1976
  • http://www.nber.org/patents/

• USPTO/ Google Patent database after 1920
  • Images and OCR
  • Citations consistently reported since 1947
  • Citations before 1947 can be constructed from document with some noise
Some important policy questions require alternative sources of data

• Overlapping, broad patents with unclear boundaries
  • Should innovations be patentable across industries (software, biotechnology, plants)?
  • Patent trolls
  • Patent pools as a mechanism to combine patents

• How to provide access to patented drugs in developing countries?
  • Enforcement of TRIPS
  • Compulsory licensing as a means to facilitate access

• With digitization, how to create incentives for creativity?
  • Digitization of news, literary works, music
  • Do authors need basic levels of copyright protection?
Economic history offers many alternative sources of data on innovation (with some work)
<table>
<thead>
<tr>
<th>Location</th>
<th>Crystal Palace 1851</th>
<th>Centennial 1876</th>
<th>World's Columbian 1893</th>
<th>Panama-Pacific 1915</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countries</td>
<td>40</td>
<td>35</td>
<td>45</td>
<td>32</td>
</tr>
<tr>
<td>Exhibitors</td>
<td>17,062</td>
<td>30,864</td>
<td>70,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Visitors</td>
<td>6,039,195</td>
<td>9,892,625</td>
<td>27,500,000</td>
<td>19,000,000</td>
</tr>
<tr>
<td>Area (in acres)</td>
<td>25.7 for buildings</td>
<td>71.4 for buildings and grounds</td>
<td>717 for grounds 49 for buildings</td>
<td>635 for buildings and grounds</td>
</tr>
<tr>
<td>Prominent Exhibits</td>
<td>McCormick’s grain reaper, Colt’s revolver, steam engines, typewriter</td>
<td>Corliss steam engine, telephone, Edison’s quadruplex telegraph</td>
<td>Electric escalator, electric elevated railway, floodlights, Ferris wheel</td>
<td>Two-color photography, Ford conveyer belt, phone line from San Francisco to New York</td>
</tr>
</tbody>
</table>

Note: from Moser (2017) *Patents and Pirates, An Economic History of Innovation in Europe and the United States*
In 1851, Europe learned about the American System of Manufacturing Exhibit of Samuel Colt’s Revolving Handguns
Corliss Steam Engine in Philadelphia in 1876
In 1893 at Chicago’s White City Josephine Cochran presented the dishwasher
Ford’s Model T assembly - 1 car every 10 minutes – at the Panama Pacific Exibition in 1915
Exhibition data can help answer questions that cannot be easily answered with patent data alone.

1. Can countries innovate without patents?
   1. Number of innovations
   2. Quality of innovations

2. Which industries need patents most?

3. What are the effects of patents on the direction of technical change?
Exhibition data can help answer questions that cannot be easily answered with patent data alone

1. Can there be innovation without patents?
   1. Number of innovations
   2. Quality of innovations

2. Which industries need patents most?

3. What are the effects of patents on the direction of technical change?
Countries **without patents** contributed many innovations at the fairs.

Note: from Moser (2017) *Patents and Pirates, An Economic History of Innovation in Europe and the United States*
Exhibits from countries without patents were high quality

Note: from Moser (2017) Patents and Pirates, An Economic History of Innovation in Europe and the United States
Why are countries without patent laws so innovative?

• Without patents, it is cheaper to copy foreign technologies
  • Inventors then improved foreign-owned technologies
  • Swiss-watchmakers started out by copying British machine
  • US cotton industry copied British machine
  • Major Dutch multinationals (Unilever, Philips) started by copying foreign technologies

• Only a small share of innovations were patented
  • 11.1% of British exhibits in 1851
  • 15.3% of US exhibits in 1876
Exhibition data can help answer questions that cannot be easily answered with patent data alone

1. Can countries innovate without patents?
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   2. Quality of innovations

2. Which industries need patents most?

3. What are the effects of patents on the direction of technical change?
Which industries need patents (most)?

- Industries in which inventions are easy to replicate depend more on patents
- Examples
  - Machinery in the 19th century
  - Some parts of plant breeding in the 20th century and today


*Note:* The cage was built around the Stark Brother's Golden Delicious tree to prevent competitors from stealing shoots of the tree; it was equipped with an alarm.

Moser and Rhode: *Did Plant Patents Create the American Rose?* in the Lerner and Stern (2012) *Rate and Direction of Technical Change, Revisited*
Secrecy is similarly ineffective for roses

- Conard & Jones Co. invests two years to introduce *rosa hugonis* (Father Hugo rose) to U.S.
- Competitors bought *rosa hugonis* and propagated it from shots, sold own versions within three years
Creation of plant patents in 1930

— From www.uspto.gov
  - Patent number, grant date, originator/inventor, assignee

— Example: PP1, New Dawn
  - Granted on August 18, 1931
  - Inventor: Henry F. Bosenberg
  - Climbing or trailing rose
  - Sport of a rose that Walter Van Fleet (d. 1922) had developed
Until the mid 1950s, most plant patents are for roses (from Moser and Rhode 2012 “Did Plant Patents Create the American Rose?”)

**Figure 3 – Plant Patents per Year, 1930-1980**

Notes: Plant patents from the USPTO Patent Statistic Reports (available at [www.uspto.gov](http://www.uspto.gov)).
10-35 percent of new roses were patented

Patenting rates increased until the mid 1950s
In some industries patenting rates have increased as alternative mechanisms became less effective.

<table>
<thead>
<tr>
<th></th>
<th>1851</th>
<th>1876</th>
<th>1893</th>
<th>1915</th>
<th>All years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share patented</td>
<td>0.0%</td>
<td>3.6%</td>
<td>19.0%</td>
<td>18.9%</td>
<td></td>
</tr>
<tr>
<td>Exhibits</td>
<td>32</td>
<td>139</td>
<td>63</td>
<td>90</td>
<td>324</td>
</tr>
<tr>
<td><strong>Manufacturing machinery</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share patented</td>
<td>43.8%</td>
<td>44.0%</td>
<td>49.4%</td>
<td>47.1%</td>
<td></td>
</tr>
<tr>
<td>Exhibits</td>
<td>32</td>
<td>468</td>
<td>358</td>
<td>34</td>
<td>892</td>
</tr>
<tr>
<td><strong>Exhibits in both industries</strong></td>
<td>64</td>
<td>607</td>
<td>421</td>
<td>124</td>
<td>1,216</td>
</tr>
</tbody>
</table>
Exhibition data can help answer questions that cannot be easily answered with patent data alone.

1. Can countries innovate without patents?
   1. Number of innovations
   2. Quality of innovations

2. Which industries need patents most?

3. What are the effects of patents on the direction of technical change?
Patenting rates vary strongly across industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Britain</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Total</td>
<td>(2) % Pat.</td>
</tr>
<tr>
<td>Mining and metallurgy</td>
<td>418</td>
<td>5.0%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>136</td>
<td>5.1%</td>
</tr>
<tr>
<td>Food processing</td>
<td>140</td>
<td>7.9%</td>
</tr>
<tr>
<td>Engines</td>
<td>406</td>
<td>24.6%</td>
</tr>
<tr>
<td>Manufacturing machinery</td>
<td>242</td>
<td>29.8%</td>
</tr>
<tr>
<td>Civil engineering</td>
<td>559</td>
<td>13.4%</td>
</tr>
<tr>
<td>Agricultural machinery</td>
<td>261</td>
<td>19.9%</td>
</tr>
<tr>
<td>Scientific instruments</td>
<td>581</td>
<td>9.6%</td>
</tr>
<tr>
<td>Manufactures</td>
<td>1,955</td>
<td>10.2%</td>
</tr>
<tr>
<td>Textiles</td>
<td>1,679</td>
<td>6.8%</td>
</tr>
<tr>
<td>All industries</td>
<td>6,377</td>
<td>11.1%</td>
</tr>
</tbody>
</table>
Same patent laws create different effects across industries

• Intellectual property rights influence the direction of technical change

• Challenge:
  • Build one system that meets needs of different industries
  • Need for transparency
  • Minimize transaction costs

Countries w/o patents only innovate in a small set of industries in which inventors depend less on patents

From Moser 2005
Key mechanisms to modify patent laws

• Patent pools
• Compulsory licensing
Patent Pools


• But negative dynamic effects on innovation
• Fewer patents, less entry during sewing machine pool (1856-1877, Lampe and Moser *Journal of Economic History* 2010)
• Divert innovation towards inferior substitute for pool technology (Lampe and Moser *Rand* 2012)
• Widespread decline in innovation for pools that formed across 20 industries in the 1930s (Lampe and Moser *Journal of Law Economics & Organization* 2016)
Without a pool, British sewing machine patents continued to increase

October 24, 1856: 
Albany Agreement

May 8, 1877: 
Pool Dissolved
Improvements in performance (speed) slowed during the pool

October 24, 1856: Albany Agreement
May 8, 1877: Pool Dissolved
Copyrights

• Protect “original works of ownership” for life of author + 70 years
• Secured automatically when work is created (currently w/o registration)
• Under 1976 Copyright Act works that can be copyrighted include
  • Literary works (including fiction, nonfiction, and computer programs) I musical works, including any accompanying words
  • Dramatic works, including any accompanying music
  • Pantomimes and choreographic works
  • Pictorial, graphic, and sculptural works
  • Motion pictures and other audiovisual works
  • Sound recordings
  • Architectural works, including vessel hull designs
Significantly more narrow than patents

• Allows for more variation, “follow-on” innovation

• Example: The Barber of Seville
  • Giovanni Paisiello (1782) “Il barbiere di Siviglia”
  • Giacchino Rossini (1816) “Il barbiere di Siviglia”
Basic levels of copyright protection encourages creativity

• Some states within Italy adopted copyrights in 1801 – as a result of variation in the timing of Napoleon’s military victories

• States with copyrights began to produce more and better operas

Giorcelli and Moser “Copyright and Creativity – Evidence from Italian Operas” (2015)
No noticeable effects of copyright extensions

Few Operas are performed after 20 years

No effects of Copyright extensions

Giorcelli and Moser (2015)
But extension are enormously costly for science

- US WWII Book Republication Program in 1942
  - Temporary (6-month) licenses to reprint German science books
- US publishers reprint exact copies of science books w/ German-owned copyrights
  - 25% lower price for average book
- 10% decline in price induced a 38% increase in follow-on science
  - Measured by citations and patents
  - Compared with Swiss science books
- Lower prices helped books to spread across US libraries

From “Effects of Copyrights on Science – Evidence from the WWII Book Republication Program” (Biasi and Moser 2016)
Summing up

• Research on IP needs analysis of patents and alternative sources on innovation

• Patents
  • Variation across industries and fields
  • Challenge to create unified, transparent system to serve all
  • Mechanisms of patent pools, compulsory licensing

• Copyright
  • Basic levels of patent protection encourage broad-based participation and creativity
  • But copyright extensions create no noticeable benefits
  • And may be extremely costly in terms of discouraging follow-on science