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/
  - Hall, B. H., A. B. Jaffe, and M. Trajtenberg (2001). "The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools." NBER Working Paper 8498.
- USPTO/ Google Patent data base 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)

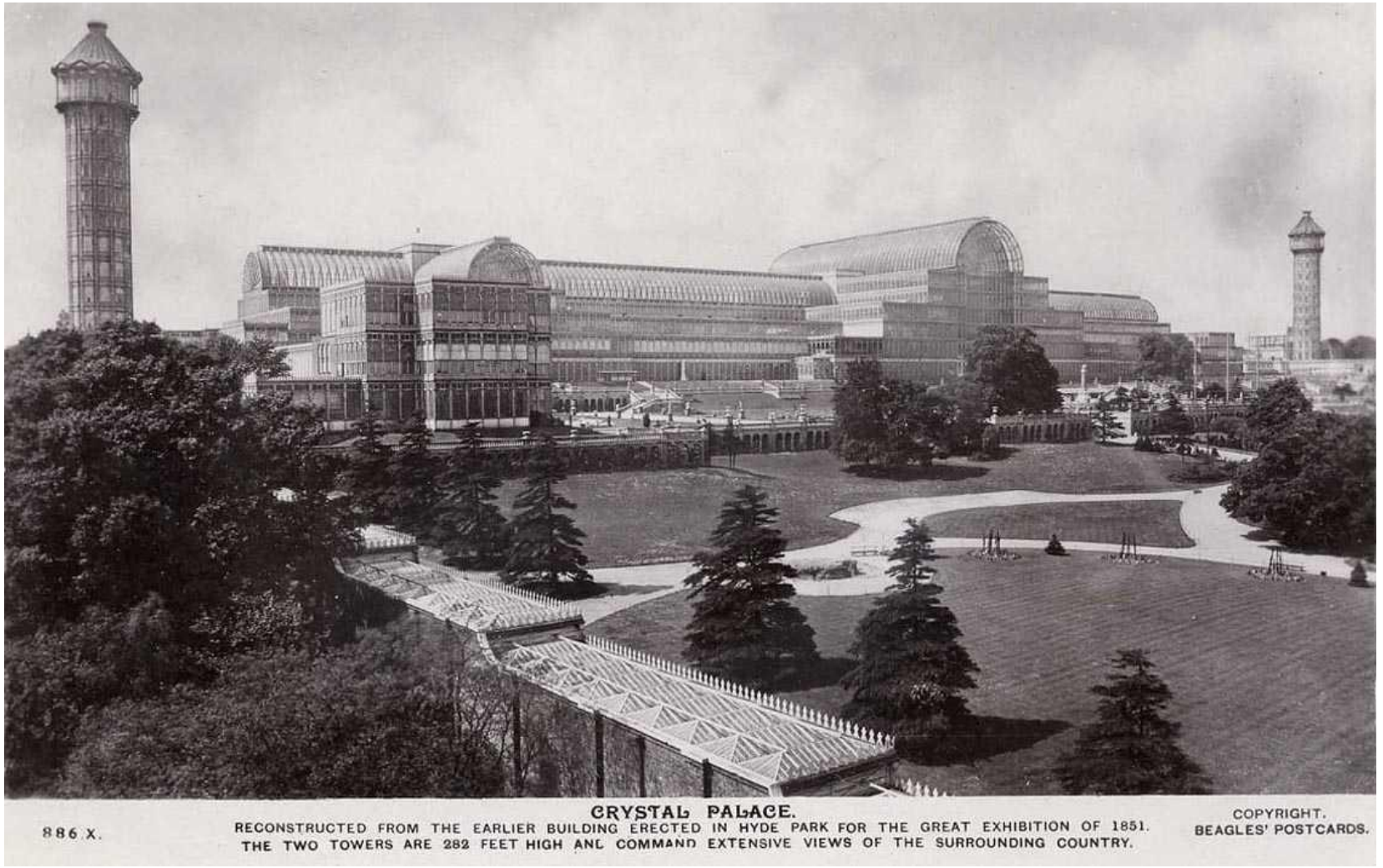


TABLE 1.1 – STATISTICS OF THE WORLD'S FAIRS OF 1851, 1876, 1893, AND 1915

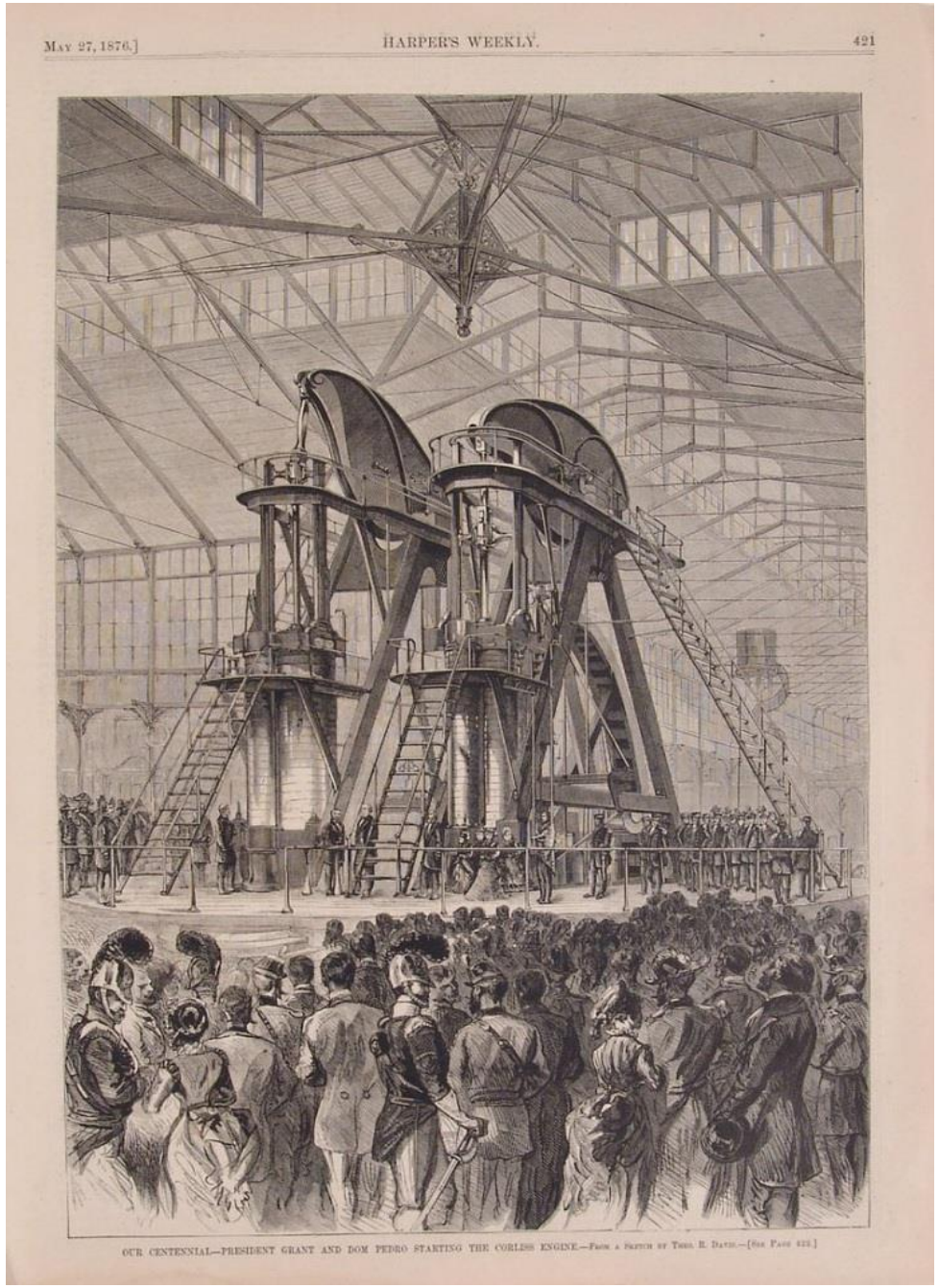
	Crystal Palace 1851	Centennial 1876	World's Columbian 1893	Panama- Pacific 1915
Location	London	Philadelphia	Chicago	San Francisco
Countries	40	35	45	32
Exhibitors	17,062	30,864	70,000	30,000
Visitors	6,039,195	9,892,625	27,500,000	19,000,000
Area (in acres)	25.7 for buildings	71.4 for buildings and grounds	717 for grounds 49 for buildings	635 for buildings and grounds
Prominent Exhibits	McCormick's grain reaper, Colt's revolver, steam engines, typewriter	Corliss steam engine, telephone, Edison's quadruplex telegraph	Electric escalator, electric elevated railway, floodlights, Ferris wheel	Two-color photography, Ford conveyer belt, phone line from Sa Francisco to New York

Note: from Moser (2017) *Patents and Pirates, An Economic History of Innovation in Europe and the United States*

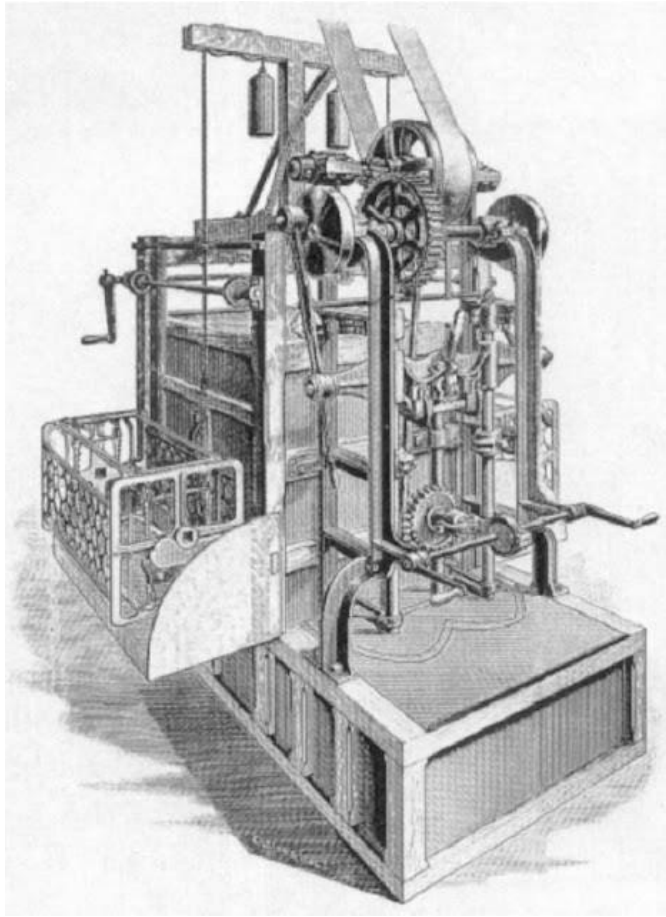
In 1851, Europe learned about the *American System of Manufacturing*

Exhibit of Samuel Colt's Revolving Handguns

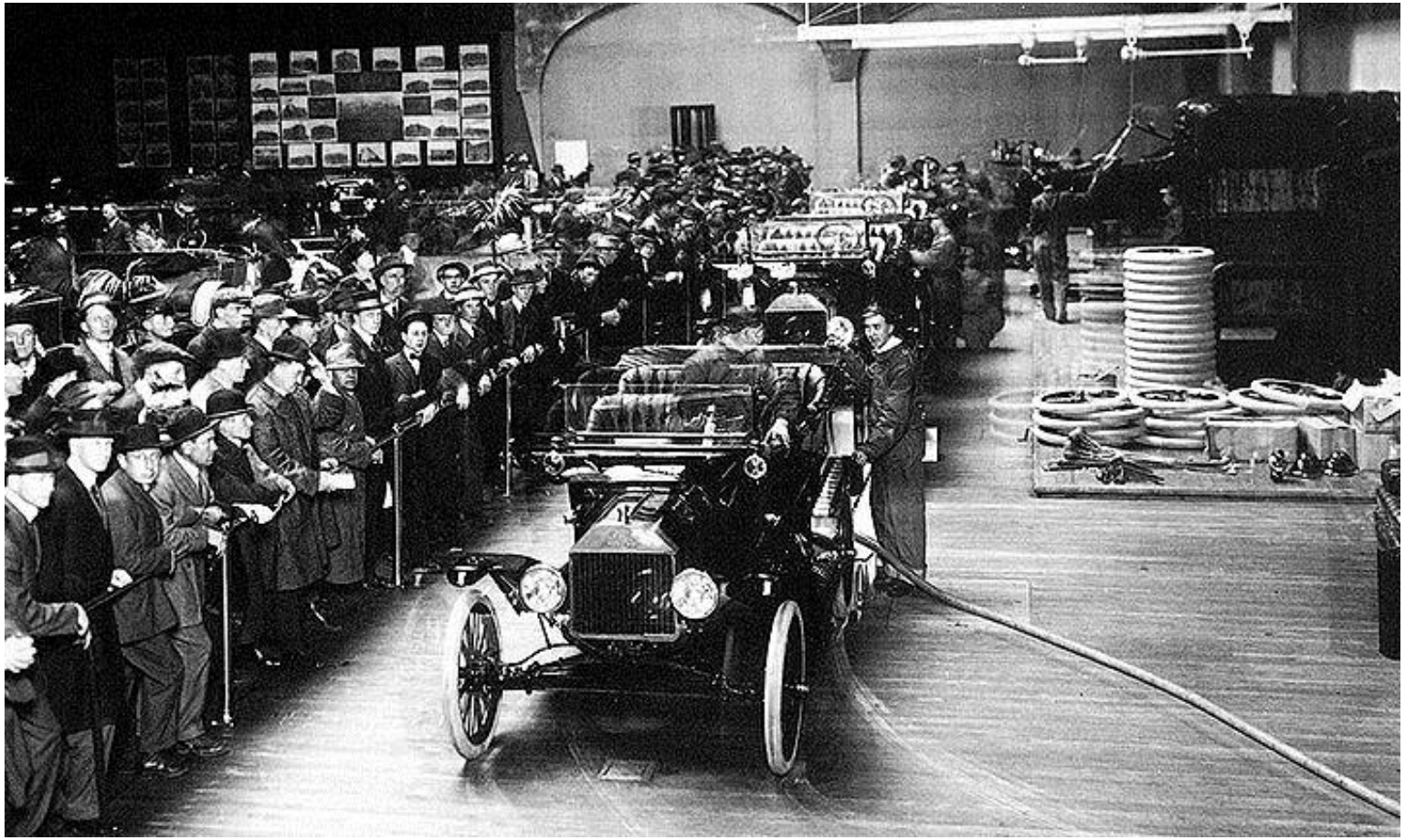
Corliss Steam Engine in Philadelphia in 1876



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?

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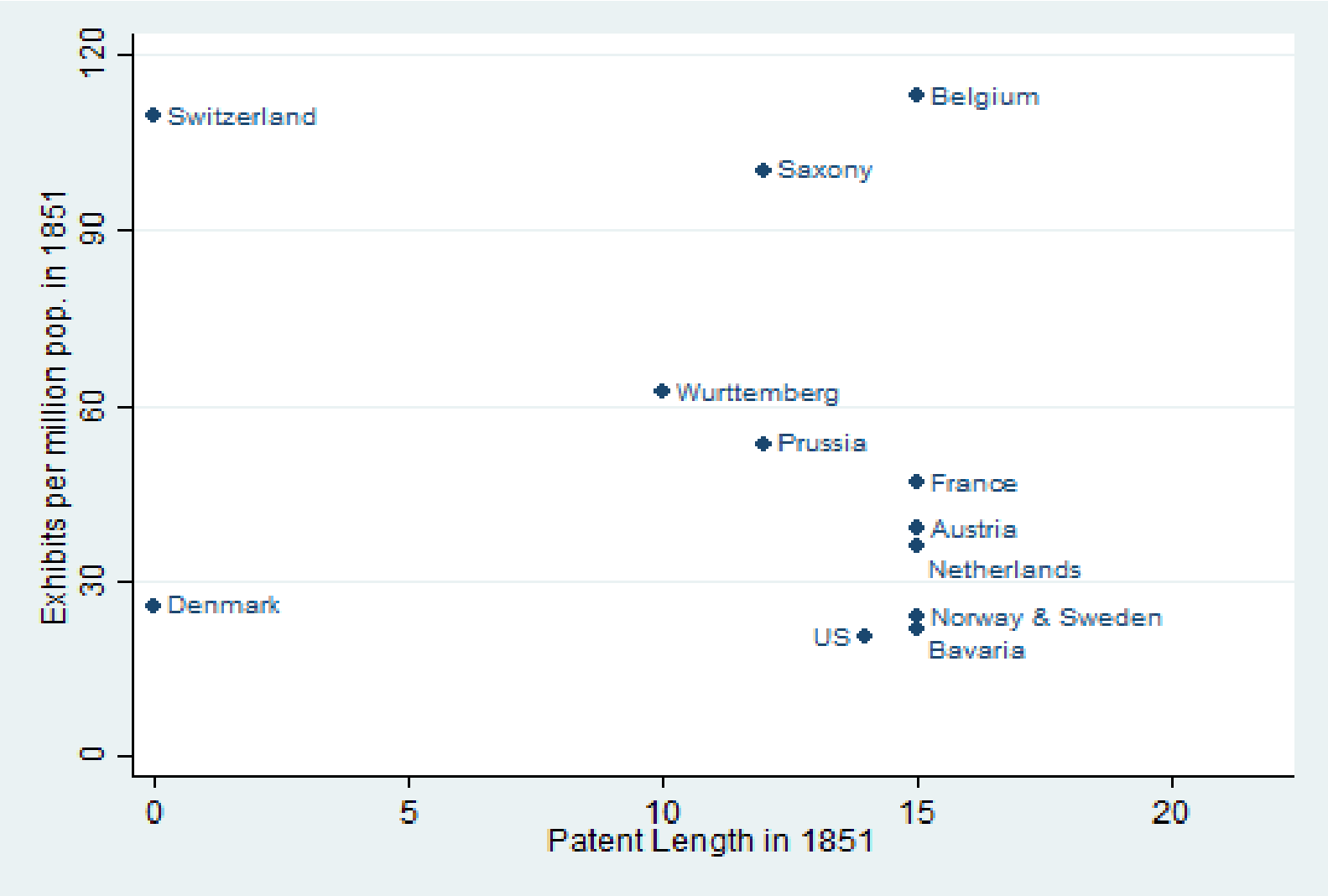
Countries without patents contributed many innovations at the fairs



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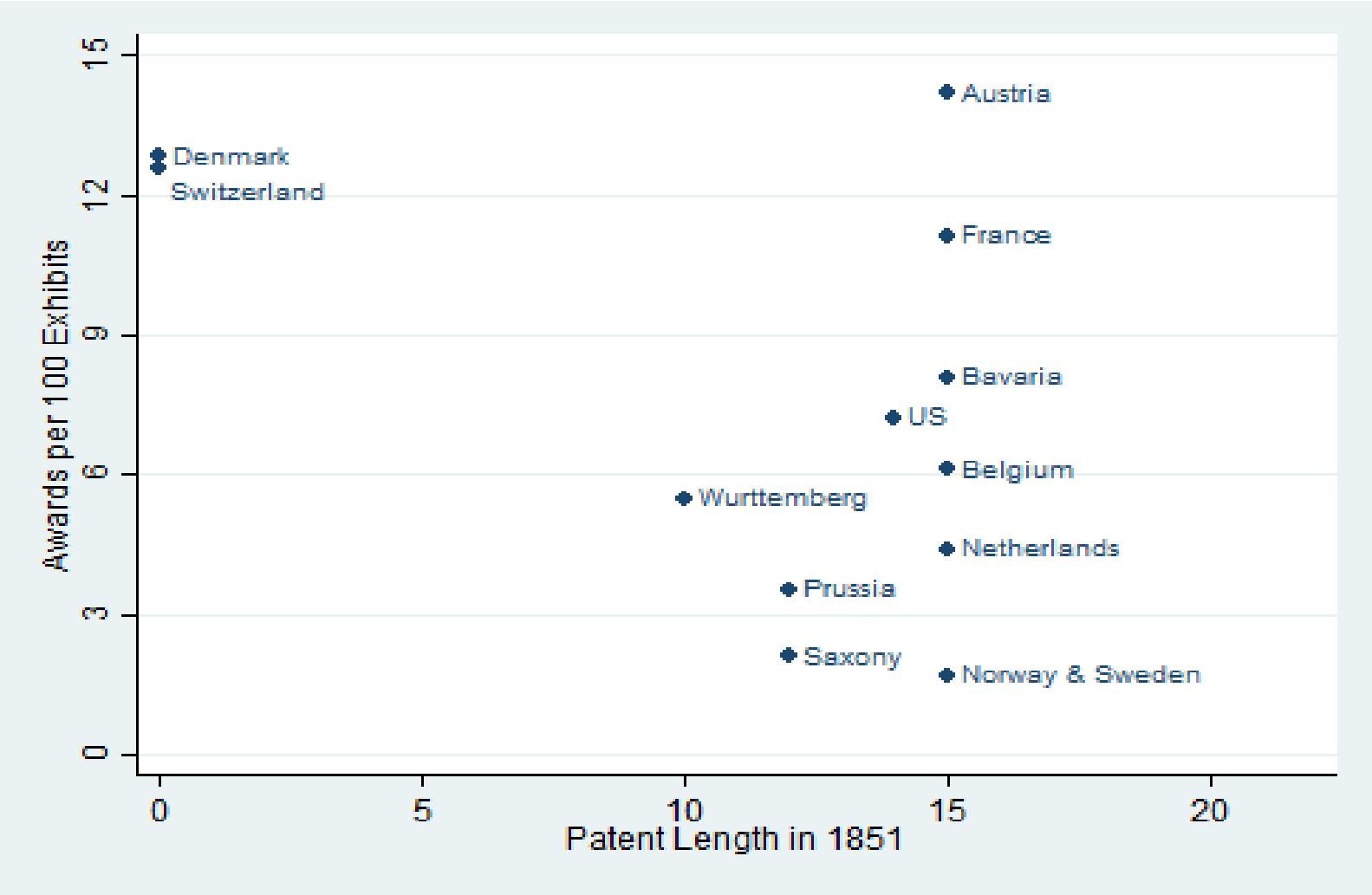
Exhibits from countries without patents were high quality



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

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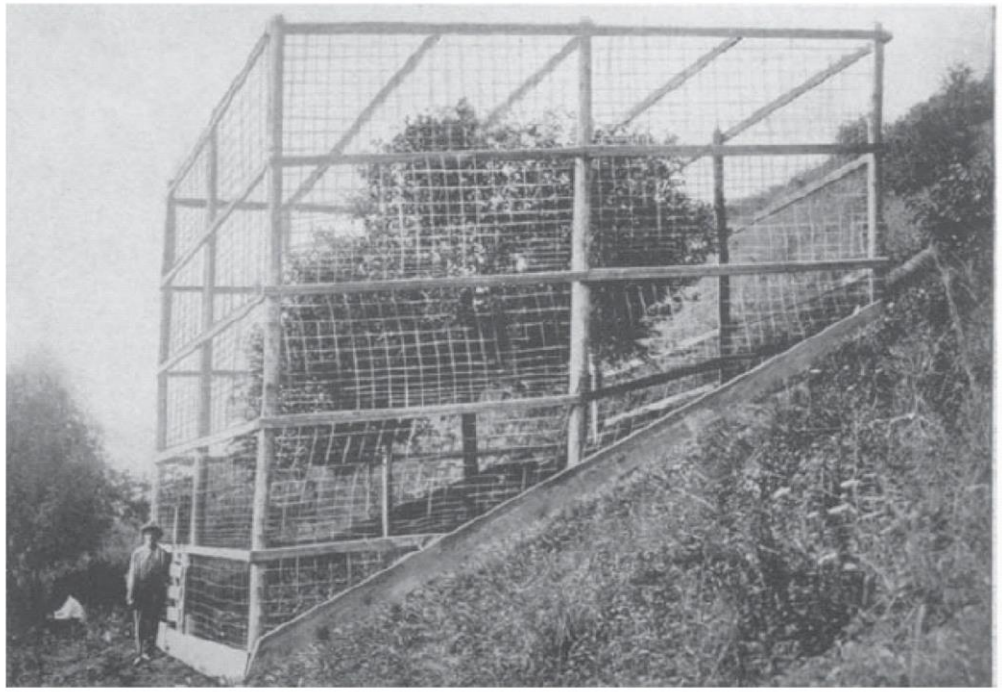
Which industries need patents (most)?

Figure 1
A Cage that Stark Brothers Nursery Built around Its Golden Delicious Apple Tree



Source: Image from Rossman (1930, p. 395), reproduced in Moser and Rhode (2012, p. 415).
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*

- 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

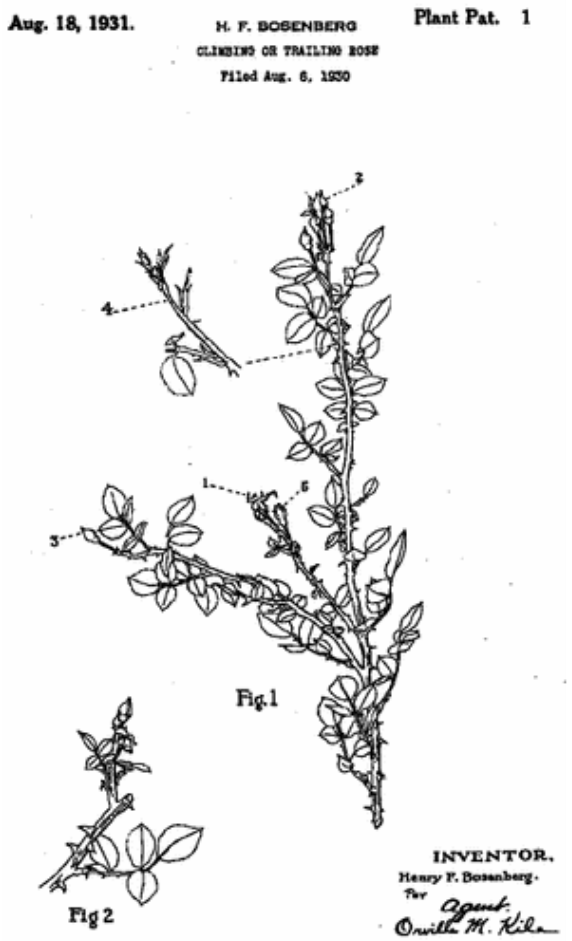
Secrecy is similarly ineffective for roses

- 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

Rosa hugonis, Father Hugo Rose.
Image from about-garden.com.

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


Aug. 18, 1931. H. F. BOSENBERG Plant Pat. 1

CLIMBING OR TRAILING ROSE

Filed Aug. 6, 1930

Fig. 1

Fig 2

INVENTOR.

Henry F. Bosenberg.

Per Agent.

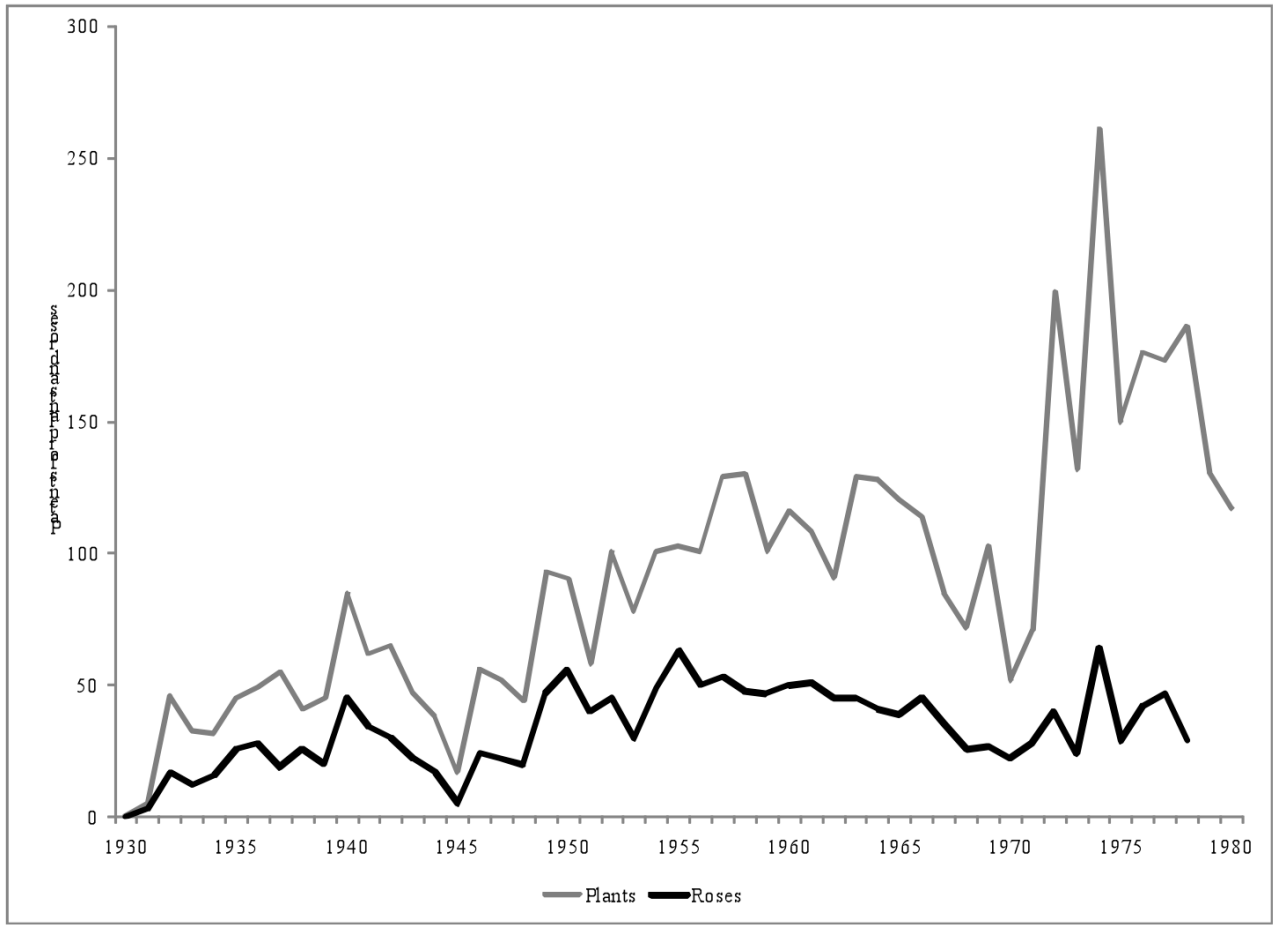
Orville M. Kile

Plant Patent 1, granted to Henry F. Bosenberg, a New Jersey gardener, on August 18, 1931

Until the mid 1950s, most plant patents are for roses

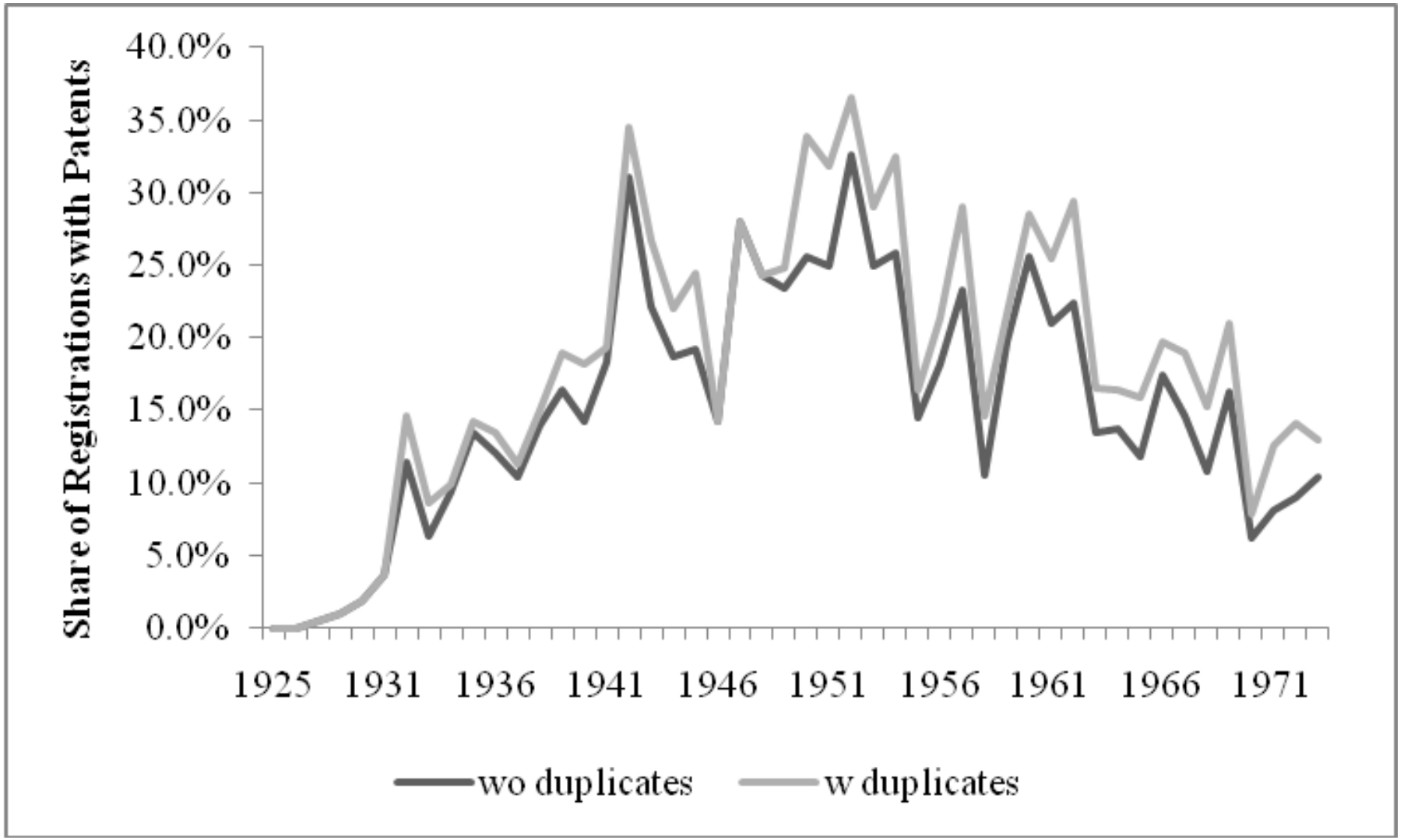
(from Moser and Rhode 2012 “Did Plant Patents Create the American Rose?”)

FIGURE 3 – PLANT PATENTS PER YEAR, 1930-1980



Notes: Plant patents from the USPTO *Patent Statistic Reports* (available at www.uspto.gov).

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 – Patenting Rates:
U.S. Exhibits of Chemicals and Manufacturing Machinery, 1851 to 1915

	1851	1876	1893	1915	All years
Chemicals					
Share patented	0.0%	3.6%	19.0%	18.9%	
Exhibits	32	139	63	90	324
Manufacturing machinery					
Share patented	43.8%	44.0%	49.4%	47.1%	
Exhibits	32	468	358	34	892
Exhibits in both industries	64	607	421	124	1,216

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Patenting rates vary strongly across industries

	Britain		United States	
Industry	(1) Total	(2) % Pat.	(3) Total	(4) % Pat.
Mining and metallurgy	418	5.0%	52	7.7%
Chemicals	136	5.1%	32	0.0%
Food processing	140	7.9%	70	7.1%
Engines	406	24.6%	31	42.0%
Manufacturing machinery	242	29.8%	32	43.8%
Civil engineering	559	13.4%	17	23.5%
Agricultural machinery	261	19.9%	27	37.0%
Scientific instruments	581	9.6%	74	16.2%
Manufactures	1,955	10.2%	98	15.3%
Textiles	1,679	6.8%	117	6.0%
All industries	6,377	11.1%	550	15.3%

Same patent laws create different effects across industries

- Intellectual property rights influence the direction of technical change
  - "How do Patent Laws Influence Innovation? - Evidence from 19th-century World Fairs" (Moser *American Economic Review* 2005)
- 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

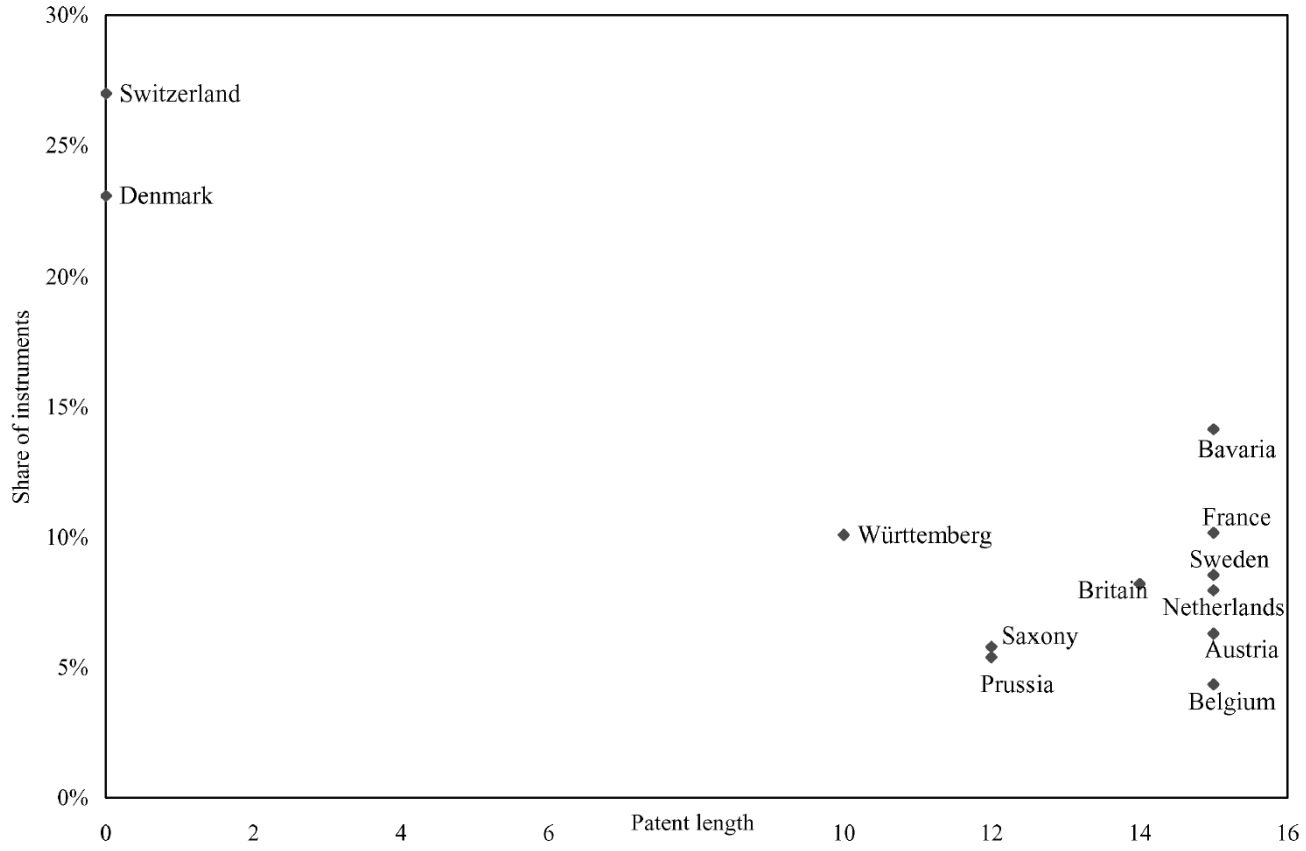


FIGURE 1. SHARES OF EXHIBITS IN SCIENTIFIC INSTRUMENTS AGAINST PATENT LENGTH IN 1851

From Moser 2005

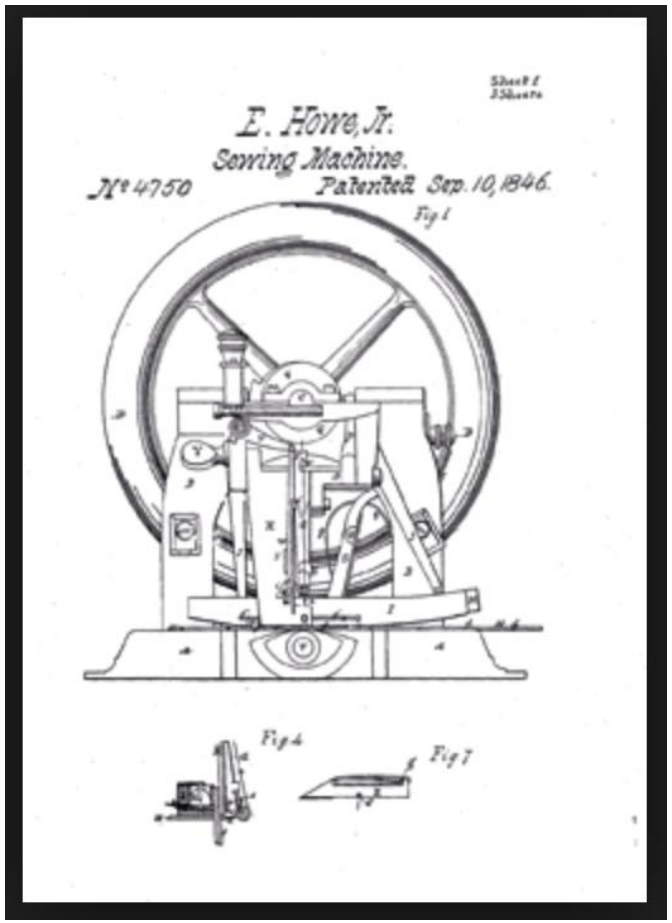
Key mechanisms to modify patent laws

- Patent pools
- Compulsory licensing

Patent Pools

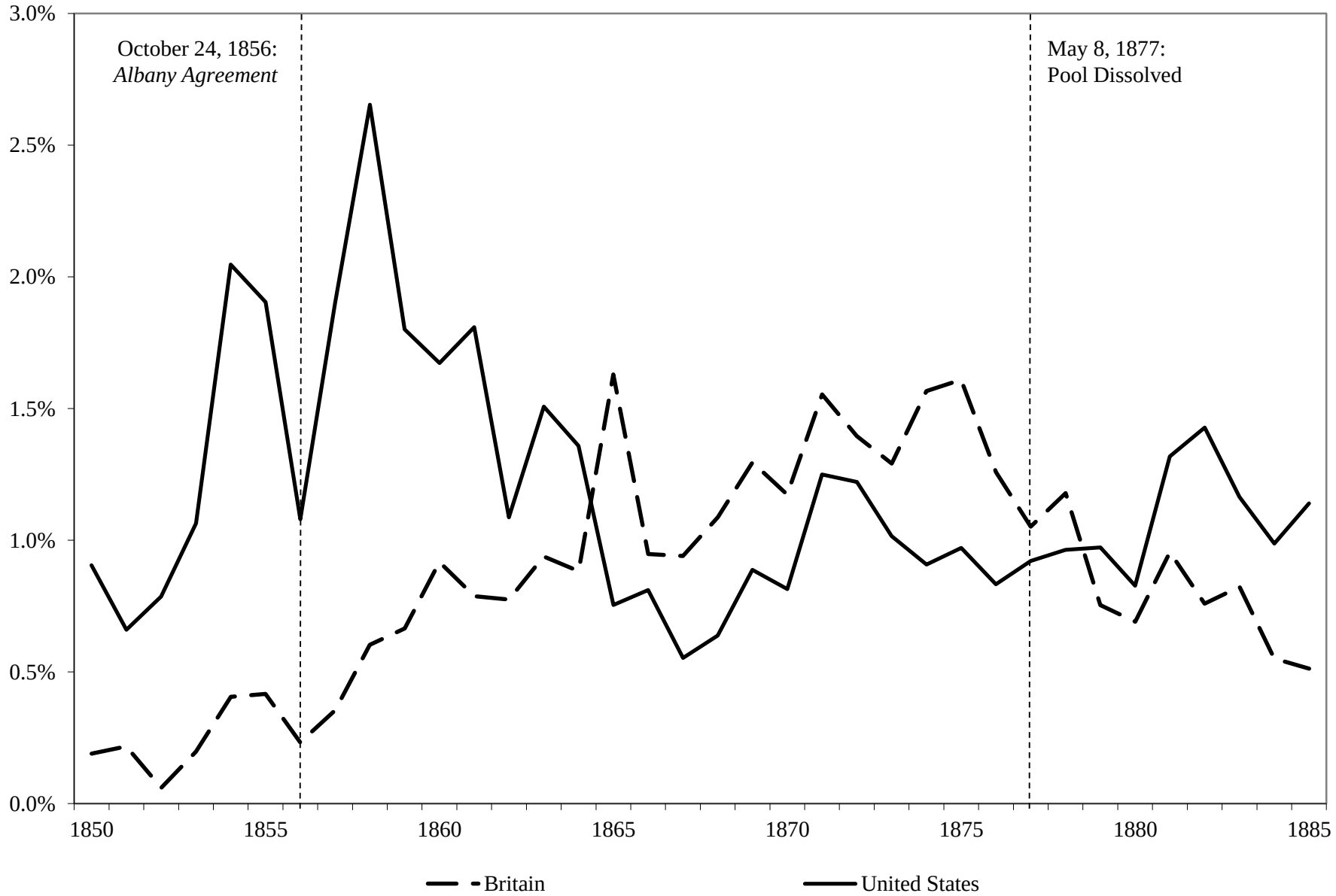
- Reduced transaction costs, lower prices (Lerner and Tirole "Efficient Patent Pools" *American Economic Review*, 2004)

- 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)

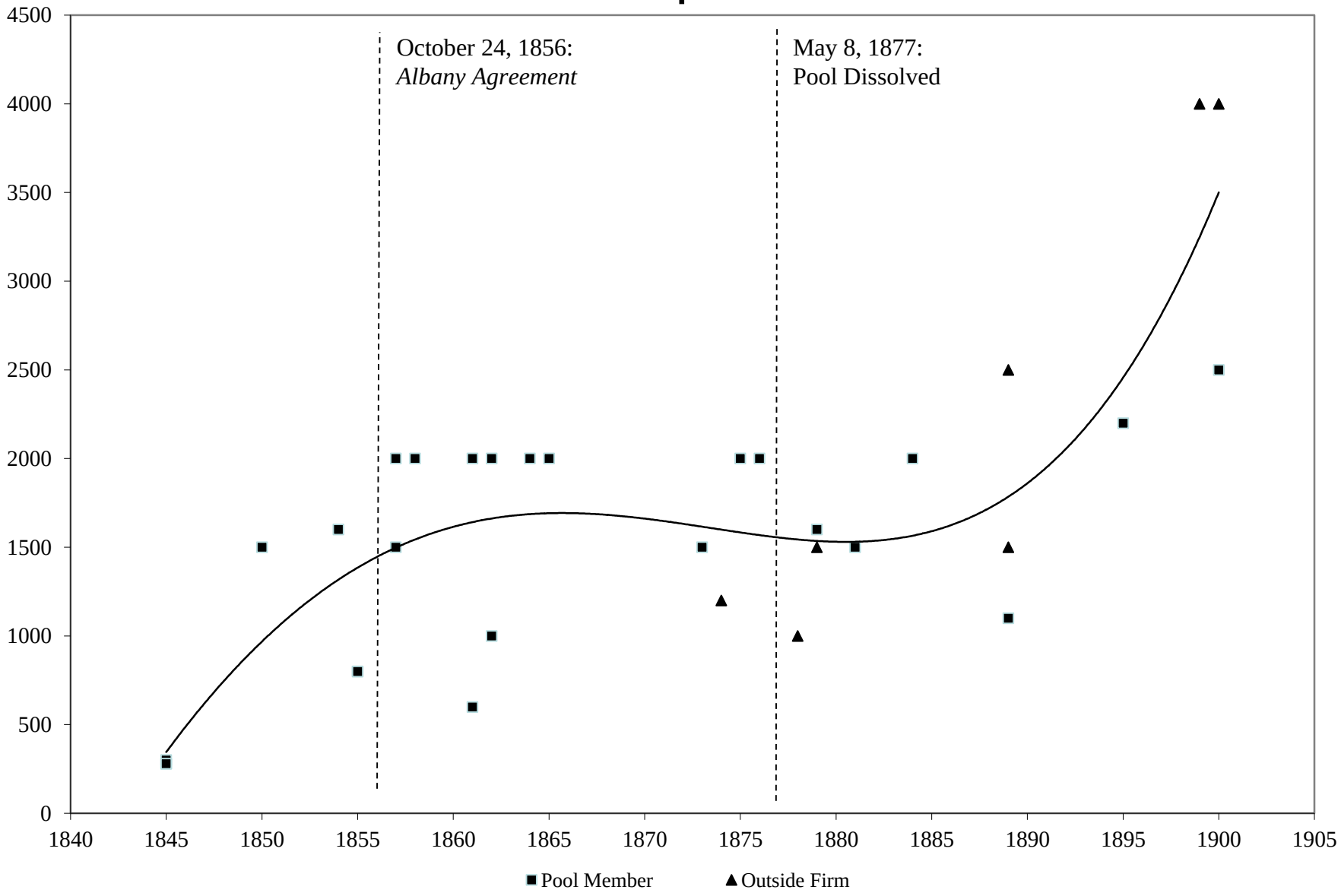


Patent drawing for Elias Howe's model of the sewing machine

Without a pool, British sewing machine patents continued to increase



Improvements in performance (speed) slowed during the pool



Copyrights

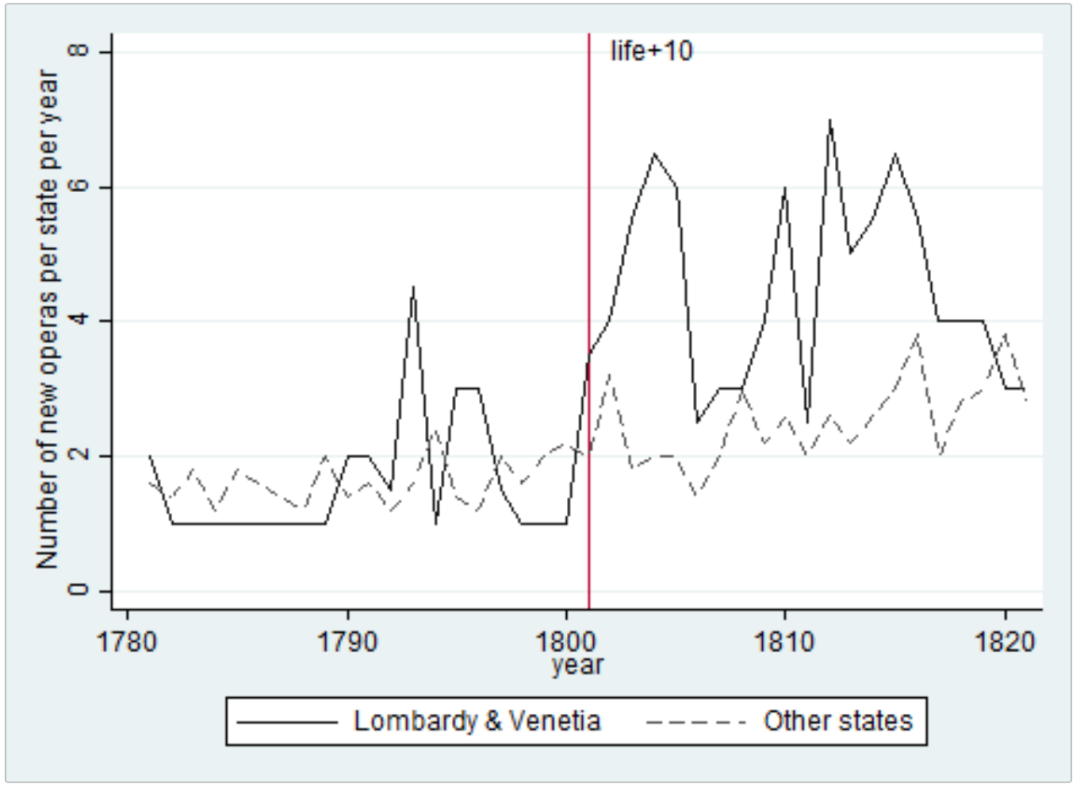
- Protect “original works of ownership” for life of author + 70 years
- Secured automatically when work is created (currently w/o registration)
- Under 1976 Copyright Act works that can be copyrighted include
  - Literary works (including fiction, nonfiction, and computer programs) I musical works, including 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”*

Gioachino Rossini in 1820, International Museum and Library of Music, Bologna

Basic levels of copyright protection encourages creativity

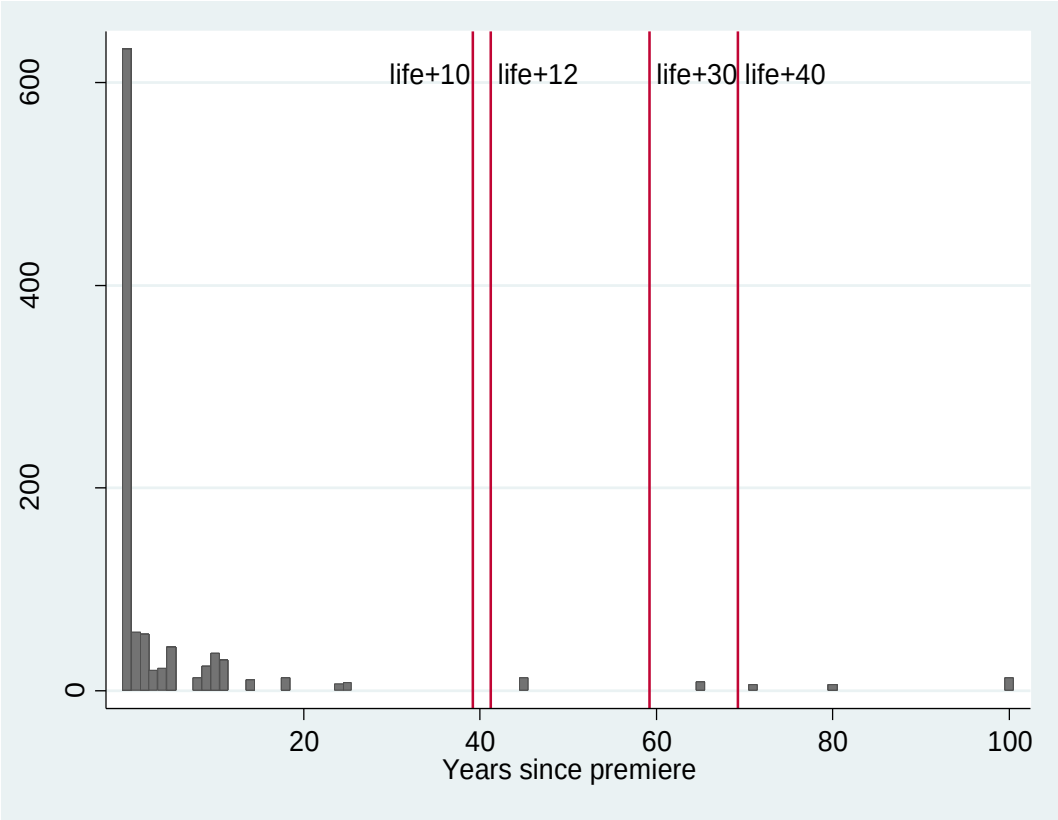


Giorcelli and Moser "Copyright and Creativity – Evidence from Italian Operas" (2015)

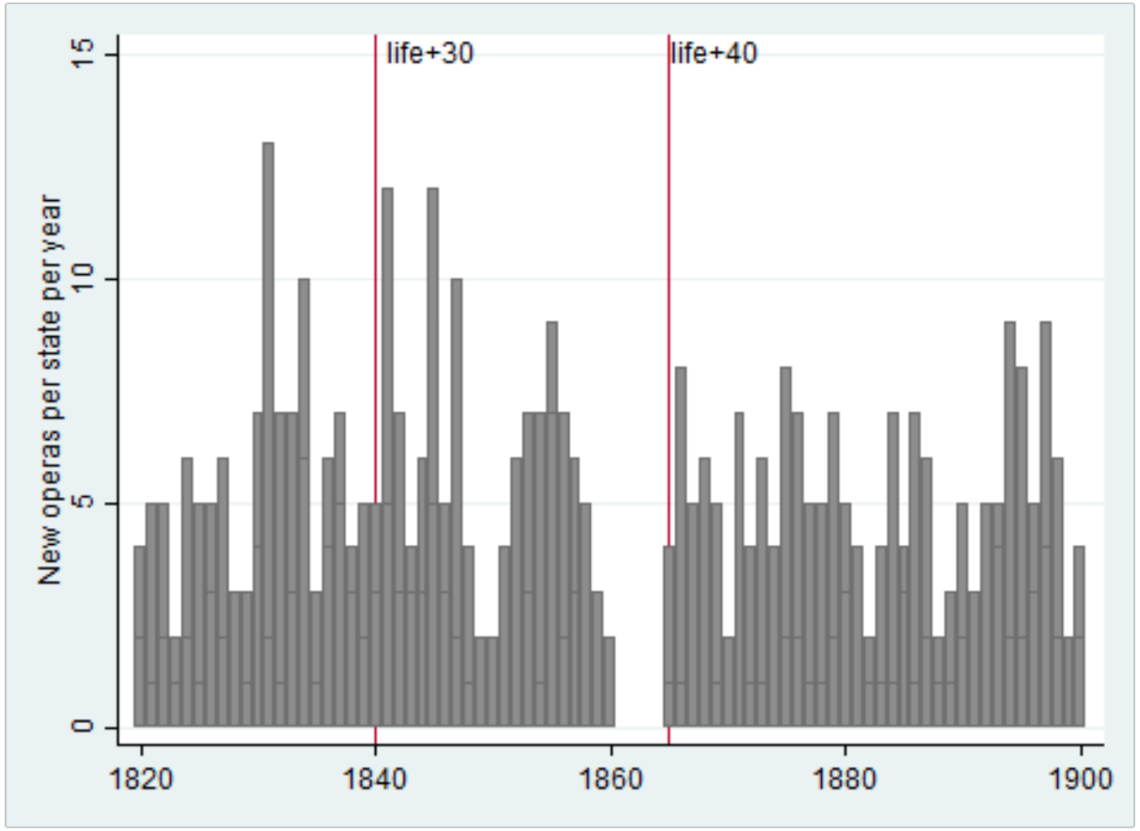
- Some states within Italy adopted copyrights in 1801 – as a result of variation in the timing of Napoleon's military victories
- States with copyrights began to produce more and better operas

No noticeable effects of copyright extensions

FEW OPERAS ARE PERFORMED AFTER 20 YEARS



NO EFFECTS OF COPYRIGHT EXTENSIONS

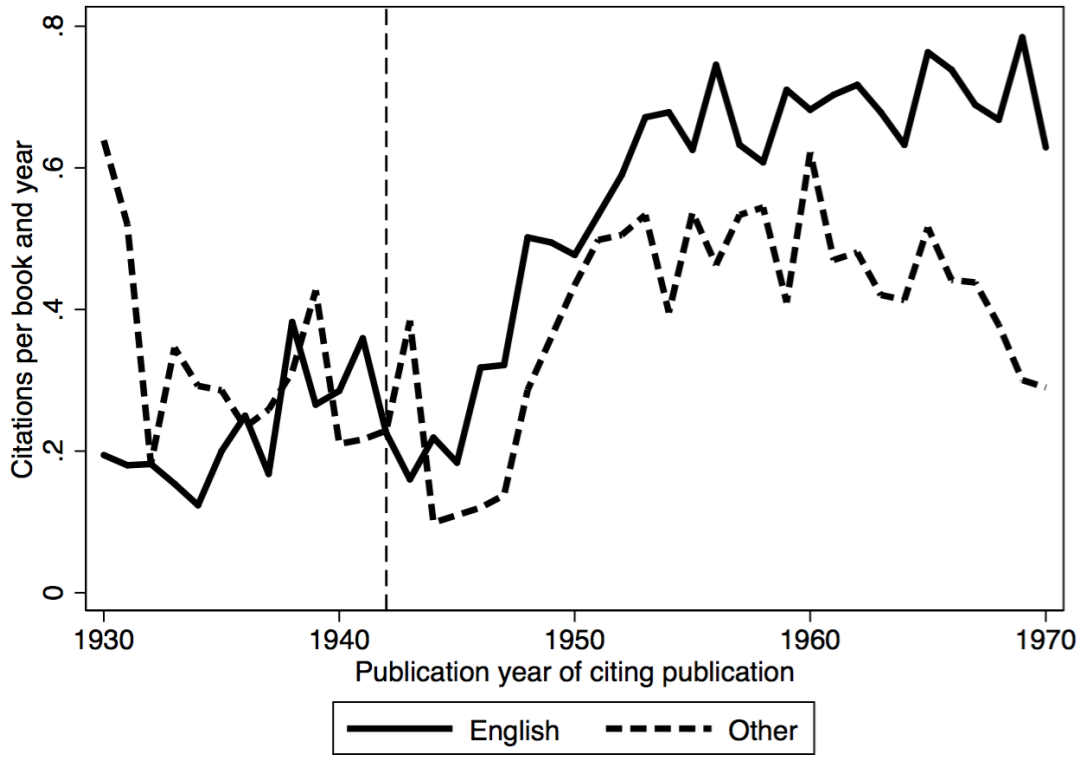


Giorcelli and Moser (2015)

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

FIGURE 1 – CITATIONS TO BRP BOOKS FROM PUBLICATIONS IN ENGLISH VERSUS OTHER LANGUAGES



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