Cradle of Modernity

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Six revolutions:

1. Revolution in transportation.
2. Revolution in communication.
4. Revolution in management and invention.
5. Revolution in countries relative standing in the world.
Revolution in transportation

- R.M.S. Oceanic → White Star Line’s first liner:
  1. Iron-hulled.
  2. Steam-powered.

- Facilitates migration: one hundred million migrants between 1870-1925 ≈ 10% of the world’s population in 1870.

- Starting in 1850, perishable organics start to be traded overseas.

- By 1900s, Europe’s beef is raised in Argentina, its mutton and wool in Australia, and its butter in New Zealand.

- Consequences:
  1. World convergence of prices.
  2. Agrarian crisis in Western Europe.
The impact of access to rail transportation on agricultural improvement.

Figure 1: Percentage change in improved farm land 1850–1860 in sample panel of counties with stable boundaries.

Table 2: Sample statistics of key variables in aggregate and in control and treatment counties.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rail = 1</th>
<th>% Improved Land in Farms</th>
<th>Ln (Per Hectare Farm Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.390</td>
<td>3.024</td>
</tr>
<tr>
<td>1850</td>
<td></td>
<td>0.411</td>
<td>3.116</td>
</tr>
<tr>
<td>1860</td>
<td></td>
<td>0.526</td>
<td>3.933</td>
</tr>
</tbody>
</table>

Source: See Table 1.

There are 278 counties in the sample. Treatment = 1 if county gained rail access between 1850 and 1860. Control = 1 (Treatment = 0) if the county does not have rail access before the Civil War. There are 195 treatment counties and 83 control counties. Observations are weighted by surface area prior to calculating sample means.

Change in Percentage of Improved Land, 1850-60

- Decrease
- 0 - 10 percentage point increase
- 10 - 20 percentage point increase
- 20 - 30 percentage point increase
- 30 - 40 percentage point increase
- Greater than 40 percentage point increase

Data source: County data from ICPSR/Haines files (see text)
Figure 2: The Midwestern railroad network at benchmark dates relative to our panel of counties with stable boundaries.

Just three covariates: the logarithm of the value of agricultural output per hectare (a measure of the land’s “yield,” in this case its revenue productivity); the percentage of total agricultural output in 1840 represented by wheat production; and the change in the wheat output percentage between 1840 and 1850.

Wheat is a crop of particular importance at this time as it was the primary “cash crop” of the period and, therefore, likely a key determinant of whether a rail line would be profitable. Each of these variables had positive and significant effects on the likelihood of gaining rail access; for example, a 10 percentage point increase in the wheat share boosts the probability of gaining rail access by 5.3 percentage points.

However, the significant positive coefficients on the agricultural variables may also be due to other factors that are omitted from the regression. For example, an earlier paper (Atack et al. 2010) examined the relationship between gaining rail access and measures of urbanization, population density, and our water transportation dummies using the same panel. Accordingly, in column 2 of Table 3 we have included measures of urbanization and population density in 1840 as well as changes in these variables between 1840 and 1850. We have also included dummy variables for access to different modes of water transportation (river, canals, and abutting the Great Lakes) while in column 3 we have also included dummy variables for each state. Adding additional controls reduces the magnitudes of the coefficients of the agricultural variables but the coefficients on the wheat “yield” variable and the “pre-trend” (1840–50) in the wheat share remain statistically significant. Moreover (not shown) several of these control variables are themselves statistically significant; for example, the percentage of wheat over the 1840s (because 1840 output was probably valued at local prices) but any such bias should be mitigated once we control for state fixed effects (since state-level variation arguably captures the most salient price variation). Our agricultural yield variable also uses the estimated value of agricultural output in its construction (the numerator).

Data sources: Railroads from Atack-Margo and National Transportation database. County data from ICPSR/Haines files (see text)
Figure 1
Gross Intercontinental Emigration from Europe, 1846-1939
(annual averages)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>1.90</td>
<td>2.22</td>
<td>2.03</td>
<td>2.18</td>
<td>1.96</td>
<td>2.32</td>
</tr>
<tr>
<td>Denmark</td>
<td>--</td>
<td>--</td>
<td>1.97</td>
<td>3.74</td>
<td>2.60</td>
<td>2.80</td>
</tr>
<tr>
<td>France</td>
<td>--</td>
<td>0.12</td>
<td>0.16</td>
<td>0.29</td>
<td>0.18</td>
<td>0.15</td>
</tr>
<tr>
<td>Germany</td>
<td>1.80</td>
<td>1.61</td>
<td>1.35</td>
<td>2.91</td>
<td>1.18</td>
<td>0.43</td>
</tr>
<tr>
<td>Great Britain</td>
<td>4.83</td>
<td>2.47</td>
<td>3.87</td>
<td>5.71</td>
<td>3.92</td>
<td>7.08</td>
</tr>
<tr>
<td>Ireland</td>
<td>18.99</td>
<td>15.16</td>
<td>11.28</td>
<td>16.04</td>
<td>9.70</td>
<td>7.93</td>
</tr>
<tr>
<td>Italy</td>
<td>--</td>
<td>--</td>
<td>4.29</td>
<td>6.09</td>
<td>8.65</td>
<td>17.97</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.50</td>
<td>1.67</td>
<td>2.66</td>
<td>4.06</td>
<td>4.62</td>
<td>5.36</td>
</tr>
<tr>
<td>Norway</td>
<td>--</td>
<td>--</td>
<td>4.33</td>
<td>10.16</td>
<td>4.56</td>
<td>7.15</td>
</tr>
<tr>
<td>Portugal</td>
<td>--</td>
<td>--</td>
<td>2.91</td>
<td>3.79</td>
<td>5.04</td>
<td>5.67</td>
</tr>
<tr>
<td>Spain</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>3.91</td>
<td>4.63</td>
<td>6.70</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.51</td>
<td>2.52</td>
<td>2.96</td>
<td>8.25</td>
<td>5.32</td>
<td>2.93</td>
</tr>
</tbody>
</table>
Our data are an unbalanced panel on 21 countries (U.K. trading partners) for the period 1870 to 1913. Table 1 provides the share of our sample in total trade with the United Kingdom, the share of the United Kingdom in global trade, and the share of our sample in global trade during the period. Here we see that although the sample's share of U.K. trade is slightly rising through time, the U.K. share in global trade is effectively halved over this period from 30% to 15%. Consequently, our sample falls from 21% to 11% of global trade in the period. However, the United Kingdom was the primary trading partner of not only the fastest-growing economies of the time (Germany, Japan, and the United States) but also those economies experiencing the most rapid decline in maritime freight rates (Australasia, India, and Japan). Table 2 summarizes the coverage of matched bilateral trade, freight, and GDP data. It should be noted that in general, the limiting variable here is GDP. By comparison, the bilateral trade data are complete, and the freight data have only a few breaks in coverage.

Our underlying gravity equation of bilateral trade flows is

\[ \text{Trade}_{\text{UK},i,t} = \frac{\ln (\text{Exports}_{\text{UK},i,t})}{\ln (\text{Imports}_{\text{UK},i,t})}/2; \]

where \( i \) indexes countries; \( t \) indexes years; \( \text{Trade} \) is the trade flow between the United Kingdom and country \( i \) in year \( t \) and is equal to \( \ln (\text{Exports}_{\text{UK},i,t})/\ln (\text{Imports}_{\text{UK},i,t}) \); \( f \) is the freight cost index to ship 1 ton of a generic commodity from Great Britain to country \( i \) in year \( t \); and \( X \) is a vector of covariates suitable to a gravity model of trade. The third-to-last term is a decade fixed effect to control for secular changes in world GDP and other variables. The second-to-last term is a country fixed effect to control for time-invariant multilateral barriers or price effects, or both.

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**TABLE 1.** TRADE RATIOS

<table>
<thead>
<tr>
<th>Sample-to-U.K. Trade Ratio</th>
<th>U.K.-to-Global Trade Ratio</th>
<th>Sample-to-Global Trade Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870–1875</td>
<td>0.7116</td>
<td>0.2969</td>
</tr>
<tr>
<td>1875–1880</td>
<td>0.7264</td>
<td>0.2629</td>
</tr>
<tr>
<td>1880–1885</td>
<td>0.7369</td>
<td>0.2310</td>
</tr>
<tr>
<td>1885–1890</td>
<td>0.7456</td>
<td>0.2193</td>
</tr>
<tr>
<td>1890–1895</td>
<td>0.7508</td>
<td>0.2098</td>
</tr>
<tr>
<td>1895–1900</td>
<td>0.7607</td>
<td>0.2013</td>
</tr>
<tr>
<td>1900–1905</td>
<td>0.7657</td>
<td>0.1940</td>
</tr>
<tr>
<td>1905–1910</td>
<td>0.7539</td>
<td>0.1692</td>
</tr>
<tr>
<td>1910–1913</td>
<td>0.7412</td>
<td>0.1514</td>
</tr>
</tbody>
</table>

Source: Estevadeordal et al. (2003); Statistical Abstract for the United Kingdom.

**TABLE 2.** SAMPLE COUNTRIES AND COVERAGE

<table>
<thead>
<tr>
<th>Countries with a Full Panel of GDP and Freight Data from 1870</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
</tr>
<tr>
<td>Japan</td>
</tr>
<tr>
<td>Canada (ends 1907)</td>
</tr>
<tr>
<td>Portugal</td>
</tr>
<tr>
<td>Ceylon</td>
</tr>
<tr>
<td>Russia</td>
</tr>
<tr>
<td>Dutch East Indies</td>
</tr>
<tr>
<td>Spain</td>
</tr>
<tr>
<td>France</td>
</tr>
<tr>
<td>United States</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>Uruguay (ends 1907)</td>
</tr>
<tr>
<td>Italy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countries with a Full Panel of GDP and Freight Data from 1884</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australasia</td>
</tr>
<tr>
<td>India</td>
</tr>
<tr>
<td>Denmark</td>
</tr>
<tr>
<td>Norway and Sweden</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countries with a Full Panel of GDP and Freight Data from 1900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
</tr>
<tr>
<td>Colombia</td>
</tr>
<tr>
<td>Chile</td>
</tr>
<tr>
<td>Philippines</td>
</tr>
</tbody>
</table>

Note: Australia and New Zealand do not enter as separate trade entities before 1887; Norway and Sweden do not enter separately until 1891.

Perishable organics came before 1850. Well before 1900 Europe's beef was raised in Argentina, its mutton and wool was raised in Australia, and its butter raised in New Zealand. International trans-oceanic trade was no longer limited to luxuries, rarities, drugs—tobacco and tea—and the occasional strategic, bulk, easily-shipped commodity like cotton. Instead, nearly anything could become the object of international trade.

Figure 9.1: The Price of Wheat in London, New York, and Chicago 1800-1980
## Price Gaps per Year

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Markets</th>
<th>1870</th>
<th>1895</th>
<th>1913</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Liverpool/Chicago</td>
<td>0.576</td>
<td>0.178</td>
<td>0.156</td>
</tr>
<tr>
<td>Meat</td>
<td>London/Cincinnati</td>
<td>0.925</td>
<td>0.923</td>
<td>0.179</td>
</tr>
<tr>
<td>Iron</td>
<td>London/Philadelphia</td>
<td>0.750</td>
<td>0.434</td>
<td>0.206</td>
</tr>
<tr>
<td>Cooper</td>
<td>London/Philadelphia</td>
<td>0.327</td>
<td>0.136</td>
<td>-0.001</td>
</tr>
<tr>
<td>Wool</td>
<td>London/Boston</td>
<td>0.591</td>
<td>0.659</td>
<td>0.279</td>
</tr>
<tr>
<td>Tin</td>
<td>London/New York</td>
<td>0.159</td>
<td>0.053</td>
<td>-0.023</td>
</tr>
</tbody>
</table>
1. 1857: First shipment of refrigerated beef from the Chicago to the East in a boxcar packed with ice.

2. 1867: First patent for a specialized refrigerator car.

3. 1873: T.C. Eastman exported chilled beef by ship from America to London (shortly annual tonnage of around 10,000 tons). The insulated cargo space was cooled by ice loaded on departure.

4. 1876-1877: C. Tellier and the steamship Frigorifique achieved the first overseas shipment of meat under artificial refrigeration (France to Argentina and back).
1. 1878: G.F. Swifts put into operation a refrigerator car to ship fresh meats. Fifteen years later 97,000 cars.

2. 1879-1880: The Strathleven, equipped with an air machine and loaded with beef, mutton, butter, and kegs, sailed from Melbourne to London (9-week voyage of about 24,000 km).

3. 1885: Berries from the Norfolk (Virginia) area were shipped by refrigerator car to New York.

4. 1901: First refrigerated banana ship, the Port Morant.
Revolution in communication

- Modern postal service: Rowland Hill in 1836.
- Electrical telegraph: Samuel Morse in 1838.
- Telephone: Alexander Graham Bell in 1876.
- First submarine cables are laid across the English Channel in the early 1850s when the *Great Eastern* lies down a telegraphic cable between Yemen and Bombay, completing a transformation of the world.
- von Reuter creates in Aachen (1851) the first news agency in the world.
Transformations

- Faster communications:
  1. Governments.
  2. Companies.
  3. Families.

- Together with transportation leads to changes such as Montgomery Ward Catalogue.

- Also, introduction of standard time: Greenwich Mean Time (GMT) in the UK (1855), US and Canada (1883), and International Meridian Conference (1884).
Global division of labor

- First truly global division of labor.

- Three areas:
  2. Areas of European settlement: West of the United States, Canada, Australia, New Zealand, Argentina.
  3. Areas of commodities: Malaysia, Colombia, Cuba, Brazil, or Ghana (and, to some degree, the U.S. south).

- How do economists explain trade?
  1. Comparative advantage (Ricardo).
  2. Different endowments (Heckscher-Ohlin).
  3. Increasing returns to scale (Dixit-Krugman).
The growth of North Atlantic manufacturing exports

Manufacturing Exports as a Share of GDP (10 Industrial Country Average)

- 0%
- 2%
- 4%
- 6%
- 8%
- 10%
- 12%
- 14%

Year

- 1700
- 1800
- 1870
- 1913

0% 7% 10% 14%

By contrast, some 40% of United States exports in 1900 were food, feeds, and beverages; and further 35% were industrial supplies and materials. Industrial supplies and materials would rise to be fully half of exports by 1910.
Cities

- New York: from 60,000 inhabitants in 1800 to 3.5 million in 1900 ⇒ port of U.S. trade.
- Melbourne: settled in 1837, by 1900 800,000 inhabitants, third largest city of the British empire ⇒ gold.
- Calcutta: small village in 1800, 700,000 inhabitants by 1900 ⇒ export of dyes and coarse fibers from Bengal.
- Alexandria ⇒ Egyptian cotton.
- Lagos ⇒ palm oil and cocoa.
- Buenos Aires ⇒ refrigerated meat.
- Shanghai ⇒ Western traders in China.
- Smyrna (current Izmir) ⇒ Ottoman empire, opium exports to China.
Cities and elevators I

- A key invention: the elevator Lifted: A Cultural History of the Elevator by Andreas Bernard.
- No elevator, no downtown skyscrapers (natural limit of buildings without elevators is 4/5 floors).
- Hoisting devices existed since antiquity.
- Elisha Otis: invents the “safety elevator” in 1852, founds the Otis Elevator company in 1853, and makes it an impression in the 1854 New York Industry exhibition.
- May 1st, 1870: First office elevator: Equitable Life Assurance Building (40 meters), built by Henry Baldwin Hyde.
- Automatic doors (1887) and electric buttons (1903) allow for quick extension.
Cities and elevators II

• Consequences:

  1. Cities can grow vertically. Development of new complementary techniques such as the steel skeleton.

  2. Social re-arrangement. Top floors go from being the ones for servants to be the premium ones.

• Importance of policy: you can think about the last 100 years as a struggle between the elevator and the car.

• Related inventions:


Other key developments

1. Department store (Paris, 1838).

2. The price tag (Philadelphia, 1861).

3. The cash register (1879).

4. Modern chemical industry.
Role of the British Empire

- After Napoleon is defeated, the United Kingdom is the world hegemon.
- Often called the Second British Empire.
- Pax Britannica ⇒ role of the Royal Navy ruling the seas. That is why the Battle of Antietam is so important.
- Dominion vs. colonies:
  1. Lord Durham report after Canada’s rebellions of 1837-1838.
  2. Key role of India and the Indian Army.
1. Gold standard. How did it work?

2. Property rights.

3. Contracts and legal system.

4. Banking and insurance.
Penang Island
Botanic Gardens

- George Town was established on Penang Island in August 1786.

- The East India Company wanted a base to challenge the Dutch spice trade and maritime supremacy in the Straits of Malacca.

- When the British come they build:
  1. Fort.
  2. Dock.
  3. Botanic garden, subordinated to the Kew Gardens in London.

- Why do you want to do that?
Rubber

- In 1876, 70,000 seeds of the rubber tree, painstakingly collected by botanists in the Amazon rain forest, were brought to Kew Gardens and planted in a greenhouse.

- About 2,800 of them germinated and were shipped to the botanical gardens in Sri Lanka and Penang.

- They propagated explosively and were used to establish rubber plantations on the neighboring Malay Peninsula.

- Until Germans invented synthetic rubber, it was a key commodity for the world economy.

- Chinese move in and establish businesses. Tamils and Sikhs came from across the Bay of Bengal to work at the rubber plantations. Political economic consequences.

- Similar examples with tea shrub to Ceylon, and coffee tree to Kenya.
• 1870-1914 is the high watermark of European imperialism:

1. Scramble for Africa: Berlin Conference (1884 - 1885) between Britain, France and Germany.
2. Asia.
3. Informal empire in South America by the U.K. and the U.S. (Cuba, Panama,...).

• Motivation for empire:

1. Empire as a rat race.
2. Empire as a protected area for exports of goods and capital (John Hobson, *Imperialism: A Study*).
John Hobson
A. Drexel and J.P. Morgan create modern investment banking.

Drexel, Morgan & Co. founded in 1871 to be an agent for Europeans investing in the United States (at Drexel death, the company becomes J.P. Morgan & Co.).

Integration of financial markets.

Role of finance:

1. Intermediate between savers and investors.
2. Distribute risk.
3. Transform short-term debt into long-term loans.
Anthony Drexel
The rise of the modern corporation

Alfred Chandler: *The Visible Hand: Scale and Scope.*

- Original problem for railroads: coordination and control.
- Cost accounting, HR, marketing, etc...
- New technologies inherent increasing returns to scale.
- Externalities.
- Appearance of modern management schools and the profession of manager.
- How do economists think about this? Coase, Hart...
The invention of invention

- Before 1870 Universities and formal institutions had played a limited role in invention. Instead, individuals.

- Modern library: Sir Anthony Panizzi in the British Museum.

- Modern research university: John Hopkins in 1873 based on a previous German model.

- Modern research lab: Menlo Park and Edison.

- Integration of industry and universities.

- National labs.

- Perhaps, even deeper, conceptual change: innovation as a product.

- Patent and copyright versus open-source.
John Hopkins
Thomas Edison