Three questions

• Most fundamental (and classic) questions in economic history.

• Big question ("Great Divergence"): why was Europe first in achieving modern economic growth?

• Small question ("Little Divergence"): why, within Europe, was Britain first?

• Named “industrial revolution” by Arnold Toynbee (1852-1883), although ‘révolution industrielle’ had been used in French since the 1820s.

• Related, temporal, question: why did economic growth continue until today rather than peter out?
that of workers in Beijing or the Yangzi Delta. After the middle of the nineteenth century, London living standards began an upward trajectory and increased their lead over China. While workers in Amsterdam in the eighteenth century also lived better than their counterparts in Beijing, the Dutch economy faltered in the early nineteenth century. By mid-century, however, growth resumed and real wages were climbing to new heights. At the same time, the rapid growth of the German economy was translating into rising real wages for workers in Leipzig. By the First World War, the standard of living of workers in the industrial core of western Europe had greatly increased over their counterparts in Beijing and Suzhou. The standard of living in China remained low and on a par with the regions of Europe untouched by the industrial revolution. Fifthly, the workers in north-western Europe with welfare ratios of four or more did not eat four times as much oatmeal as their 'bare bones' diet presupposes. Instead, they ate higher-quality food—beef, beer, and bread—that was a more expensive source of calories. In addition, they bought a wide range of non-food items. In the eighteenth century, these included the Asian imports and novel manufactures that comprised the 'consumer revolution' of that era. By the same token, workers in north-western Europe could afford the basket of goods shown in table 5, while workers in Asia could not, and had to subsist on the 'bare bones' baskets. After all, in regions of settled agriculture, the 

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Figure 5. Welfare ratios

Source: As described in section VI.
The least expensive way to get calories is to boil the cheapest grain into a gruel or porridge. In northern Britain, the poorest people ate oat porridge; in the Yangzi Delta, they ate wheat gruel.

Figure 6 tests the generality of these conclusions by including all of the Asian welfare ratios for comparison. There was variation in experience, but that variety does not qualify the conclusion that Asian living standards were at the low end of the European range. The history of living standards in Japan, India, and Canton was very similar to that of Beijing or Suzhou. Real wages in Istanbul, as shown by Özmucur and Pamuk, were at a level as low as China’s, so it may have characterized much of the non-industrializing world in the eighteenth century. There is evidence of rising living standards across Asia after 1870, but the gains were not enough to catch up to the standard of mid-eighteenth-century London or Amsterdam, let alone the much higher standard of living enjoyed by workers in those cities in the early twentieth century.

Figure 6 broadens our comparison by inserting the welfare ratio of Oxford, with the view that London may be exceptional in terms of real wages among English towns. Indeed, real wages in Oxford were always lower than in London, although the gap narrowed from the late eighteenth century. Nonetheless, at a welfare ratio between 2.5 and 3.0 during the eighteenth century, Oxford still seemed far more

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44 Li, *Agricultural development*, p. 207, n. 25.
45 Özmucur and Pamuk, ‘Real wages’.
The industrious revolution

- First, a prelude.

- Industrious revolution noted by De Vries (1994).

- Increase in hours worked since the end of the middle ages: longer days, fewer holidays, less “Mayday” Mondays.

- Particularly important in reformation countries.

- Reasons?

- Actually, increases in the hours of work seem a constant: Neolithic revolution.
The Industrious Revolution

CONSUMER BEHAVIOR
and the HOUSEHOLD ECONOMY, 1650 to the PRESENT

JAN de VRIES
“In short, at the very deepest levels of material life, there is at work a complex order, to which the assumptions, tendencies and unconscious pressures of economies, societies and civilizations all contribute.” Fernand Braudel, *Les Structures du quotidien: le possible et l'impossible.*

- Fork became popular in 14th century Italy. By 1600, commonly used for eating by merchant and upper classes. Extended later across Europe.
- Chairs also became popular in the 16th century. Before that, reserved for upper classes (we still call it “chair” in a professor).
- Brandy and other distilled liquors: 16th-17th centuries.
- Fashion.
- Multiplication of merchant ships by five.
Three popular answers to “Why Britain?”

1. Good institutions, in particular after the Glorious Revolution of 1688 (Daron Acemoglu and Jim Robinson).

2. Scientific/technological innovations created by a “culture of growth” (Joel Mokyr).

3. High wages created by international trade and urbanization induced technological innovation (Robert Allen).
Mixed answers

• We have many slightly different versions of each of these answers (and intermediate positions).

• For example, Allen emphasizes that: “an effective innovation system based on a high level of human capital, the appropriate engineering capability, and a few scientific breakthroughs” were necessary to respond to high wages.
The Glorious Revolution of 1688, I

- Overthrow of James II by William III.
- Invited by a substantial fraction of the English elite:

**Letter of the Immortal Seven**

We have great reason to believe, we shall be every day in a worse condition than we are, and less able to defend ourselves, and therefore we do earnestly wish we might be so happy as to find a remedy before it be too late for us to contribute to our own deliverance...the people are so generally dissatisfied with the present conduct of the government, in relation to their religion, liberties and properties (all which have been greatly invaded), and they are in such expectation of their prospects being daily worse, that your Highness may be assured, there are nineteen parts of twenty of the people throughout the kingdom, who are desirous of a change; and who, we believe, would willingly contribute to it, if they had such a protection to countenance their rising, as would secure them from being destroyed.
The Glorious Revolution of 1688, II

- Army financed by Amsterdam.

- Crosses the Channel in October-November of 1688. Quickly defeats James.

- William III and Mary II officially replaced him on February 13, 1689.

- William is a weak ruler:
  
  1. War with France.
  2. Foreigner.
Institutional changes: political

- Bill of Rights of 1689:

  1. That the pretended power of suspending the laws or the execution of laws by regal authority without consent of Parliament is illegal;

  2. That levying money for or to the use of the Crown by pretence of prerogative, without grant of Parliament, for longer time, or in other manner than the same is or shall be granted, is illegal;

  3. That it is the right of the subjects to petition the king, and all commitments and prosecutions for such petitioning are illegal;

  4. That the raising or keeping a standing army within the kingdom in time of peace, unless it be with consent of Parliament, is against law;

  5. That election of members of Parliament ought to be free;

  6. That the freedom of speech and debates or proceedings in Parliament ought not to be impeached or questioned in any court or place out of Parliament;

  7. And that for redress of all grievances, and for the amending, strengthening and preserving of the laws, Parliaments ought to be held frequently.
Institutional changes: economics

- Act of Union 1707 between England and Scotland.
- Inclosures Acts.
- In general, inclusive set of economic institutions.
- Dynamic process to be developed over time.
Articles of Union

Greeks, in the holy year 1374 of the era of the
Reign of Her Most Excellent Majesty alone by the Grace of God,
Queen of England, Scotland, France and Ireland Defender of the
FAITH and in the year of our Lord 1707, was done at
Westminster, the twentieth day of April last past. In Pursuance of the
Act of the Parliament of England in the Year of Our Lord
1707, and
The Parliament of Scotland in the Year of Our Lord
1707, and
In Pursuance of the
FAITH and in the year of our Lord 1707, was done at
Westminster, the twentieth day of April last past. In Pursuance of the
Act of the Parliament of England in the Year of Our Lord
1707, and
The Parliament of Scotland in the Year of Our Lord
1707, and
In Pursuance of the
FAITH and in the year of our Lord 1707, was done at
Westminster

18

Sir John Houblon.
Governor.

Sir John Sibbery.
Lord Keeper.

Mr. Michael Goffrey
Deputy Governor.
Plan of a Mediaeval Manor.

This plan of a manor is wholly conventional. It is intended to show: (1) the various features that might be found in an English manor (i.e., itself a village of the medieval period); (2) the more important changes in the agricultural system which occurred in England from the fourteenth century onward. Many of these remain features of ours, apparend in similar form in the cotidians.
Critics of institutional view

- Interest rates did not fall.
- Property rights were more secure and taxes were lower in France.
- Important point was that 1688 gave England an effective government, not a limited government.
- For example, the Royal Navy could be properly financed.
- Fiscal-military state $\Rightarrow$ big success during the Seven Years War (1756-1763).
- Growing literature on state capabilities.
1688-1815 is a period of fast technological innovation.

Moreover, an organized system of technological innovations appears.

Most of them were engineering innovations, not scientific innovations.

Even if relatively easy to copy, most ideas do not spread much away from Britain.
The canonical examples

- Traditional account: agriculture, textiles, and steam engine.

- Today, we have a much broader view.

- For instance, many advances appeared first in the Royal Shipyards.

- But it is still worthwhile to review some of canonical examples.

- We have already talked about the steam engine, so let’s concentrate on agriculture and textiles.
Innovations in agriculture, I

- Norfolk four-course system:
  1. Wheat for humans.
  2. Turnip for animals.
  3. Barley with clover and ryegrass undersown.
  4. Clover and ryegrass were grazed or cut for feed.

- Developed first in Flanders. Introduced in England in 1730 by Charles Townshend.

- Eliminates fallow, incentivates enclosing.
Innovations in agriculture, II

- Better plowing: Rotherham plow, successors with iron plows.
- Better seeding: Jethro Tull (1674-1741)’s seed drill (1701) replaces broadcasting.
- Selective breeding: Robert Bakewell (1725-1795) breed the New Leicester sheep.
- Agricultural shows.
- Trade publications.
Textiles

- Old tradition of clothing trade in wool in England.

- Flying shuttle, by John Kay in 1733 ⇒ weaving.

- Spinning jenny, by James Hargreaves in 1764 ⇒ spinning.

- Water frame, by Richard Arkwright in 1767 ⇒ factory.

- Mule, by Samuel Crompton in 1779.

- Self-acting mule, by Richard Robert in 1825 and 1830.

- Other advances in bleaching, pattern printing, ...
Other technological innovations

1. Gears, rollers, and flyers.

2. Longitude.

3. Lights.


5. Iron and steel.


7. Canned food.
Historians of science vs. economists

- Many historians of science focus on the autonomous role of science in developing inventions and progress (the “Newton paradigm”).

- However, economists emphasize the role of profit.

- Classical study of Schmokler: *Invention and Economic Growth, 1963*.

- Innovation is determined by the size of the market and profit.

- Examples:
  1. Horseshoe, many innovations in the late 19th century and early 20th century, stop afterward.
  3. Drugs for Malaria versus drugs for male impotence.
Reasons

1. Patent system.

2. Enlightenment.

3. Higher rate of return due to relative prices.
• What is an idea?

• What are the basic characteristics of an idea?

  1. Ideas are *nonrivalrous* goods.

  2. Ideas are, at least partially, *excludable*. 
Different types of goods

1. Rivalrous goods that are excludable: almost all private consumption goods, such as food, apparel, consumer durables fall into this group.

2. Rivalrous goods that have a low degree of excludability: tragedy of the commons.

3. Nonrivalrous goods that are excludable: most of what we call ideas fall under this point.

4. Nonrivalrous and nonexcludable goods: these goods are often called public goods.
Examples of different goods

Rivalrous goods
- Lawyer services
- CD player
- Floppy disk
- Fish in the sea
- Sterile insects for pest control

Nonrivalrous goods
- Encoded satellite TV transmission
- Computer code for a software application
- Operations manual for Wal-Mart stores
- National defense
- Basic R&D
- Calculus
Nonrivalrousness and excludability of ideas

- Nonrivalrousness: implies that the cost of providing the good to one more consumer, the *marginal cost* of this good, is constant at zero. Production process for ideas is usually characterized by substantial fixed costs and low marginal costs. Think about software.

- Excludability: required so that firm can recover fixed costs of development. Existence of intellectual property rights like patent or copyright laws is crucial for the private development of new ideas.
Intellectual property rights and the industrial revolution

- Ideas engine of growth.
- Intellectual property rights needed for development of ideas.
- Sustained growth recent phenomenon.
- Coincides with establishment of intellectual property rights.
Data on ideas

- Measure technological progress directly through ideas.
- Measure ideas via measuring patents.
- Measure ideas indirectly by measuring resources devoted to development of ideas.
Important facts

• Number of patents issued has increased: in 1880 roughly 13,000 patents issued in the U.S., in 1999 150,000.

• More and more patents issued in the U.S. are issued to foreigners. The number of patents issued to U.S. firms or individuals constant at 40,000 per year between 1915 and 1991.

• Number of researchers engaged in research and development (R&D) in the U.S. increased from 200,000 in 1950 to 1,000,000 in 1990.

• Fraction of the labor force in R&D increased from 0.25% in 1950 to 0.75% in 1990.
Is the level of R&D optimal?

- Sources of inefficiency:
  1. Monopoly power of intermediate good producers.
  2. Externalities in research.

- Possible remedies.

- Implications for antitrust policy.
Is the level of R&D optimal?

- Will we have innovation in the absence of a patents system?

- Boldrin and Levine (2003) have argued that we would.

- Why? Time between new invention and other competitors can produce the same good.

- Evidence from the market of generics versus brand drugs.

There is an alternative view of growth: Schumpeterian models of creative destruction.

Loosely based on the insights of Joseph Schumpeter.

New products replace old products: Ipod replaced CDs, CDs replaced LPs, LPs replaced Wax cylinders.


An interesting aspect of these models is that they generate growth cycles.
<table>
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<tbody>
<tr>
<td>England</td>
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<td>68</td>
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<td>Belgium</td>
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<td>Germany</td>
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<td>France</td>
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<td>22</td>
</tr>
<tr>
<td>Spain</td>
<td>9</td>
<td>20</td>
</tr>
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</table>
Spread to Europe

- Belgium, early 19th century.
- France, Germany.
- Only later in 19th century to the south and east of Europe.
- U.S. is a somehow different case.
The remaining four rows give descriptive statistics of the control variables used in parts of our analysis. The treated polities lie slightly more to the north and to the west of the control polities (and are thus closer to Paris). The share of Protestant population is also similar between treated and control polities.

### III. Reduced-Form Evidence

In this section we use ordinary least squares (OLS) regressions to investigate the reduced-form relationship between our three measures of treatment and the urbanization rate. The figure below illustrates the urbanization rates by treatment group.

**Figure 2A. Urbanization Rates, by Treatment Group**

- **Urbanization rate (in percent)**
- **Year**: 1700, 1750, 1800, 1850, 1900
- **Treatment**
- **Control (west of the Elbe)**
- **Difference**

**Figure 2B. Urbanization Rates, by Treatment Group**

- **Urbanization rate (in percent)**
- **Year**: 1700, 1750, 1800, 1850, 1900
- **Treatment**
- **Control (whole sample)**
- **Difference**
points higher in areas occupied by Napoleon. The remaining four rows give descriptive statistics of the control variables used in parts of our analysis. The treated polities lie slightly more to the north and to the west of the control polities (and are thus closer to Paris). The share of Protestant population is also similar between treated and control polities.

III. Reduced-Form Evidence

In this section we use ordinary least squares (OLS) regressions to investigate the reduced-form relationship between our three measures of treatment and the urbanization rate.
Estimates from equation (3) are shown in panel B of Table 6. The first column, using the sample west of the Elbe and population in 1750 as weights, shows a strong relationship between our French occupation interaction variable and the reform index. The coefficient estimate is 1.166 (standard error = 0.107). This strong relationship indicates that even though there were reforms in German areas not occupied by the French (perhaps because of “defensive modernization”), occupation by the French was a significant determinant of reform. Column 2 replaces the French occupation interaction variable \( t \times t_{1800} \times i_j \) with a set of interactions of year dummies (from 1850 on) with years of French presence and reports the \( p \)-value of joint significance of all these interaction terms. This specification also supports the hypothesis of a link between French rule and the implementation of reform (\( p \)-value = 0.000).

Finally, columns 3–5 confirm these results by looking at specifications without population weights and using the whole of Germany including areas east of the Elbe in the sample. The magnitudes of the estimated coefficients are very similar.

### B. Two-stage least squares Estimates

We next turn to the 2SLS estimates of the effect of our reform index on urbanization. We posit the following second-stage equation:

\[
\begin{align*}
  u_{jt} &= d_t + \delta_j + \phi \times R_{jt} + \nu_{jt}, \\
  F-statistic excluded instruments &= 119.7, 121.6, 61.85, 87.57, 43.71, \\
  p-value F-statistic &= 0.000, 0.000, 0.000, 0.000, 0.000.
\end{align*}
\]

#### Panel A. OLS estimation

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<th>West of the Elbe</th>
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<td></td>
<td>Weighted (1)</td>
<td>Weighted, overid (2)</td>
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<tr>
<td>Reforms index</td>
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<td></td>
<td>[0.114]</td>
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#### Panel B. First stage

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<tbody>
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<td>French presence × post1800 &amp; trend</td>
<td>1.166</td>
<td>1.166</td>
</tr>
<tr>
<td></td>
<td>[0.107]</td>
<td>[0.143]</td>
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<tr>
<td>F-statistic excluded instruments</td>
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<td>121.6</td>
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<tr>
<td>p-value F-statistic</td>
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#### Panel C. 2SLS estimation

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<tr>
<td>Number of states</td>
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</tr>
<tr>
<td>p-value overidentified test</td>
<td>0.328</td>
<td>0.328</td>
</tr>
</tbody>
</table>

**Notes:** All regressions have full set of territory and year dummies. Robust standard errors clustered by territory. Weighted regressions are weighted by territories’ total population in 1750. The overidentified regression in column 2 uses a full set of interactions of “Years of French presence” and year dummies as excluded instruments.