

Chapter 9

Understanding Technological Growth

A little history of technological progress

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Remark

- ❑ I can only present an overview of some of the main themes about the history of TP.
- ❑ You must read the chapter.

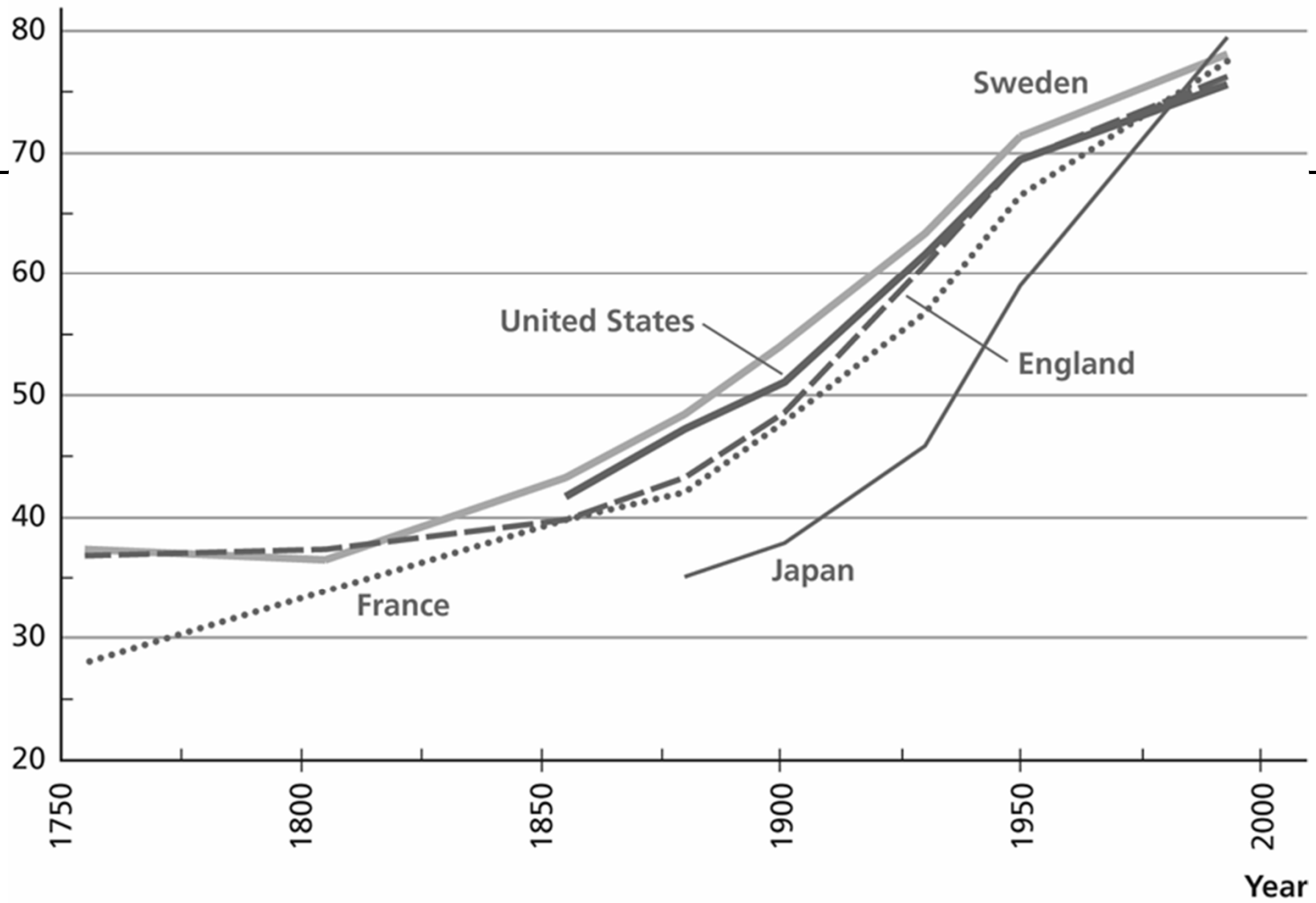
Productivity growth in Europe before the industrial revolution

Period	Annual Growth Rate of Income per Capita, \hat{y}	Annual Growth Rate of Population, \hat{L}	Annual Growth Rate of Productivity, \hat{A}
500–1500	0.0%	0.1%	0.033%
1500–1700	0.1%	0.2%	0.166%

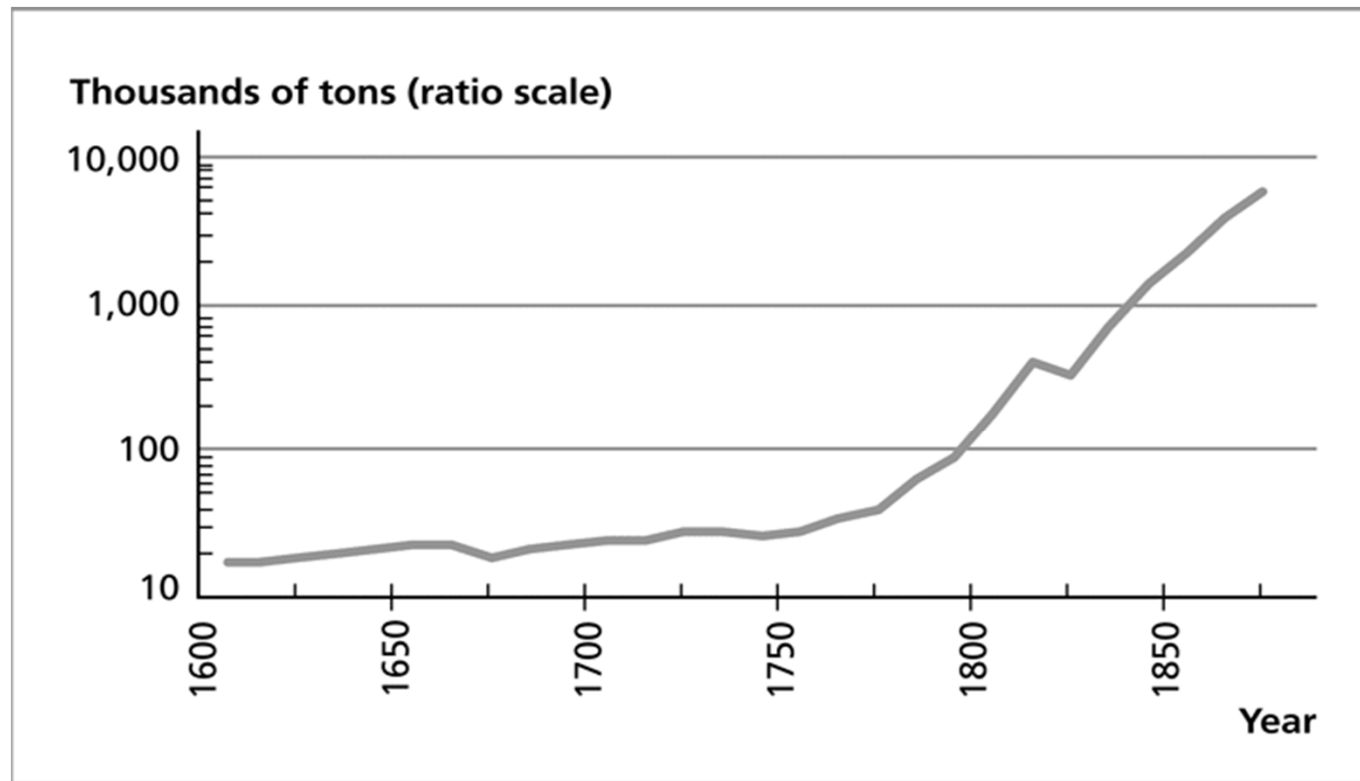
The industrial revolution in Britain

- ❑ 1st Industrial Revolution: 1760-1830
 - Drastic technological advances in
 - ❑ Textiles
 - ❑ Mechanical energy
 - ❑ Metallurgy
 - Prices of textiles plummeted. That is when people started using underwear (in Scotland also).
 - Dramatic improvements in people's lives. (Next slide fig 4.8 on evolution of life expectancy.)
 - Major structural changes
 - British employment in agriculture, forestry and fishing drops from 48% to 25%.
 - That of Industry and mining and industry rises from 22% to 41%.

Life expectancy at birth (years)

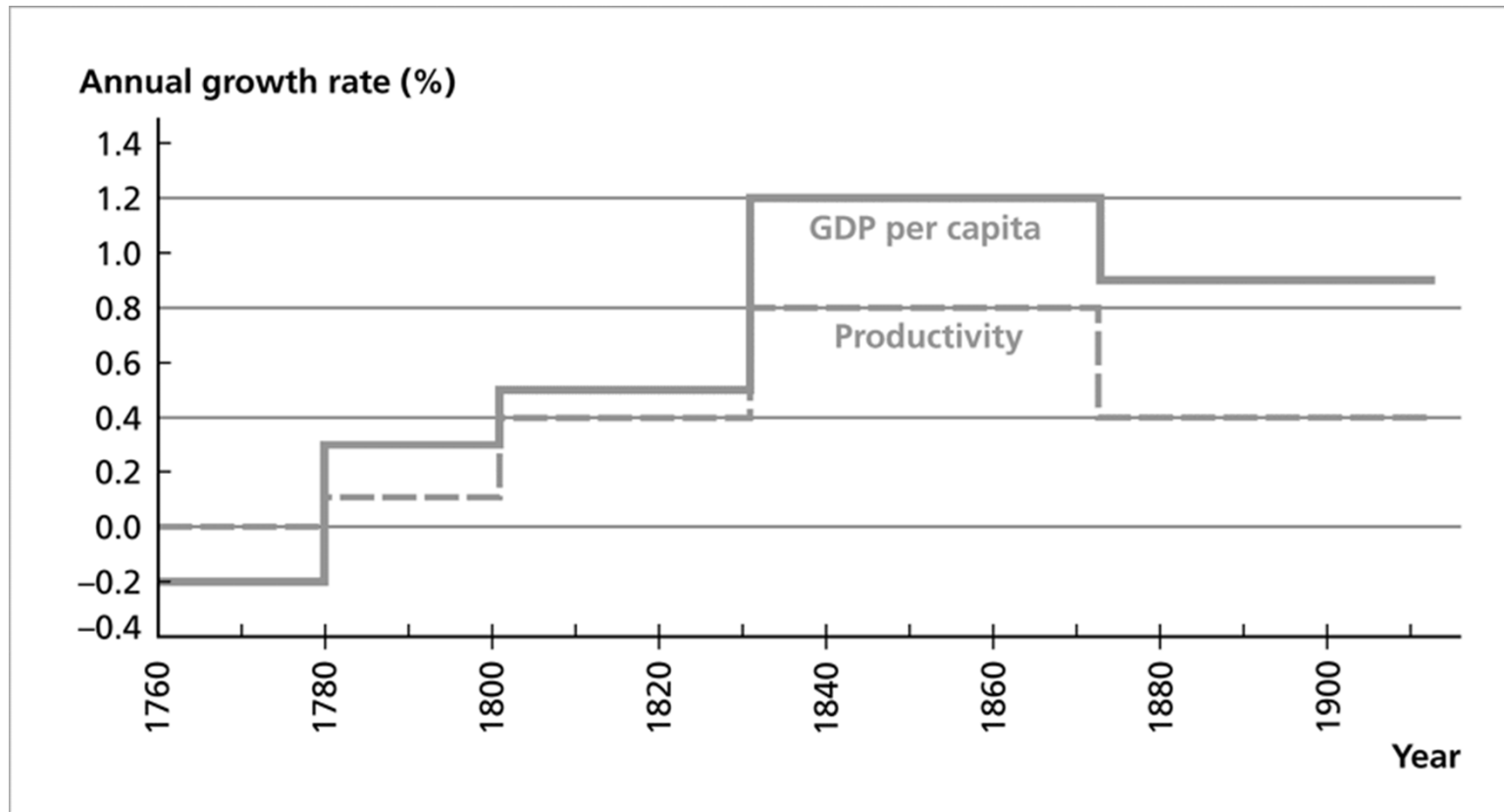


British Iron Production, 1600–1870



Source: Riden (1977).

British Output and Productivity Growth, 1760–1913



Source: Crafts (1996).

The industrial revolution in Britain

- ❑ As previous slide shows, productivity growth did not stop with the first industrial revolution.
- ❑ 2nd Industrial Revolution: 1860-1900
 - Drastic technological advances in
 - ❑ Chemistry
 - ❑ Electricity
 - ❑ Steel
 - ❑ Mass production

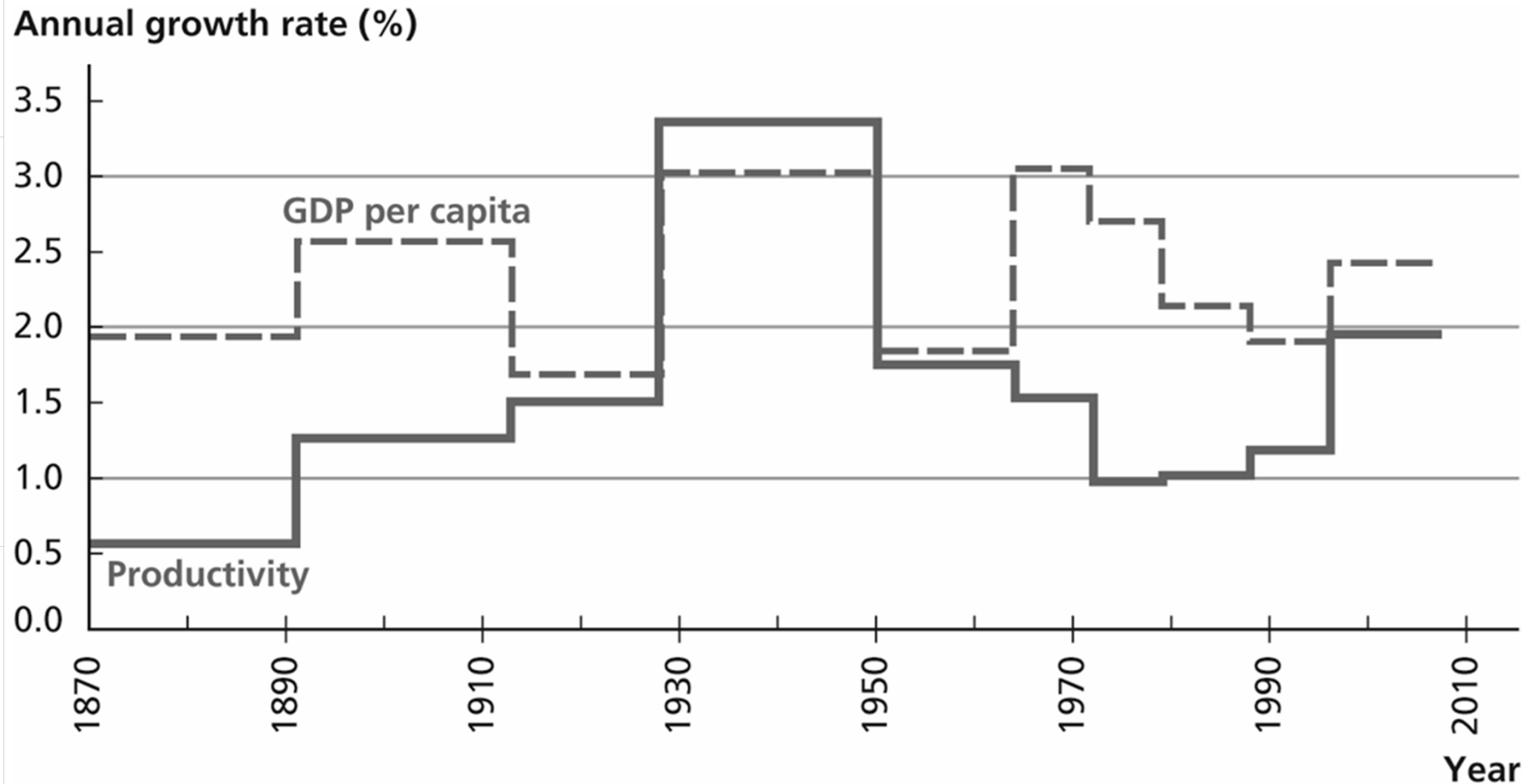
Industrial revolution

- Productivity growth was large historically.
 - 0.4% in Britain 1801-1831
 - 0.8% max between 1831 and 1900
- Productivity growth was not so large compared to what followed.
- So what is so revolutionary about it?
 - New pattern and diffusion?

1890-1971: Diffusion and new pattern

- Productivity growth average 1.99% USA.
 - “Diffusion” of previous innovations.
 - E.g. light bulb was invented in 1879. By 1899, only 3% of households used any. By 1929, 70% did.
 - General purpose technologies change modes of production and trigger other inventions, e.g.,
 - Steam engines
 - Electric motors
 - Railroads
 - Maybe revolutionary because of the new pattern of continual growth.

U.S. Output and Productivity Growth, 1870–2007



1970-1995: Productivity slowdown

- Productivity slowdown to 1.06% USA due to
 - Lower TP?
 - Same TP but lower efficiency?
 - Where are ITs?
- 1995-2007
 - Productivity growth of 1.95% per year in USA.
 - Due to diffusion of ITs?
 - 3rd Industrial Revolution?

Producing new technology

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Producing new technology

- Knowledge is produced by combining factors of production
 - physical capital
 - human capital
 - Pre-existing knowledge
- Big question:

Does more pre-existing knowledge increase or decrease the productivity of the knowledge creation process?

Knowledge creation

Two opposite effects:

1. Fishing-out effect
2. Larger knowledge base

▣ Weil thinks that first effect is larger.

Knowledge creation and competition

- ❑ Creative destruction: Patent race causes decreasing returns to creation due to duplication of efforts.
- ❑ I don't agree:
 - Firms try different avenues.
 - Motivation from competitive process: "effective" effort may be larger

Knowledge creation

□ Some inescapable facts:

- The number of G5 researchers has increased from 251,000 in 1950 to 3.5 million in 2007.
- TP did not increase by such a factor of 14.
- We cannot expect the number of researchers to increase by a factor of 14 every 50 years.
- But numbers are likely to increase a lot for the near future, esp. with human capital accumulation in China, India, etc.

Differential TP and structural changes

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Differential TP and structural changes

- ▣ TP does not occur at the same pace in all sectors.
- ▣ (Take note.)

Differential TP and structural changes

- ❑ Long run effects of TP depend on what happens to fraction of income spent on that sector.
- ❑ Outlook:
 - High TP sectors tend to be in goods manufacturing.
 - Manufacturing is a declining share of income.
 - Services tend to have low TP and increasing income shares.
 - Suggests that income growth is bound slow down.
 - What about the health and environmental sectors?