



# The Industrial Revolution, the Anthropocene and Their Many Histories

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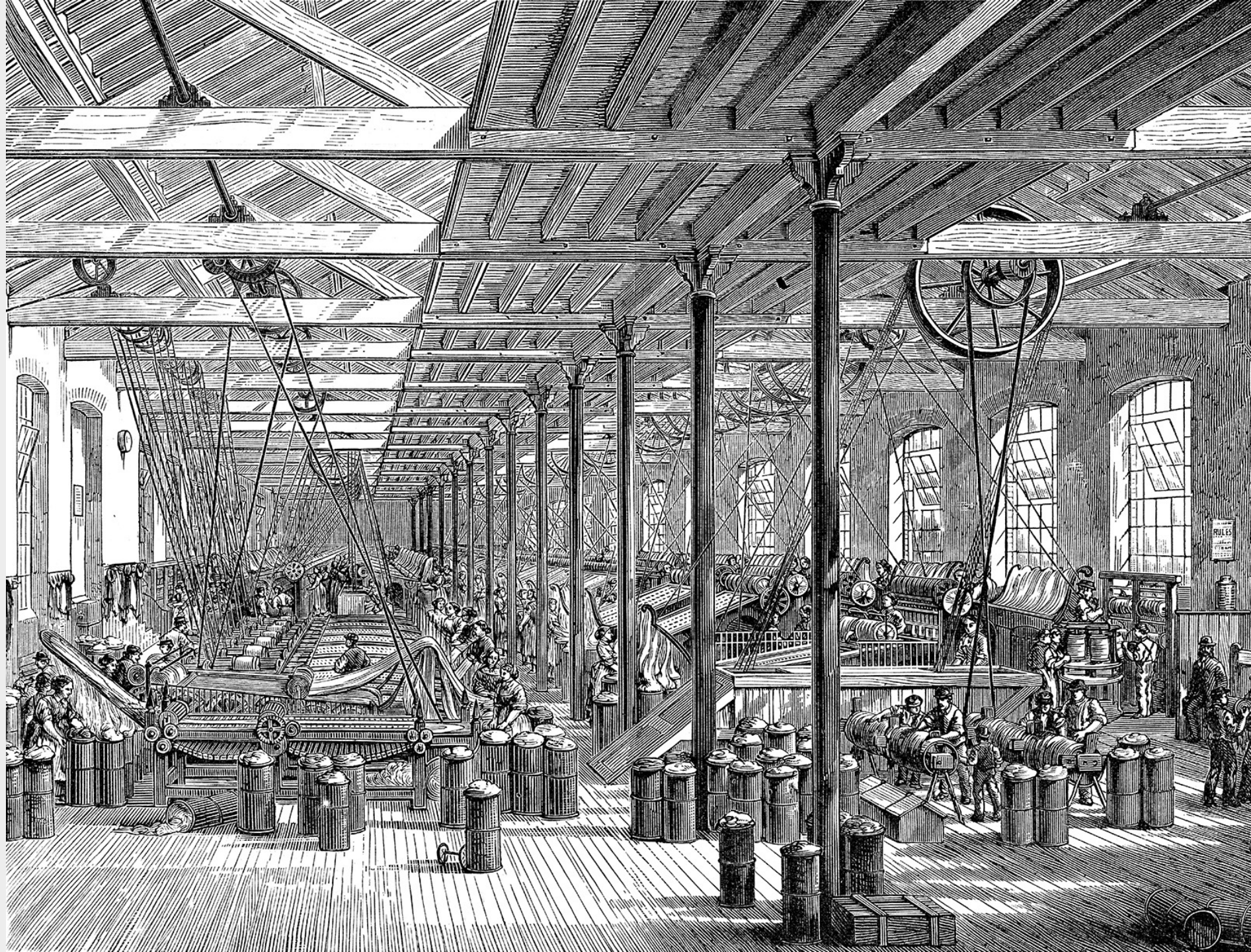
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# The Industrial Revolution

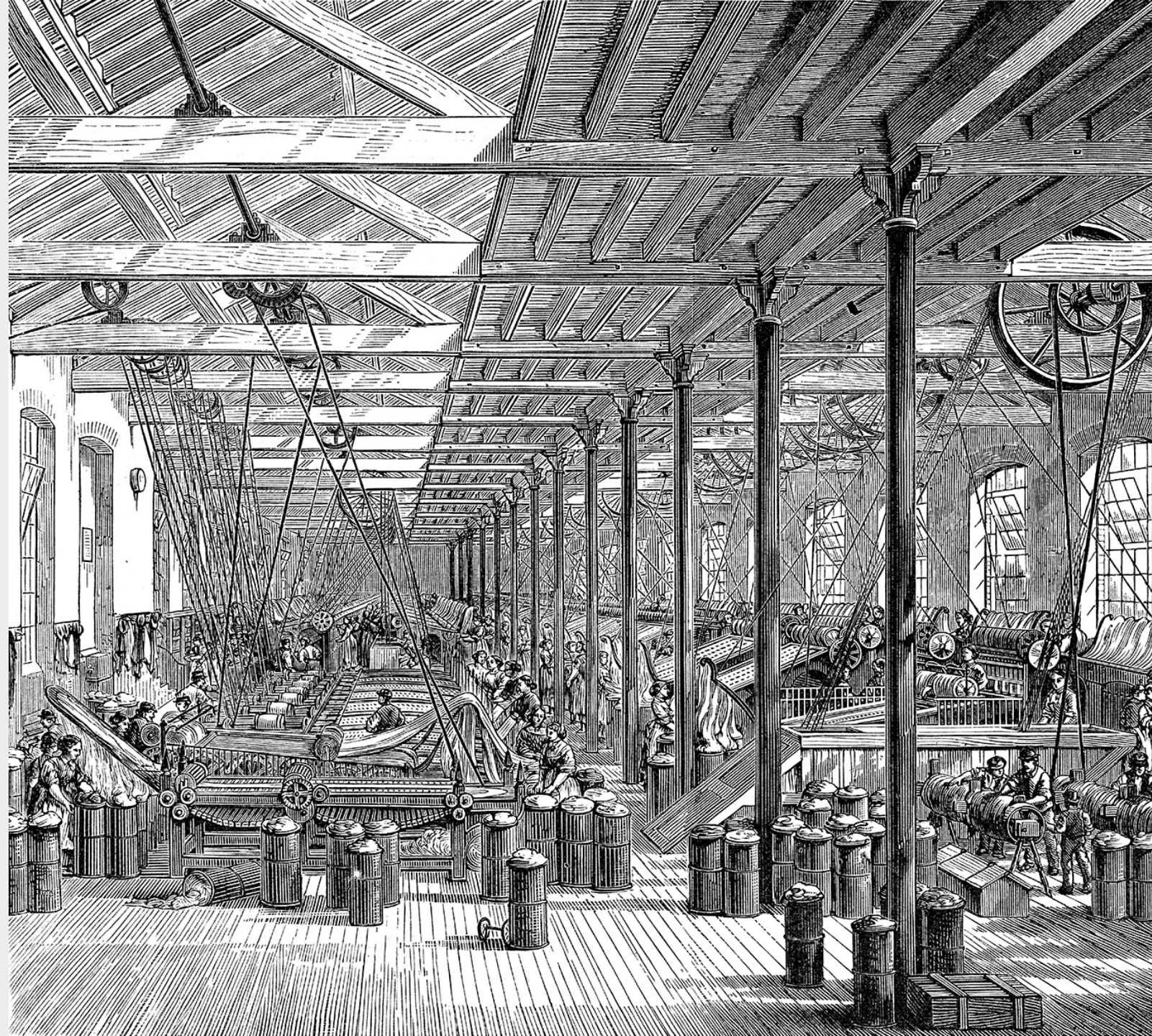




# The Industrial Revolution

“The Industrial Revolution was a period of rapid technological advancement and economic growth that occurred in Europe and North America in the late 18th and early 19th centuries. It marked a shift from manual labor to machine-based manufacturing, the development of new technologies and industries, and the growth of factories and urbanization. While it brought about significant progress and economic prosperity, it also had negative impacts on workers, traditional ways of life, and the environment.”

(ChatGPT)





# The Industrial Revolution

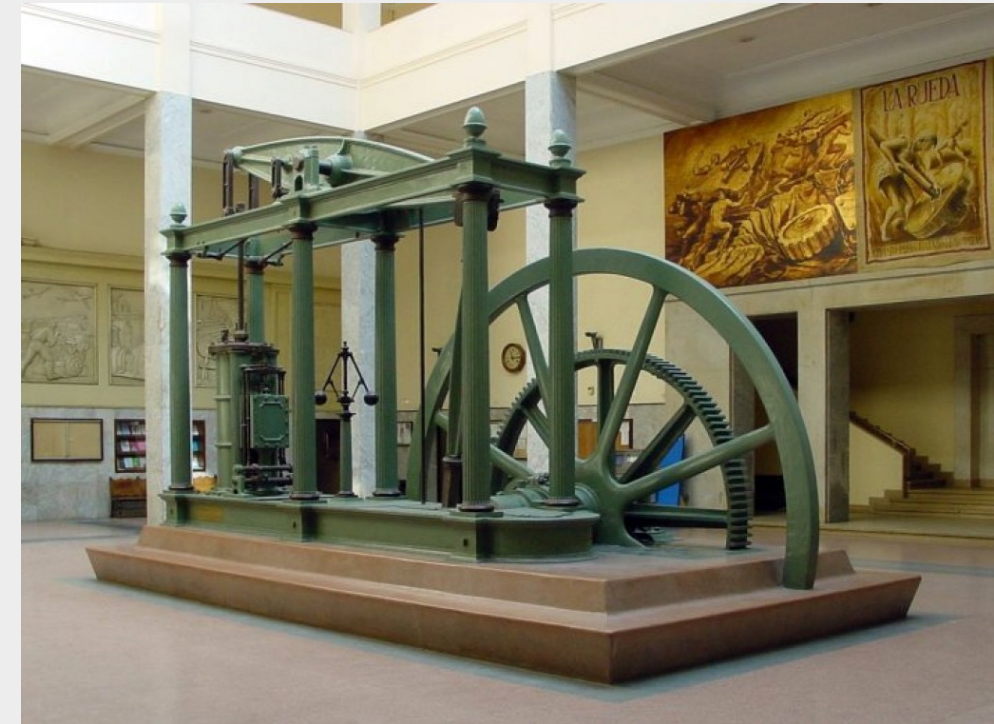
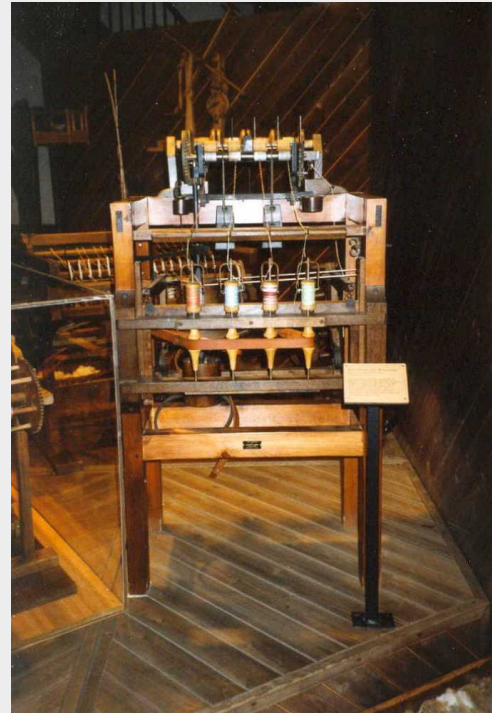
- Sustained economic growth
- Population growth
- Urbanization
- Industrial economy
- Capitalism
- Fossil fuels





# Technological Innovation

- Spinning Jenny (James Hargreaves 1764, patent 1764)
- Water frame (Richard Arkwright 1765, patent 1769)
- Steam engine (James Watts 1763-, patent 1781)



# Structure of the Lecture

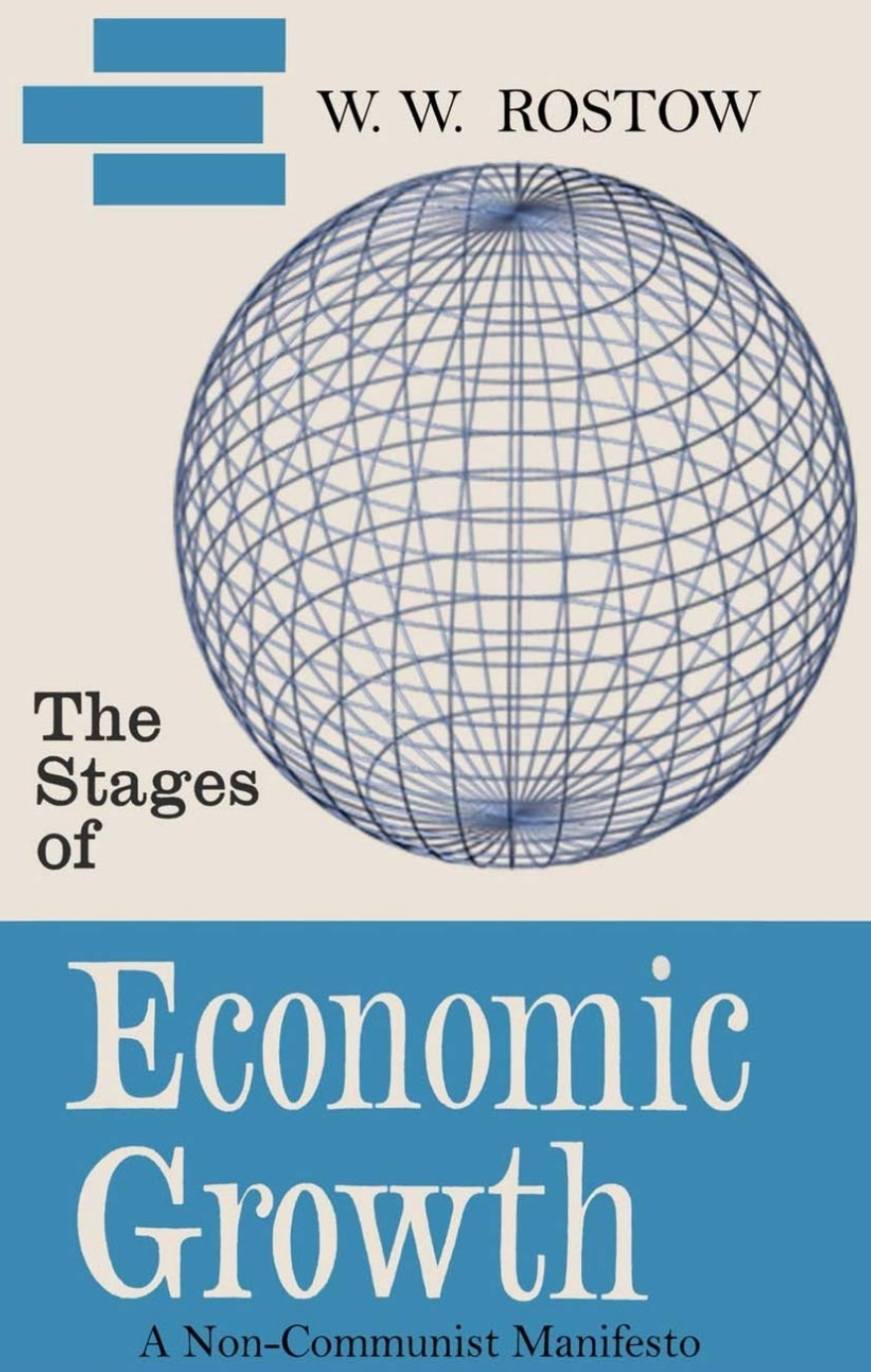
- Part 1:  
Different interpretations of the Industrial Revolution
- Part 2:  
Relationship to the Anthropocene and "Technology,  
Power and the Future of Humanity"





Walt Whitman Rostow, 1960

“Take-off” 1783-1802



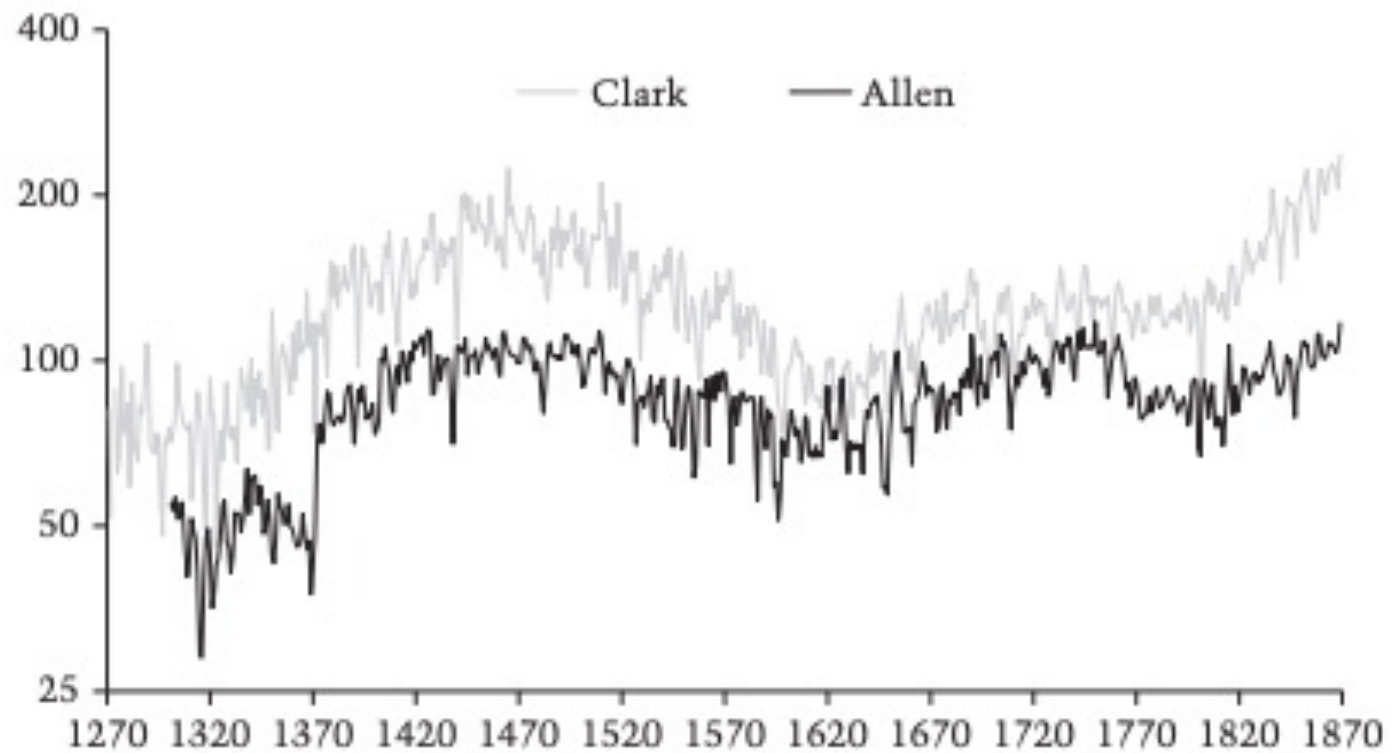


FIGURE 1.02 Indexed daily real wage rates of unskilled building and farm workers, 1270–1870 (1700 = 100, log scale). Sources: Allen (2001); Clark (2005).

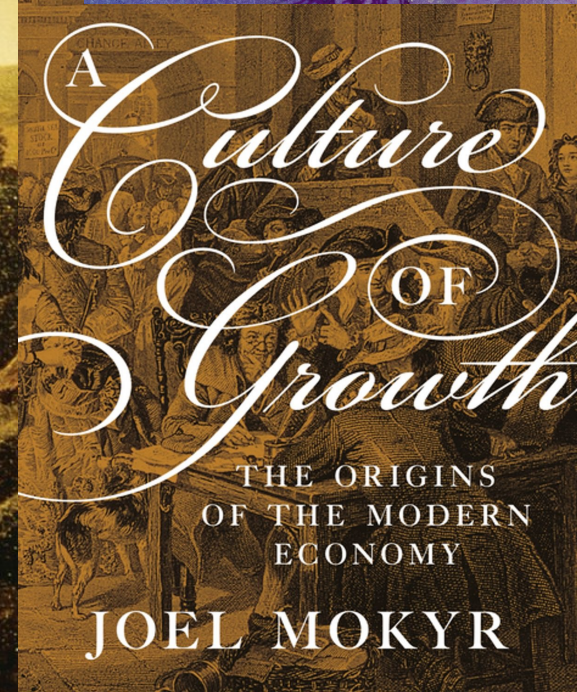
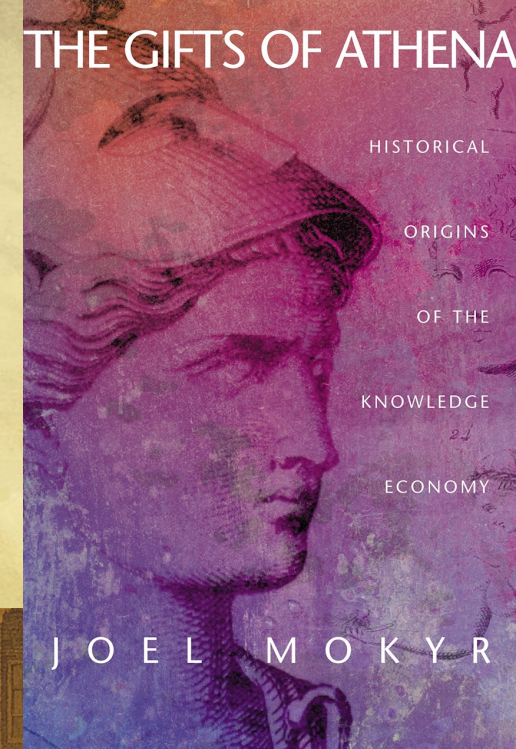
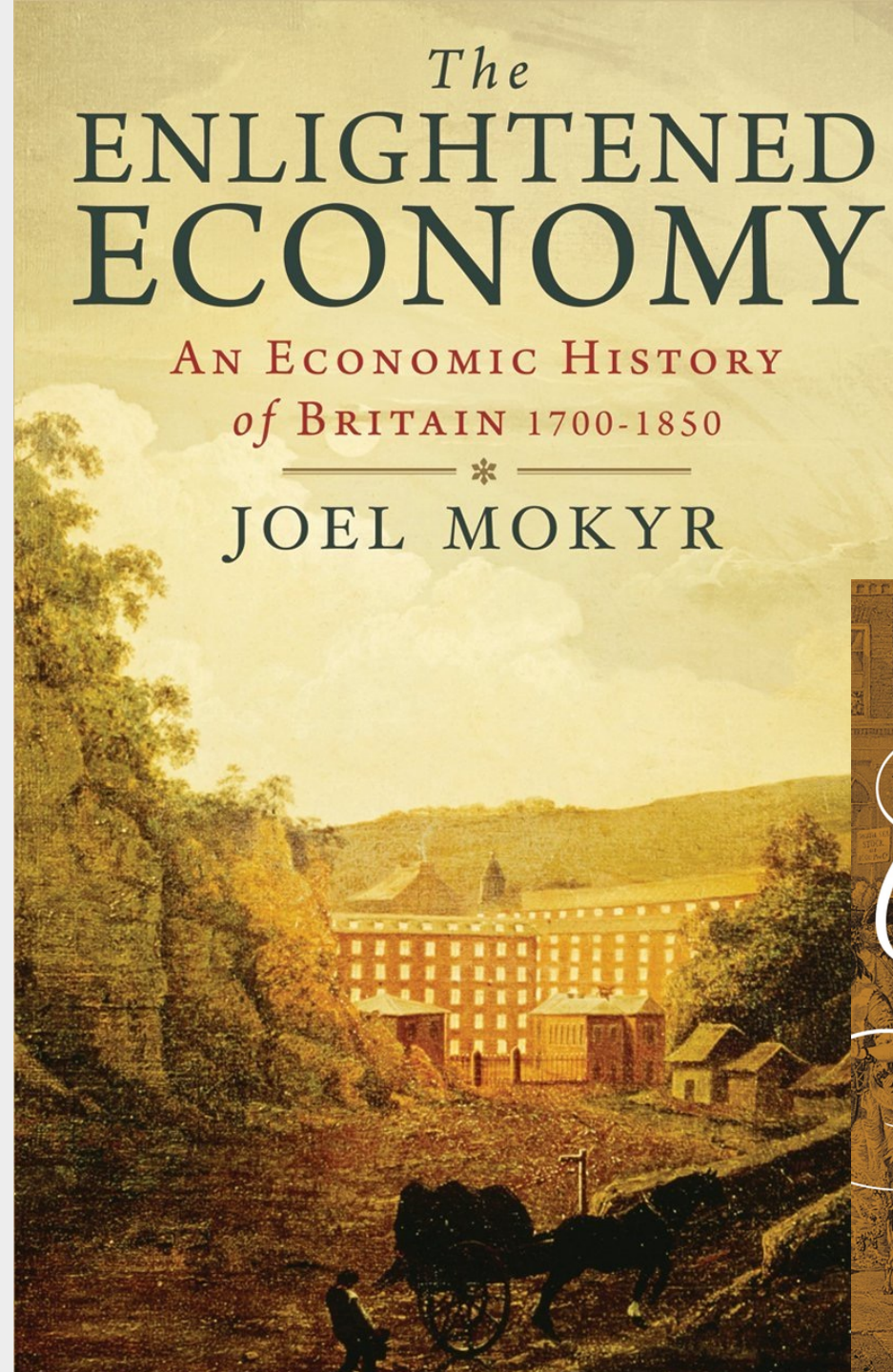
Broadberry et al., *British Economic Growth, 1270–1870*, 2015, s. 15.





## Enlightened Economy? (Mokyr)

- "Enlightened economy"
- "Knowledge economy"
- "Culture of growth"
- Enlightenment culture promoting improvement and progress
- Technological innovation

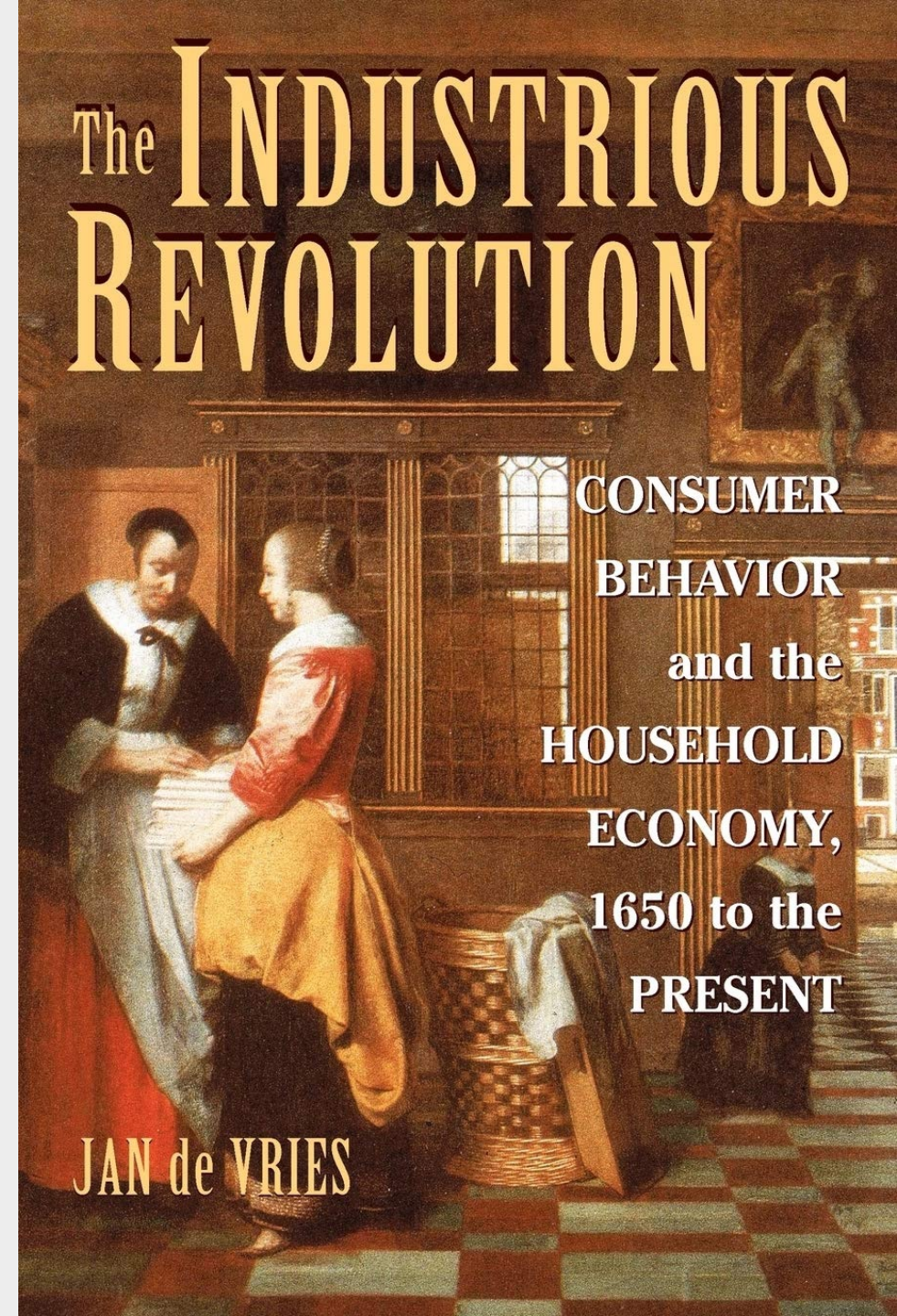




# The Industrious Revolution (de Vries, 2008)

A revolution preceding the industrial

- Industriousness
- Household productivity
- Consumption
- Liberation of labour from the agrarian sector

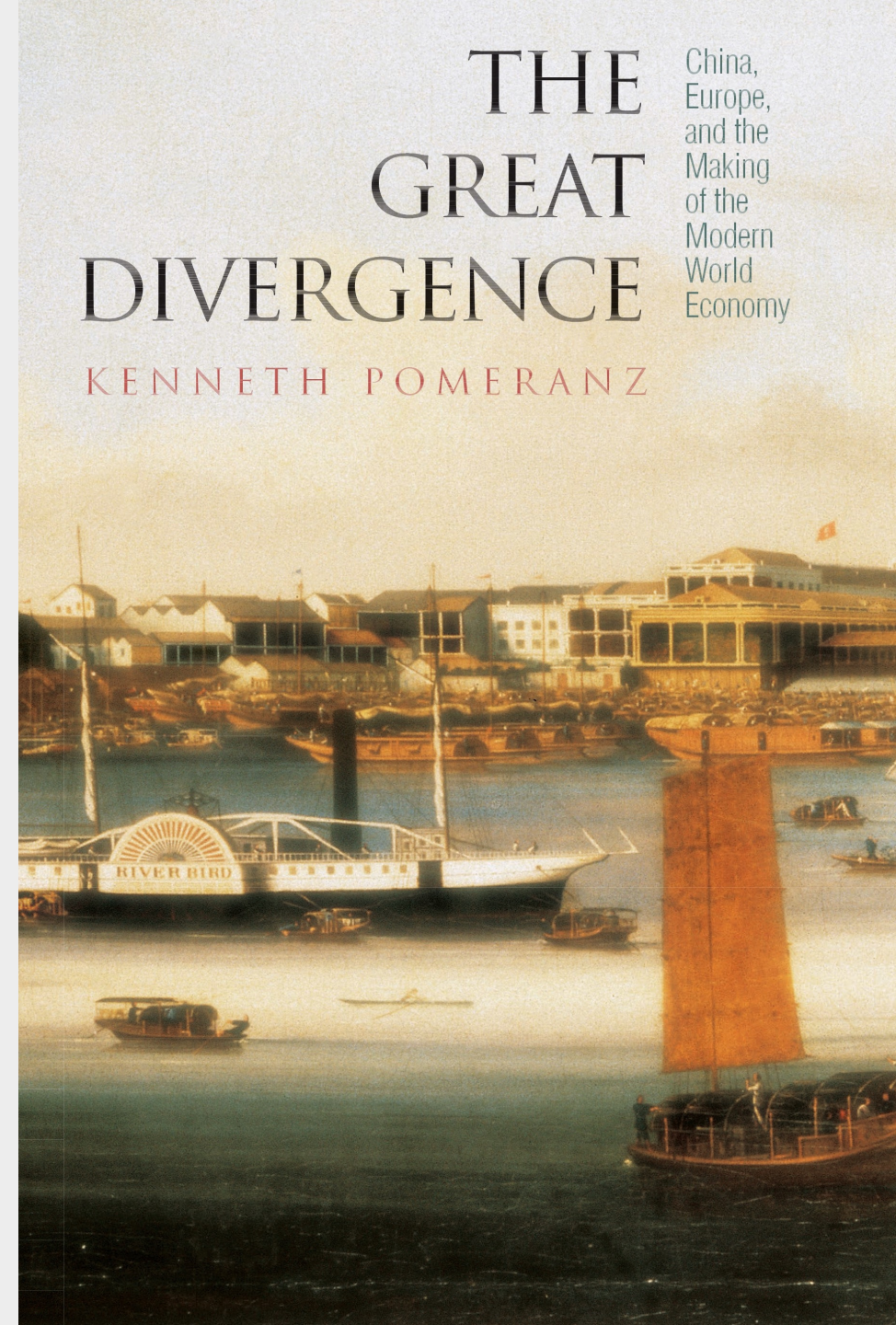




# The Great Divergence (Pomeranz, 2000)

Why Europe (Great Britain) and not China (the Yangtze delta)?

- Coal (geographical proximity to cities and water)
- Colonies ("ghost acres")





# Evolutionary History (Russell, 2011)

- Long-fibre cotton necessary for mechanized spinning
- 5000 years of cotton cultivation and selection in America
- Greater genetic variation in “New world” cotton than in the “Old world”
- Colonial access to long-fibre cotton from the Americas (part of the slave-trade in Liverpool and Lancashire)

## EVOLUTIONARY HISTORY

UNITING HISTORY AND BIOLOGY TO  
UNDERSTAND LIFE ON EARTH

EDMUND RUSSELL





# What causes?

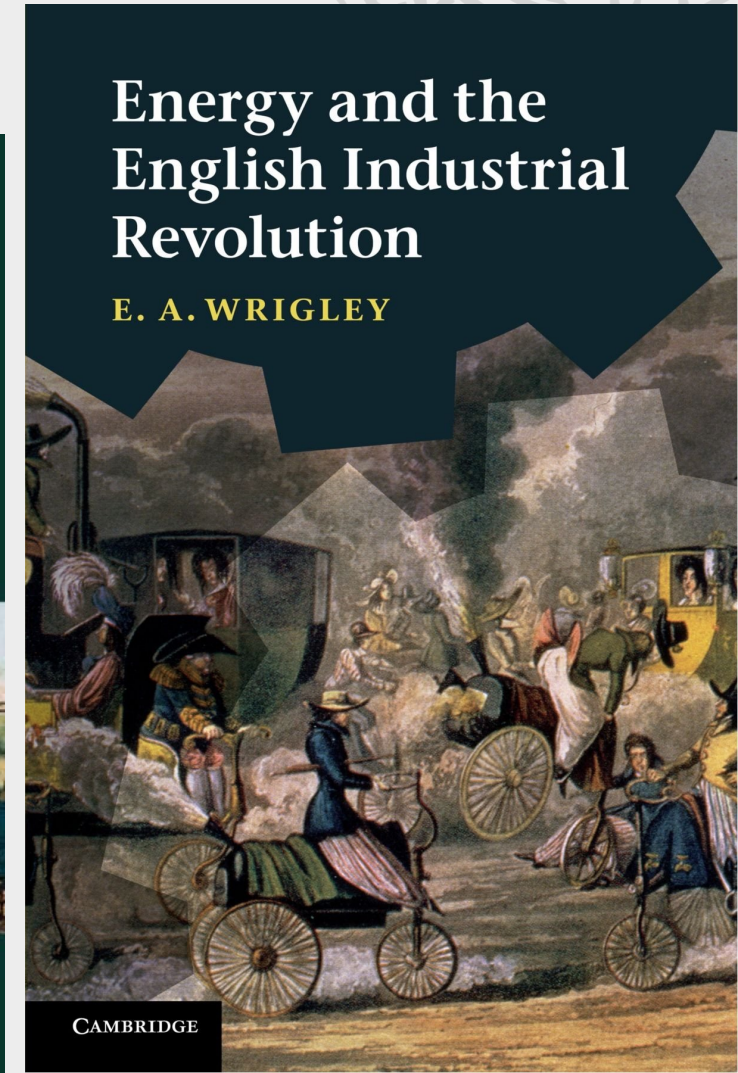
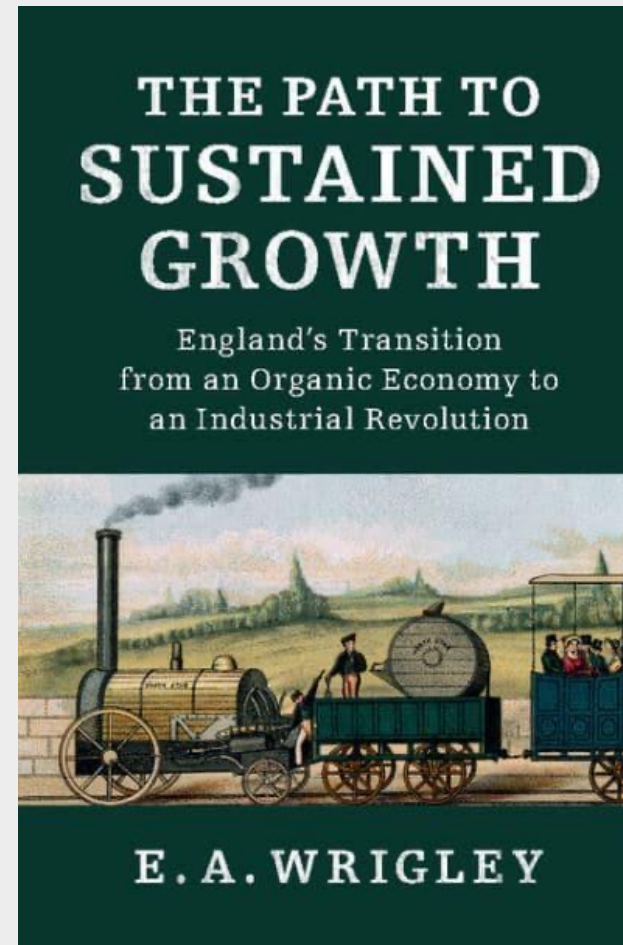
- Cultural/intellectual? (Mokyr)
- Industriousness/consumption? (de Vries)
- Geography and colonialism? (Pomeranz)
- Evolutionary? (Russell)
- Technological innovation?
- Organization? (the factory system)



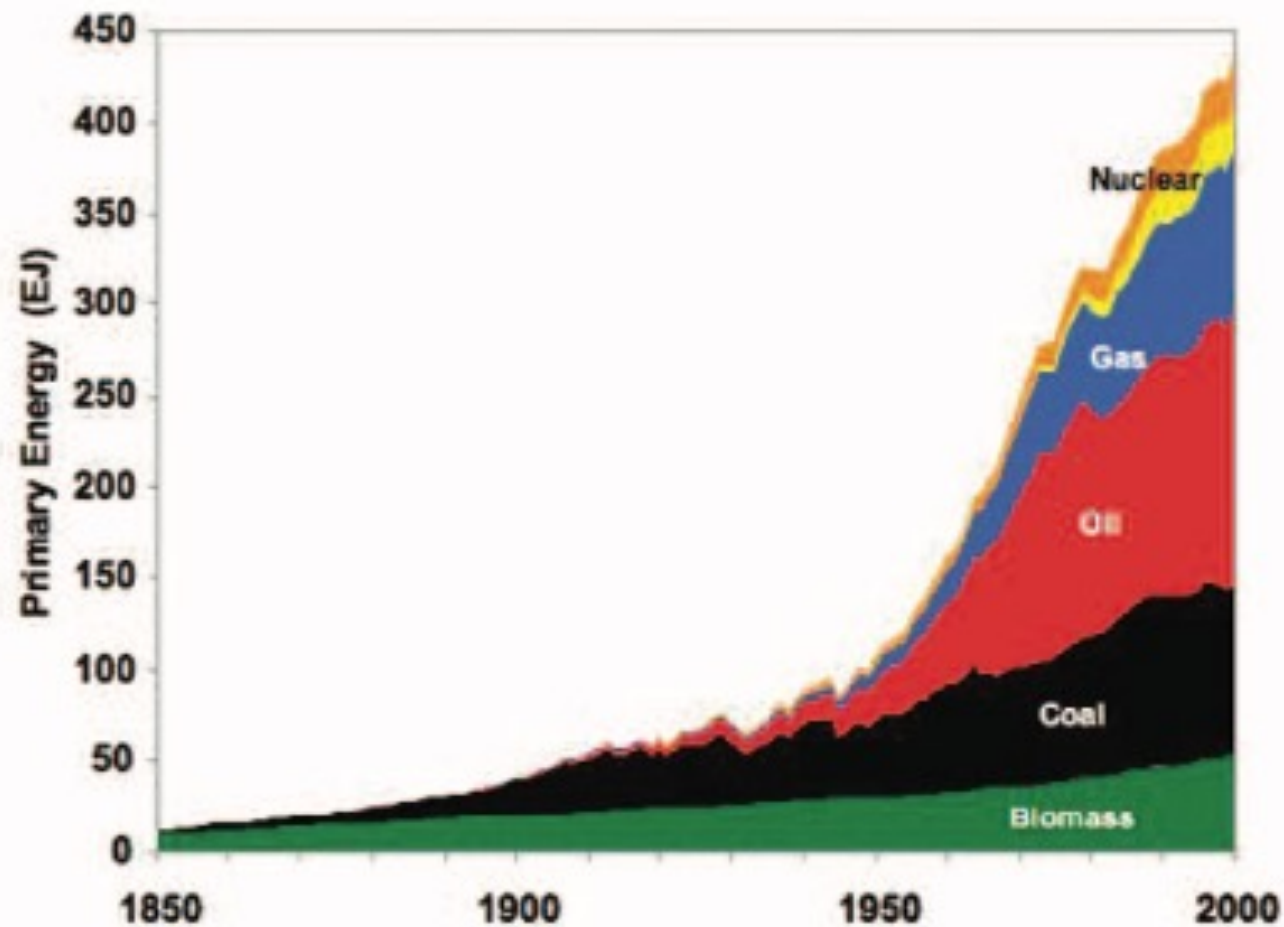


# Energy Transition from Organic to Inorganic Economy (Wrigley)

“As long as mechanical energy came principally from human or animal muscle and heat energy from wood, the maximum attainable level of productivity was bound to be low. Exploitation of a new source of energy in the form of coal provided an escape route from the constraints of an organic economy...”





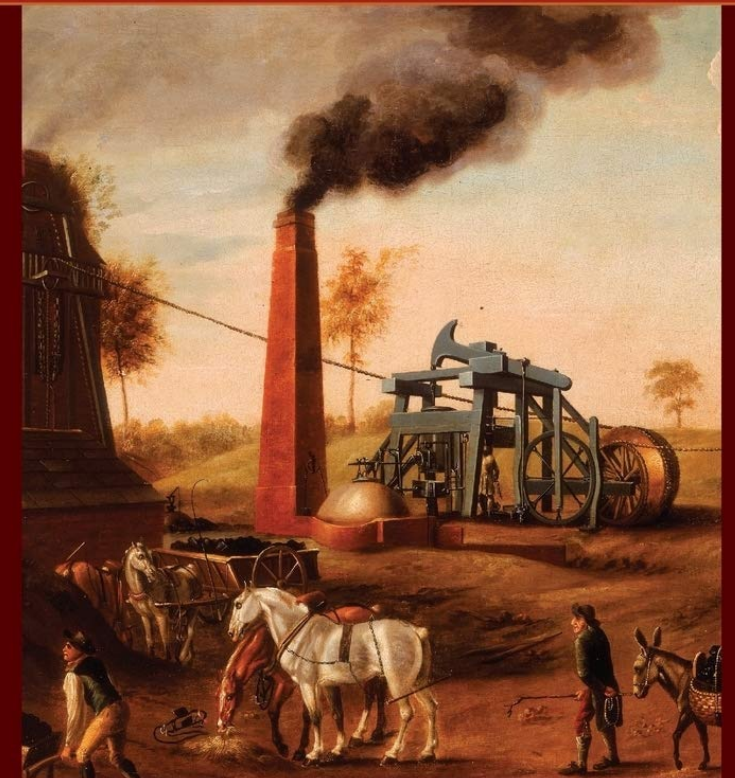


Nakicenovic #1

TU-Wien & IIASA 2003

# THE BRITISH INDUSTRIAL REVOLUTION IN GLOBAL PERSPECTIVE

Robert C. Allen



CAMBRIDGE

## Economic Incentives (Allen, 2009)

- Relatively expensive labour
- +
- Relatively cheap coal
- =
- Incentive for using coal

Table 7.1 *Stationary power sources in Great Britain*

	1760	1800	1830	1870	1907
Steam	5,000	35,000	160,000	2,060,000	9,659,000
Water	70,000	120,000	160,000	230,000	178,000
Wind	10,000	15,000	20,000	10,000	5,000
Total	85,000	170,000	340,000	2,300,000	9,842,000

"Explaining the slow adoption of steam power in the cotton industry is an important problem for the historian of its technology." (172-173)



## Fossil Capital (Malm, 2016)

- Coal, an irrational choice?

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# FOSSIL CAPITAL



The Rise of Steam Power  
and the Roots of Global Warming

ANDREAS MALM

## Fossil Capital (Malm, 2016)

- Coal, an irrational choice?
- “The transition from water to steam in the British cotton industry did not occur because water was scarce, more expensive or less technologically potent – on the contrary, steam gained supremacy *in spite of water being abundant, cheaper and at least as powerful, even and efficient.*” (93)
- “The process cries out for an explanation not only of why it happened so late, but of *why steam power was adopted at all.*” (57)

# FOSSIL CAPITAL



The Rise of Steam Power  
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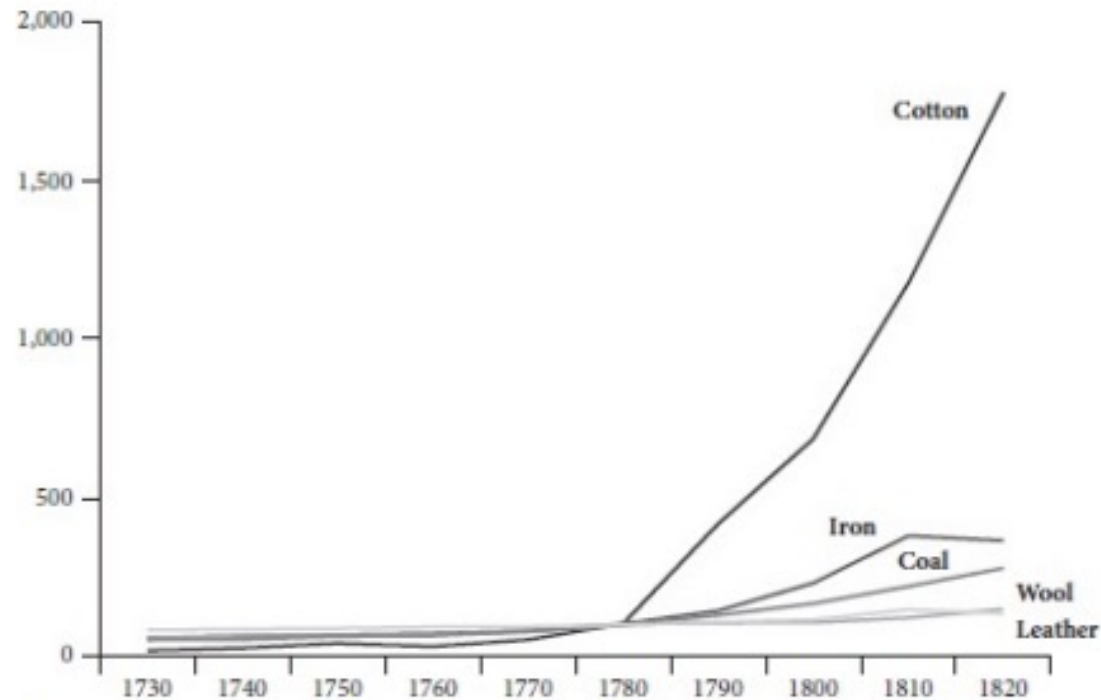


Figure 3.1. The cotton explosion. Growth in index numbers of real production for five British manufacturing sectors, 1730–1820. 1780 = 100.<sup>27</sup>

## Fossil Capital (Malm, 2016)

### Space

- Factories in cities
- Replaceable labour

### Time

- Optimization of working hours
- 1833 Factory Act, etc.

# FOSSIL CAPITAL



The Rise of Steam Power  
and the Roots of Global Warming

ANDREAS MALM



# Summary

- Conflicting explanatory models for both the industrial revolution and the transition to fossil fuels
- Development closely tied to a range of cultural, societal, political and biological aspects
- Unpredictable and undeterministic
- But great consequences...



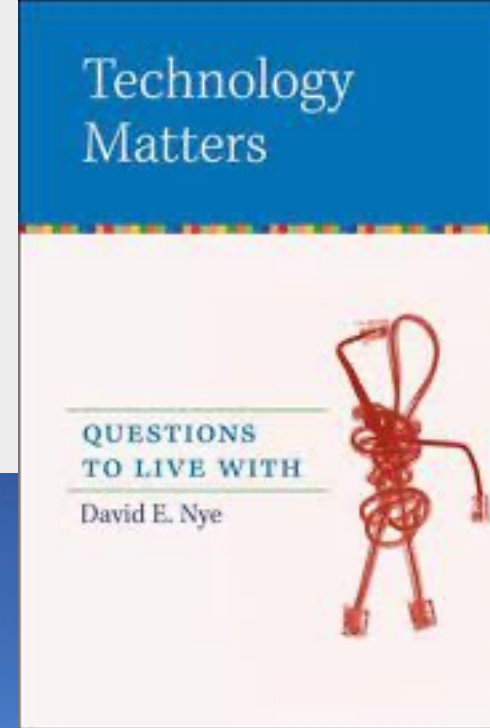


# Technological Determinism?

"people become enmeshed in a web of technical choices made for them by their ancestors. This is not determinism, though it does suggest why people may come to feel trapped by choices others have made." (20-21)

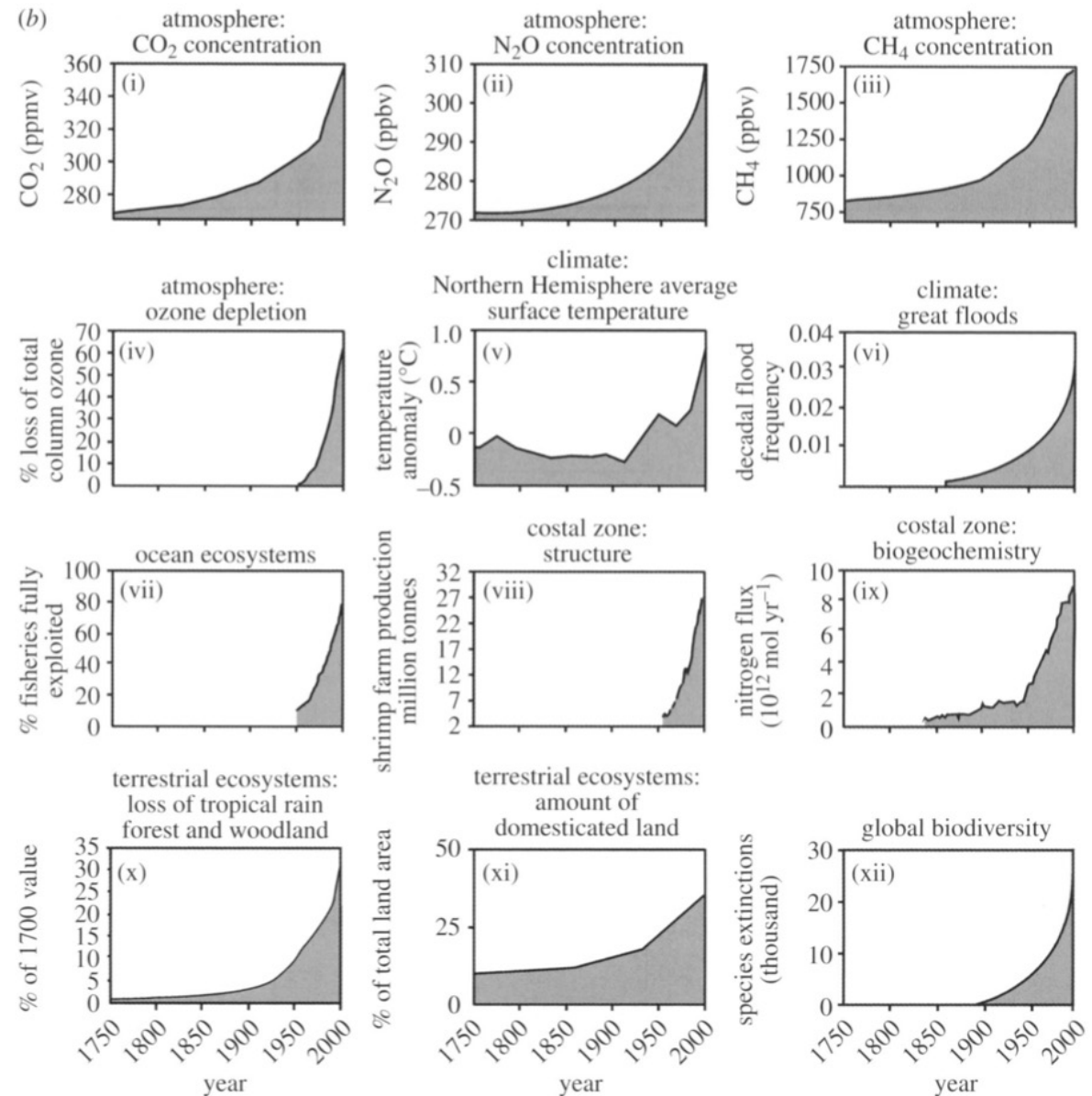
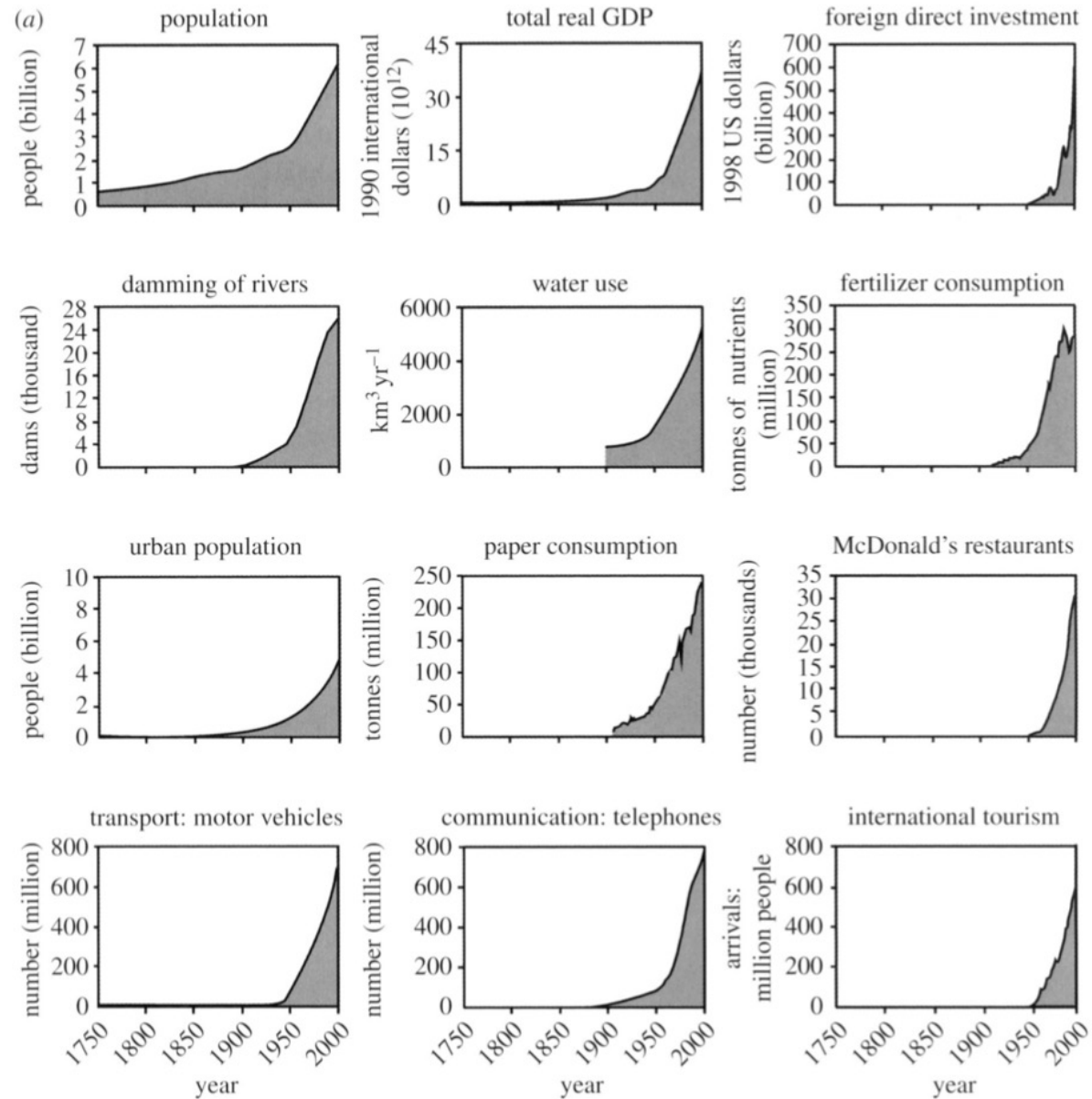
"Technological momentum" ➡ "soft determinism"

"Path dependence"





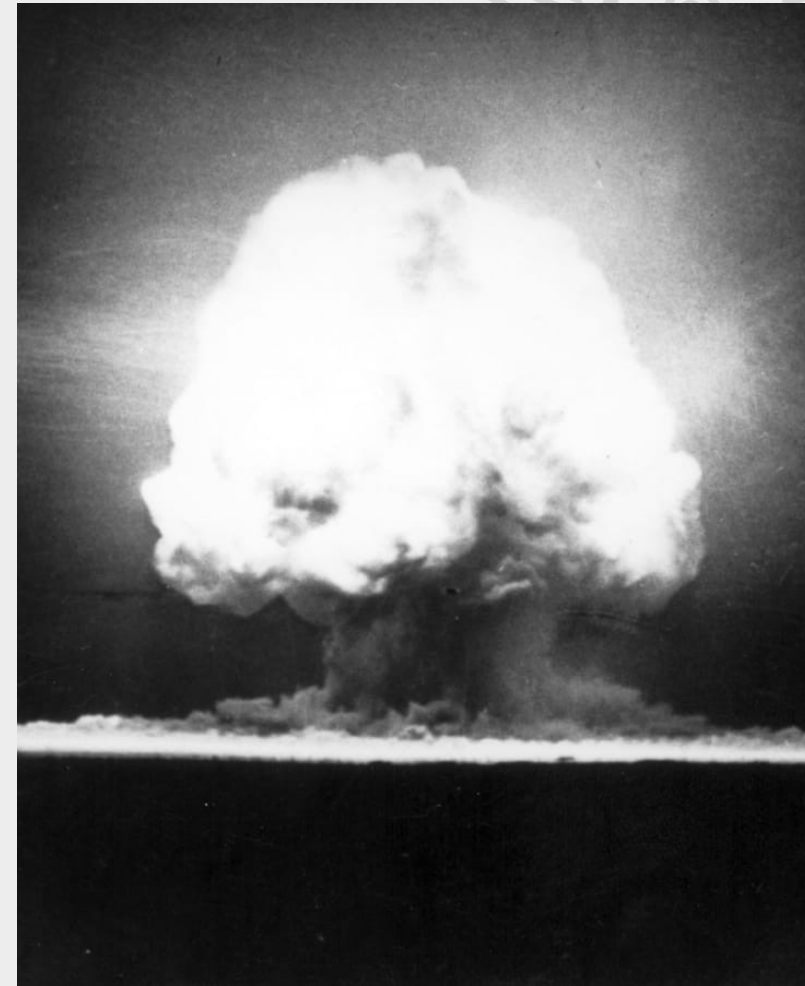
# "The Great Acceleration" Steffen et al. 2011





## Start Date of the Anthropocene?

- "Early anthropocene" ca. **8000 years ago**, Neolithic Revolution (William Ruddiman)
- **Ca. 1500**: globalization and the colonialization of the Americas (Simon L. Lewis & Mark A. Maslin)
- **Ca. 1800**: the industrial revolution
- **1945**: atom age and mass consumption (Anthropocene Working Group)





# The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature

Authors: Steffen, Will, Crutzen, Paul J., and McNeill, John R.

Source: AMBIO: A Journal of the Human Environment, 36(8) : 614-621

## Technological Determinism?

- Hunter-gatherers
- Fire (*Homo erectus*)
- Domestication of plants and animals
- Neolithic revolution (Holocene)

"The mastery of fire by our ancestors provided humankind with a powerful monopolistic tool unavailable to other species, that **put us firmly on the long path towards the Anthropocene.**" (614)



...or specific society?  
*Anthropocene?*

# The geology of mankind? A critique of the Anthropocene narrative

**Andreas Malm and Alf Hornborg**

- Anthropocene narrative
- "Species thinking"
- Sociogenic climate change?
- Technocene?
- Capitalocene?

The Anthropocene Review

2014, Vol. 1(1) 62–69

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"Jason W. Moore's scope is vast, and few could pull off so ambitious an analytical achievement.... There's enough scholarship, wit and insight... for a lifetime."

—RAJ PATEL, author of *Stuffed and Starved*

## ANTHROPOCENE *or* CAPITALOCENE?

*Nature, History, and the Crisis of Capitalism*

CONTRIBUTORS INCLUDE

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EDITED BY

JASON W. MOORE



# Technological solutions?

"Technology **must play a strong role** in reducing the pressure on the Earth System [...] Although improved technology is essential for mitigating global change, it **may not be enough on its own**. Changes in societal values and individual behaviour **will likely be necessary**" (619)

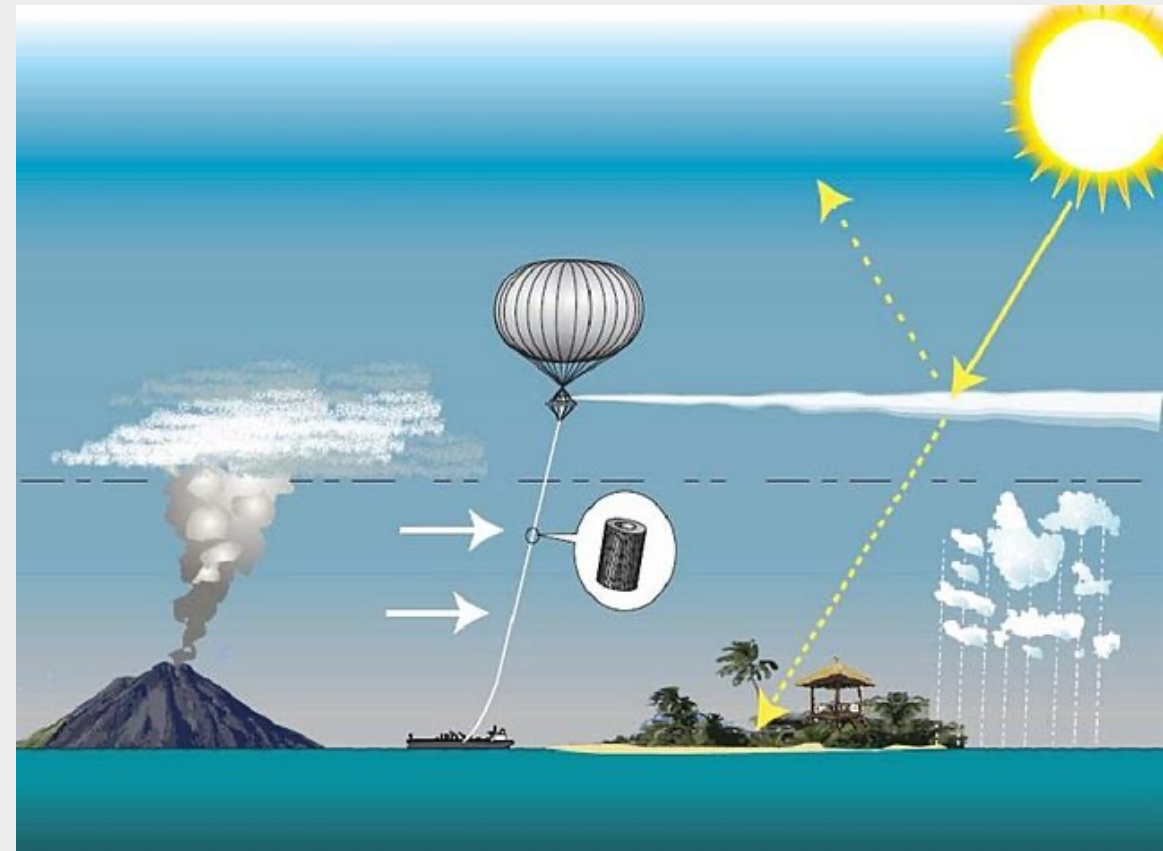
"Geo-engineering involves **purposeful manipulation by humans of global-scale Earth System processes** with the intention of counteracting anthropogenically driven environmental change such as greenhouse warming." (619)

"Looking more deeply into the evolution of the Anthropocene, **future generations of *H. sapiens*** will likely do all they can to prevent a new ice-age by adding powerful artificial greenhouse gases to the atmosphere. Similarly, any drop in CO levels to low concentrations, causing strong reductions in photosynthesis and agricultural productivity, might be combated by artificial releases of CO<sub>2</sub>, maybe from earlier CO<sub>2</sub> sequestration. And likewise, far into the future, *H. sapiens* will deflect meteorites and asteroids before they could hit the Earth." (620)

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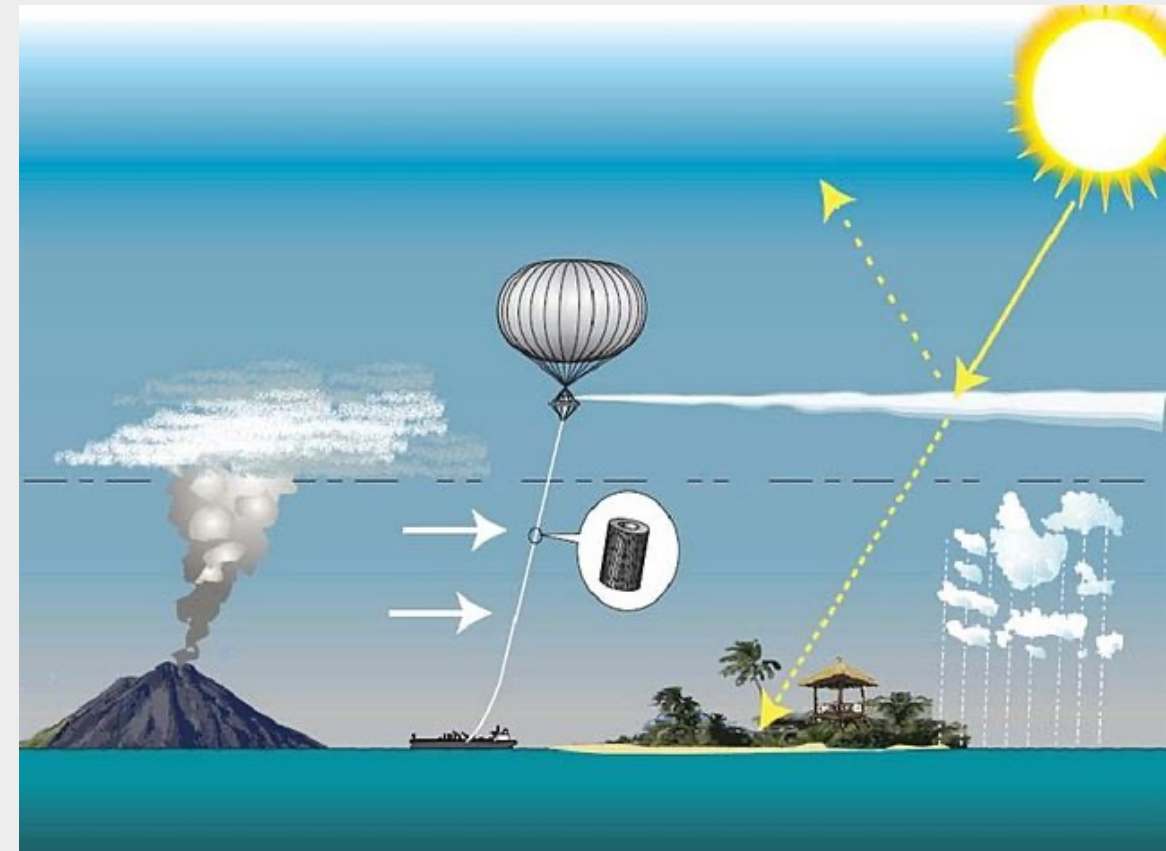
# Technological solutions?

“For the present, however, just the suggestion of geo-engineering options can raise serious ethical questions and intense debate. In addition to fundamental ethical concerns, a critical issue is the **possibility for unintended and unanticipated side effects that could have severe consequences**. The cure could be worse than the disease. For the sulphate injection example described above, the residence time of the sulphate particles in the atmosphere is only a few years, so if serious side-effects occurred, the injections could be discontinued and the climate would relax to its former high CO<sub>2</sub> state within a decade.” (620)

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# Technological solutions?

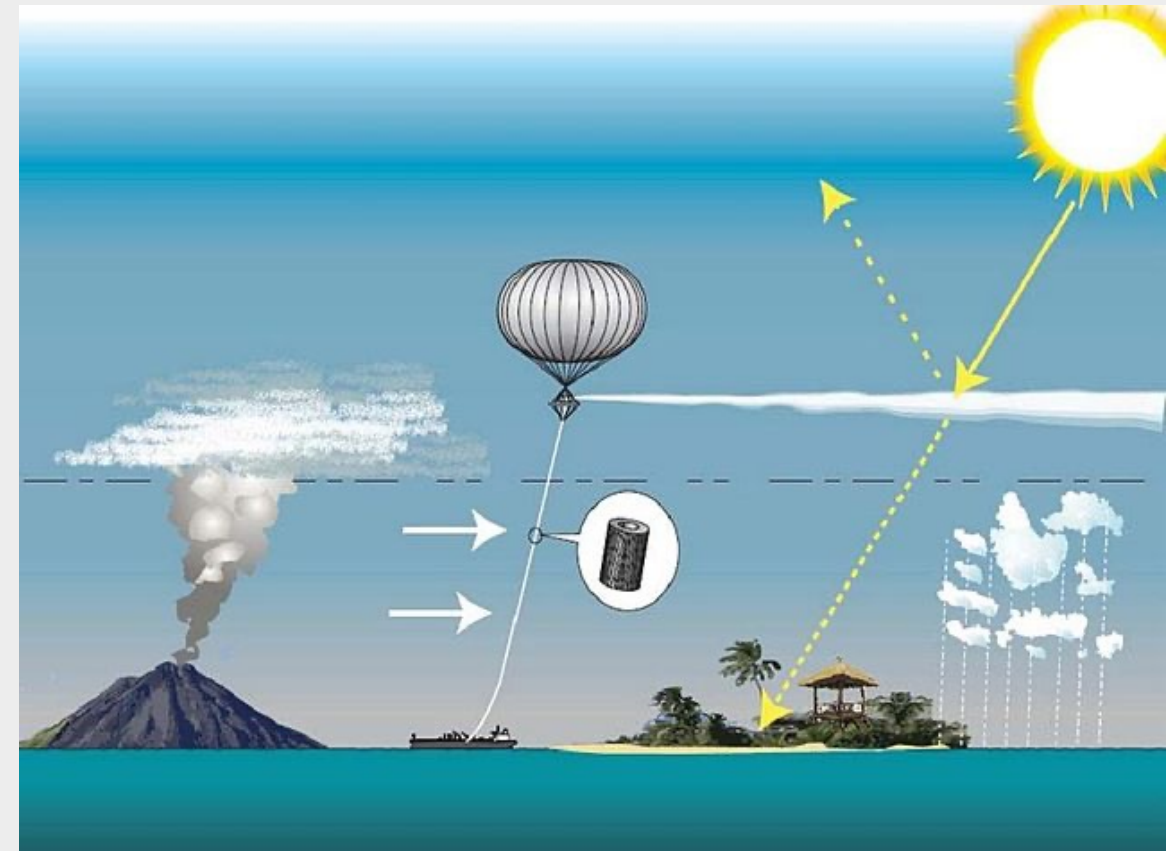
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“The Risk Society” (Ulrich Beck)

“Geo-engineering involves **purposeful manipulation by humans of global-scale Earth System processes** with the intention of counteracting anthropogenically driven environmental change such as greenhouse warming.” (619)





# Summary

- The Industrial Revolution and fossil fuels:  
multifaceted history with many potential causes, and many  
alternative paths which were never taken
- Soft determinism/Path dependence
- Anthropocene/Technocene/Capitalocene?  
(Historical dating matters!)
- The role of technology in the future? Solution or root of the problem?

