A historical painting depicting a man and a woman in 17th-century attire. The man, on the left, is wearing a dark robe and has a large, ornate feathered hat. He is looking down at a balance scale and some coins on a table. The woman, on the right, is wearing a white ruffled collar and a red robe. She is looking towards the man. The background features a large open book, a lit candle, and various scientific and mathematical instruments like a quadrant and a telescope.

Analysis of IR

PS 1599 | Week 3: Technology and Sustainability

Michaël Aklin
University of Pittsburgh

Administration

- Office hours + meetings
- Emails
- Website
- Question?

What did we talk about last time?

Plan for today

- In theory:
 - Welfare ← Development
 - Development ← Technology
 - Thus: technology ✓
- Evidence #1: Neolithic revolution
- Today: evidence #2, Industrial revolution(s)
- Today/next time: when technology goes too far

2. Industrial revolution

- Misnomer...
- Period of **economic, social, political** transformations
- Shift from agriculture to industry
 - 1st Industrial rev: ~1760-1830 (UK)
 - 2nd Industrial rev: ~1870-1914
 - Since then: 3rd and 4th IR
- Enabled by new energy tech: steam, spinning jenny, etc

England

	1500	1700	1900	1950
Calories	1.8k	2.2k	3k	3.1k
Life expectancy	34	38	46	69
Location	Rural	Rural	Rural	Urban
Literacy rate	5-15%	~50%	90%+	95%+
Cities >500k (world)	2	7	44	

What makes countries/regions
grow (economically)?

Types of growth

Growth (and development) can happen in four ways

1. *Smith-ian* growth: **market** expansion
2. *Solow-ian* growth: **capital** accumulation (machines, etc.)
3. Scale growth: more people, **division of labor**
4. *Schumpetarian* growth: **technological** disruptions

- #1 and #2 limited potential (cannot ‘rediscover’ China...)
- #3 helps but is slow
- #4 is key

Context: Medieval times and Renaissance

- Until 1600s: no clear trend in (median) living standards
- Does *not* mean **stability** (eg Black Death:~-50%)
- Does *not* mean **stagnation**
 - Trade (Smith-ian): global trade networks
 - Capitalism (Solow-ian): banking, accounting, money
 - Technology: agri, paper, medical science, universities
- But few **permanent** changes

1600s

- Change in W Europe starting around 1600s (**Enlightenment**)
- Expansion of regional+global markets (goods, finance)
- Growth of science: physics, statistics, philosophy
- Development of modern state (property rights+law)
- But still little change in welfare

1st Industrial revolution

- Schumpetarian process
- Starts in UK, 1760s-1830s (spreads later)
- Rapid **productivity growth** (output per worker/year)
 - More goods and products available
 - Declining prices of such goods
 - Shift from agriculture to manufacturing (**industrialization**)
 - Eventually: large increase in GDP and welfare

How?

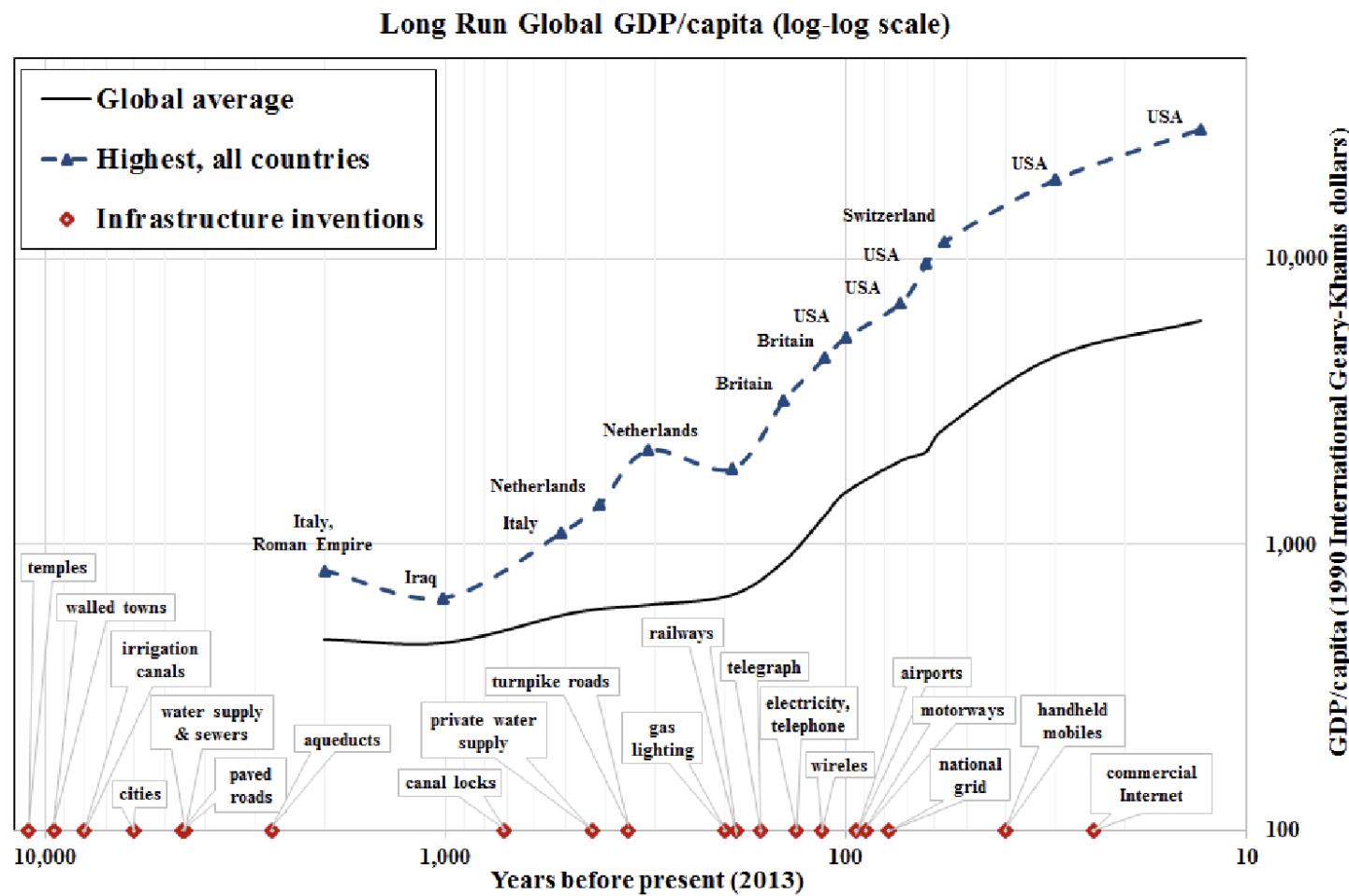


Figure 1. Time line of infrastructure innovations and economic growth

Source: Author's own elaboration for infrastructure invention dates (see text). GDP/capita data from Maddison (2007) - country maximum values exclude small oil states after 1920.

Source: Goldsmith (2014).

How?

Three steps

- Tech change in small sectors (**mechanization**):
 - Textiles. Cotton and “spinning Jenny”
 - Minnig. Coal, steam engine, deep mining.
 - Metallurgy. Coal, blast furnace.
- These sectors become more important overall
 - Size of the economy
 - Urban workers
- Later: technological **spillovers** (learning)

Broader impact

Deep causes

- Tech was key...
- But what triggered its development?
- Why UK 1760s? Mystery! Hypotheses:
 - Colonies? Small and poor...
 - Political institutions? But Netherlands...
 - Energy? Netherlands vs. Belgium...
 - “Culture” (Max Weber, etc.)? But Belgium...

Major consequences

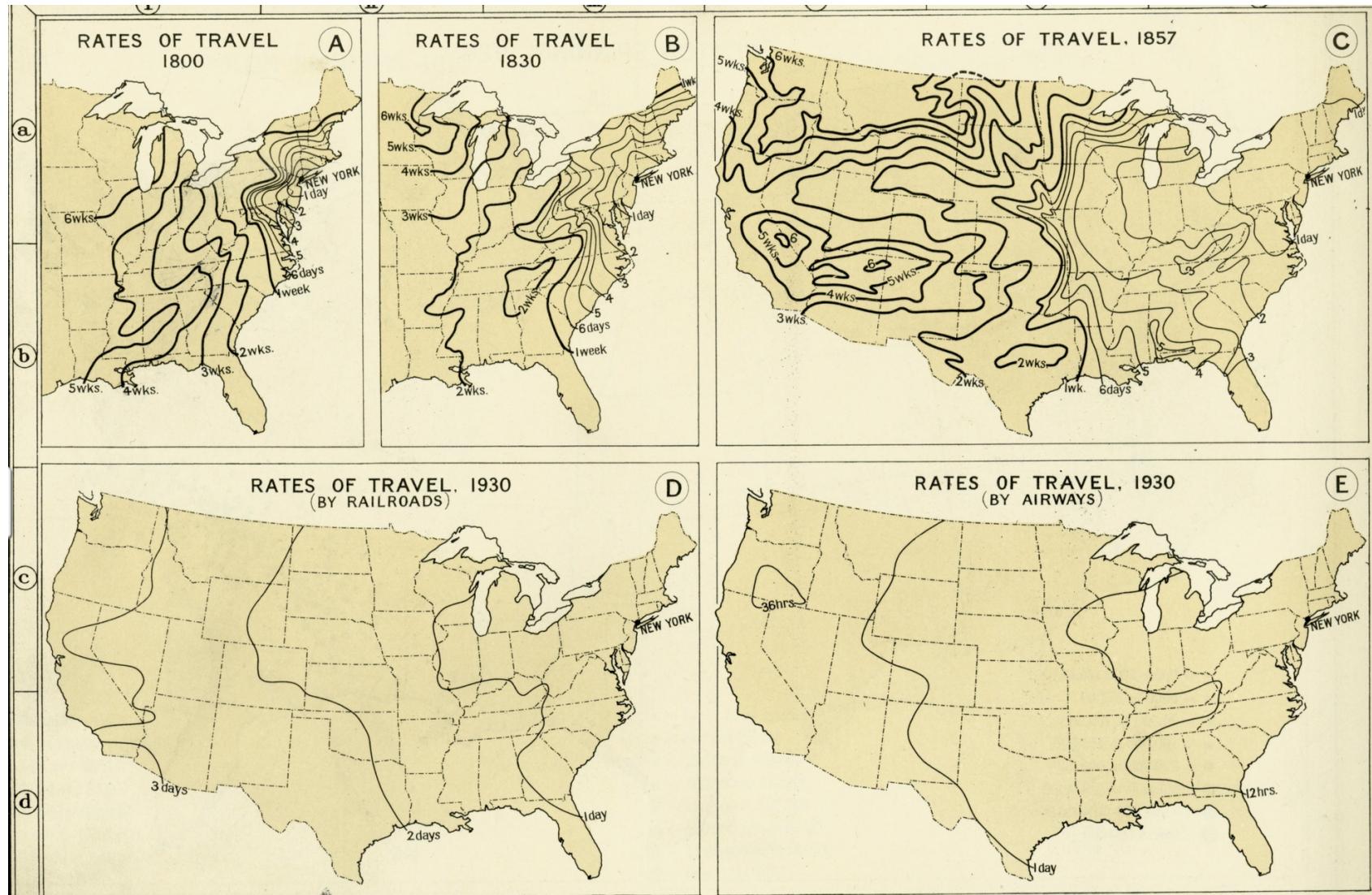
- Short term
 - Period of low growth (!)
 - Low wages (!) and urban poor (“proletariat”)
- Long term
 - Improvements in life quality
 - Rise in living standards, esp among poor
 - Decline of rural world
 - Expansion of public services (schools, public health)

2nd Industrial revolution

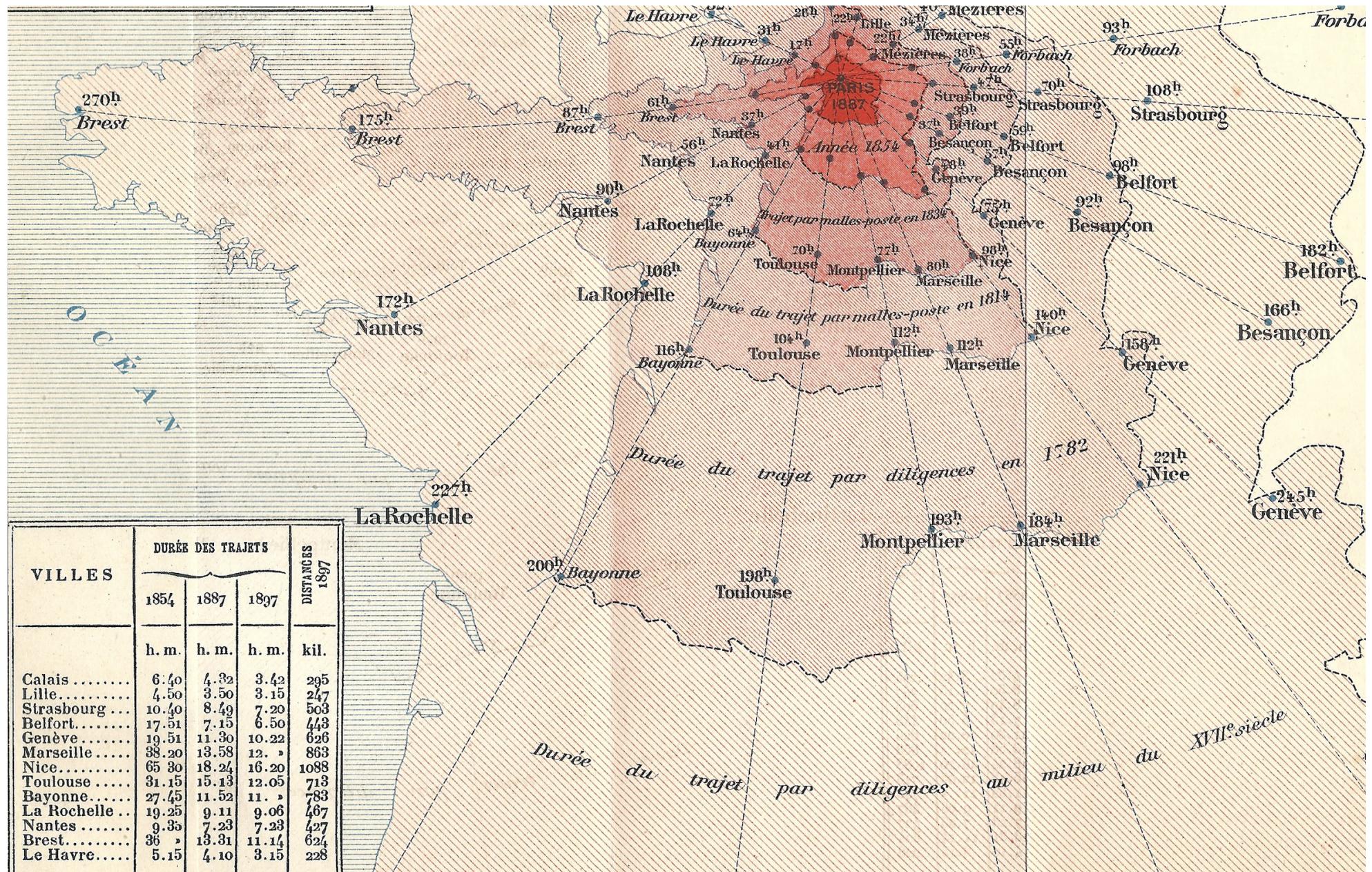
- Pause of innovation after 1820s
- Around 1870s until WWI:
- 2nd generation of innovations
 1. Transportation infrastructures (trains, steam boat)
 2. Energy infrastructures (eg grid) for **mass production**

What were the consequences
of transportation innovations?

World is becoming small



Isochrome map of US. Source: Atlas of the historical geography of the United States



Isochrome map of France

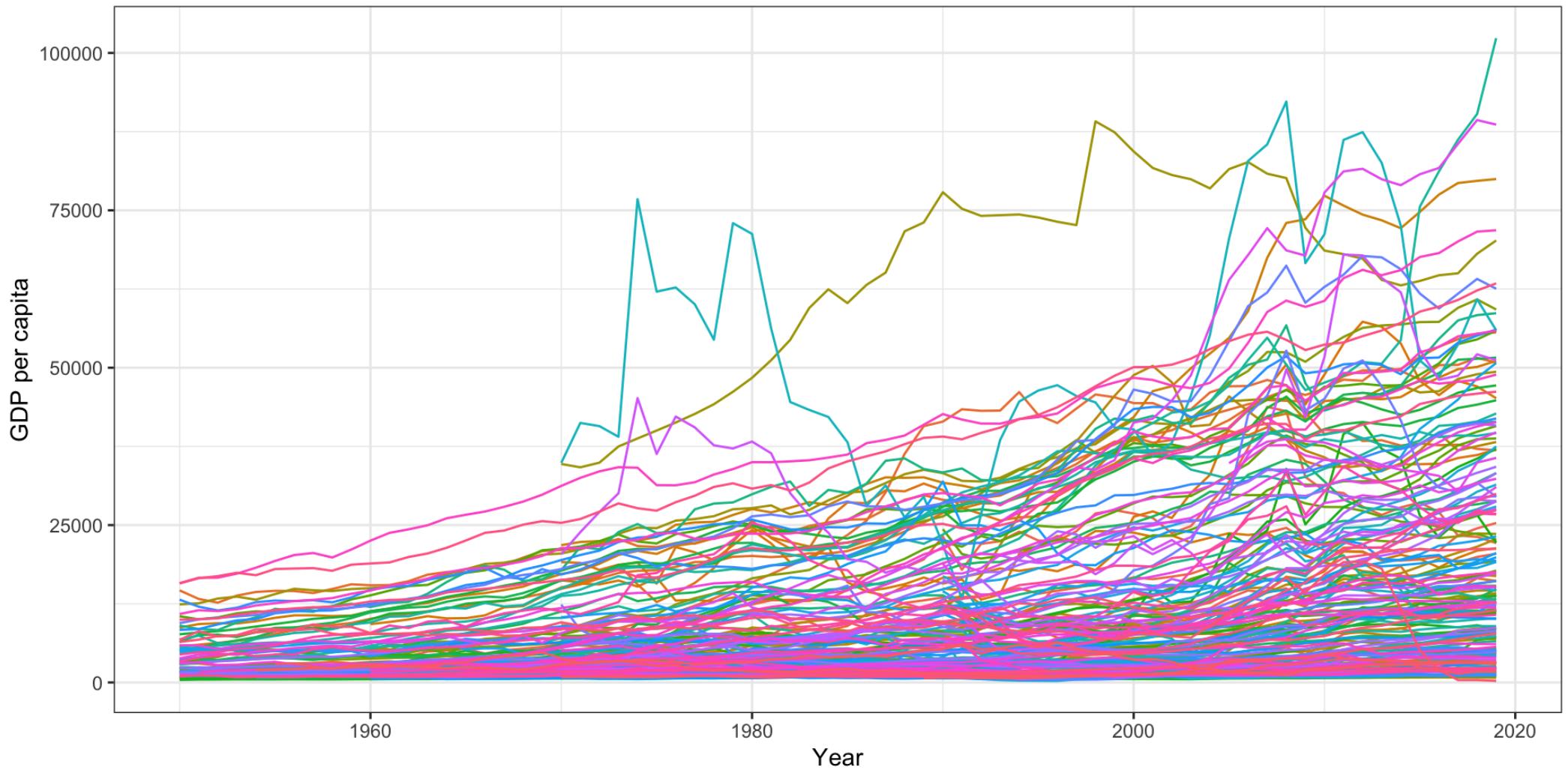
Some consequences

- Labor market. Eg:
 - UK w/ train station → pop growth + shift male workers away from agriculture
 - Germany: train tracks → pop growth for bigger parishes
- Erasure of local culture. Eg France: 50% of pop doesn't speak French in 1789
- Urbanization: working class, marxism, demand for social protection, education

3rd and 4th Industrial revolutions

- New phases of transformation of societies
- 3rd IR: “digital” revolution (~1960s onward)
- 4th IR: “cyber” revolution: AI, Internet of Things, etc.
- Technology is key
 - Energy services
 - Computers

GDP/capita since 1950



GDP per capita. Figure: Aklin. Data source: Penn World Tables.

Challenges

1. Are technological innovations slowing down?

- Worry about **stagnation**
- Challenge measuring growth; GDP is not adequate

2. Are technologies hurting us?

- Worry about **sustainability**
- Unprecedented risks of disaster

Conclusion

- IR = unprecedented levels of welfare
- Diff with past: few cases of backsliding
- Doesn't mean everything is great...
 - Inequality across/within countries
 - Hedonic treadmill
- Yet: would you trade your seat with anyone in the past?
- Bigger problems: what's next?
 - Negative side effects of tech
 - Will growth stop?

Questions?

aklin@pitt.edu

Source for title page painting: Quentin Matsys, *The Money Changer and His Wife*

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