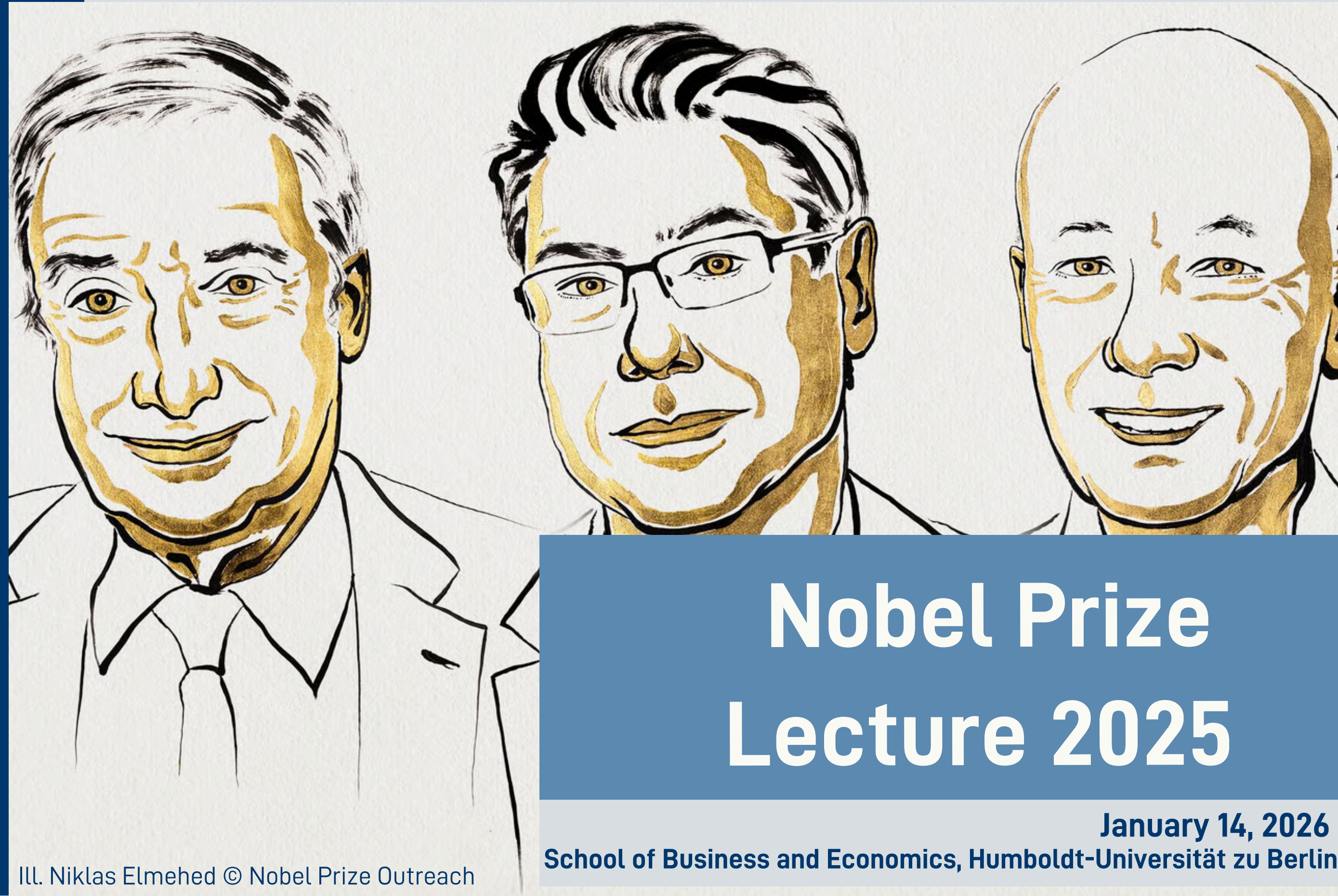


Economic Growth through Technological Progress and Creative Destruction

Chi Hyun Kim & Ben Schumann



Nobel Prize Lecture 2025

January 14, 2026

School of Business and Economics, Humboldt-Universität zu Berlin

Ill. Niklas Elmehed © Nobel Prize Outreach

Agenda

1.

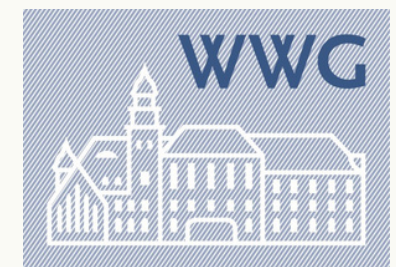
- Welcome Remarks
Prof. Dr. Daniel Klapper
- Nobel Prize Lecture
Prof. Chi Hyun Kim & Prof. Ben Schumann
- Q&A Session

2.

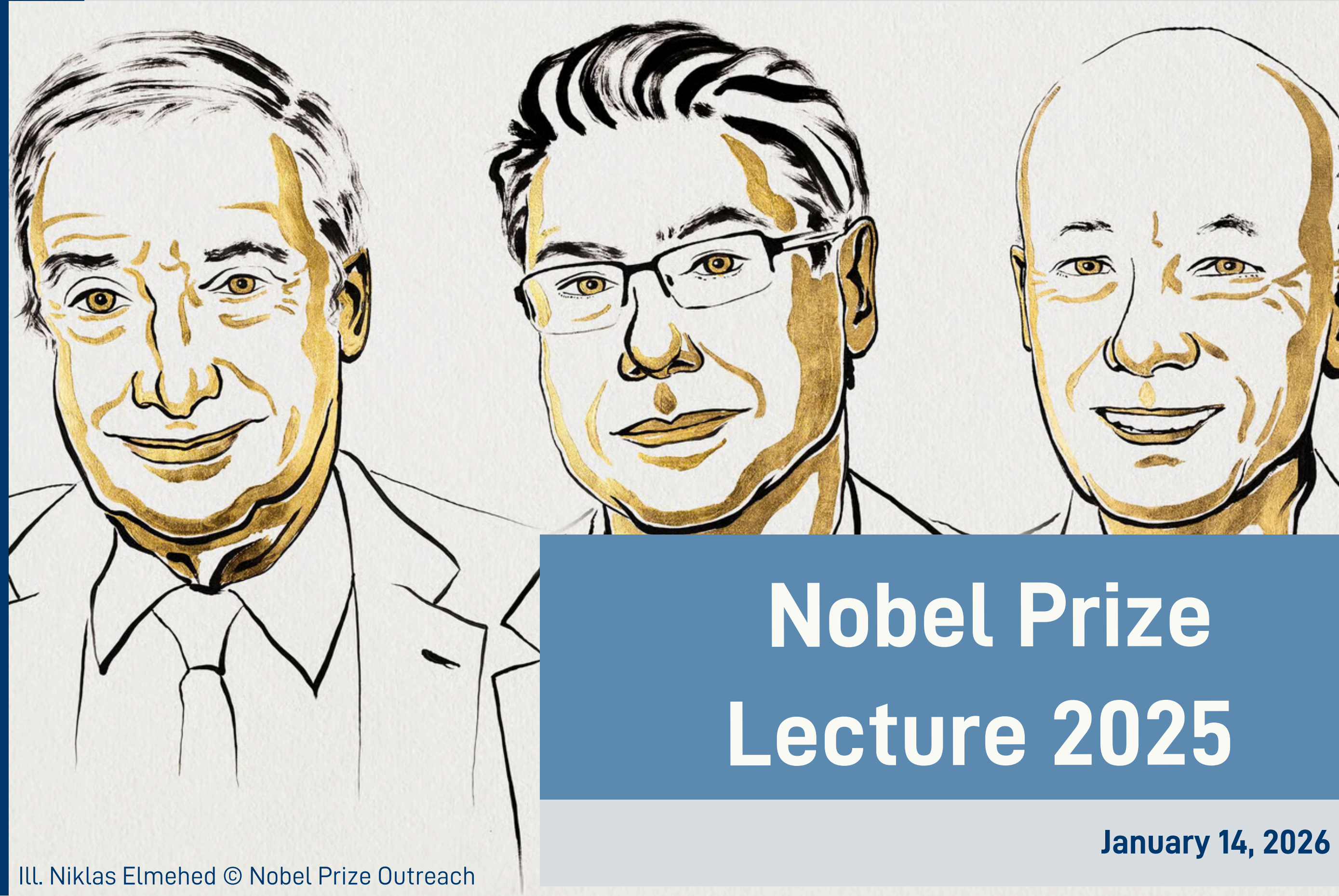
- New Year's Reception

Welcome Remarks

- **Prof. Dr. Daniel Klapper**
Dean, School of Business and
Economics
Humboldt-Universität zu Berlin
- *"The School of Business and
Economics at Humboldt-
Universität zu Berlin warmly
welcomes you to the
Nobel Prize Lecture 2025."*



**Chi Hyun Kim &
Ben Schumann**



Nobel Prize Lecture 2025

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The Nobel Prize Laureates in Economics 2025



Philippe Aghion



Peter Howitt



Joel Mokyr

"For having explained innovation-driven economic growth"

Who are they and what did they win the Nobel Prize for?

- ▶ Phillipe Aghion: Collège de France and INSEAD, Paris, France, The London School of Economics and Political Science, UK
- ▶ Peter Howitt: Brown University, Providence, RI, USA

“for the theory of sustained growth through creative destruction”

- ▶ Joel Mokyr: Northwestern University, Evanston, IL, USA, Eitan Berglas School of Economics, Tel Aviv University, Israel

“for having identified the prerequisites for sustained growth through technological progress”

Understanding the role of innovation on economic growth

$$\underbrace{Y_t}_{\text{GDP}} = A_t f(N_t, K_t)$$

- ▶ N_t = labor, K_t = capital, A_t = Productivity, Change in $A_t \approx$ Innovation
- ▶ In the macroeconomic literature, A_t often measured as a residual $\Rightarrow$ **black box!**

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 - How did A_t start growing in the first place?

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 - How did A_t start growing in the first place?
- ▶ Aghion and Howitt's research focuses on the **mechanisms** of A_t
 - What does it take for firms to keep on innovating?
 - What is the role of Schumpeter's "creative destruction" work in generating innovation?

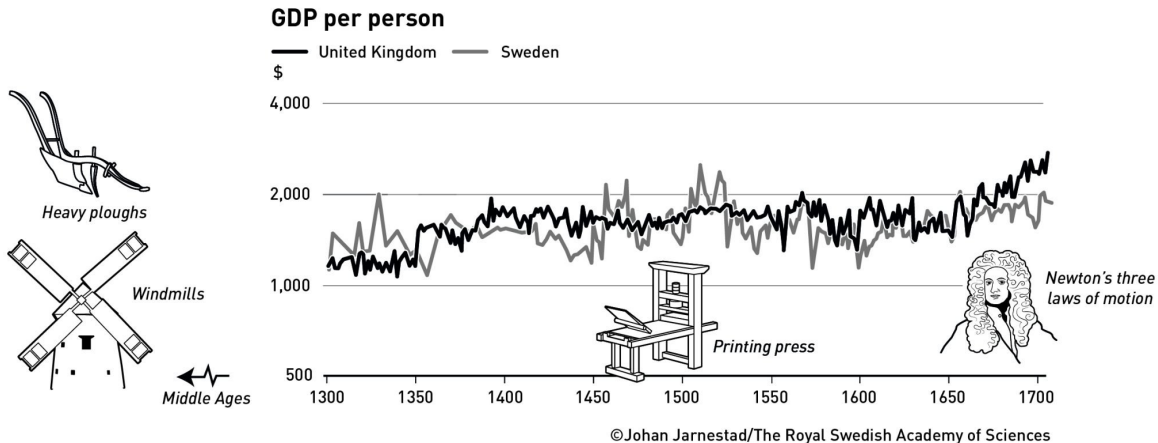
Why an economic historian should never try to predict the future

Joel Mokyr

“I am more likely to be elected pope than win [a Nobel Prize]. And I am a Jew.”

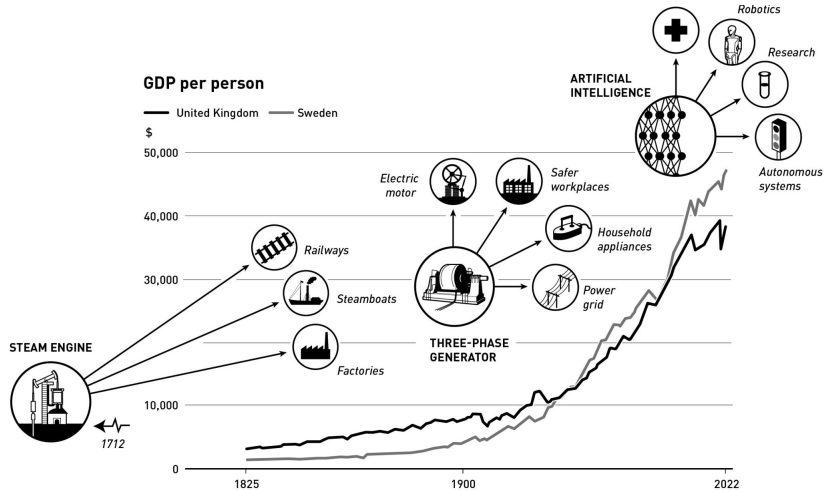
The mysterious stagnation of aggregate productivity

For a long time, despite frequent innovations, **aggregate productivity** A_t hardly grew



The mysterious explosion of aggregate productivity

But then with the industrial revolution, A_t took off - lifting millions out of poverty



©Johan Jarnestad/The Royal Swedish Academy of Sciences

An economic miracle?

In his **THIRTEEN** books, Mokyr traces out the roots of productivity growth

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Characterizes the **industrial revolution**

1. as a series of **macro inventions**...
 - "Radical, paradigm-shifting innovations"
 - Examples: steam engine, vaccinations

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Characterizes the **industrial revolution**

1. as a series of **macro inventions**...
 - "Radical, paradigm-shifting innovations"
 - Examples: steam engine, vaccinations
2. followed by acceleration of **micro inventions**
 - "Incremental improvements that unlock economic potential of macro counterparts"
 - Example: separate condenser, which made steam engines financially viable

But why?

Mokyr: “But why didn’t this sequence happen in previous centuries?”



Why didn't growth accelerate before?

Previous episodes: innovations largely happened through **trial and error**

- ▶ People often knew **how to do things** $\Rightarrow$ lots of "prescriptive knowledge"
- ▶ But **not why it worked** $\Rightarrow$ very little "propositional" knowledge
- ▶ Essentially: knowledge without deeper understanding

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Examples: in previous periods we had

1. "engineering without mechanics",
2. "iron-making without metallurgy",
3. "farming without organic chemistry",
4. "medical practice without microbiology"

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In such a world, **difficult to keep innovating** on the new invention

1. Lack of propositional knowledge
2. **Limited interaction** between those **who made things** and those **who knew things**

Europe in the 18th century - A “Goldilocks” scenario

18th-century Europe (especially Great Britain) ⇒ Perfect breeding ground for growth

1. Culture: increasingly values scientific reasoning ⇒ Scottish Enlightenment
2. Culture: well-established system of universities ⇒ all over Europe

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4. Politics: political fragmentation + Pan-European intellectual networks
⇒ No authoritarian ruler could suppress new ideas

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⇒ Science could flourish and was increasingly valued by governments and practitioners

It's the political and cultural environment, stupid!

Exponential economic growth in Europe during and after the Industrial Revolution...

- ▶ did not happen because Europeans were more creative at that time
- ▶ or only because of newly discovered resource endowments and trade routes
- ▶ but mainly because of the **cultural and political environment**

Prerequisites for growths according to Mokyr

Economic progress is critically dependent on three conditions...

1. Open intellectual inquiry
2. Free exchange of ideas
3. Vigorous defence of scientific principles

Prerequisites for growths according to Mokyr

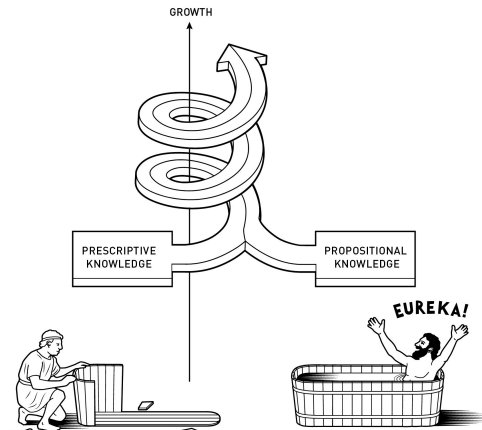
Economic progress is critically dependent on three conditions...

1. Open intellectual inquiry ✓
2. Free exchange of ideas ✓
3. Vigorous defence of scientific principles ✓

If all these are met, **science and practice interact** and create frequent innovation

Mokyr's Feedback Loop

Interaction of “propositional knowledge” (science) and “prescriptive knowledge” (practice)



⇒ **key mechanism that explains surge of economic growth** during industrial revolution

An example: Mokyr's feedback loop in action

- ▶ **Practice precedes theory** (17th c.) Early microscopes were developed by artisans ⇒ observations of microorganisms ⇒ lacked medical explanation.

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- ▶ **Practice catches up to theory** ⇒ Creates biggest welfare improving innovation in history?



- ▶ The **practice** to **systematically use soap** and the capabilities to cheaply produce it!

From a spark to a flame

Mokyr taught us the **prerequisites** to kickstart growth through innovation

But how can we **sustain it**?

Enter: Aghion & Howitt



Philippe Aghion



Peter Howitt

Confidence is key?

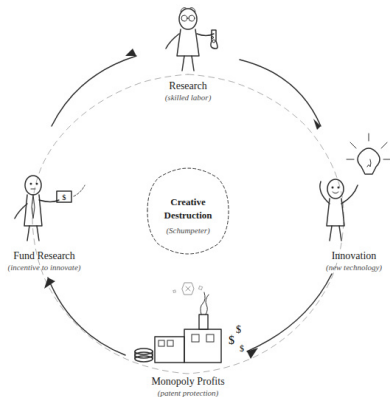
Phillipe Aghion and Peter Howitt

"According to Howitt, Aghion predicted from the beginning that this work would win them the Nobel Prize, a confidence that proved prescient" (Committee for the Prize in Economic Sciences in Memory of Alfred Nobel 2025)

A model of growth through creative destruction

- ▶ Schumpeter's Insight (1942): economic progress comes from entrepreneurs creating new products that replace old ones—a process of "creative destruction"
 - BTW: did you know that Schumpeter almost became a professor at the Humboldt?
- ▶ Aghion and Howitt transformed this intuition into a rigorous theoretical framework
 - What drives long-run growth
 - Why growth rates differ across economies
 - Whether markets produce the "right" amount of innovation
- ▶ Award winning paper published in Econometrica 1992
 - Cited by 18102! (December 29th 2025)

The innovation cycle



- ▶ Firms invest in research hoping to discover something new
- ▶ Successful innovators get a **patent**
⇒ become the new monopolist
- ▶ They earn profits until someone else innovates and replaces them
⇒ **"creative destruction"**

How to stimulate innovation

Aghion & Howitt show that you can stimulate innovation by...

Raising the reward

- ▶ Stronger market power allows firms to capture more of that prize
- ▶ Larger market size means a bigger prize

Lowering the cost

- ▶ More skilled population reduces cost for research (professor wages?!)
- ▶ Better research technology means the same effort yields more discoveries

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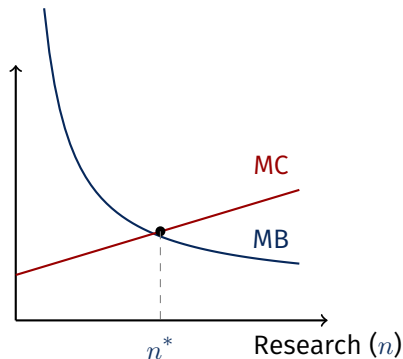
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Key insight: Perfect competition produces zero innovation in this model
Some degree of market power is **necessary** for growth!

Is more research always better then?



The short answer is **no!**

- ***Marginal costs rise***

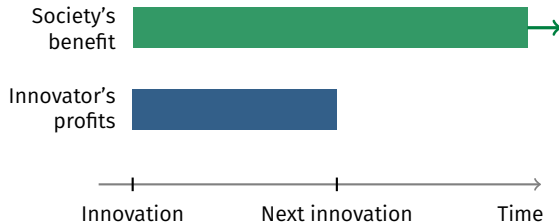
As more firms chase innovation, competition for skilled workers drives up wages

- ***Marginal benefits fall***

More research today means faster creative destruction tomorrow — your profits get wiped out sooner

Temporary profits for firms, permanent progress for society

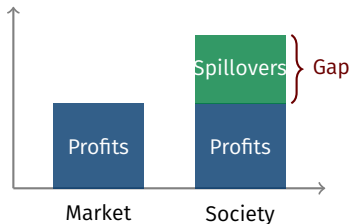
- ▶ Innovation is not only good for the firm, but makes the economy more productive as a whole!
 - Innovators capture profits only temporarily (until the next innovation replaces them) ...
 - but the knowledge they create stays forever — benefiting all future inventors and raising living standards for everyone



Wedge between laissez-faire and optimal growth

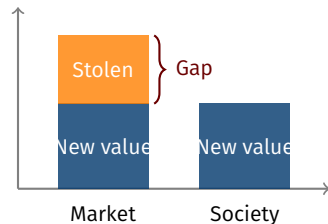
Society's profit $\neq$ market profits $\rightarrow$ gap between market outcomes and social optimum!

Benefits of Innovation



- **Knowledge spillovers:** innovators cannot charge future inventors who build on their work
 $\rightarrow$ **Markets underinvest in research**

Value Created by Innovation



- **Business stealing:** entrants ignore profits they destroy from incumbents
 $\rightarrow$ **Markets overinvest in research**

What does this mean for policymakers?

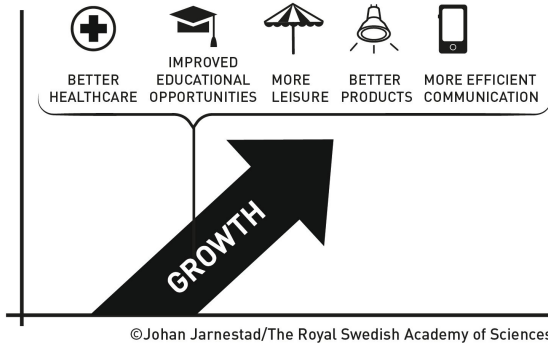
- ▶ "More R&D is always better" is too simple: innovation creates both positive spillovers (benefiting future inventors) and negative externalities (destroying other businesses)
- ▶ Competition policy and innovation policy go hand in hand: monopoly power encourages innovation but distorts production — policymakers must balance both
- ▶ R&D subsidies are not always the answer:
 - Subsidies work best when innovations are large and knowledge spillovers dominate
 - But they can backfire when business-stealing is already excessive

Design matters more than spending!

Effective policy tools can include:

- ▶ Patent length and breadth design
- ▶ Competition policy
- ▶ Targeted R&D subsidies (not blanket support)

Sustained growth has transformed human welfare in just 200 years



"Economic growth cannot be taken for granted. We must uphold the mechanisms that underlie creative destruction, so that we do not fall back into stagnation." — Nobel Committee, 2025

Looking ahead...

Benign



AI augments humans



Humans forget how to innovate (but happy)

Extinction

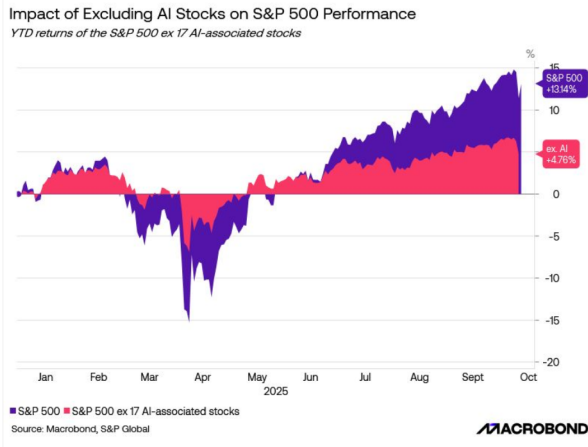


AI turns against humans



Humans lose all autonomy

Predicting a future with AI...



At least investors predict AI to generate large profits in the future
⇒ What about growth? Let's "ask" the Nobel laureates...

AI and growth through the lens of the Nobel laureates

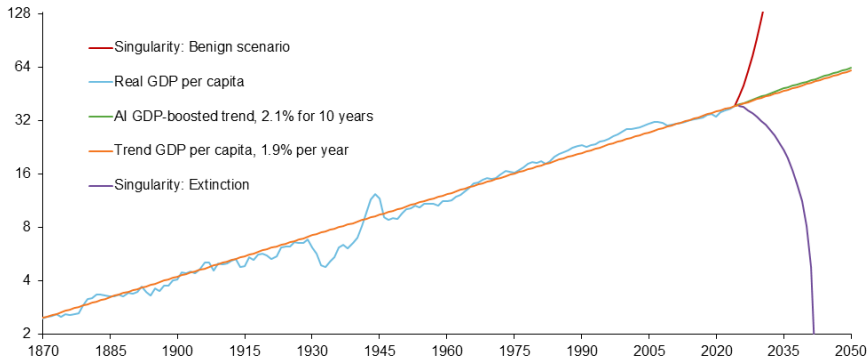
	Optimistic view	Pessimistic view
Aghion/Howitt	Increased innovation size leading to higher incentives to innovate	Risk of frequent creative destruction leading to less incentives to innovate
Mokyr	Theoretical knowledge more accessible to practitioners	Knowledge without true understanding? Without understanding, no innovation

► In short: it can go either way! ...

... and the Federal Reserve also agrees

Chart 1
AI scenarios

1990 dollars (thousands), log scale



NOTES: The blue line is real gross domestic product (GDP) per capita in 1990 dollars. The orange line is a trend line fitted to the data for 1870–2024 with a trend growth rate of 1.9 percent per year. The red, green and purple lines are hypothetical paths for per capita GDP based on different scenarios.

SOURCES: Bureau of Economic Analysis; Haver Analytics; Macrohistory.net; United Nations; authors' calculations.

Federal Reserve Bank of Dallas

So lets ask our (machine) overlords

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Kim and Schumann (HU): “But what about **inequality?**” (2025)

⇒ Growth effects are likely positive, but inequality may also matter for overall welfare

Outlook: AI and inequality

AI affects inequality

- ▶ **Wealth and income inequality** likely to increase:
 - Widening of the gap between capital and labor income (Acemoglu, 2024)
 - Profit concentration for firms with major breakthroughs (Nvidia)
- ▶ The effect on **wage inequality** unclear: predicted to destroy more middle-skill and high-skill jobs relatively more to previous automation waves

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And inequality may also alter the effects of AI on growth

- ▶ Fear of AI-induced inequality increases political resistance and reduces AI adoption
- ▶ Low adoption rates $\Rightarrow$ innovation capabilities of AI not fully exhausted

Conclusion

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Mokyr: to **kickstart growth** you need...

- ▶ a political environment that values research and intellectual inquiry (today?)
- ▶ frequent exchange between science and practice

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- ▶ innovation and competition (creative destruction) are the key ingredients
- ▶ growth will only happen if firms have incentives to innovate (profits)

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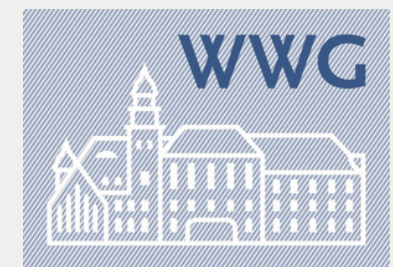
AI and the future of economic growth

- ▶ AI effects on growth most likely positive,
- ▶ but inequality considerations will be key for welfare and to exploit full potential of AI

Thank you for your attention and keep on innovating!

New Year's Reception

- Thank you for your attention and for your interest.
- The School of Business and Economics warmly invites all participants to attend the **New Year's Reception.**



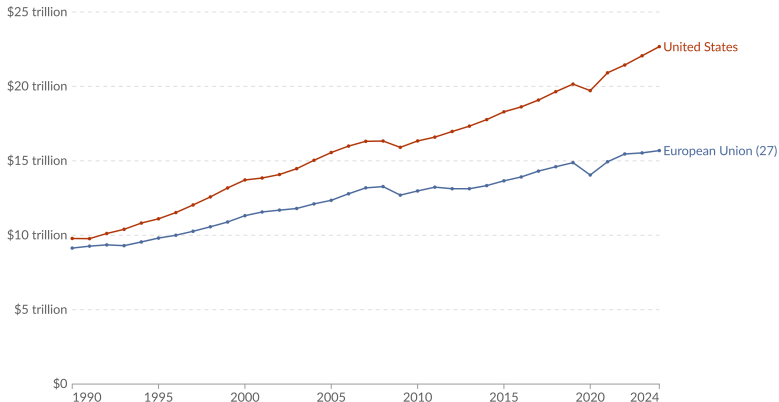
Appendix

Yes, US GDP grew faster than the euro area

Gross domestic product (GDP), 1990 to 2024

Our World
in Data

This data is expressed in US dollars. It is adjusted for inflation but does not account for differences in living costs between countries.



Data source: National statistical organizations and central banks, OECD national accounts, and World Bank staff estimates (2025)

Note: This data is expressed in constant 2015 US\$.

OurWorldinData.org/economic-growth | CC BY

But was it productivity? Let's account for increases in living costs and population

GDP per capita

Our World
in Data

GDP per capita is a country's gross domestic product divided by its population. This data is adjusted for inflation and differences in living costs between countries.



Data source: Eurostat, OECD, IMF, and World Bank (2025)

OurWorldinData.org/economic-growth | CC BY

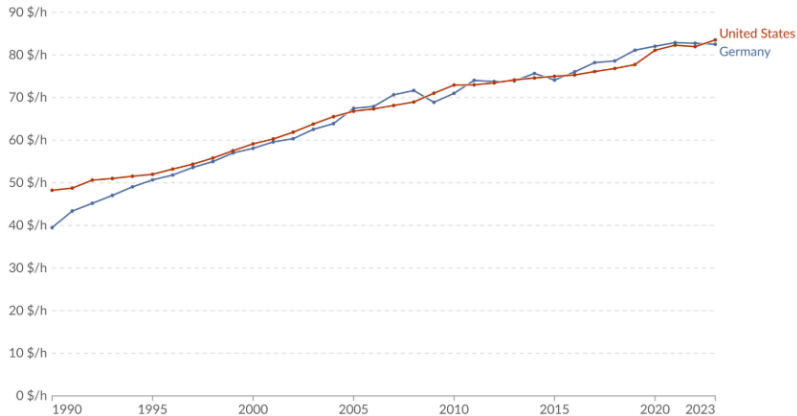
Note: This data is expressed in international-\$ at 2021 prices.

But was it productivity? Let's account for working hours

Productivity: output per hour worked

Our World
in Data

Productivity is measured as gross domestic product (GDP)¹ per hour of work. This data is adjusted for inflation and differences in living costs between countries.



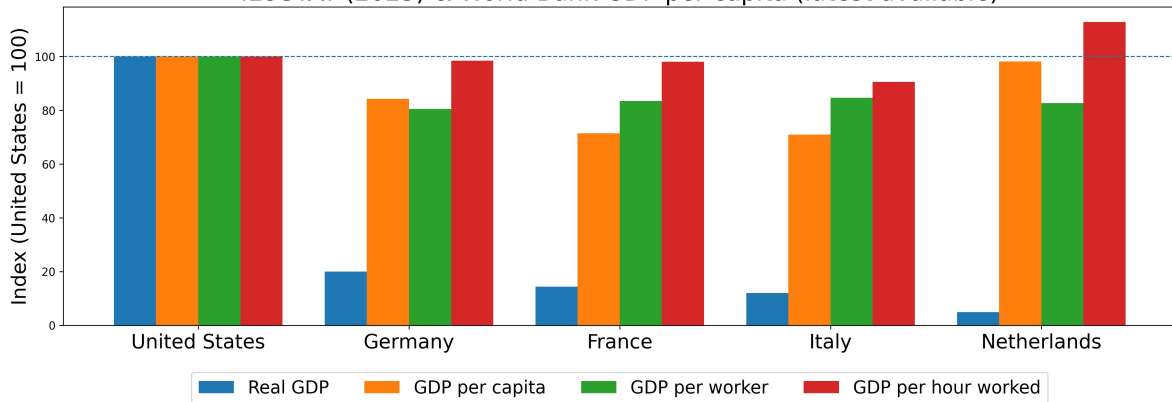
Data source: Feenstra et al. - Penn World Table (2025)

OurWorldinData.org/economic-growth | CC BY

Note: This data is expressed in international-\$² at 2021 prices per hour, using multiple benchmark years to adjust for differences in living

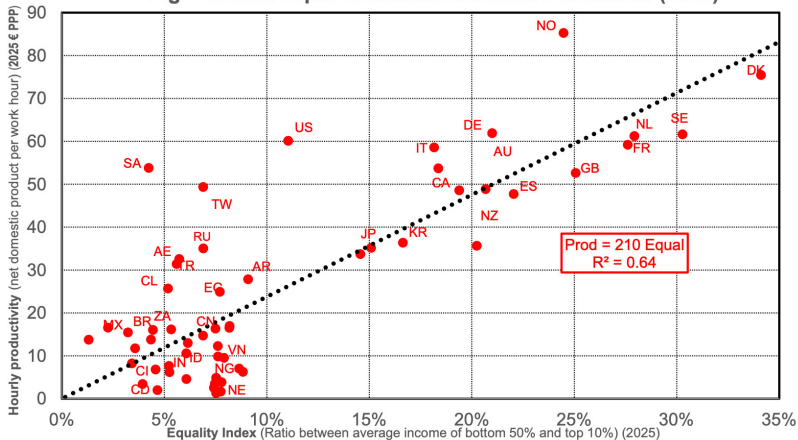
Americans work more, but are equally productive per hour (when adjusted for higher costs of living in the US)

Real GDP and Income/Productivity Measures Compared to the United States
ILOSTAT (2025) & World Bank GDP per capita (latest available)



More equal countries tend to be more productive

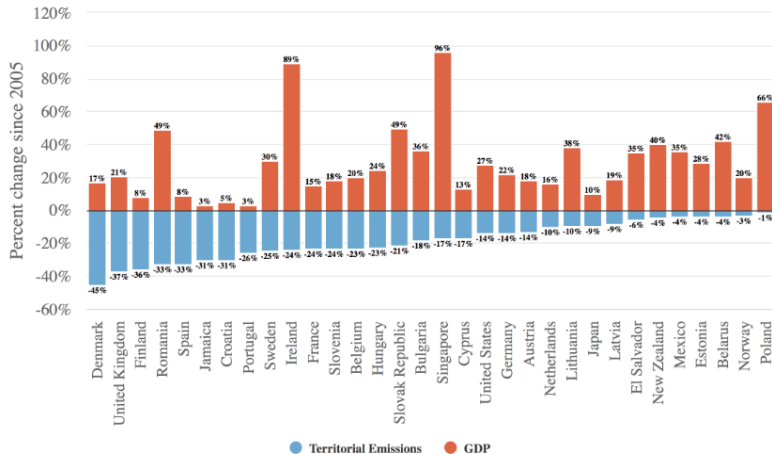
Fig. 44. More Equal Countries Are More Productive (2025)



Interpretation. On average, more equal countries are also more productive. Using a simple cross-country linear regression in 2025 (48 main countries), we find that if the equality index B50/T10 rises by 10 percentage points (say from 10% to 20%, i.e. from an income scale of 1-to-10 to 1-to-5), then hourly productivity increases by 21€. **Note.** Oil-rich countries (SA, US, NO) have unusually high productivities. **Sources and series:** wid.world (C2a)

Innovation has reduced the link between emissions and growth

Decoupling of territorial emissions and GDP: 2005-2019



Data: Global Carbon Project and the World Bank

But not yet in all parts of the world

Change in CO₂ emissions and GDP, China

Our World
in Data

Consumption-based emissions are national emissions that have been adjusted for trade. This measures fossil fuel and industry emissions. Land-use change emissions are not included.

Table

Line

Bar

Edit

