Artificial Intelligence and Economic Growth

Chad Jones

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What are the implications of A.I. for economic growth?

- Long-run growth

- Share of GDP paid to labor vs capital

    ○ The labor market

- What should we do about possible catastrophic risks?

Key Papers

- Zeira (1998 QJE): original automation model

- Acemoglu and Restrepo (2017, 2018, 2019, 2020, 2021, 2022, 2023)

- Hemous and Olson (2016)

- B. Jones and Liu (2024)

- This talk draws heavily on
    - Aghion, Jones, and Jones (2019) "Artificial Intelligence and Economic Growth"
    - Jones (2024 AER Insights) "The A.I. Dilemma: Growth versus Existential Risk"
    - Jones (2025) "How much should we spend to reduce A.I.'s existential risk?"

Two starting points (Aghion, B. Jones, and C. Jones, 2019)

- A.I. is a continuation of automation

  - Automation = replace labor in particular tasks with machines and algorithms

  - *Past:* textile looms, steam engines, electric power, computers

  - *Future:* driverless cars, paralegals, pathologists, maybe researchers, maybe everyone?

- A.I. may be limited by Baumol's cost disease

  - *Baumol:* growth constrained not by what we do well but rather by what is essential and yet hard to improve

Baumol Bottlenecks and Intuition

- Baumol: Tasks are complements rather than substitutes (EofS< 1)

  ○ Initially tasks done with L, automation = discovering how to use K instead

- Labor share of GDP

  ○ Automation (K replaces L): ↑ capital share and ↓ labor share

  ○ Better computers: ↓ capital share and ↑ labor share

- These can balance:

  ○ Even if 99% of tasks are done with capital

  ○ Computers are so good that capital is very cheap

  ○ EofS< 1 means that price effects dominate and labor share remains high

**Theory: A.I. in the idea production function**

- Economic growth comes from people producing ideas

  ○ What if machines can substitute for people at an increasing number of tasks?

- More ideas $\Rightarrow$ higher productivity

  ○ Likely to increase the level of productivity substantially

  ○ An increase in the rate of automation could speed up growth

- Extreme version: If all research tasks are automated, then a growth explosion is theoretically possible

  ○ Increasing returns from nonrivalry plus machines can do nearly everything...

What would A.I. accelerating economic growth look like?

- Near-term productivity boosts from A.I.

    ○ Software: 25% productivity improvements already

    ○ In the next decade: A.I. agents that can automate most coding?

    ○ Virtuous circle: code up even better A.I. agents

- Eventually $\Rightarrow$ virtual research assistants that automate cognitive work

    ○ Humans do much cognitive work remotely $\Rightarrow$ virtual A.I. assistants?

    ○ Ask them to invent new ideas?

    ○ E.g. better chips, better robots, medical technologies, etc.

    ○ A.I. + robots for physical tasks

- Potential to raise productivity substantially over the next two decades?

Average income per person in the U.S.

2023 DOLLARS, RATIO SCALE
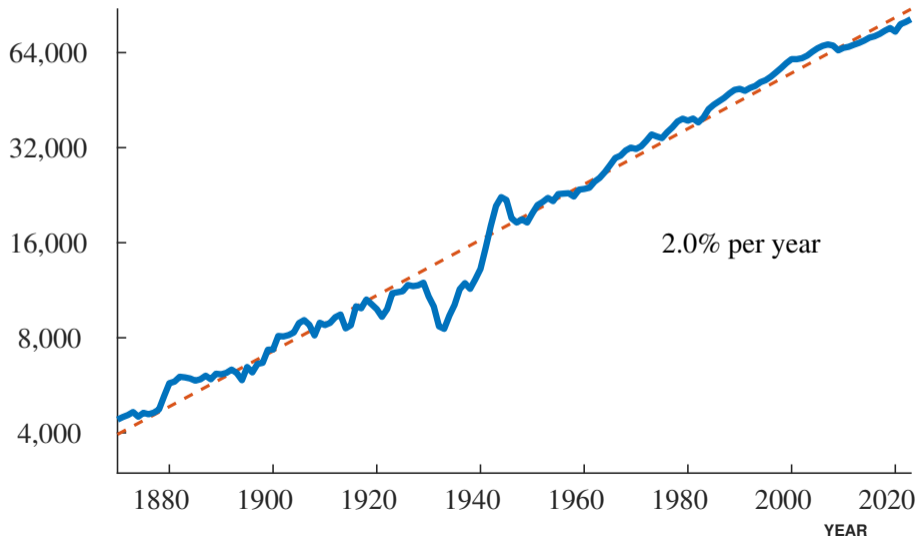
2.0% per year

YEAR

Bottlenecks and Baumol Effects

- Automation has been going on for 150 years with no speed up in growth
  - Electricity, engines, semiconductors, the internet, smartphones
  - Yet growth always 2% per year

- Maybe those great ideas are what *kept* growth from slowing
  - Most pessimistic view: Perhaps A.I. = latest great idea letting us maintain 2% growth for a while longer.

- Economic history $\Rightarrow$ may take longer than we expect
  - Electricity and computers changed the economy over 50 years
  - Even if AI takes 30 years to have full impact, could still be large

The Labor Market, Jobs, and Meaningful Work

- The world where A.I. "changes everything" is a world where GDP is incredibly high
  - The size of the pie available for redistribution is enormous
  - Transition could be hard. Also, what about developing economies?

- As we get richer, we naturally work less
  - Rising leisure, lower retirement ages. This is a good thing!
  - "Work" is a bad in most of our models

- But there is also good work, meaningful work
  - Chess more popular than ever despite iPhone $>$ Magnus Carlsen
  - We may choose to value experiences involving people (arts, music, sports)
    Recall Baumol effects can keep labor share high?

A.I. and Existential Risk: A Thought Experiment (Jones, 2024 AERI)

- More impressive than electricity, but more dangerous than nuclear weapons?

- The Oppenheimer Question:
  - If nothing goes wrong, A.I. accelerates growth to 10% per year
  - But a one-time small chance that A.I. kills everyone
  - Use it or not? What risk are you willing to take: 1%? 10%?

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- Two findings:
  1. High living standards and diminishing returns $\Rightarrow$ only take small risk
  2. But 10% growth $\Rightarrow$ cure cancer, heart disease
     Willing to take large risks (25%) to cut mortality rates in half

We do not need a 4th flat screen TV or a 3rd iphone.
Need more years of life to enjoy already high living standards.

How much should we spend to reduce A.I.'s catastrophic risk? (Jones 2025)

- Covid pandemic: "spent" 4% of GDP to mitigate a mortality risk of 0.3%

    ○ A.I. risk is at least this large $\Rightarrow$ spend at least this much?

    ○ Are we massively underinvesting in mitigating this risk?

- Better intuition

    ○ VSL = $10 million

    ○ To avoid a mortality risk of 1% $\Rightarrow$ WTP = $1\% \times \$10$ million $= \$100,000$

    ○ This is more than 100% of a year's per capita GDP

    ○ Xrisk over two decades $\Rightarrow$ **annual investment of 5% of GDP**

    ○ Large investments worthwhile, even with no value on future generations

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  Incomplete: ignores the "effectiveness" of mitigation

  but intuition is correct; see paper.

Final Thoughts

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- How much did the internet change the world between 1990 and 2020?

  - How much will A.I. change things between 2015 and 2045? More or less?

  - I believe the answer is much more

  - Just because changes take 30 years instead of 5 years does not mean that the ultimate effects will not be large

- Are we massively underinvesting in mitigating risks?

  - Exernalities and race dynamics: A.I. labs do not internalize the risks to all of us

  - Should we tax GPUs and use the revenue to subsidize safety?