ECONOMIC POLICY CHALLENGES FOR THE AGE OF AI

THE IMPACT OF AI ON ECONOMY, FINANCE AND SUPERVISION

BANK OF FINLAND AND FINNISH FINANCIAL SUPERVISORY AUTHORITY

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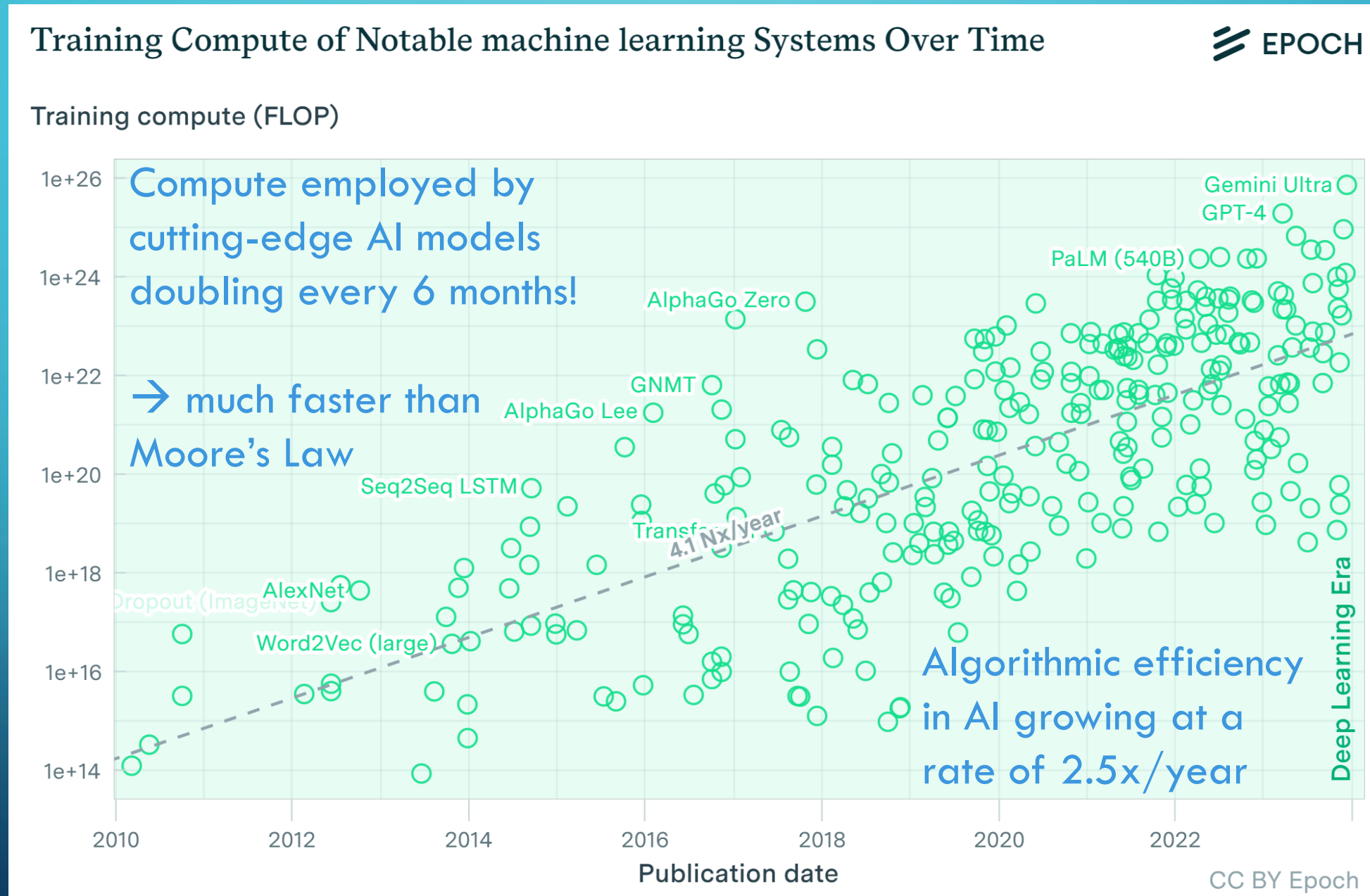
PART I: TECHNOLOGICAL ADVANCES


Training Compute of Notable machine learning Systems Over Time
EPOCH
Training compute (FLOP)
Compute employed by cutting-edge AI models doubling every 6 months!
→ much faster than Moore's Law
Algorithmic efficiency in AI growing at a rate of 2.5x/year
4.1 Nx/year
Deep Learning Era
Gemini Ultra
GPT-4
PaLM (540B)
AlphaGo Zero
GNMT
AlphaGo Lee
Seq2Seq LSTM
AlexNet
Word2Vec (large)
1e+26
1e+24
1e+22
1e+20
1e+18
1e+16
1e+14
2010
2012
2014
2016
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2020
2022
Publication date
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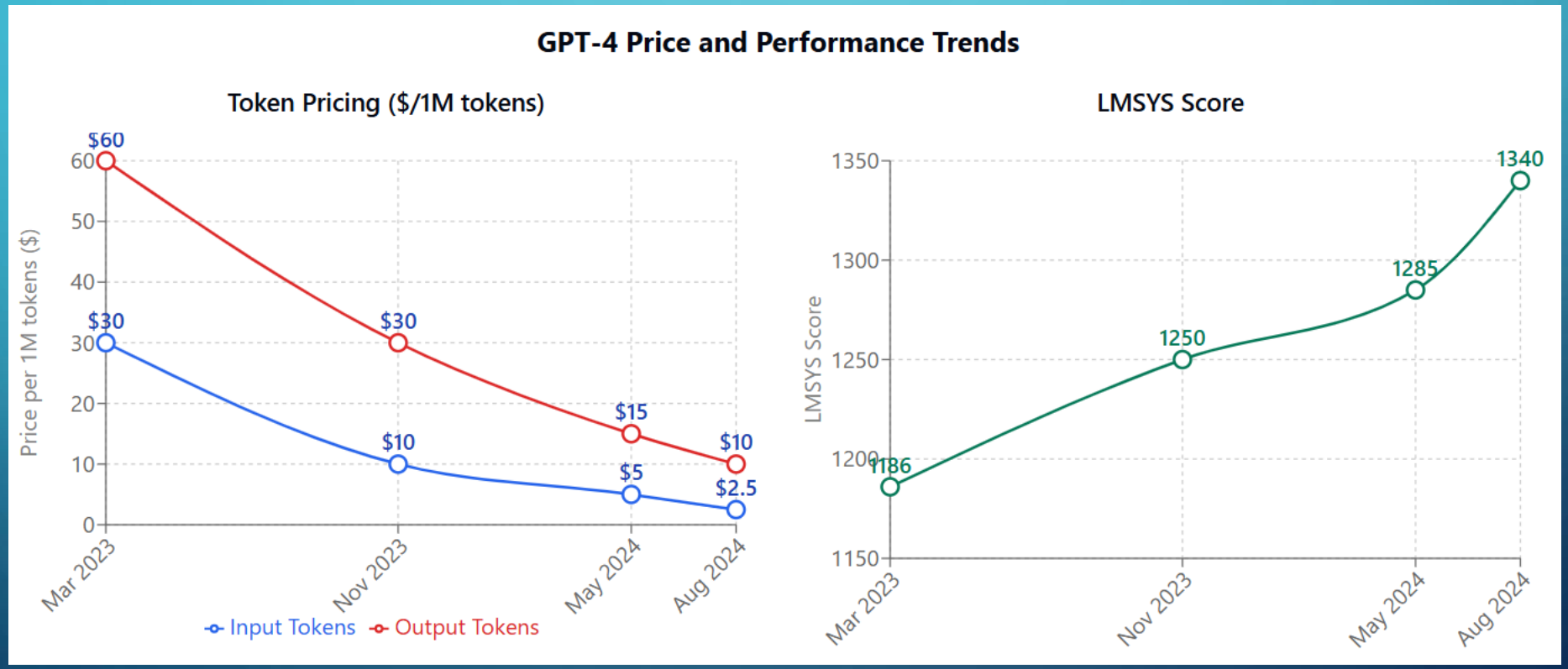
RAPID PACE OF ADVANCES IN AI

Frontier AI models are rapidly becoming better and more efficient



Most recent progress: models (like OpenAI's o1) are learning to reason

AI PROJECTIONS

Over the coming year: Emergence of AI Agents

- Will act autonomously to achieve goals in financial markets and economy
- Will automate many complex cognitive tasks

Over the medium term: Emergence of Artificial General Intelligence (AGI)

- AGI = AI that can automate any cognitive task performed by humans including creativity, emotional intelligence, etc.
  - Potential for recursive self-improvement, "intelligence explosion“
- Rapid advances in robotics imply automation of physical work

PART II: ECONOMIC EFFECTS

Witnessing the productivity gains from rapid advances in Gen AI

[Journal of Economic Literature]

Journal of Economic Literature 2023, 61(4), 1281–1317
https://doi.org/10.1257/jel.20231736

Generative AI for Economic Research: Use Cases and Implications for Economists†

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1. *Int*

LLMs Level Up—Better, Faster, Cheaper: June 2024 Update to Section 3 of "Generative AI for Economic Research: Use Cases and Implications for Ec

Journal

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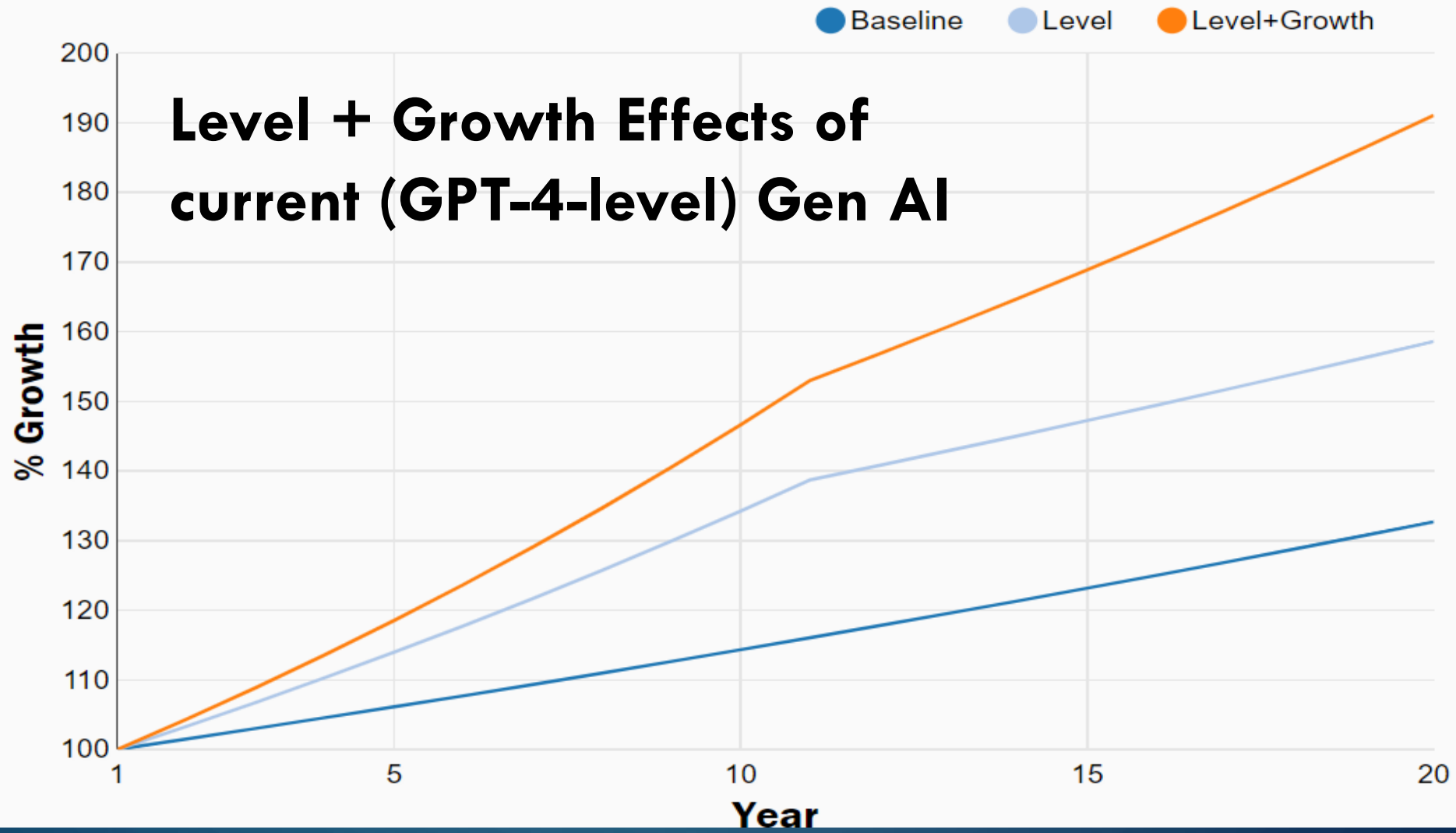
December 2024 Update of

Generative AI for Economic Research: LLMs Learn to Collaborate and Reason

Figure 2. Possible Growth Trajectories



Brookings report "Machines of mind: The case for an AI-powered productivity boom," with Martin Baily and Erik Brynjolfsson

MARKET CONCENTRATION IMPLICATIONS

Current market for AI is extremely competitive (unlike for chips) and growing rapidly

Concerns for competition:

- high fixed costs → natural monopolies
- risk of market tipping
- risk of vertical integration with existing monopolies

ultimately: advanced AI may also lead to concentration of political power

→ Paper on "Concentrating intelligence: scaling and market structure of artificial intelligence" (with Jai Vipra; forthcoming, *Economic Policy, 2025*)

PART III: FUTURE SCENARIOS

FUTURE SCENARIOS

Scenarios with > 10% probability:

I) Business as usual: productivity boost akin to internet boom

II) AGI within 10-20 years: gradual advancement towards AGI

III) AGI within 2-5 years: rapid advancement in coming years

→ See "Scenario Planning for an A(G)I Future" (IMF F&D Magazine)

ECONOMIC IMPLICATIONS OF AGI

AGI & robots can perform all cognitive and physical task humans can perform

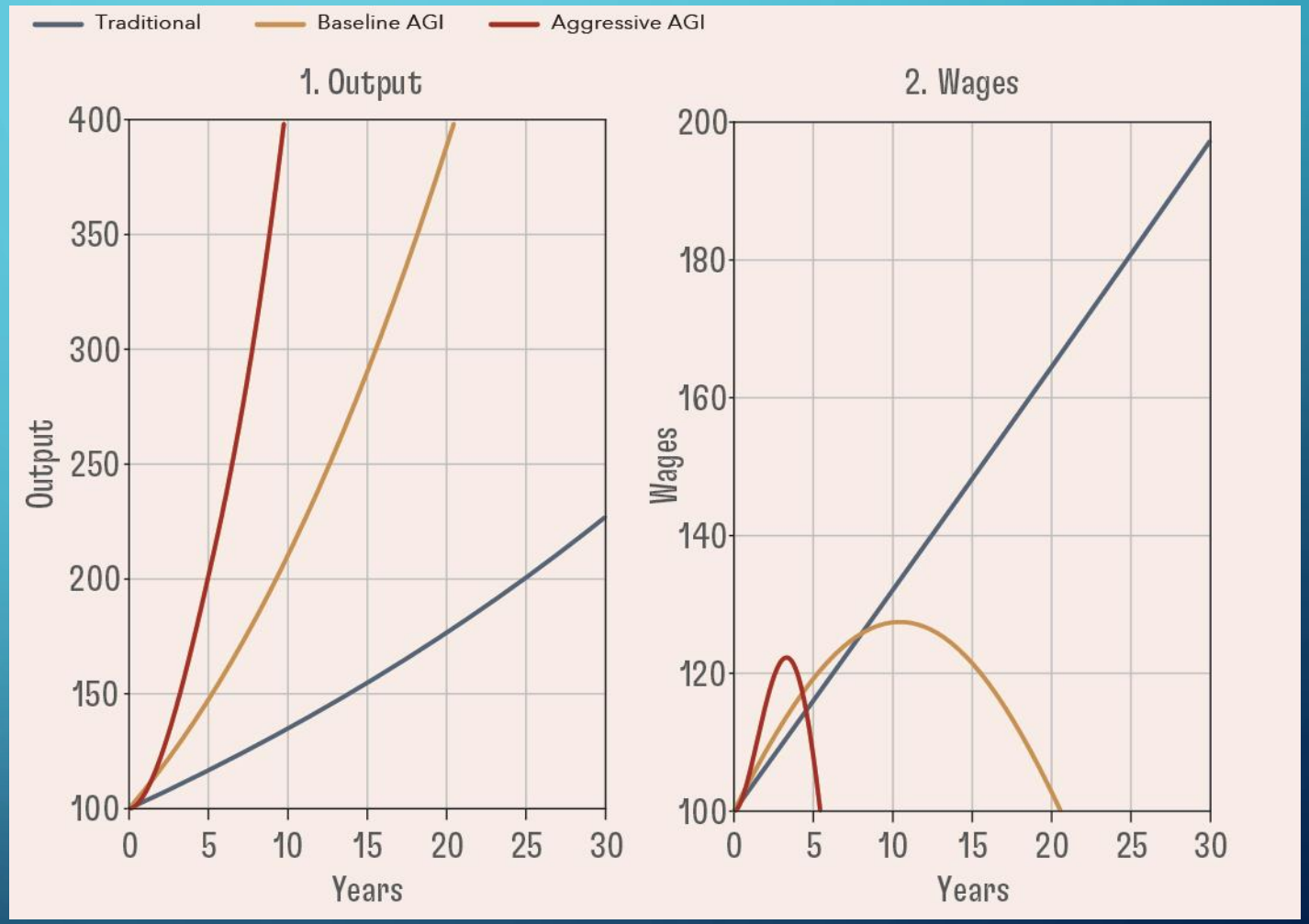
Two main implications:

1. Labor is no longer a bottleneck to output expansion
2. Labor loses its special status

IMPACT ON OUTPUT & WAGES

Rapid advances towards AGI would

- turbo-charge growth
- but depress wages



REMAINING ROLES FOR LABOR POST-AGI

TEMPORARY TECHNICAL AND SOCIAL BARRIERS

- Slow diffusion
- Trust
- Implicit knowledge
- Laws and regulatory delays

FUNDAMENTAL HUMAN-CENTRIC ASPECTS

- Authenticity of human connection
- Human identity in sports and arts
- Religious beliefs and practices
- AI alignment and oversight

BUT: Shift from humans to AI and robots as primary economic drivers

PART IV: POLICY IMPLICATIONS

ROLE OF ECONOMICS IN PREPARING FOR THE AGE OF AI

1) Understand the economic forces driving the AI transformation
2) Forecast the economic effects of the AI transformation
3) Help prepare economic policies for the AI transformation

EIGHT KEY CHALLENGES FOR ECONOMIC POLICY

1. Inequality and income distribution
2. Education and skill development
3. Rethinking macroeconomic policy frameworks

} will only cover these

4. Social and political stability
5. Antitrust and market regulation
6. Adapting intellectual property frameworks
7. Environmental implications
8. Global AI governance

→ "Economic Policy Challenges for the Age of AI," NBER WP 32980, Sept. 2024

1. INEQUALITY AND INCOME DISTRIBUTION

- Potential for unprecedented levels of income concentration
- Benefits of AGI may accrue primarily to capital owners

→ Rethinking income distribution/social insurance not tied to work

- Proposal of a "Seed UBI (Universal Basic Income)"

→ Challenge most severe for global income distribution

Fundamental question: Do humans need work if they can't earn a living from it?

2. EDUCATION AND SKILL DEVELOPMENT

Shifts in demand and supply of education:

- Economic value of education will decline
- Civic value will endure
- AI-driven alternatives for personalized learning

→ Declining demand for skills & traditional education

- Shift from cognitive labor to capital investments in AI

3. RETHINKING MACROECONOMIC FRAMEWORKS

- Rethinking aggregate demand management (eg Phillips curve)
- Adapting monetary policy frameworks
- Shifting fiscal policy and revenue sources
- Managing potential rapid shifts in productivity
- Redefining economic indicators and measurements

CHALLENGES OF IMPLEMENTATION

- Rapid pace of development
- Consensus between public and private sector interests
- Institutional inertia / new processes required
- Sectoral regulation / legal frameworks (eg in medicine, law, education, etc)
- Environmental considerations

PART IV: AI IN FINANCIAL MARKETS

AI IN FINANCIAL MARKETS

"You can see the future first in finance"

→ financial sector work is cognitive and has always been at the forefront of automation

→ we already have lots of experience with automated agents & their risks

Two points of concern:

(i) Advanced AI agents & AGI will aggravate existing risks

(ii) disruption in the rest of the economy may trigger disruption in financial system

See **Intelligent financial system: how AI is transforming finance** (BIS Working Paper No 1194, June 2024, with Aldasaro, Gambacorta, Shreeti and Stein)

CURRENT PHASE: AI AGENTS IN FINANCE

AI Agents in Finance

- Are currently receiving massive investments
- Will automate entire workflows [without human involvement]

Examples: trading agents, risk management agents, robo-advisors, credit risk analysis agents, loan approval systems, securitization agents, debt collection agents, scamming agents, etc.

Opportunities: productivity gains, reduced biases

Challenges: cybersecurity, alignment & oversight of AI, including by regulators

FINANCIAL STABILITY IMPLICATIONS

→ **Automating Financial Instability**

- first example: 1987: automated portfolio “insurance”
- AI agents are:
  - faster
  - more opaque
  - may be more uniform/correlated

UPDATING FINANCIAL REGULATION FOR THE AGE OF AI

- Proactive regulation crucial to mitigate risks
- Key principles: transparency, accountability, fairness, safety, oversight

  → EU's Assessment List for Trustworthy Artificial Intelligence (EU ALTAI), US NIST AI Risk Management Framework

- Operationalize principles across the AI lifecycle:
  - Design: governance guidelines, technical documentation
  - Deployment: pre-deployment checks, incident reporting
  - Monitoring: economic impact assessment, public engagement
- International coordination essential, given cross-border implications of finance

FINANCIAL STABILITY RISKS FROM REAL DISRUPTION

Scenario planning needs to consider a new set of financial risks:

1. Devaluation of labor, esp skilled → Risk of consumer defaults
2. Obsolescence of traditional businesses → Corporate revenue disruption
3. Interest Rate Surge → Deterioration in credit quality
4. Government Revenue Losses → Threatened debt sustainability
5. International "Intelligence Divide" → Severe terms-of-trade losses
6. Political Instability → Further undermining of financial stability

SCENARIO PLANNING: IT'S CRUNCH TIME

If you knew that AGI will be achieved in 2 years,

- What do we need to understand better?
- What should your organization do now?
- What policies should we have in place in two years?