

Brandeis

INTERNATIONAL
BUSINESS SCHOOL

AI AND FINANCIAL STABILITY RISK: IS THIS TIME DIFFERENT?

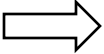
Stephen G. Cecchetti

www.moneyandbanking.com

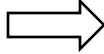
Technology is the key to rising standards of living



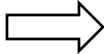
Metal coins
Ephesus 650 BCE



Paper money
China 1024 CE



Debit card 1966 CE



Apple Pay 2014 CE

Payments: cheap, fast, resilient, secure

What about AI?

- Potential benefits
 - Lowers cost and improves access
 - Faster and higher quality services
 - Improves oversight
- Possible risks
 - Destabilizes the financial system
 - Malicious uses
 - Objectives conflict with those of society

HAL 9000

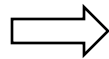
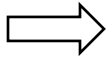
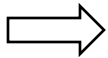
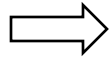
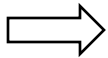
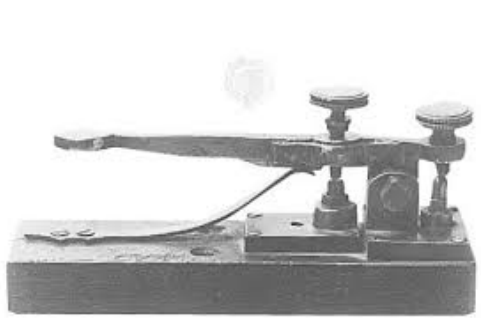


From 2001: A Space Odyssey, 1968.

Will AI destroy mankind?

- The Fermi Paradox:
High likelihood of advanced extraterrestrial life, but no evidence
- One resolution:
The technology needed to colonize other planets destroys us before we can use it.
- Is AI that technology?
- Will AI achieve self-awareness and destroy us?

The positive role of technology



Cheaper

Faster

Greater access

Some recent innovations in finance

Conceptual advances

(Software)

- Credit cards (1950s)
- Index funds (1960s)
- ATMs (1960s)
- Options pricing (1970s)
- Pass-through
and tranching (1970s)
- RTGS (1980s)
- Spreadsheet (1980s)
- Blockchain ? (2000s)

IT improvements

(Hardware)

- Computer (1940s)
- Fiber optics (1950s)
- Internet (1960s)
- Mobile phone (1970s)
- Personal computer (1980s)
- Smart phone (1990s)
- Cloud computing (2000s)

Note: Dates of initial invention are in parentheses.

Positive effects of innovation on finance

- Cheaper, faster, and greater access
- Allows measurement and pricing of a broader range risks
- Increases range of available securities (e.g. derivatives, fund shares)
- Increases volume of transactions
- Increases settlement speed reducing counterparty risk & spillovers
- Improves ability to monitor and mitigate vulnerabilities
- Improves security

But financial innovation creates financial stability risk

Examples:

- Derivatives: margin calls that lead to fire sales
- Securitization: mispricing and interconnections
(chains create principal-agent problems)
- Algorithmic trading: flash crash

The system is already unstable

- Banking Crises:
 - 150 countries
 - 1970 to 2017
 - 155 banking episodes
- Impact of banking crises:
 - Median GDP loss: 25%
(3 yrs, relative to trend)
 - Median fiscal cost: 9% of GDP
(related to restructuring of the financial sector)

Source: Laeven and Valencia, Systemic Banking Crises Revisited, 2018.

What threats could AI pose to finance stability?

- Existing threats
 - Does AI intensify existing threats?
 - Are our tools adequate to address any intensified threats?
- New threats
 - Are there any new threats?
 - Do we have tools to address them?

What is AI?

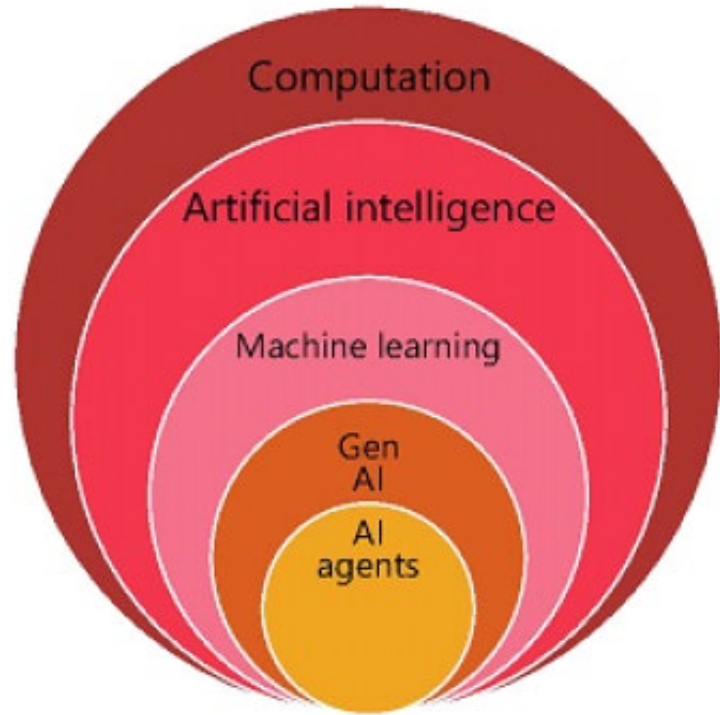


Figure 1: Decoding AI

Source: [Aldasoro, et.al., BIS June 2024.](#)

- AI encompasses many technologies
- What is new is the ability to
 - Process unstructured data (text, images, and sound)
 - Synthesize large amounts of data
 - Interact with people

Definition of AI in Eurostat survey

Artificial intelligence (AI) refers to systems that exhibit intelligent behaviour by analysing their environment and with a degree of independence taking actions to achieve certain goals.

AI uses technologies such as text-mining, computer vision, machine learning and deep learning.

Artificial intelligence systems can be purely software-based, e.g.:

- *business virtual assistants (chatbots) based on natural language processing;*
- *speech and face recognition systems based on computer vision or speech recognition systems;*
- *machine translation software;*
- *data analysis based on e.g. machine learning;*

or embedded in devices, e.g.:

- *autonomous robots for warehouse automation systems or production assembly operations;*
- *autonomous drones for production surveillance or package handling, etc.*

Source: Eurostat, [Questionnaire on ICT usage in enterprises 2023](#).

Some possible uses of AI in finance

- Retail investors

- Asset allocation
- Saving & retirement decisions
- Access

- Institutional investors

- Asset choice
- Timing trades
- Risk management

- Financial institutions

- Resource allocation
- Credit assessments
- Model development & validation
- Compliance & audit

- Authorities

- Improve monitoring
- Facilitate stress testing
- Simulate large network models
- Aid monetary policy decisions

Some possible uses of AI in finance

- Retail investors

- Asset allocation
- Saving & retirement decisions
- Increase access

- Institutional investors

- Asset choice
- Timing trades
- Risk management

- Financial institutions

- Resource allocation
- Improve credit assessments
- Model development & validation
- Compliance & audit

- Authorities

- Improve monitoring
- Facilitate stress testing
- Simulate large network models
- Aid monetary policy decisions

We don't know what people are doing now!

Key principles

- Financial institutions are technology companies
 - The 8 US GSIBs spend ~\$60 bn/yr on tech \Rightarrow US banking system spends >\$100bn
 - EU spending is probably only about half that
- **By the time authorities see it, the private sector has been doing it for years**
- The official sector is in an arms race that it will lose

Existing sources of systemic risk & regulatory responses

Sources of systemic risk

- Runs
- Fire sales
- Common exposure
- Procyclicality
- Operation/Cyber risk

Regulatory responses

- Capital & liquidity requirements
- Stress tests
- Concentration limits
- Required disclosure
- Central clearing
- Central bank lending

What *AI* says about financial stability risks from AI

- Model risk and opacity
 - Data limitations
 - Black boxes
 - Excessive dependence
(w/o human oversight)
- Increased interconnectedness
- Faster transmission of shocks
- Cybersecurity vulnerabilities
- Concentration of platforms
- Unpredictable interactions
- Exploitation by malicious actors
 - Trigger bank runs
 - Create market crashes
- Regulatory Risks
 - Rapid adoption by private sector
 - Authorities need to build expertise
 - Traditional approaches are insufficient

Source: perplexity.ai with the prompt “What are the financial stability risks from AI?”

What *AI* says about financial stability risks from AI

- Model risk and opacity
 - Data limitations
 - Black boxes
 - Excessive dependence (w/o human oversight)
- Increased interconnectedness
- Faster transmission of shocks
- Cybersecurity vulnerabilities
- Concentration of platforms
- Unpredictable interactions
- Exploitation by malicious actors
 - Trigger buy runs
 - Capital market crashes
- Regulatory Risks
 - Rapid adoption by private sector
 - Authorities need to build expertise
 - Traditional approaches are insufficient

NONE OF THESE ARE NEW!

Source: perplexity.ai with the prompt “What are the financial stability risks from AI?”

What *authorities* see as the financial stability risks from AI

- Complexity and opacity \Rightarrow poor understanding, misaligned objective
- Uniformity and herding \Rightarrow risk model monoculture
- Interconnectedness \Rightarrow difficult to map
- Speed \Rightarrow hard to intervene in a timely way
- Malicious uses \Rightarrow attempts to disrupt and destabilize the system

None of these risks are new

- **Complexity and opacity**
People are complex, black boxes with bugs (errors are difficult to detect)
- **Uniformity and herding**
We all learn the same finance theory and have the same software on our computers
- **Interconnectedness**
We are unable to map the complex web of relationships in the financial system
- **Speed**
High-frequency trading started when NASDAQ developed an electronic platform in 1983
- **Malicious uses, manipulation and accidents**
Cyber threats have been around as long as computers

How AI may intensify existing systemic risks

- Increases common exposure & procyclicality
- Increases market speed under stress
- Increases concentration risk
- Further limit model diversity
- Increases market manipulation & cyber risk
- Reduces ability for human intervention
- Increases blind trust, reducing oversight
- Increases gap between private and official sectors

Respond by reinforcing current tools

- Capital & liquidity req.
- Stress tests severity
- Concentration limits
- Model validation req.
- Disclosure
- Resilient infrastructure
- Liquidity backstops
- Develop supervisory AI?

How can we regulate, supervise, and sanction code?

Example: High costs AI create barriers to entry

- Training Meta's Llama 3
 - 70 billion parameters trained on 15 tr tokens
 - Used 16,384 GPUs (\$9bn for hardware)
 - Training produced 1,900 metric tons of carbon
- OpenAI/ChatGPT per day (estimates)
Cost \$100,000, 10mn queries, 0.4 tons (air travel >2mn tons/day)
(Just getting started: 8.5 bn Google searches per day.)
- Costs are increasing
 - ChatGPT-6 could cost \$100bn to train
 - Global data centers will require trillions of dollars
 - Will tech firms build nuclear reactors to meet energy demands?

Is it winner takes all?

Remedy:
Competition policy?
Require access?

Example: AI may intensify existing data problems

- Scarcity
- Biases and errors
- Misinformation can become training data
- Illusion of precision
- Legal and privacy risks
- Free rider problems reduce quality

No single remedy

Clear needs:

Protect data ownership

Operator humility

(unenforceable)

Can we license and certify AIs as we do for people?

Does AI create *new* risks to financial stability?

- Will AIs stop responding to human commands?
- Will AIs alter objectives from those it is given?
- Will AIs act maliciously on its own?

Not just financial
stability risks!

Enormous externalities \Rightarrow we cannot trust firms or individual jurisdiction

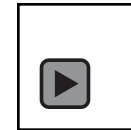
(Commitments to “responsible scaling policies” are not going to work)

NotebookLM

I created a folder in Google's NotebookLM with 20 papers and reports.

I asked it to generate a podcast that focuses on Financial Stability and AI.
The result is 6:30 minutes long.

Here is a clip:



Brandeis

INTERNATIONAL
BUSINESS SCHOOL

AI AND FINANCIAL STABILITY RISK: IS THIS TIME DIFFERENT?

Stephen G. Cecchetti

www.moneyandbanking.com