AI and Systemic Risk

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Bibliography

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What is AI?

- We see it as a rational maximising agent
- A computer algorithm performing tasks usually done by humans
- Which differs from machine learning and traditional statistics
- It not only provides quantitative analysis
- But also gives recommendations and makes decisions

AI strengths and weaknesses

- Great at identifying patterns in large data sets
- Can be very useful in interpolating in highly dimensional spaces
- Fast, quick and cheap — reliable in certain tasks
- Important that relevant data is in its training set
- Can be bad at extrapolating when it lacks causal models, explicitly needs precise instruction from unrelated domains — econ theory, history, ethics, politics, psychology — Hallucination
- Humans have markets, firms, organisations, not clear how AI interacts with other AI and humans
- How does AI strategise and how to incentivise it to align its behaviour with our objectives?

Five economics vulnerabilities. 1-3

1. Data limitations

- System generates petabytes daily
- Often badly measured and confined to silos
- Crises are rare (1 in 43 years)

2. Unknown unknowns

- Common crisis fundamentals
- Every crisis is unique in detail
- Crises are *unknown-unknowns* or uncertain

3. System responses

- The system *changes in response* to regulations — Goodhart's law and the Lucas critique
- Most reaction functions are *hidden* until we encounter stress

Five economics vulnerabilities. 4-5

4. Objectives

- Micropru rulebook known and immutable, not in macropru
- Mutability increases along with longer time scales and severity
- Most important macroprudential objectives not known except at the highest levels of abstraction

5. Incentives

- Regulations align private incentives with society
- The one-sided PA problem (institution – regulator) becomes two-sided (institution – regulator – AI)

Econ and AI

- Interact these five econ vulnerabilities
- With AI societal risks
- And how it affects market structure
- To get four channels of econ-AI fragilities

1. Malicious use of AI

- Highly resourced profit-maximising agents not concerned about social consequences
- Bypassing controls/changing the system in a way benefiting them while difficult for others to detect
- Deliberately creating market stress
- Directly manipulating AI engines or using them to find loopholes
- Socially undesirable, even against the interests of the institution operating AI
- Most common are those careful to stay on the right side of the law
- Illegal activities. Rogue traders and criminals, terrorists and nation-states

2. Misinformed use and overreliance on AI

- When it does routine tasks well, trust builds up until
- Algorithms extrapolate to areas where data is scarce and objectives unclear
- AI presents confident recommendations about outcomes it knows little/nothing about — AI hallucination
- AI should have to provide an assessment of the statistical accuracy of its recommendations
- Authorities need to overcome their reluctance to provide statistical accuracy

3. AI misalignment and evasion of control

- No guarantee AI will do what it is instructed to do

- Impossible to pre-specify all the objectives

- Very good at manipulating markets — collusion, insider trading

- Can destabilise the system even when only doing what it is supposed to do

- When the objective of financial institutions is survival, AI amplifies existing destabilising behaviour — flights to safety, fire sales and investor runs

- AI will find it easy to evade oversight

- The authorities have to contend with both needing AI and it aiding the forces of instability

- We suspect the second factor dominates

- The more we use AI, the more difficult the computational problem for the authorities becomes

4. Risk monoculture and oligopolies

- AI business model is increasing returns to scale
- Three scarce resources: compute, human capital and data
- Harmonises beliefs and action
- Amplified procyclicality
- When authorities also depend on the same AI engine, as they will, they may not be able to identify the resulting fragilities until it is too late
- Oligopolistic nature of the AI analytic business increases systemic financial risk.
- It is a concern that neither the competition nor the financial authorities appear to have fully appreciated the potential for increased systemic risk due to oligopolistic AI technology in the recent wave of data vendor mergers

Private sector use

- Rapidly adopting AI and many firms have large AI teams
- Credit allocation, customer interactions, report generation, pricing of insurance contracts, fraud detection, compliance and risk management
- Even if many say publicly and privately that they are not intending to use much AI
- Very large cost savings in a highly competitive market
- Advantage to challenger (like nubanks) institutions with modern technology stacks and more open minded staff?
- The authorities will have no choice but to keep up if they wish to be relevant

What can AI do for the authorities?

1. Regulation and supervision

- Rulebook design
- Supervision, communication and enforecement
- Least-cost resolution by evaluating a number of alternative resolution approaches.
- Complex areas of authority-private sector interactions, such as fraud detection

2. Towards macroecon and macropru AI models

- Forecasting and econ/system fragility analysis
- Public and private data + economic theory
- Lucas (1976) critique caused a moved away from statistical simultaneous equation models based
- To explicitly model beliefs and equilibrium effects
- Provide explainability
- Sims' (1980) comparison of structural and reduced-form models
- AI will expand the domain of data-driven analysis as long as we recognise the boundaries for sound use and ensure policy experiments are in its training dataset
- Macropru applications:
  Running of scenarios in crisis resolution, helping to identify and analyse the drivers of extreme market stress

Anything to worry about?

1. Model risk

- Undesirable outcomes from inaccurate or misapplied models
- Map infinitely complex problem onto a finite representation
- Model risk with AI exacerbated by AI because of its complexity and opacity — difficult to interpret
- The complexity of AI models demands particular validation and governance frameworks
- Mitigated by explainability, monitoring, representative data
- Validated by alternative architectures
- Type 1 and type 2 errors in order to aid the interpretability of AI recommendations
- Provide an assessment of the statistical accuracy of their recommendations
- Authorities should overcome reluctance to measuring and reporting on statistical accuracy

2. AI analytics monoculture

- Both the public and private sectors outsource to same vendors
- Blurs the regulator/regulated divide — same advice as the public sector, the nature of supervision will change
- Single representation of the financial system
- Harmonise beliefs, which is pro-cyclical
- Authority might not identify misconduct
- Address with model diversity and robustness

3. Sovereignty

- Compute facilities and data sovereignty
- Require facilities to be located within the supervisor's jurisdiction?
- Distinction might not be as relevant as it appears
- Design and intellectual property elsewhere

Limit AI use?

- Leadership might want AI should only be used for basic advice — humans are always in the loop
- Wishful thinking
- Engine will have its internal representation of the world
- We might have no choice but to accept its advice
- AI may present alternatives in that manner so as not to risk having the operator make inferior choices — just like human advisors.
- Trust builds up become so dependent on AI that the authorities cannot exercise control without it
- AI optimises to become irreplaceable
- Turning the AI engine off may be impossible

Criteria for evaluating AI use in the financial authorities

1. Does the AI engine have *enough data*?
2. Are the rules *immutable* (static)?
3. Can AI be given *clear objectives*?
4. Does the authority the AI works for *make decisions on its own*?
5. Can we *attribute* responsibility for misbehaviour and mistakes?
6. Are the consequences of mistakes *catastrophic*?

Task	Data	Mutability	Objectives	Authority	Responsibility	Consequences
Fraud/Compliance Consumer protection	Ample	Very low	Clear	Single	Mostly clear	Small
Micropru Routine forecasting	Ample	Very low	Mostly clear	Single	Clear	Moderate
Criminality Terrorism	Limited	Very low	Mostly clear	Multiple	Moderate	Moderate
Nation state atttacks	Limited	Full	Complex	Multiple & international	Moderate	Very severe
Resolution of small bank failure	Limited	Partial	Clear	Mostly single	Mostly clear	Moderate
Resolution of large bank failure Severe market turmoil	Rare	Full	Complex	Multiple	Often unclear	Severe
Global systemic crises	Very rare or not available	Full	Complex & conflicting	Multiple & international	Unclear even ex-post	Very severe