AI-Powered Trading, Algorithmic Collusion, and Price Efficiency

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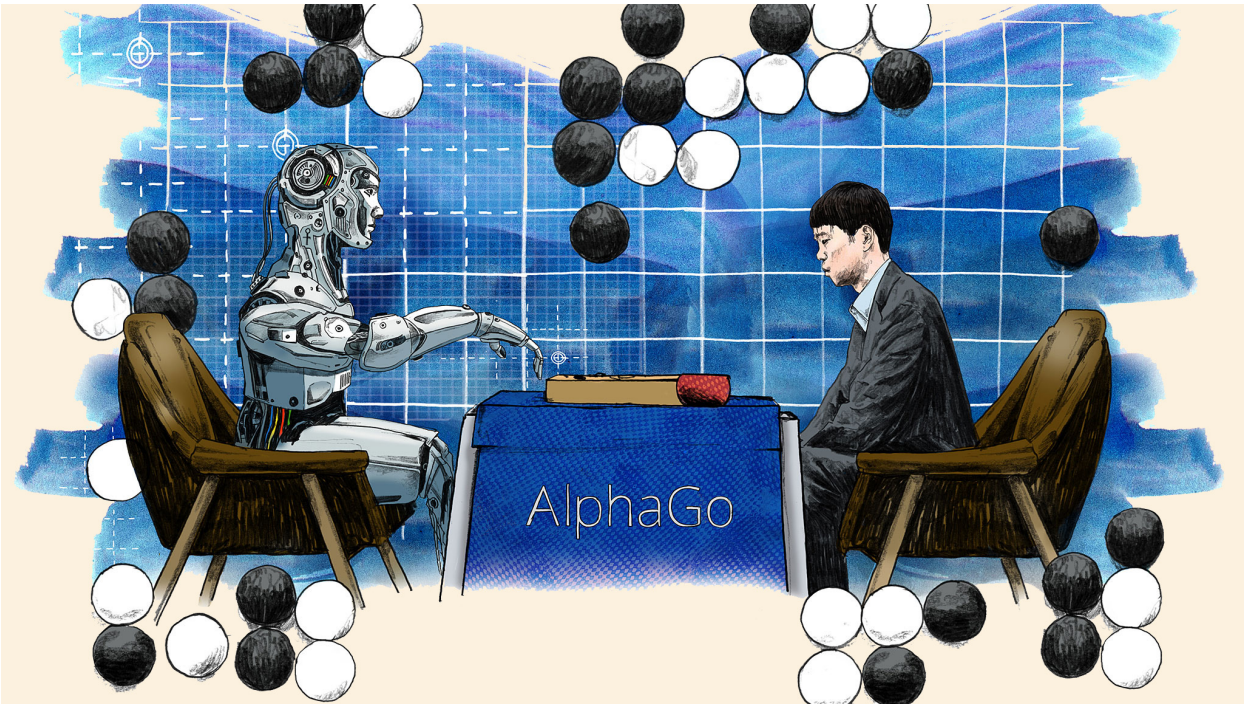
What is “AI-powered trading?”

AI-powered trading:

Algorithmic trading system **+ reinforcement-learning (“RL”) algorithms**

RL algo is a key approach of AI, and serves as the backbone of “AlphaGo”



Note: # possible legal moves ($\approx 10^{170}$) $\gg$ # atoms in the universe ($\approx 10^{80}$)

Capacity of RL-backed AI algos $\gg$ human cognitive capacity for specific tasks

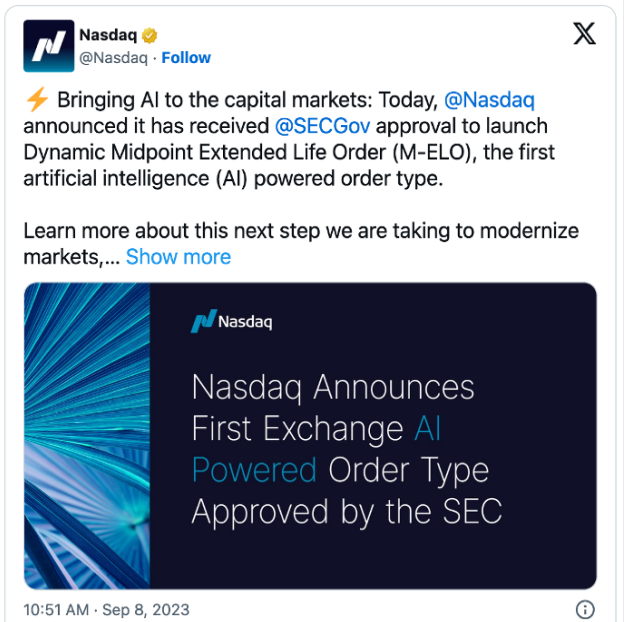
Rise of AI-powered trading in financial markets

SEC approved Nasdaq's AI trading system

- Using RL algos to facilitate AI trading

Other examples on AI trading execution:

- FX digital trading platforms (e.g., MetaTrader)
- RL-powered trading firms (e.g., XTX Markets, Kavout)
- Crypto trading platforms



AI pricing algos in e-commerce, gasoline, and housing rental markets

- "AI collusion" has emerged as a new potential antitrust challenge
- Definition: Autonomous self-interested algos learn to achieve and maintain coordination without agreement, communication, or even intention
- Lawsuits were filed, and congress was urged to reform Antitrust Law

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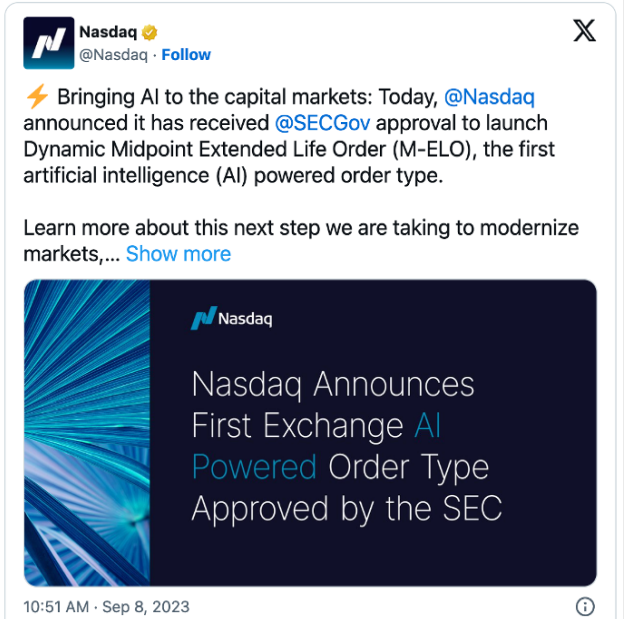

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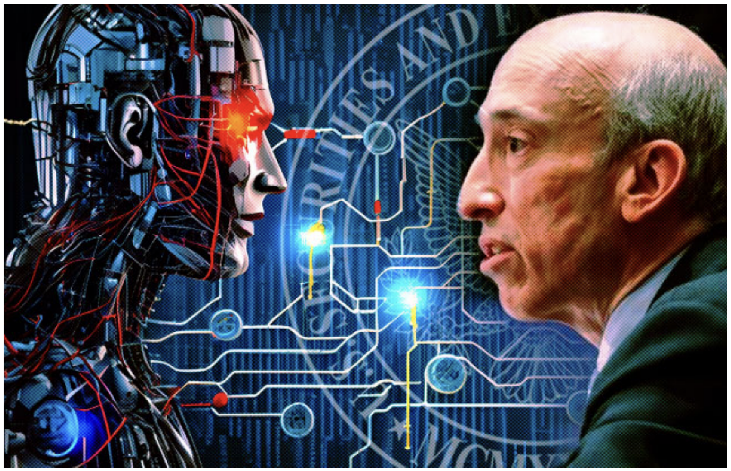
Risk of AI-driven market manipulation

SEC Chair, Gary Gensler, has warned that

"Financial market instability, or even a financial crisis, caused by AI is nearly unavoidable without regulation.

"Even if the humans aren't talking, the machines will start to have a sense of cooperation. We've already seen this in high-frequency trading."



Why is AI collusion particularly challenging for regulators?

AI collusion falls outside the scope of existing antitrust enforcement frameworks, which focus on

- The detection of explicit communication or evidence of shared intent

  This is emphasized by legal and economic studies (e.g., Harrington, 2018; Massarotto, 2025)

- The prevailing view: communication is vital for humans to sustain collusion

  This is supported by many case studies and experimental research on human tacit collusion

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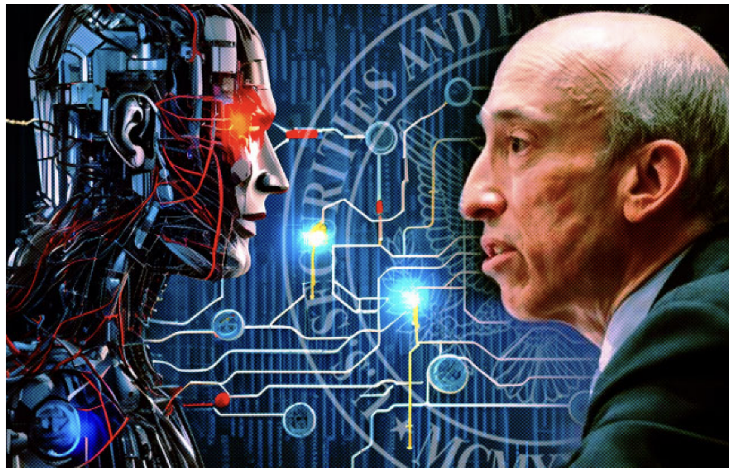

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Legal gap is particularly salient in financial markets

Financial markets differ from product markets in their role in the economy:

- They serve as a mechanism for aggregating information
- They facilitate price discovery, with market makers playing a central role
- They can be a source of systemic risk due to financial market instability

The boundary between illegal and lawful communication is often difficult to define or detect in financial markets:

- Illegal communication used to facilitate market manipulation
- Lawful communication used to enhance financial market stability

Question:

Is AI collusion without communication a blessing or a deeper sin?

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Impact of AI collusion on financial market stability

A blessing:

- AI arbitrageurs' collusion $\uparrow$ $\Rightarrow$ The risk of bubbles and crashes $\downarrow$
- AI funders' collusion $\uparrow$ $\Rightarrow$ Funding liquidity risk $\downarrow$ (e.g., the risk of runs $\downarrow$)
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A deeper sin:

- AI speculators' collusion $\uparrow$ $\Rightarrow$ The risk of bubbles and crashes $\uparrow$
- AI speculators' collusion $\uparrow$ $\Rightarrow$ Market liquidity $\downarrow$, funding liquidity risk $\uparrow$
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Dou_Goldstein_Ji (2025): "AI collusion" can robustly arise through two distinct mechanisms, undermining competition and market liquidity

Market liquidity $\downarrow$

$\xrightarrow{\text{Liquidity feedback loop}}$ Funding liquidity $\downarrow$ $\Longrightarrow$ financial instability $\uparrow$

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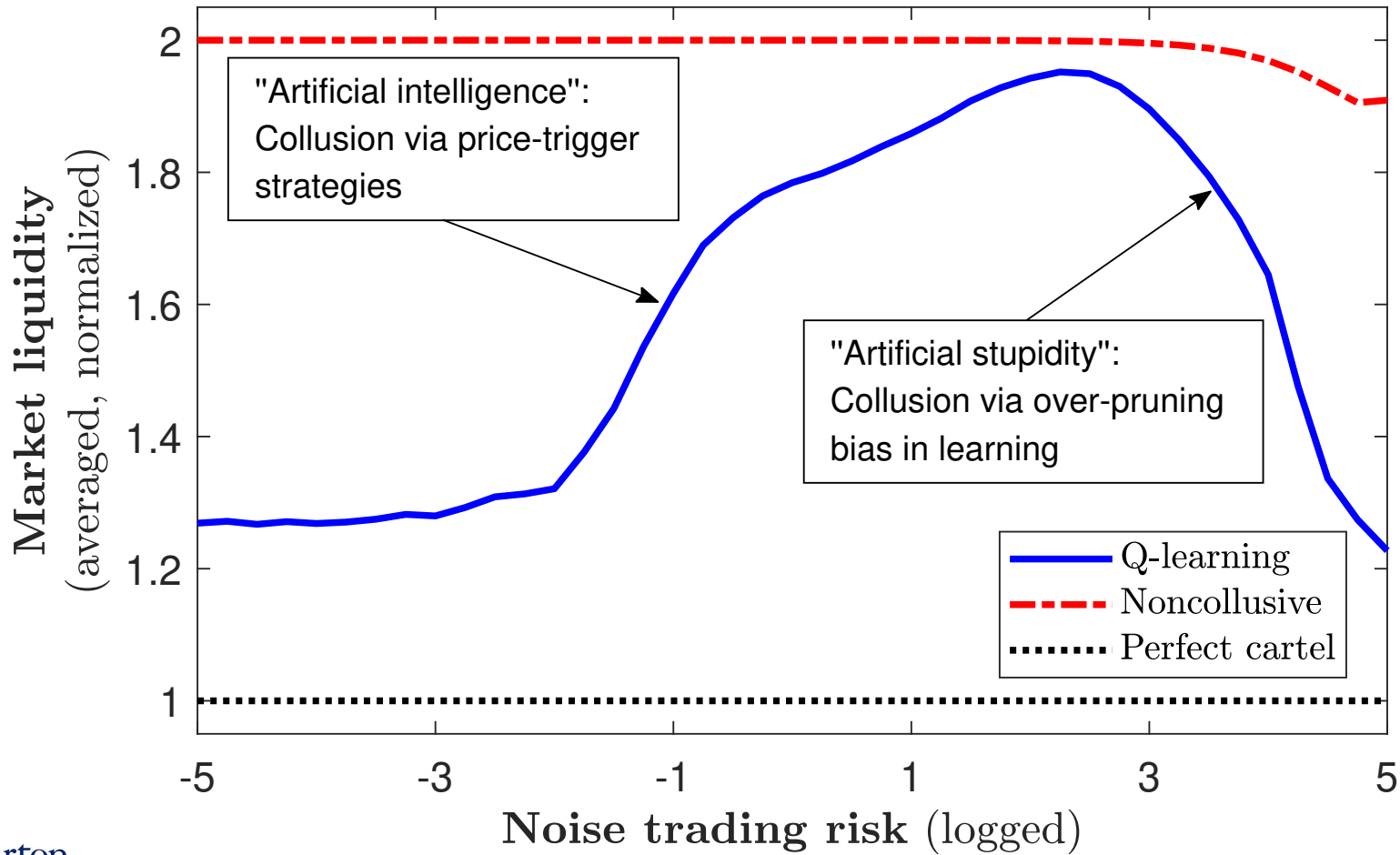
Two algorithmic mechanisms & their impact

"AI collusion" emerges without communication or intended codes

- Through price-trigger strategies (artificial "intelligence")
- Through over-pruning bias in learning (artificial "stupidity")



Insights & policy implications

An urgent need to study the algorithmic behavior (or "psychology") of machines (Goldstein_Spatt_Ye, 2021)

- Unlike humans, whose decisions reflect logic, emotion, and higher beliefs
- AI relies on pattern recognition and advanced optimization capabilities
- Existing frameworks grounded in human behavior are insufficient for analyzing AI equilibrium

Novel insights that lie outside established paradigms:

- AI $\Rightarrow$ behavior that resembles logical thinking and strategic reasoning
- AI $\Rightarrow$ behavioral distortions distinct from human biases

Regulatory challenges: Restricting algo complexity or memory capacity

- It may help deter price-trigger AI collusion
- It can unintentionally reinforce over-pruning bias AI collusion

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