

AI and Big Holdings Data: Opportunities for Central Banks

by Xavier Gabaix, Ralph Koijen, Robert Richmond, Motohiro Yogo

discussion by

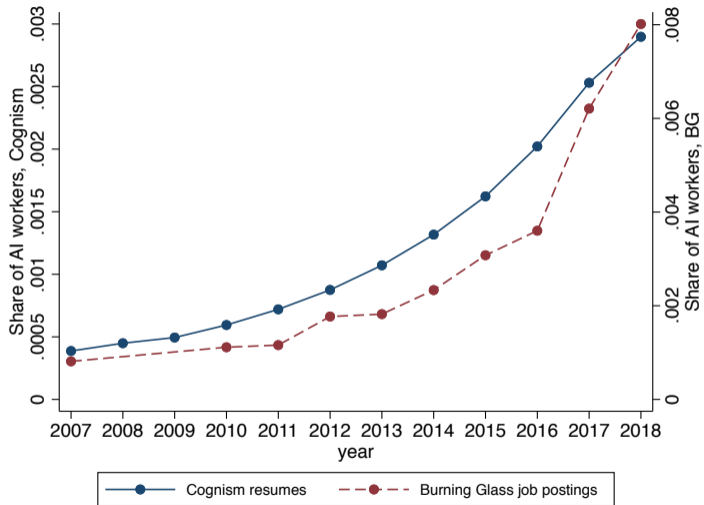
Tania Babina (Columbia, NBER, CEPR)

TaniaBabina.com & TaniaBabina on LinkedIn/X

Session 1: Opportunities and Risks from AI for Central Banks

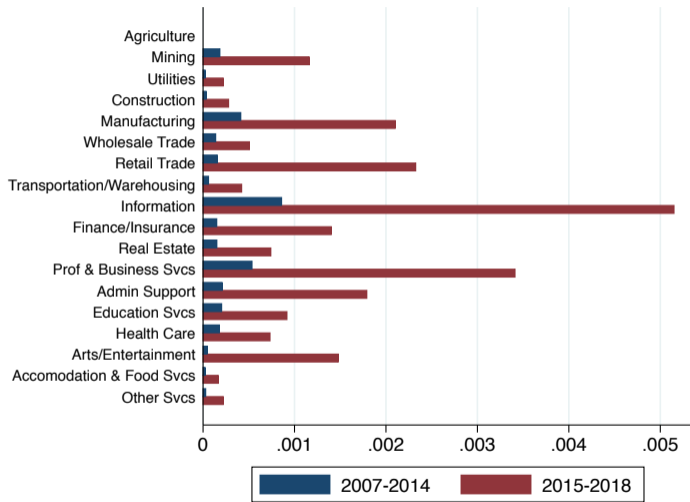
BIS, June 2024

Fast growth in AI-skilled human capital



Babina, Fedyk, He, Hodson (2024)

Fast growth in AI-skilled human capital across all industries



Babina, Fedyk, He, Hodson (2024)

How AI played an instrumental role in making mRNA vaccines

AI was key to making Moderna's COVID mRNA vaccine. Its role in mRNA therapeutics will rapidly grow in the coming years.

KEY TAKEAWAYS

● Years before Moderna created a highly effective mRNA vaccine against COVID, the company put into place AI systems to accelerate the research process. ● These systems allowed the company to ready its vaccine for human trials in just 42 days. ● AI machine learning models are set to further accelerate the research process, putting mRNA medicine into overdrive to the benefit of all.

Examples of AI use for product innovation: makes cars safer

Revolutionizing Road Safety: Role of Computer Vision in Vehicle Collision Prediction



Priyanka Kumari

Jan 18, 2024 • 7 min read



Examples of AI use for product innovation: helps with investing

Mo, an AI Chatbot Powered by Morningstar Intelligence Engine, Debuts in Morningstar Platforms

The beta version pairs Microsoft Azure's OpenAI Service with Morningstar's extensive breadth of independent investment research to provide summarized, conversational insights

CHICAGO, May 11, 2023 /PRNewswire/ -- [Morningstar, Inc.](#) (Nasdaq: MORN), a leading provider of independent investment insights, today launched a beta version of its generative artificial intelligence chatbot named "Mo" across [Morningstar Investor](#), [Research Portal](#), [Direct](#), and [Advisor Workstation](#) platforms. Powered by the Morningstar Intelligence Engine, a platform that pairs Morningstar's extensive investment research library with Microsoft's Azure OpenAI Service, Mo is designed

Artificial Intelligence: opportunities and risks for Central Banks

- Explosion in Artificial Intelligence (AI) investment over the past decade
 - ▶ Due to data accumulation, plunging computational costs, and methodological advances
 - ▶ AI: Machine learning (ML), computer vision (CV), natural language processing (NLP)
- AI in private sector
 - ① Inventors of AI: OpenAI (eg, chatGPT)
 - ② Users of AI: Moderna (eg, vaccine development)
- Economic research on AI relevant for Central Banks
 - ① Understanding economic impact of AI: growth, labor, financial stability, climate
 - ② Using AI methods in research: forecasting, supervision, communication, **policy evaluation (this paper!)**

Roadmap

- ① Understanding economic impact of AI: growth, labor, financial stability, climate
- ② Using AI methods in research: forecasting, supervision, communication, policy evaluation

Roadmap

- 1 Understanding economic impact of AI: growth, labor, financial stability, climate
- 2 Using AI methods in research: forecasting, supervision, communication, policy evaluation

1. Understanding economic impact of AI: growth

- Theory: How would AI affect **economic growth**?
 - ▶ Technological change is key driver of investment opportunities and economic growth (Romer 1990; Aghion and Howitt 1992)
 - ▶ AI might be a general purpose technology that typically generates broad-based growth (Agrawal, Gans, and Goldfarb 2019)
- Empirical evidence so far
 - ▶ Already observe AI's effect on growth of adopting firms and industries (Babina, Fedyk, He, Hodson 2024 (a); Rock 2023)
 - ▶ AI spurs growth mostly via **product innovation**: AI-investing firms have more product patents and trademarks, and updates to product offerings (Babina, Fedyk, He, Hodson 2024 (a))
 - ▶ But, so far, AI adoption is not wide-spread (10-15% of US firms), limiting the growth impacts of AI in aggregate

1. Understanding economic impact of AI: labor

- Theory: How would AI affect **labor**?
 - ▶ Early conceptual work disagreed on labor market implications of AI
 - ★ AI as automation predicted large labor displacement (Acemoglu and Restrepo 2019)
 - ★ AI as prediction technology emphasized ambiguous labor market consequences (Agarwal, Gans, and Goldfarb 2018)
 - ▶ AI occupational exposure measures predicted mostly replacement of *high-skilled* labor (Felten, Raj, Seamans 2018; Brynjolfsson, Mitchell, Rock 2018; Webb 2020): in contrast with earlier technologies (software, robots) that mostly replaced *low-skilled* labor
- Empirical evidence so far
 - ▶ In contrast to the predictions of automation effects of AI on labor, AI-investing and AI-inventing firms increase employment of, specifically, *high-skilled* workers (Babina, Fedyk, He, Hodson 2024 (b); Chen and Wang 2024)
 - ▶ Emerging work suggests that generative AI can improve worker productivity across the skill distribution (Brynjolfsson et al 2023; Casal and Kessler 2023; Agarwal et al 2023; Noy and Zhang 2023)

1. Understanding economic impact of AI: financial stability

- Theory: How would AI affect **financial stability**?
 - ▶ AI investments can lead to increased financial fragility and elevated systematic risk (Financial Stability Board 2017)
 - ★ AI leads to shared reliance on the same datasets, cloud computing providers, and similar models tested on short-term time series
 - ★ This common reliance can lead to crash risk during market downturns
 - ▶ AI could undermine financial stability because of malicious use and misinformation (Danielsson and Uthemann 2024)
- Empirical evidence so far
 - ▶ We find that indeed firms' AI investments are associated with increased systematic risk (Babina, Fedyk, He, Hodson 2024 (c))
 - ▶ Increase in systematic risk is mostly driven by days when stock market goes up (not down)
 - ▶ This upside risk captures **positive** growth option value of AI investments

1. Understanding economic impact of AI: climate risk

- Theory: How would AI affect **climate risk**?
 - ▶ AI models require a lot of computing power and energy to train
 - ▶ OpenAI's CEO Sam Altman: limiting factor to AI development is computing power
- Empirical evidence so far
 - ▶ “Progress [in deep learning] is rapidly becoming economically, technically, and environmentally unsustainable” (Thompson, Greenewald, Lee, Manso 2023)
 - ▶ Main AI models could be regulated as public utility sector

Roadmap

- 1 Understanding economic impact of AI: growth, labor, financial stability, climate
- 2 Using AI methods in research: forecasting, supervision, communication, policy evaluation

2. Using AI methods in economic research relevant for Central Banks

- **Forecasting:** economic activity, markets, inflation dynamics
- **Supervision:** summarize bank reports, pick bank managers, find weaknesses in bank financial statements
- **Communication:** communicating policy changes (Wei Jiang et al 2023; Hansen, Kazinnik 2023)
- **Policy evaluation:** use AI methods to understand policy effectiveness
 - ▶ This paper uses asset demand systems for policy evaluation
 - ▶ This paper uses AI methods in clustering together companies that are more similar according to investors holding them

Use of asset demand systems for policy evaluation

- Usual assumption in asset pricing: investors are very sensitive to asset price changes (investors' price elasticity is high)
- Ralph and his co-authors' earlier work shows that this assumption is inaccurate
 - ▶ Very intuitive: investors' asset demand depends on net costs and benefits of holding an asset
 - ▶ Babina, Jotikasthira, Lundblad, Ramadorai (2021) show that local taxes create investor clienteles for US municipal bonds with important implications for asset prices
- Asset demand systems framework incorporates asset price (in)elasticity
 - ▶ Role of AI: cluster firms that are more similar according to investors holding them
- Very important consideration from policy perspective: why elasticity is what it is
 - ▶ Determines policy effectiveness and its costs: efficient vs inefficient from welfare perspective
 - ▶ Example: regulatory capital requirements push banks to hold certain assets. Banks' willingness to sell those assets and substitute into [whatever Central Bank wants them to buy] is not just determined by return expectations, but by capital regulations
 - ▶ From policy perspective, crucial to understand what is the price elasticity in a given context and why it is high or low

Thank you!