AI in finance

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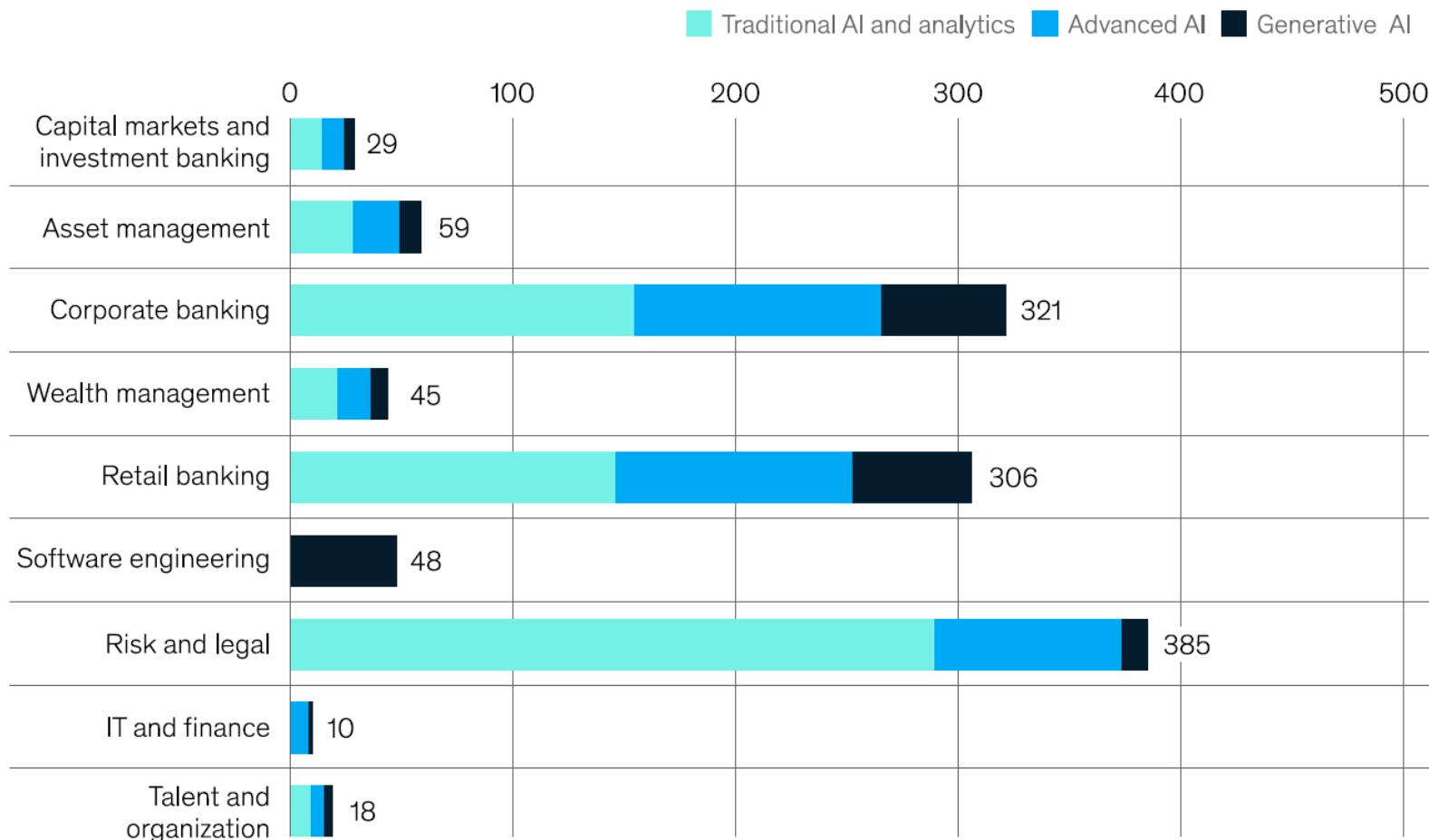G7 Seminar on AI, Florence

March 21, 2024

Outline

- Main uses of AI in finance

- FinTech and lending

- Algorithmic trading and market stability

- Systemic risk

- Policy tradeoffs

Main uses in finance

- AI impact will happen in all industry sectors, but largest in banking/finance, high tech and life sciences
- Banking/finance is intensive in information processing
  - Banking facing a deep reestructuring
- Hard information on the rise (substitute for collateral) with the use of AI/ML using big data
  - Credit allocation (screening and monitoring)
  - Risk management
  - Compliance (AML, KYC, fraud)
  - Asset management (robo-advising)
  - Trading
  - Supervision

Generative AI has the potential to add new value to banks- because of increased productivity (between $200 bn and $340 bn annually)

Value created by AI at stake by segment and function,[1] $ billion

Legend: ▮ Traditional AI and analytics ▮ Advanced AI ▮ Generative AI

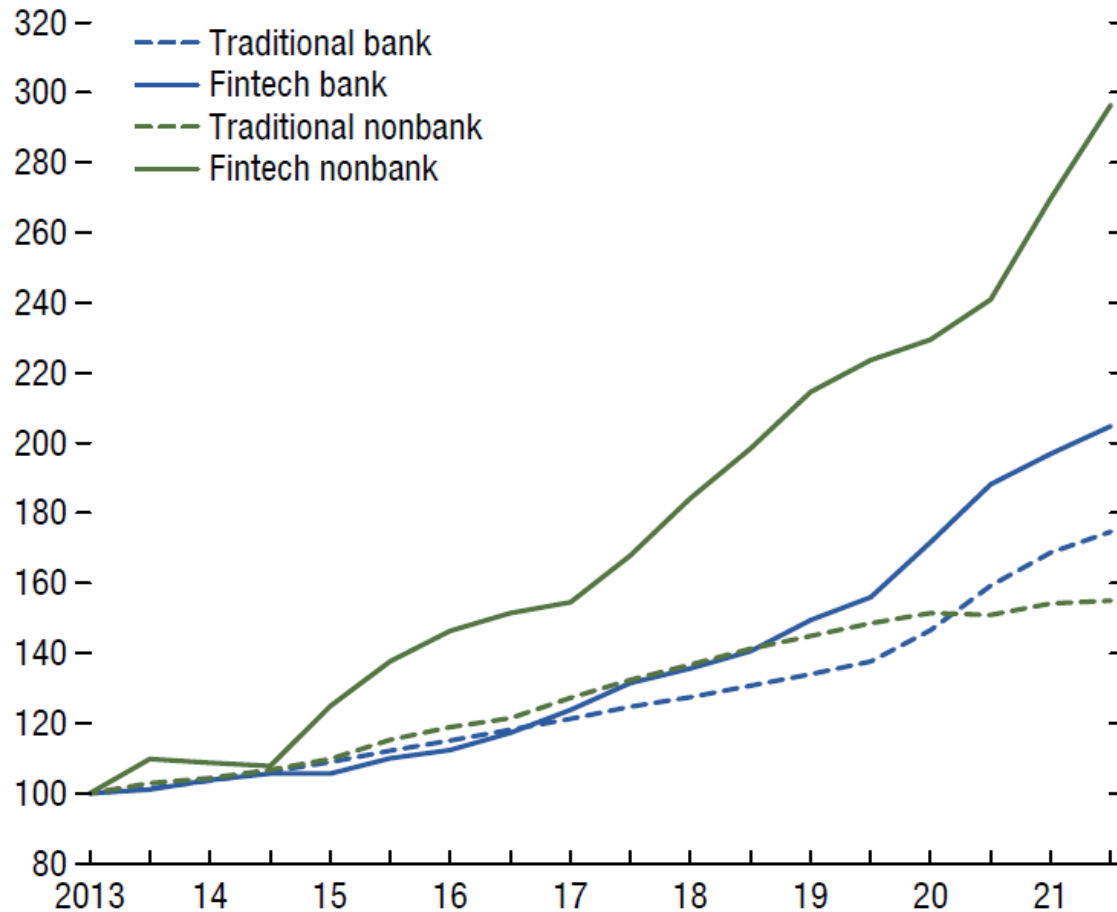| Segment/Function	Value ($ billion)
Capital markets and investment banking	29
Asset management	59
Corporate banking	321
Wealth management	45
Retail banking	306
Software engineering	48
Risk and legal	385
IT and finance	10
Talent and organization	18

[1]Assumes 0% overlap of traditional AI and generative AI (genAI assume lower end of value stake), top-down estimation based on projected growth and value pools

Source: McKinsey (2023). *Capturing the full value of generative AI in banking.* Generative AI in banking and financial services – McKinsey Financial Services

Impact of FinTech/AI in lending markets: consequences for investment, bank stability and welfare

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Fintech lenders' asset growth

1. Growth of Assets of Fintech Lenders
(2013:H1=100)

Legend:
- Traditional bank (dashed blue)
- Fintech bank (solid blue)
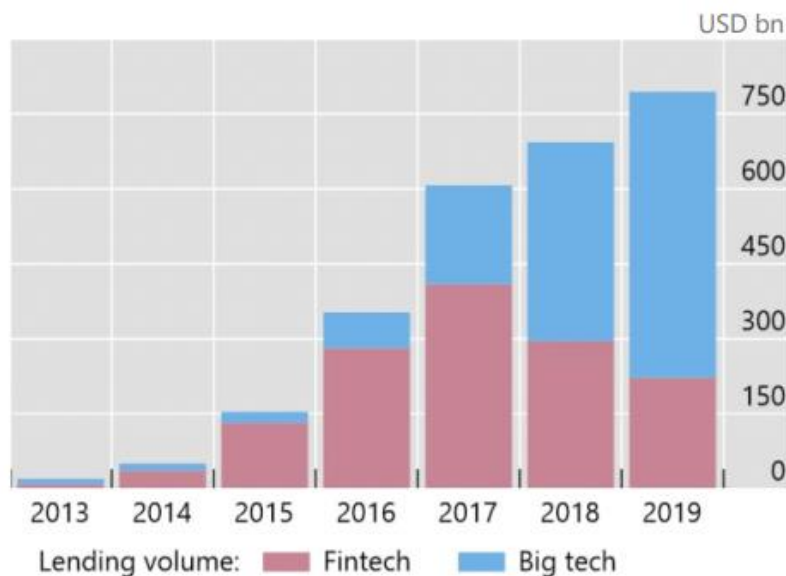- Traditional nonbank (dashed green)
- Fintech nonbank (solid green)

Source: IMF; Global Financial Stability Report, Chapter 3
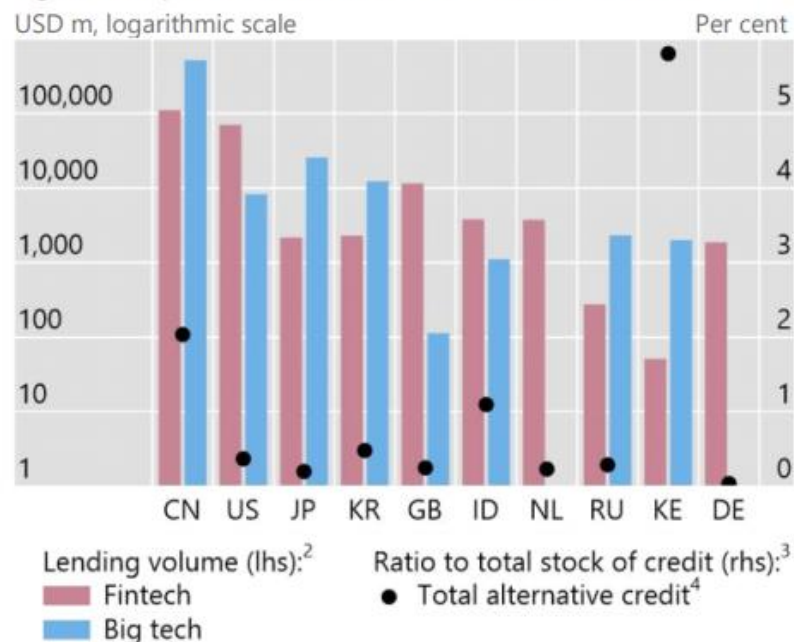
Fintech credit v.s. Bigtech credit

Global big tech credit is booming, overtaking fintech credit

Big tech credit is overtaking fintech credit[1]

These alternative forms of lending are becoming a significant portion of total credit in a few economies

Lending volume: ■ Fintech ■ Big tech

Lending volume (lhs):[2]
■ Fintech
■ Big tech

Ratio to total stock of credit (rhs):[3]
● Total alternative credit[4]

Figures include estimates. CN = China, US = United States, JP = Japan, KR = Korea, GB = United Kingdom, ID = Indonesia, NL = Netherlands, RU = Russia, KE = Kenya, DE = Germany.

[1] 2019 fintech lending volume figures are estimated on AU, CN, EU, GB, NZ and US.   [2] Data for 2019.   [3] Domestic credit provided by the financial sector. Data for 2018.   [4] Total alternative credit is defined as the sum of fintech and big tech credit. Data for 2019.

Sources: IMF World Economic Outlook; World Bank; Brismo.com; Cambridge Centre for Alternative Finance and research partners; WDZJ.com; companies' reports; authors' calculations.
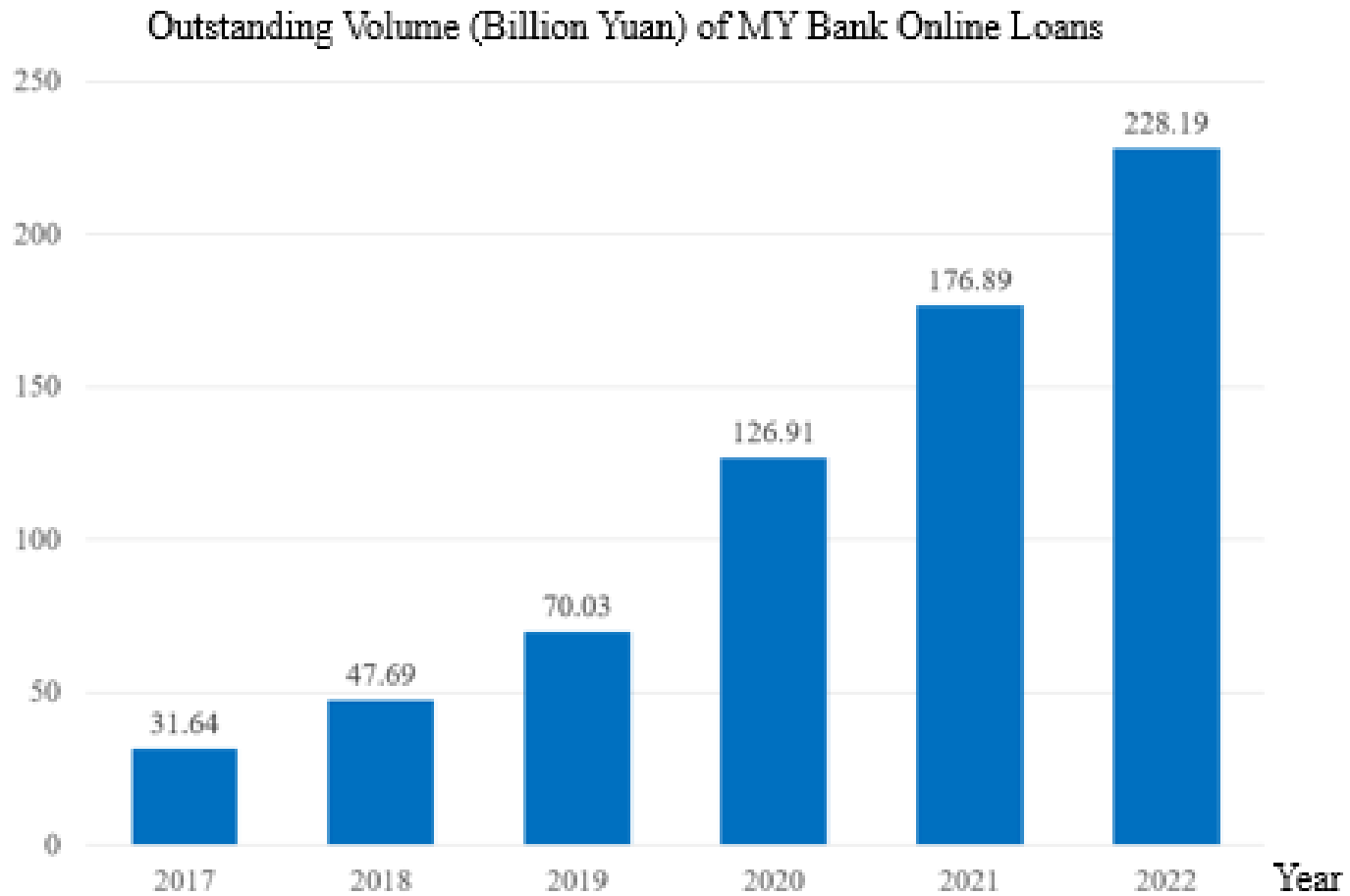
Individual-Micro-Small business lending of MY Bank in China

The Number (Million) of Individual-Micro-Small Enterprises Supported by MY Bank Digital Loans
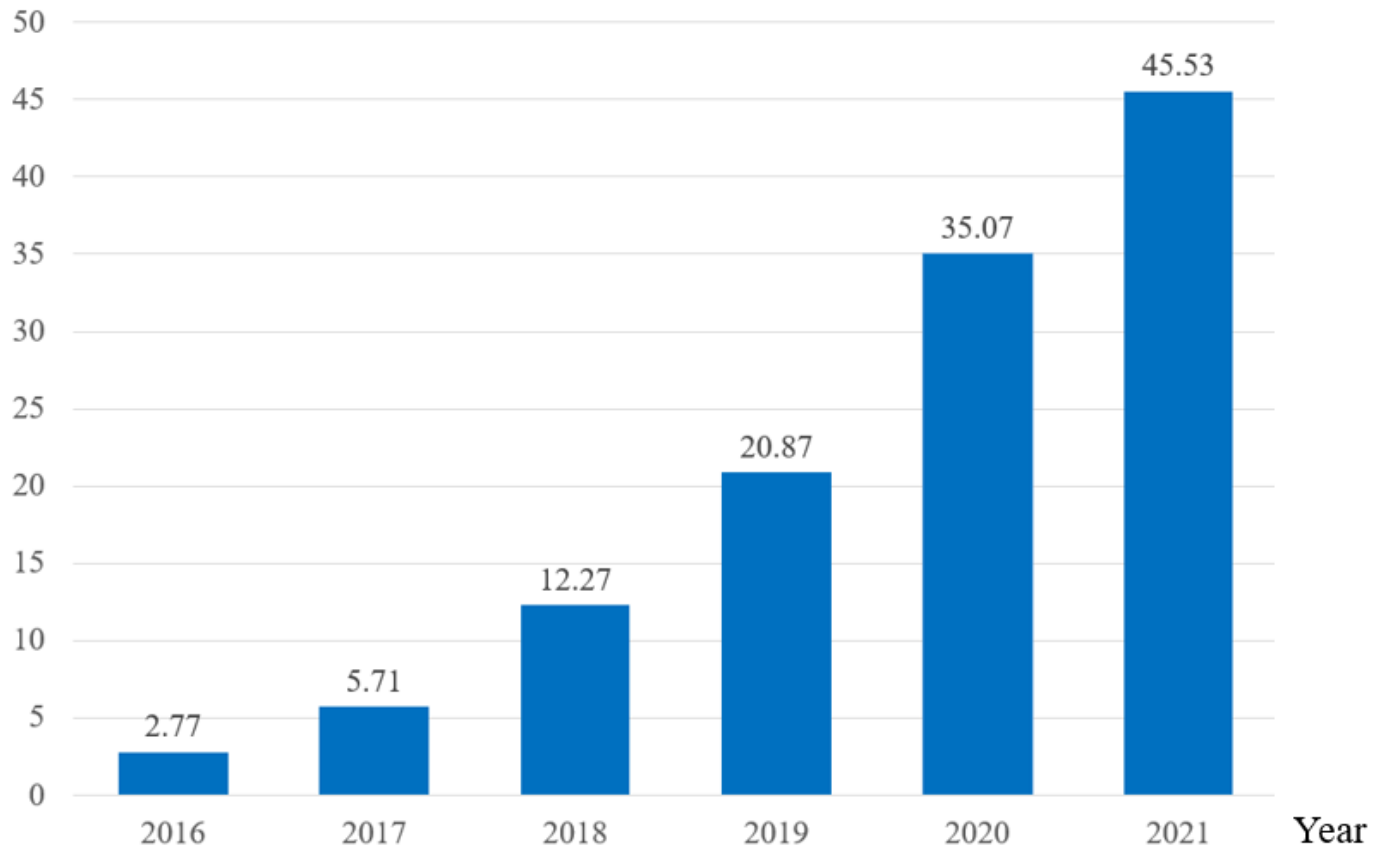
Source: Annual reports of MY Bank 2016-2021

Loan Volume of MY Bank in China

Outstanding Volume (Billion Yuan) of MY Bank Online Loans

Source: Annual reports of MY Bank 2017-2022

FinTech and efficiency

- Screening and monitoring

  - Effective *screening* of candidate borrowers using big data/ML (e.g., Mercado Libre in Argentina, Frost et al. 2019).

  - Algorithmic underwriting outperforms the human underwriting process (10% higher loan profits and 7% lower default rates in autos (Jansen et al. 2023).

  - Improve *monitoring* within real-time information (e.g., threatening to exclude misbehaving borrowers from the platform, Liu et al. 2022, Frost et al. 2019).

- Speed and flexibility

  - Immediacy in loan approval (e.g., Ant Financial Mybank online application: 3min to fill -1s approval-0 human intervention).

  - Fintechs process mortgage applications 20% faster than other lenders with no higher defaults and adjust supply more elastically in response to exogenous mortgage demand shocks (Fuster et al. 2019).

- Price discrimination

  - Interest rate-setting models for mortgages offer superior performance than non-fintechs (Buchak et al. 2019).

  - The use of ML increases the loan rate disparity among borrowers (Fuster et al. 2022).

Benefits of FinTech

- Stability
  - One standard deviation higher pre-crisis IT adoption led to 10% fewer non-performing loans during the GFC in the US (Pierri and Timmer 2020).

- Financial inclusion
  - Increased *financial inclusion* to unserved/underserved people (e.g., Africa).

- Growth
  - Banks with superior IT adoption have higher loan *growth* (Dadoukis et al., 2021; Branzoli et al., 2021).
  - *Entrepreneurship* is stronger in US countries that are more exposed to IT-intensive banks (Ahnert et al., 2022).

To what extent does the emergence of FinTech make banking

more contestable?

more or less stable?

better or worse aligned with social welfare?

Lending markets:

- The impact of an overall adoption of IT depends on its type

IT improvements in monitoring and competition
(Vives and Ye 2023a)

Improvement in monitoring efficiency	Related technology
Type I: In collecting and/or processing information	ML with big/unconventional data, advances in cloud storage/computing, information management software
Type II: Improvement in communication (decreasing physical distance friction)	diffusion of internet, video conferencing, smart phone, mobile apps, social media
Type II: Hardening soft information (decreasing expertise distance friction)	ML with big/unconventional data, credit scoring, AI

- Type I improvement enhances investment and social welfare (monitoring incentive).

- Type II improvement decreases bank differentiation, increasing competitive pressure, and has a hump-shaped effect on investment and social welfare (rent sharing between entrepreneur and bank).
  - SME lending by banks with better IT is less affected by the distance from their borrowers (Ahnert et al., 2022).
  - When entrepreneurs' moral hazard problem is severe, IT-induced competition is more likely to reduce investment and welfare.

- Price discrimination is not welfare-optimal (plausible scenarios).

- Both types of IT improve welfare when they extend the market.

The effects of entry of fintechs
(Vives and Ye 2023b)

- If banks have less flexibility in pricing than fintechs:
  - A fintech can penetrate the lending market with no advantage in monitoring efficiency or funding cost.
  - For entrepreneurs of the same characteristics, banks' monitoring effort is higher than the one of fintechs (and fintech borrowers are more likely to default).
  - Fintech entry may decrease entrepreneurs' investment if the competition within fintechs is not sufficiently intense.

- When banks can price as flexible as fintechs, fintech entry happens only if they have better efficiency or funding costs.

- Fintech entry is unambiguously good when it extends the market to unserved customers.
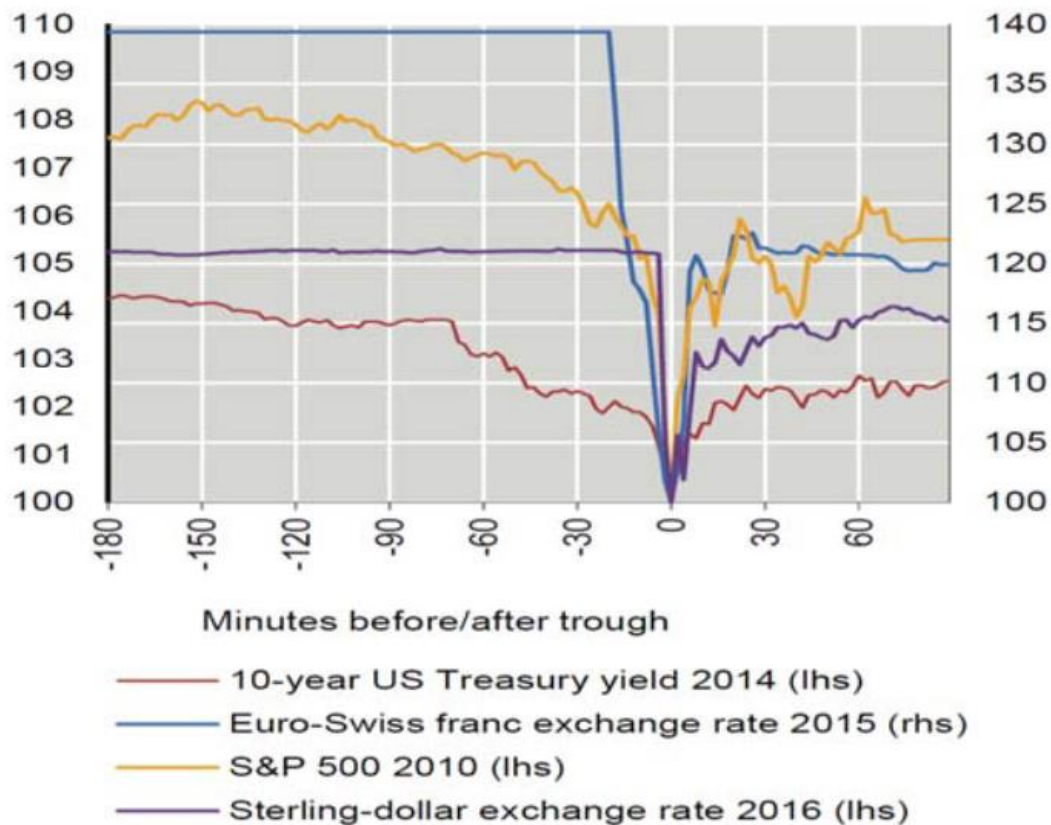
Algorithmic trading, AI-driven market making, market structure change, and market fragility

Flash events: Episodes of sudden liquidity dry-ups with large price movements that quickly reverse

Selected historic intraday moves

Index: 100 = intraday trough   Index: 100 = intraday trough

Minutes before/after trough

— 10-year US Treasury yield 2014 (lhs)
— Euro-Swiss franc exchange rate 2015 (rhs)
— S&P 500 2010 (lhs)
— Sterling-dollar exchange rate 2016 (lhs)

Source: BIS (2017), "The Sterling 'Flash Event' of 7 October 2016", Markets Committee Paper 9.
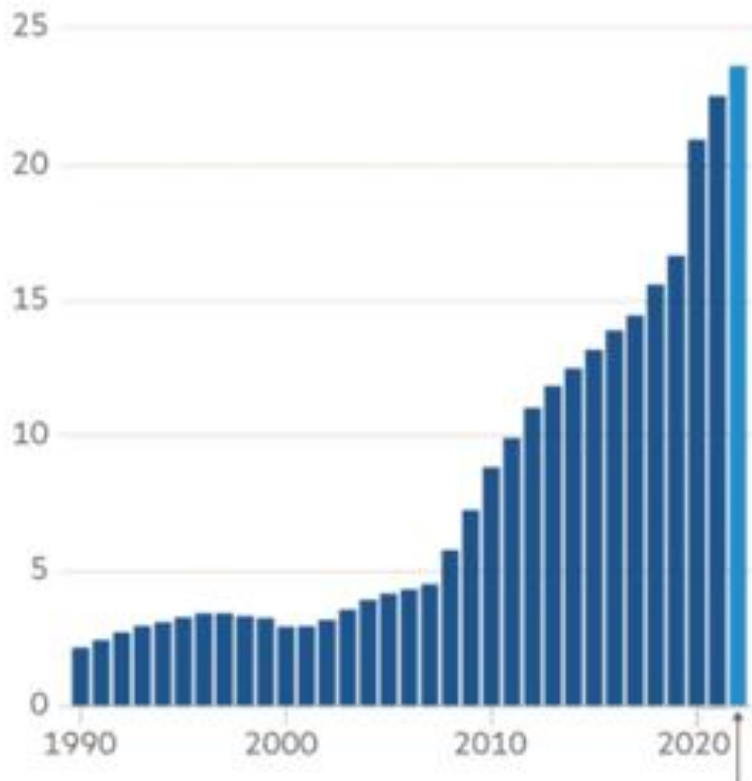
Hard to trade in Treasuries

Hard to trade in Treasuries: liquidity has deteriorated ...

Market depth ($mn, one-month moving average)*
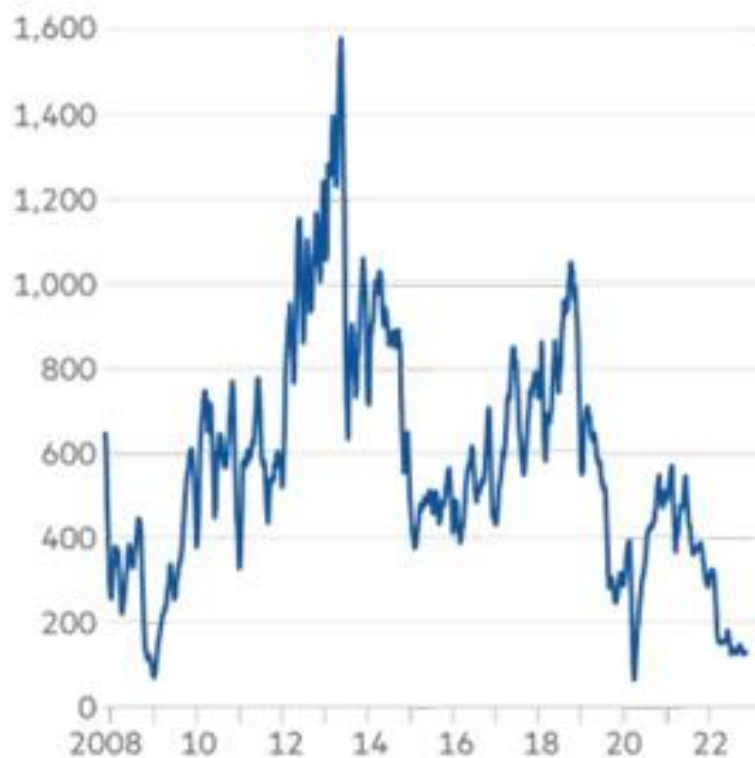
... in a market that has become vastly larger

Total amount of Treasury debt outstanding ($tn)

*JPMorgan metric of depth in two-, five-, 10- and 30-year Treasuries, converted to 10-year equivalents. 2022 is as of October
Sources: JPMorgan; Sifma

Fragility in the US Treasury market

- Financial Stability Report of the Fed (November 2022):
    - "The continued low level of market depth means that liquidity remains more sensitive to the actions of liquidity providers that use high-frequency trading strategies to replenish the order book rapidly."
    - "Greater concentration of liquidity provision among firms that may follow similar strategies can be a source of fragility, making it more likely that liquidity could further deteriorate sharply in response to future shocks."

- Market watchers
    - "The odds of a financial accident are just higher"

- Ransomware attack on ICBC disrupts trades in US Treasury market (FT, November 2023).

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Electronification and change in market structure

(a) Trading floor: liquidity supplied by professional agents.

(b) LOB: all-to-all trading

Consequences
(Cespa and Vives, 2023)

Market information is vital to trade and provide liquidity

Despite that there are more potential liquidity suppliers and there is more information provision:

(a) Participation of some liquidity suppliers is variable (for technical, disruption or regulatory reasons) and

(b) there are *frictions* limiting some traders' access to reliable and timely *market information*

⇒ *modern markets have improved liquidity and welfare on average (normal times) but at the cost of increased fragility*: small changes in market parameters may have large effects in liquidity

A feedback loop

- Market opacity can prevent the participation of non-standard liquidity providers in the market and impair the risk-bearing capacity of the market.

- A drop in liquidity may increase the demand for liquidity and generate a further drop in liquidity.
  - This happens when the market's risk-bearing capacity is insufficient to absorb traders' hedging needs (liquidity demand is strong, volatility of payoff large, traders/market makers with high risk aversion).
  - The withdrawal of market makers aggravates fragility.

- *Policy* to foster risk sharing, market stability, and improve welfare:
  - Disclosure/transparency to make available reliable market information.
    - Consolidated tape in Europe.
  - Continuous dealer participation in the market.

New sources of systemic risk

- Augmented risk of flash crashes, amplified by the speed, complexity, and opaque nature of AI-driven trading.

- AI models lack of explainability makes difficult to foresee or understand systemic risks until they manifest.
  - AI not good for unknown-unknowns (better for unknowns-knowns)

- AI may increase *correlation* in predictions and strategies (e.g., in lending, trading).

- IRS and concentration tendency.
  - Failure of third-party providers (e.g., concentration risk in cloud providers) and cyberattacks.

- Risk management (microprudential): AI guardrails (internal or regulatory) akin to VAR and capital requirements.

- Governance lags behind AI development, and international cooperation is lacking.

New technology raises new issues

Stability/integrity

Data

Privacy   Efficiency
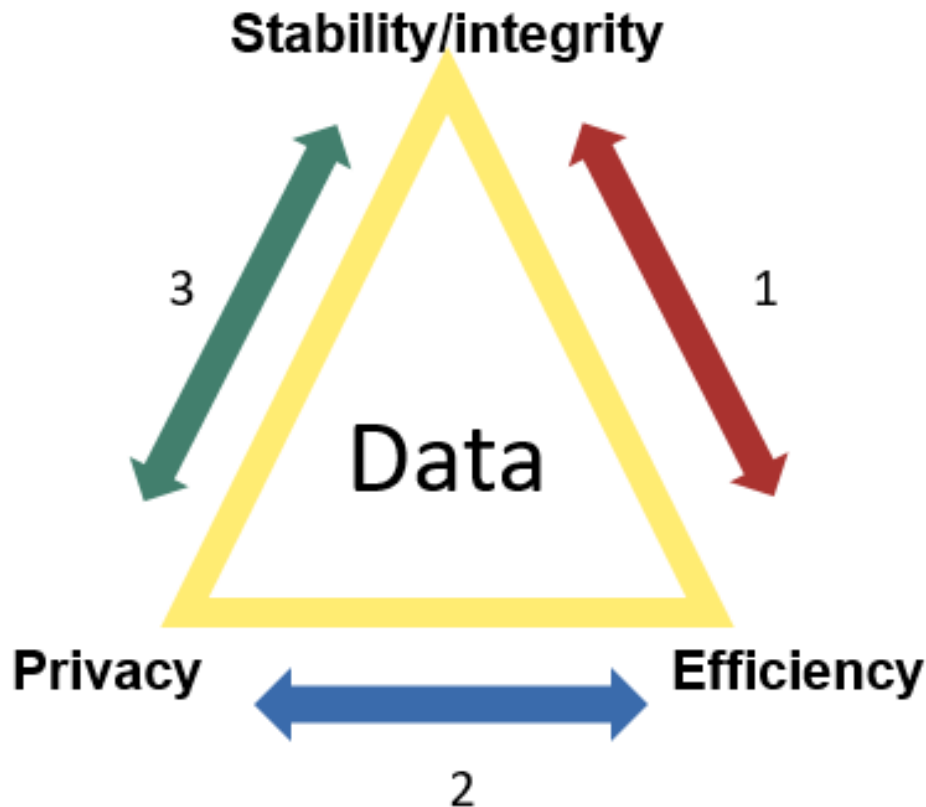
1. "Traditional" stability-competition tradeoff, to adapt

2. Access to data for providers vs anonymity (eg better/worse access to credit; or misuse)

3. Access to data for regulatory goals vs anonymity (eg AML/CFT, supervision, judicial)

Source: Carletti, Claessens, Fatás and Vives (2020)

References
http://blog.iese.edu/xvives/

- Carletti, E., Claessens, S., Fatás, A. and Vives, X. (2020). The Bank Business Model in the Post-Covid-19 World, CEPR.

- Cespa, G. and Vives, X. (2023). Market Opacity and Fragility, WP.

- Duffie, D., Foucault, T., Veldkamp, L. and Vives, X. (2022). Technology and Finance, CEPR.

- Vives, X. (2019). Digital Disruption in Banking, *The Annual Review of Financial Economics,* 11, 243-272.

- Vives, X. and Ye, Z. (2023a). Information Technology and Lender Competition, WP.

- Vives, X. and Ye, Z. (2023b). Fintech Entry, Lending Market Competition and Welfare, WP.

Digital Disruption in Banking

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Abstract

This review surveys technological disruption in banking, examining its impact on competition and its potential to increase efficiency and customer welfare. It analyzes the possible strategies of the players involved—incumbents and FinTech and BigTech firms—and the role of regulation. The industry is facing radical transformation and restructuring, as well as a move toward a customer-centric platform-based model. Competition will increase as new players enter the industry, but the long-term impact is more open. Regulation will decisively influence to what extent BigTech will enter the industry and who the dominant players will be. The challenge for regulators will be to keep a level playing field that strikes the right balance between fostering innovation and preserving financial stability. Consumer protection concerns rise to the forefront.