Financing Innovation---
Cooperation between China and U.S.

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I.The importance of China-US cooperation in finance and economics

II. China-US VC/PE market status and cooperation

III. Next steps for China and U.S.

Sequoia Capital: Honeymoon phase cooperation between China and U.S. in financing innovation

- On June 6, 2023, The US venture capital giant Sequoia Capital announced to split off its Chinese businesses into an independent firm due to geopolitical challenges.
- Since 2005, Sequoia Capital has raised large amounts of money from the US to invest in China and is a symbol of the era when US money and Chinese tech companies were in their honeymoon phase.





The United States is strengthening its restrictions on investments in China

• On July 19, 2023, the House Select Committee On China sent letters to four venture capitals (GGV, GSR, Walden International and Qualcomm), expressing "serious concerns" on their investments in AI, semiconductor, and quantum computing startups in China.

1.The importance of China-US financial cooperation

More than 40 percent of the world economy

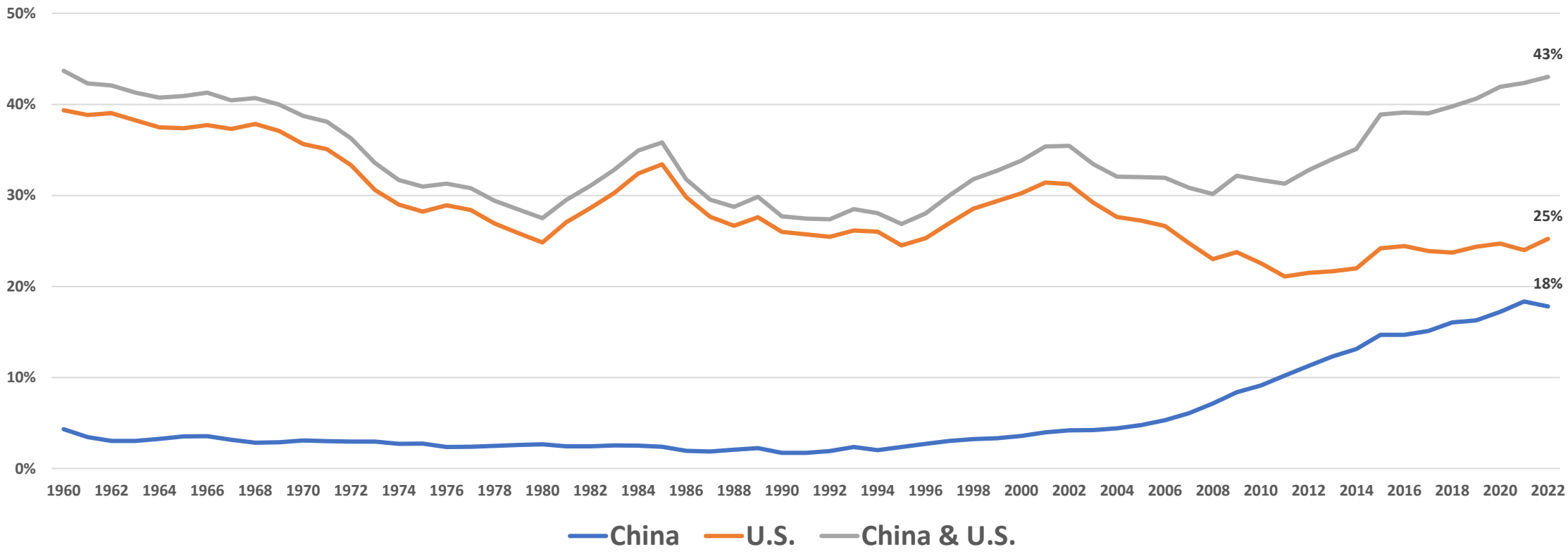


Figure 1. Percent of GDP between 1960 and 2022

Source: World Bank

Nearly a third of global trade

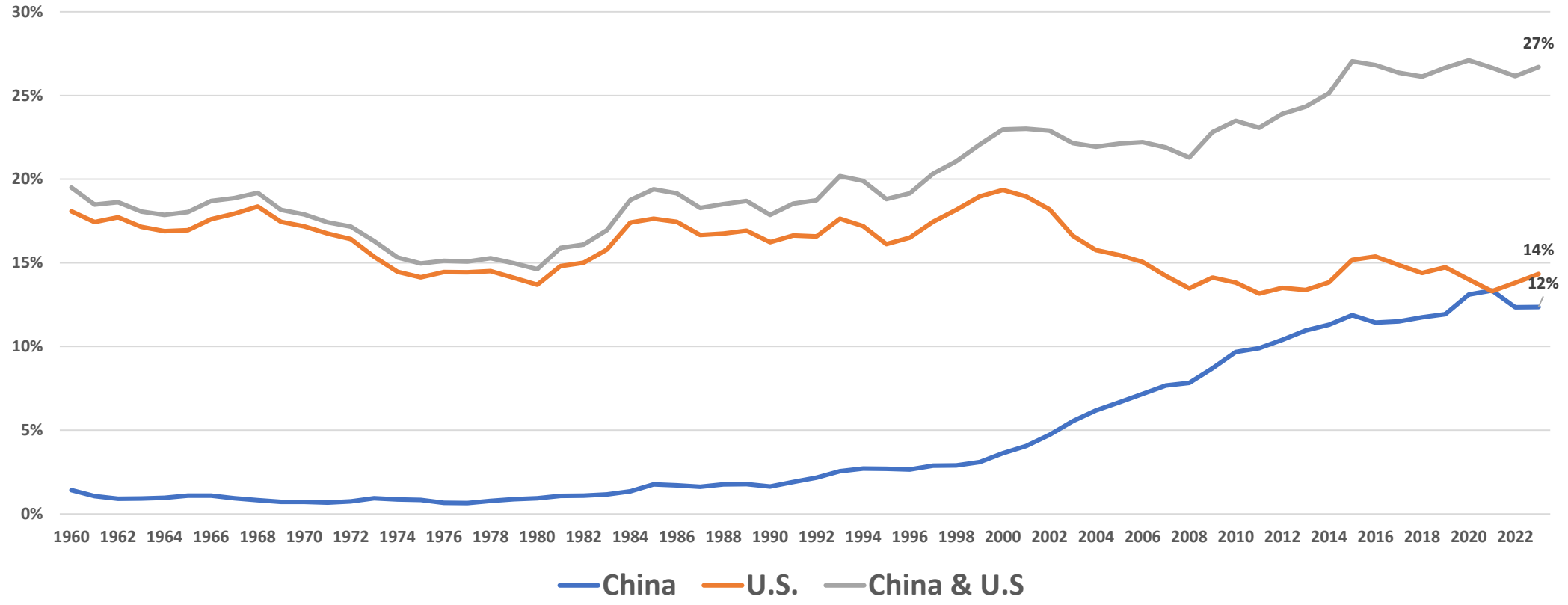


Figure 2. Percent of trade value since 1960

Source: Wind, National Bureau of Statistics of China

U.S. : dropped From 2nd to 3rd (Since 2019)

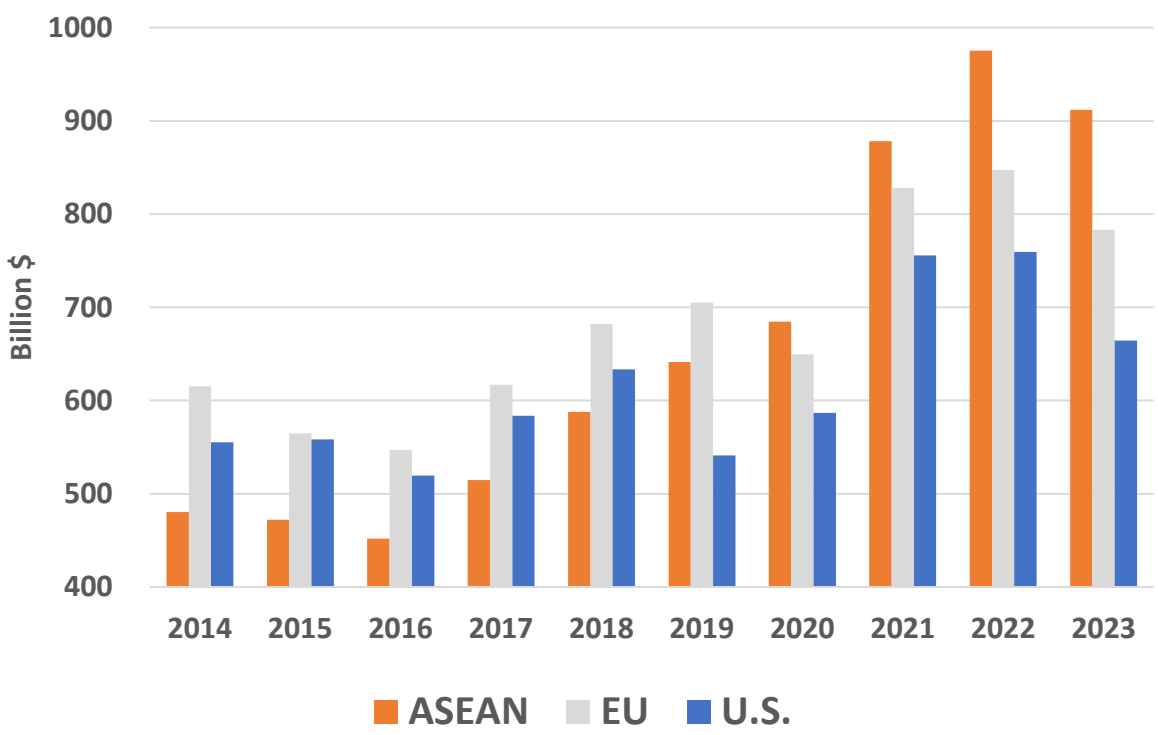


Figure 3. Trading partners of China

China: be replaced by Mexico (Since 2019)

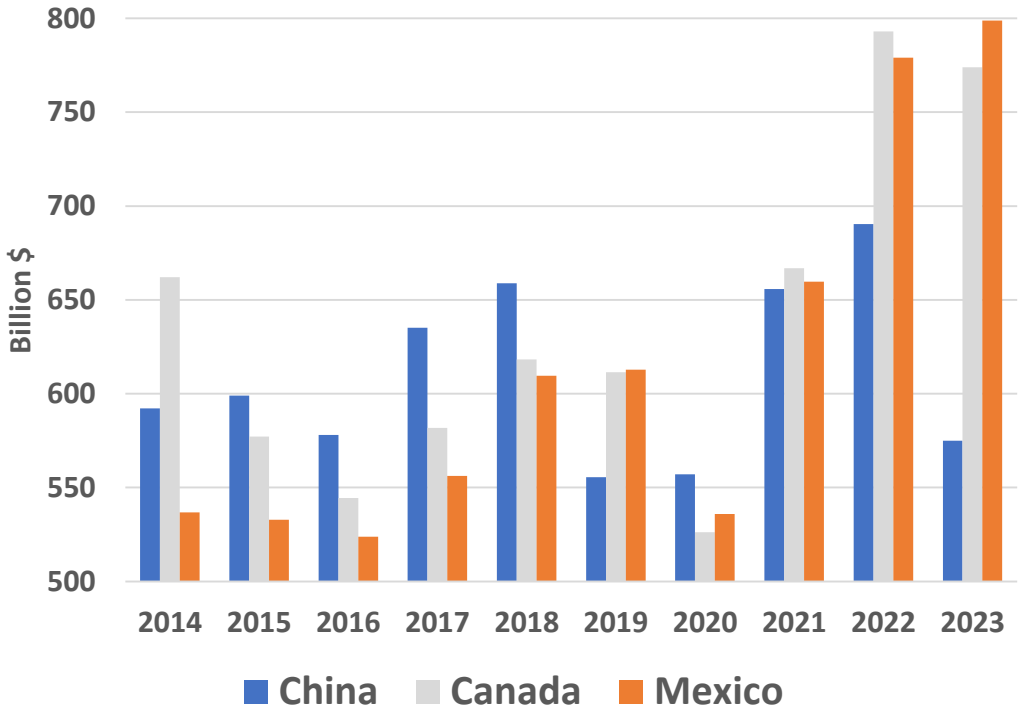


Figure 4. Trading partners of U.S.

Source: General Administration of Customs of the People's Republic of China

China-U.S. Markets are Closely Trade-linked

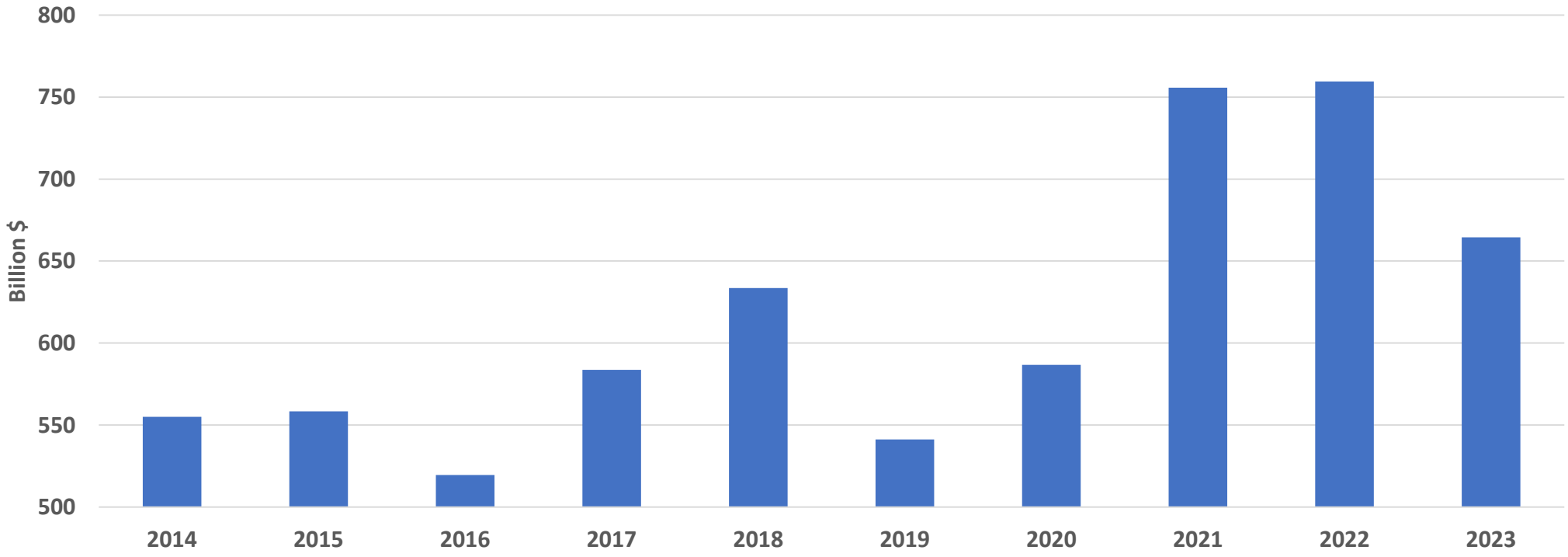


Figure 5. China-U.S. trade volume

Source: General Administration of Customs of the People's Republic of China

Finance is important in both economy

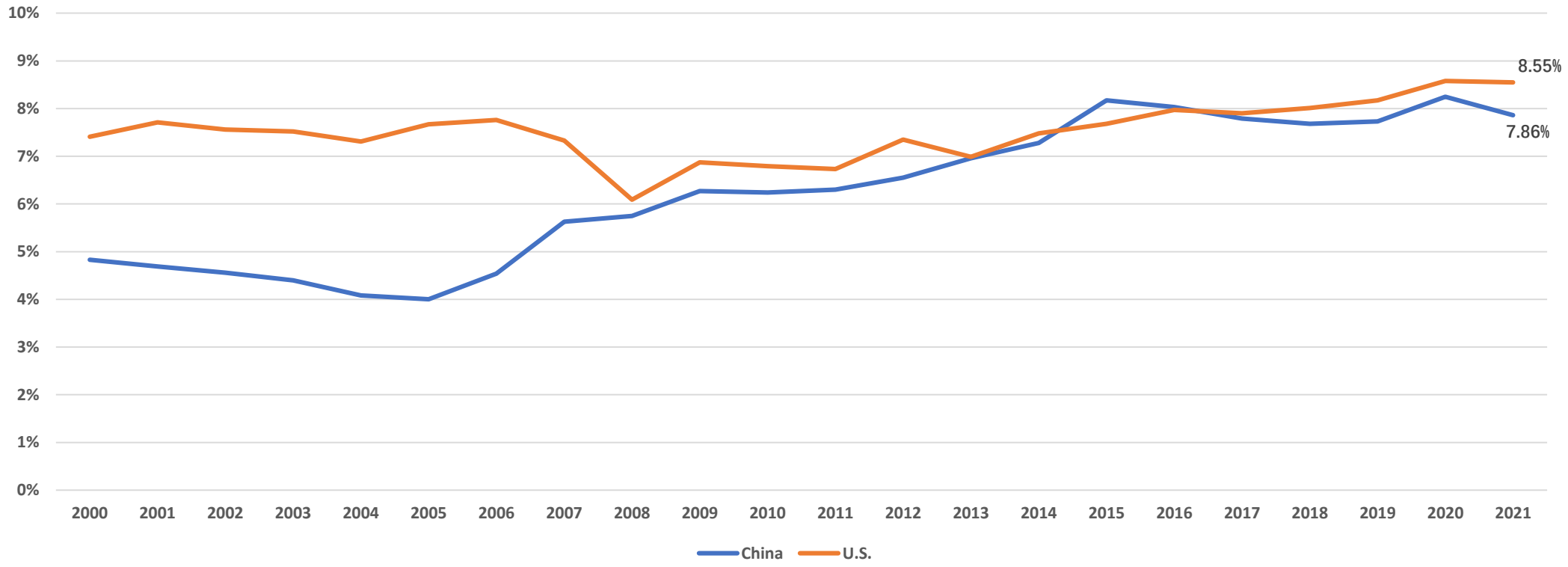


Figure 6. Percent of financial value-added in GDP since 2000

Source： OECD

China and U.S. are Important Innovative Countries

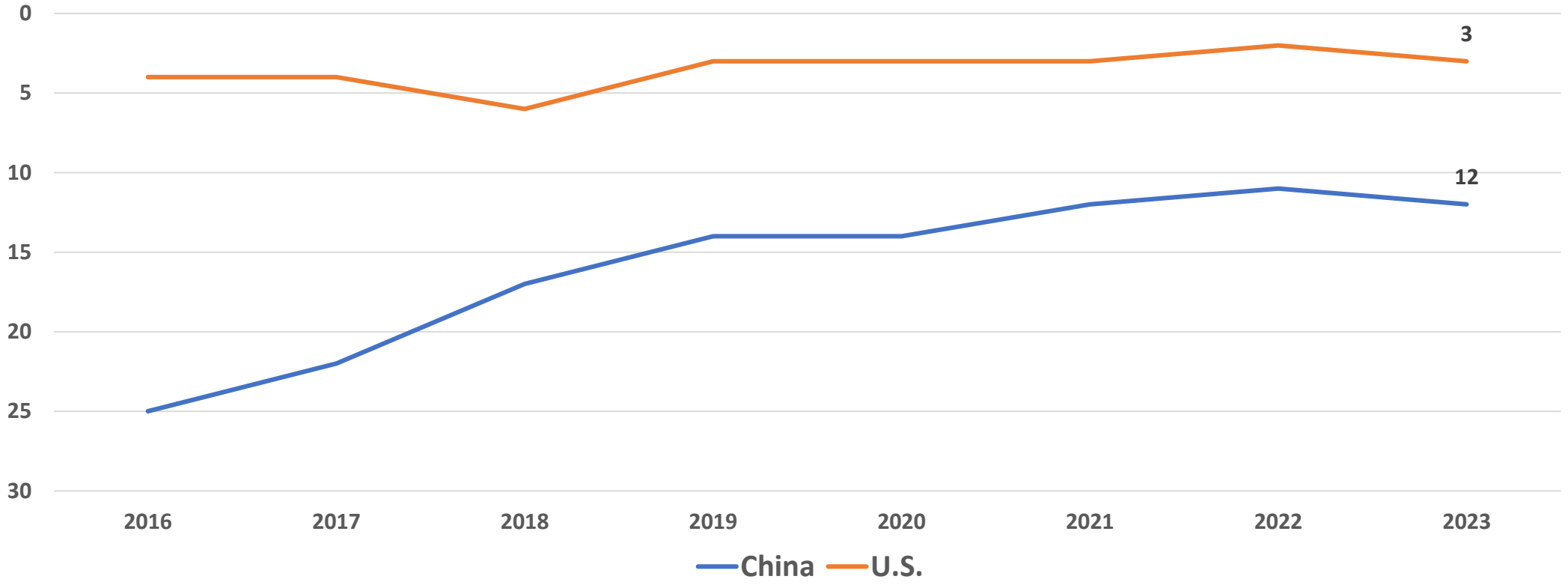


Figure 7. Rank in global innovation index

Source： WIPO

Nearly Half of the PCT patent application

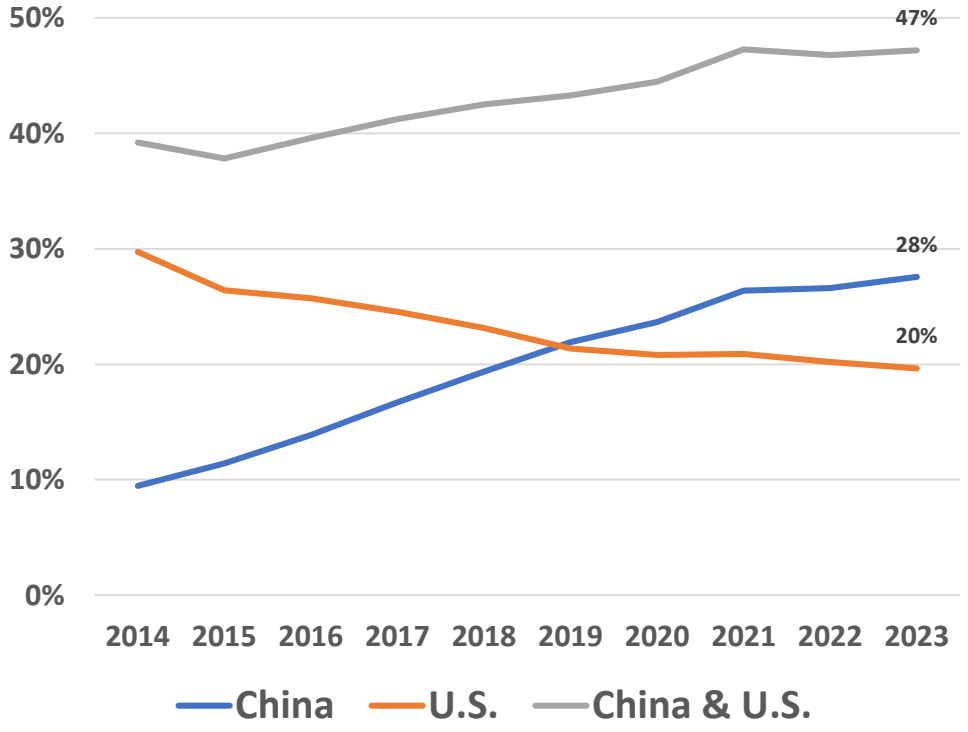


Figure 8. Percent of PCT patent application filed

China: From 4th to 3rd U.S.: No.1

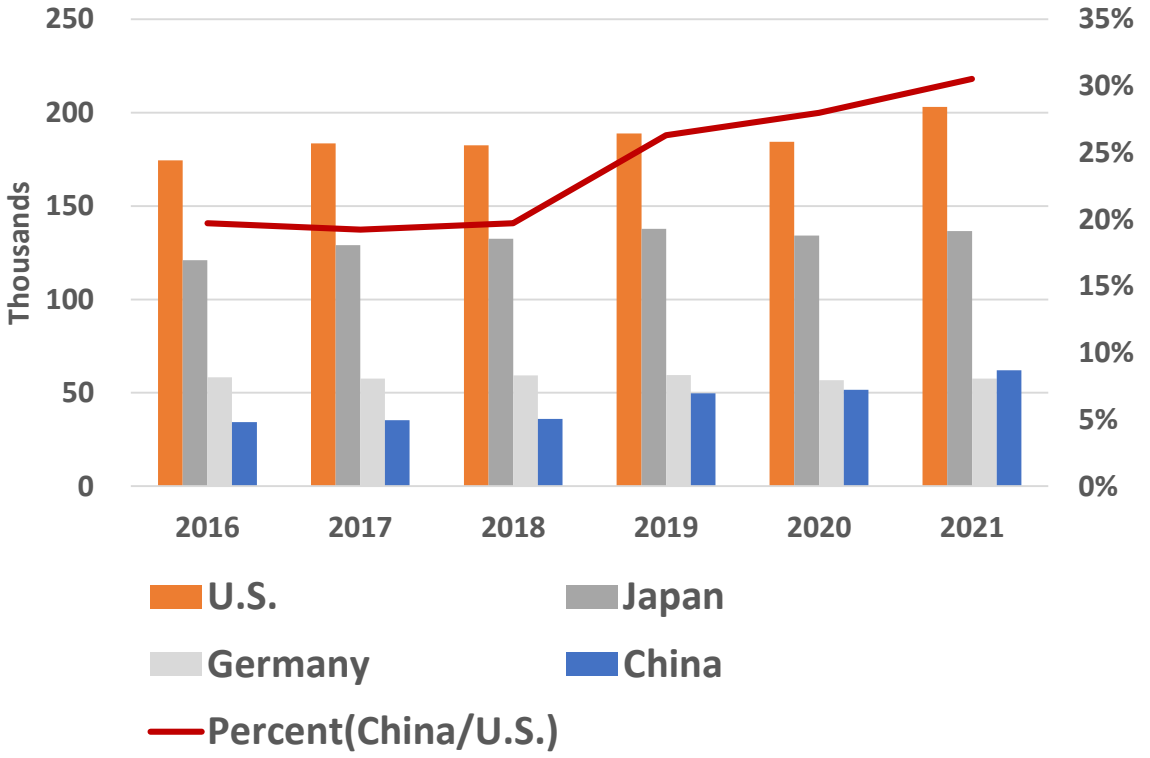


Figure 9. PCT national phase entries

Source: WIPO

The knowledge flow ratio has continued to rise and converged to 1 gradually since 1990

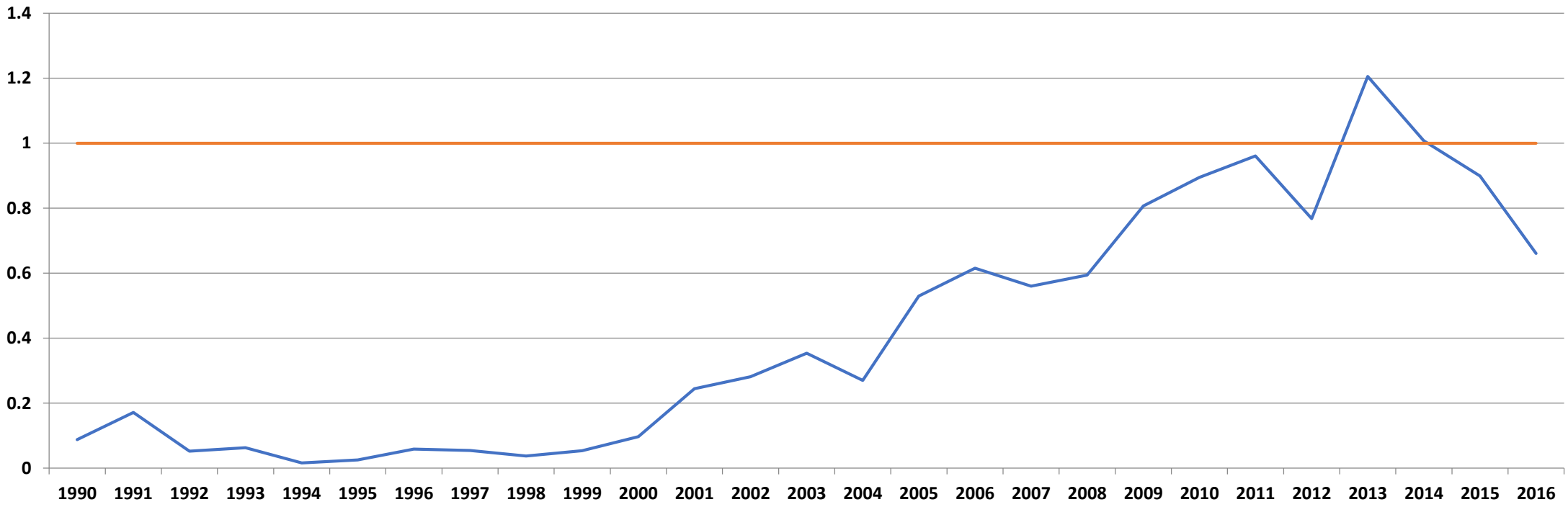


Figure 10. Knowledge flow ratio: patent citations from China to US/from US to China

source： USPTO

Global Economic Growth Needs New Engines

Table 1. Real GDP growth (annual %) of major countries

	2020	2021	2022
The Whole World	**-3.06**	**6.23**	**3.09**
U.S.	**-2.77**	**5.95**	**1.94**
EU	-5.65	6.01	3.45
United Kingdom	-10.36	8.67	4.35
France	-7.54	6.44	2.45
Germany	-3.83	3.16	1.81
Italy	-8.97	8.31	3.72
Canada	-5.04	5.29	3.82
Japan	-4.15	2.56	0.95
South Korea	-0.71	4.30	2.61
Australia	-0.33	2.11	4.27
China	**2.24**	**8.45**	**2.99**
India	-5.83	9.05	7.24
Russia	-2.65	5.61	-2.07
South Africa	-5.96	4.70	1.91
Brazil	-3.28	4.99	2.90
Argentina	-9.90	10.72	4.96
Mexico	-8.65	5.84	3.90
Saudi Arabia	-4.34	4.33	8.68
Turkiye	1.86	11.44	5.53
Indonesia	-2.07	3.70	5.31

Source:-World Bank

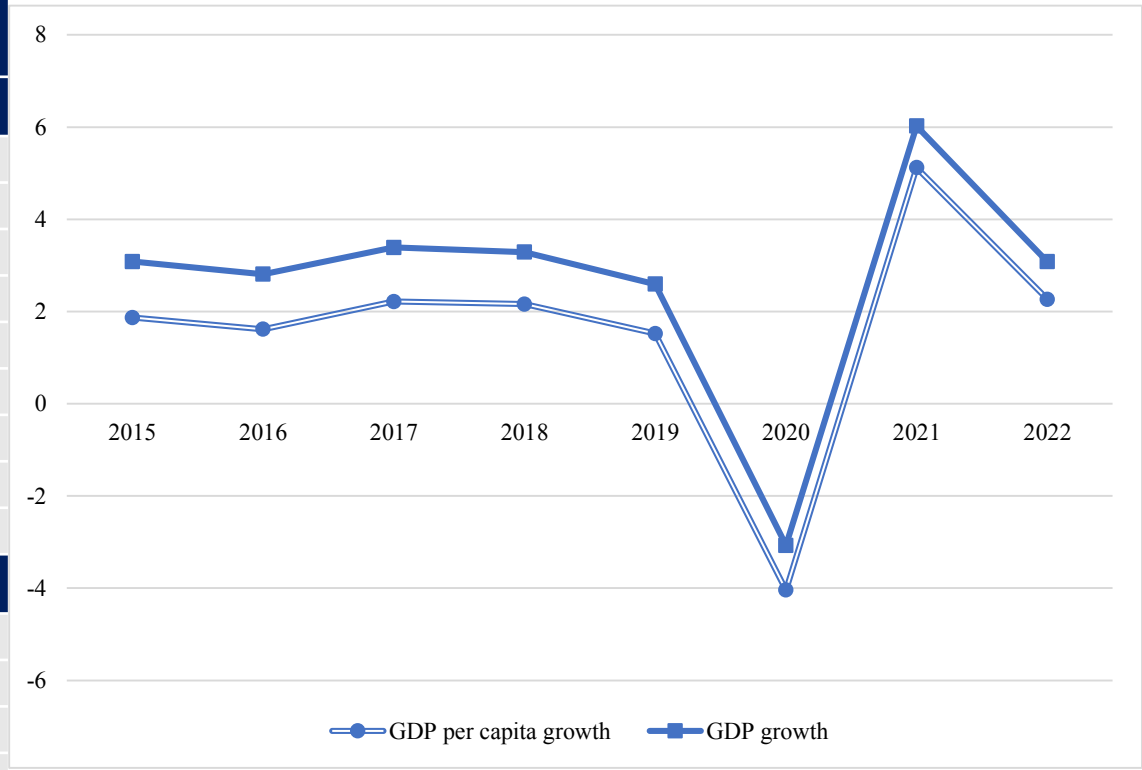


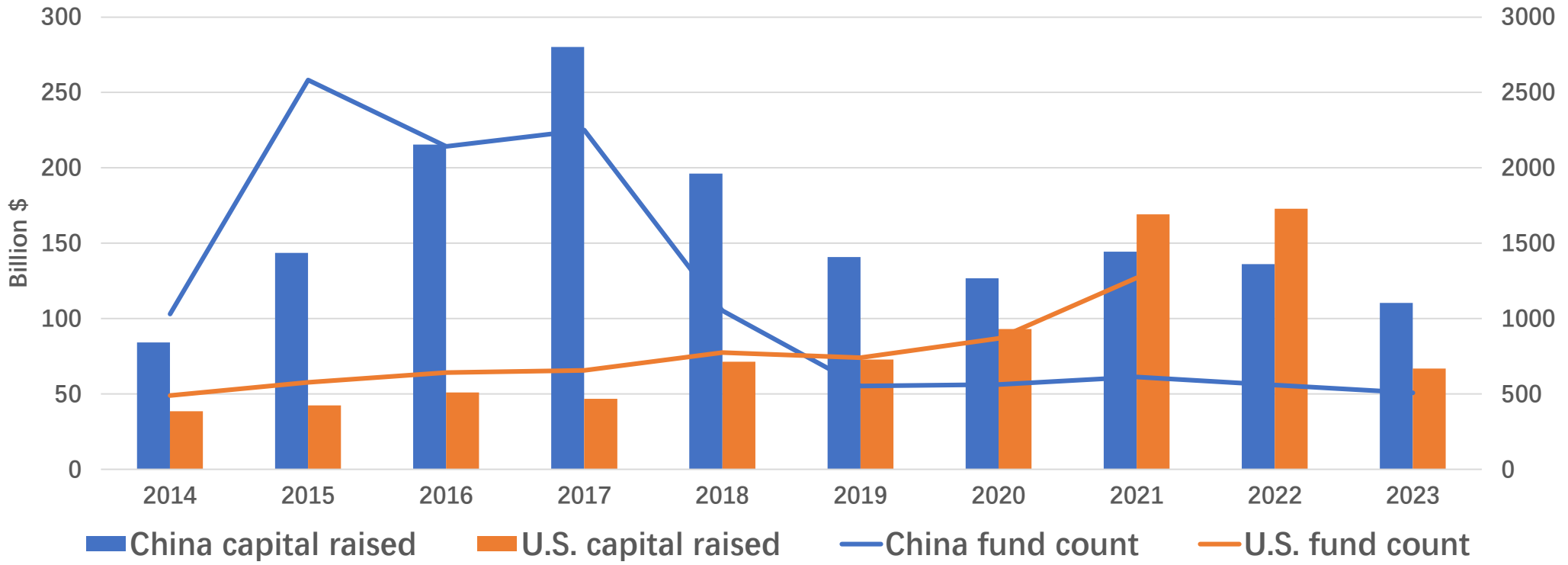
Figure 11 Growth of global GDP and GDP per capita

II. China-US VC/PE market cooperation

VC/PE Fundraising in China and U.S.

China: Declined since 2018

U.S.: Continue to rise



Source: PitchBook, NVCA 2024 Yearbook
PitchBook, Venture Monitor 2022
Zero2IPO

Figure 12. Capital Raised and Fund Count

VC/PE fundraising in China by USD decreased since 2018

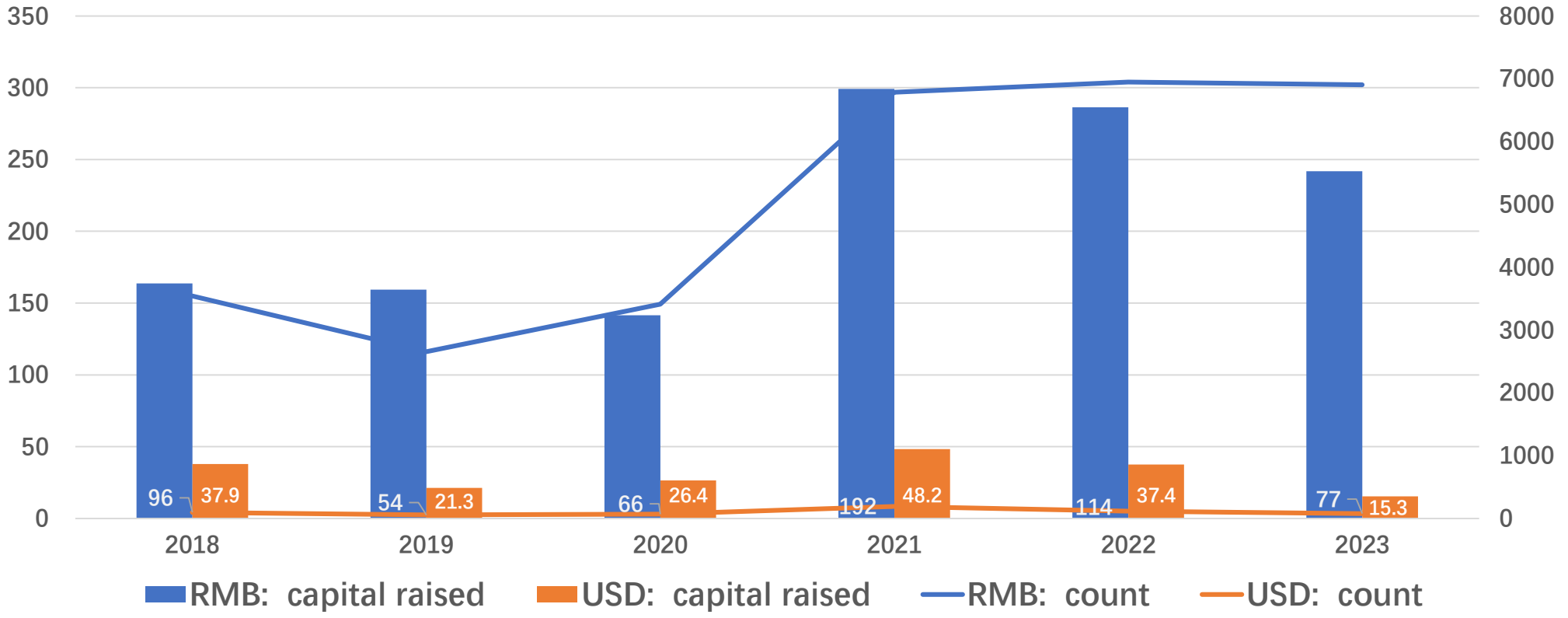


Figure 13. USD funds and RMB funds in China

Source: Zero2IPO

VC/PE fundraising activity in China by US-headquartered firms

- In 2022, capital raised by US-headquartered firms reached $11bn, the highest level in recent years.
- Excluding HongShan and Sequoia Capital, China VC/PE fundraising activity by US-headquartered firms has seen a fairly steady decline in terms of capital raised since 2018.

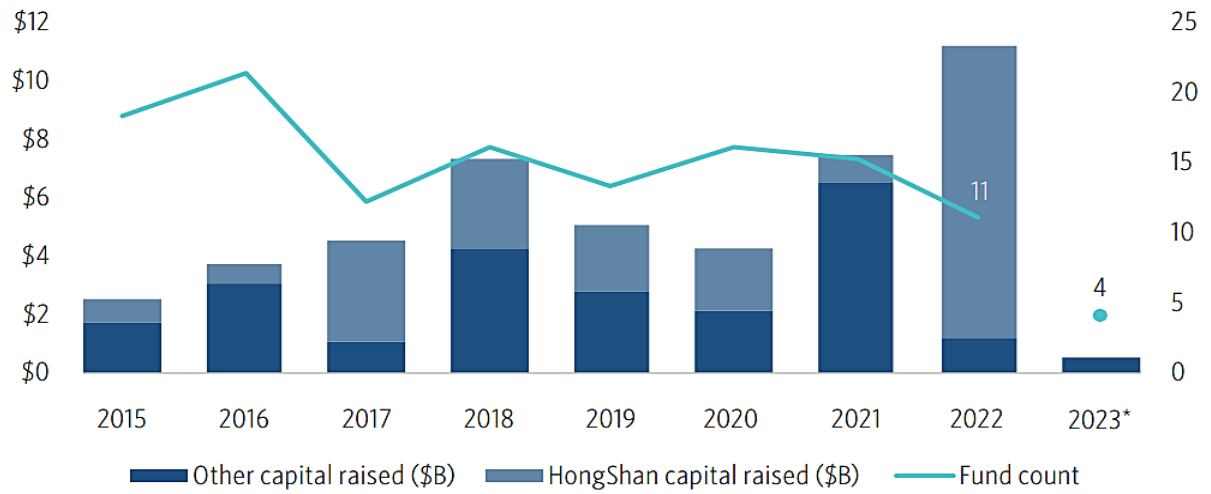


Figure 14. VC/PE fundraising activity by US-headquartered firms (HongShan versus other)

Source:PitchBook·Geography:Mainland China and Hong Kong (China)
*As of July 12,2023
Note:This chart includes Hong Kong-based funds.Firms with US parent entities or secondary office locations in China are included in the US investor scope.HongShan includes all of Sequoia Capital's fundraising in China.

Deal Value & Deal Count

China: Decreased slightly since 2018
U.S.: Rising between 2018 and 2021 and reversed in 2022

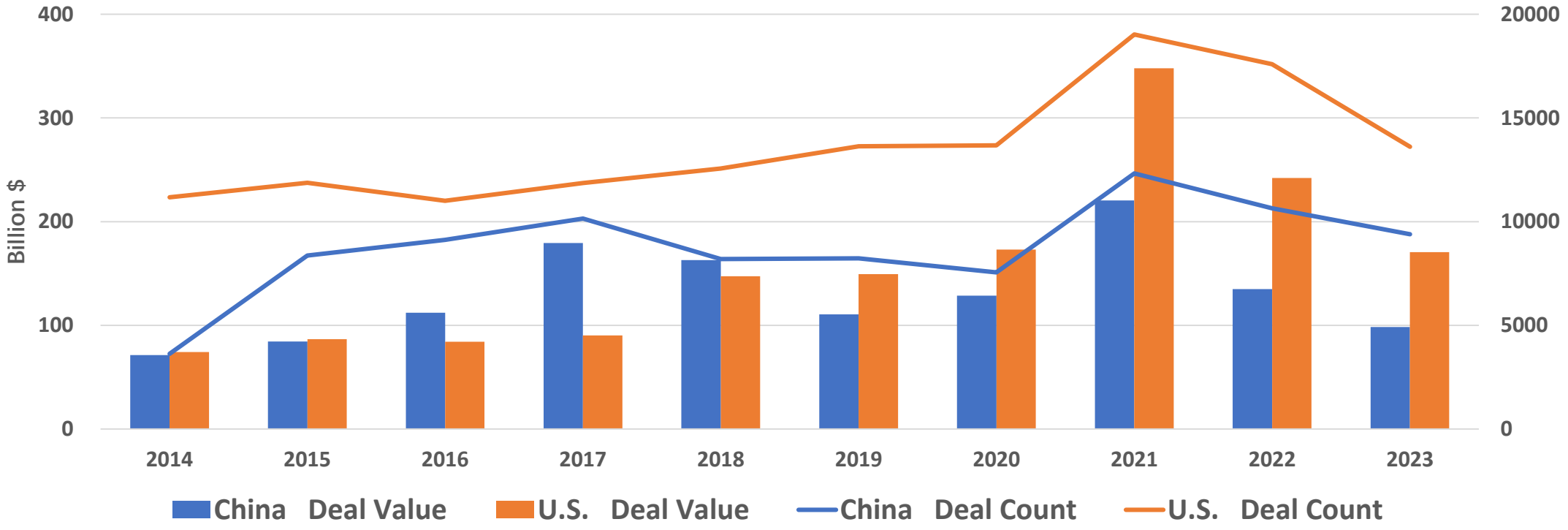


Figure 15. Deal Value & Deal Count

Source: PitchBook, NVCA 2024 Yearbook
Zero2IPO

The US investor participation in China's VC/PE market has declined

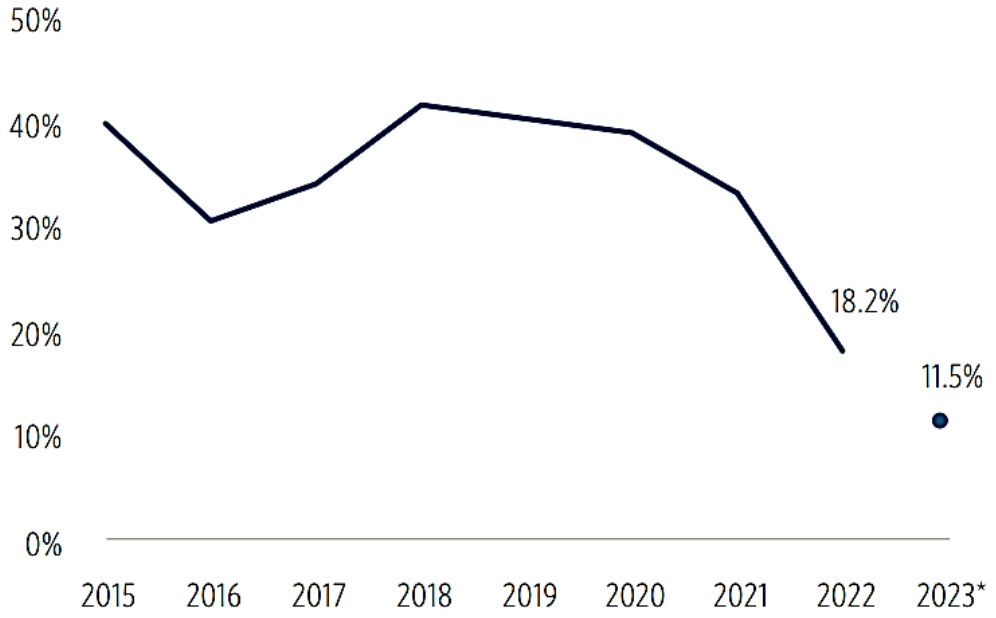


Figure 17. Deals with US investor participation as a share of all VC/PE deal value

Source:PitchBook·Geography:Mainland China
*As of July 12,2023
Note:Firms with US parent entities or secondary office locations in China are included in the US investor scope.

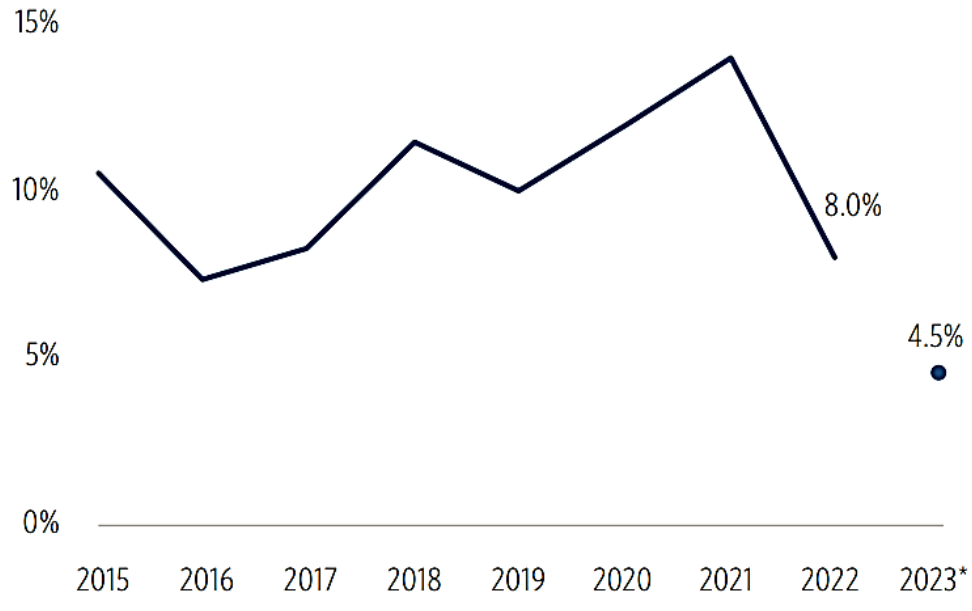


Figure 18. Deals with US investor participation as a share of all VC/PE deal count

Source:PitchBook·Geography:Mainland China
*As of July 12,2023
Note:Firms with US parent entities or secondary office locations in China are included in the US investor scope.

U.S. venture investments in China peaked in 2018

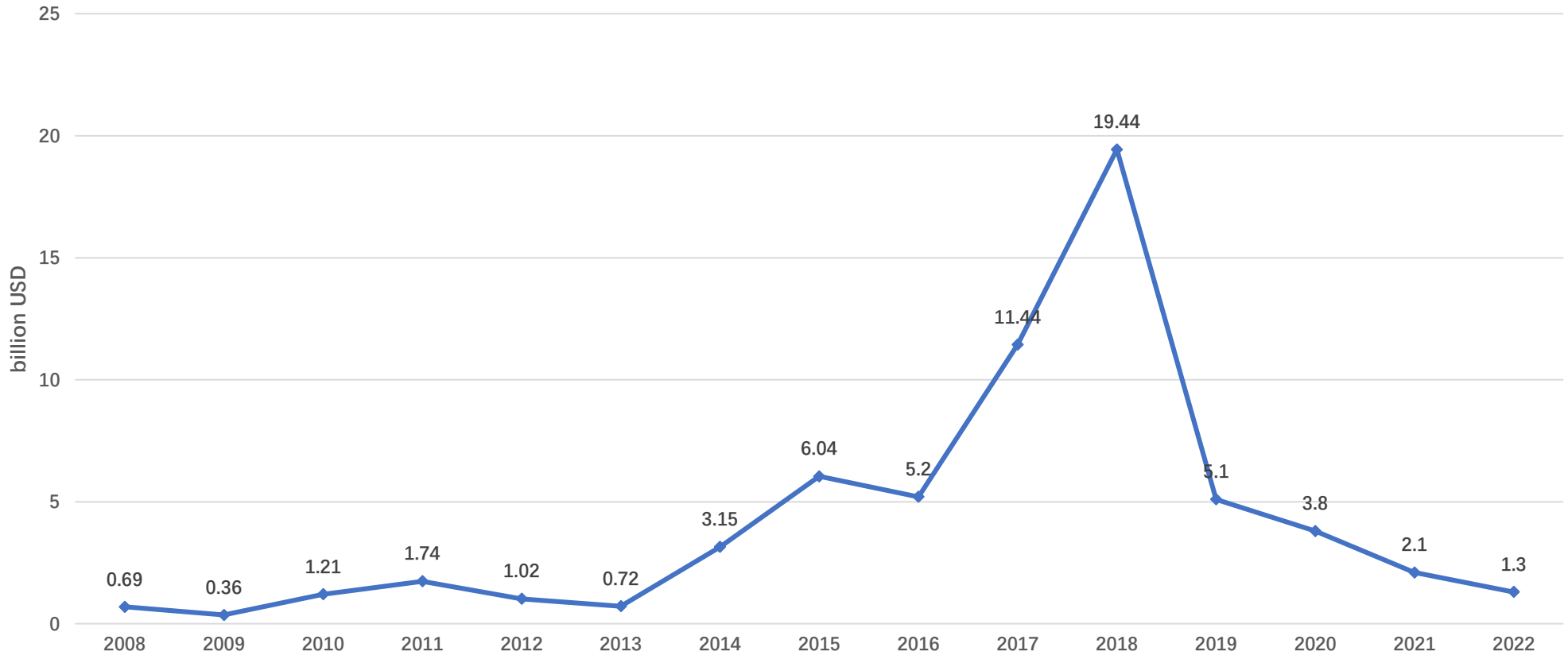


Figure 19. Changes in U.S. VC/PE Investment in China

Source:Rhodium Group Database

Assets Under Management

Assets under management in both China and U.S. keep growing

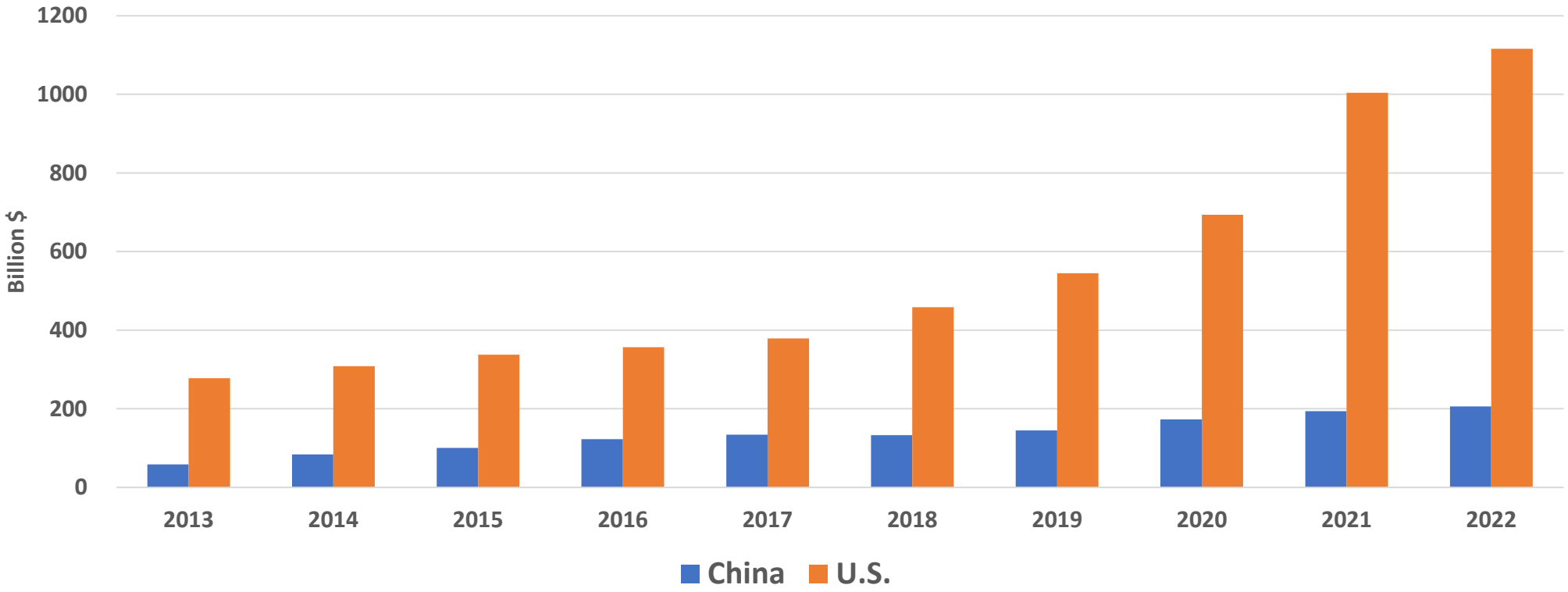


Figure 20. Assets Under Management

Source: PitchBook NVCA 2024 Yearbook
Venture Capital Development in China 2023

Exit activity in China declines sharply

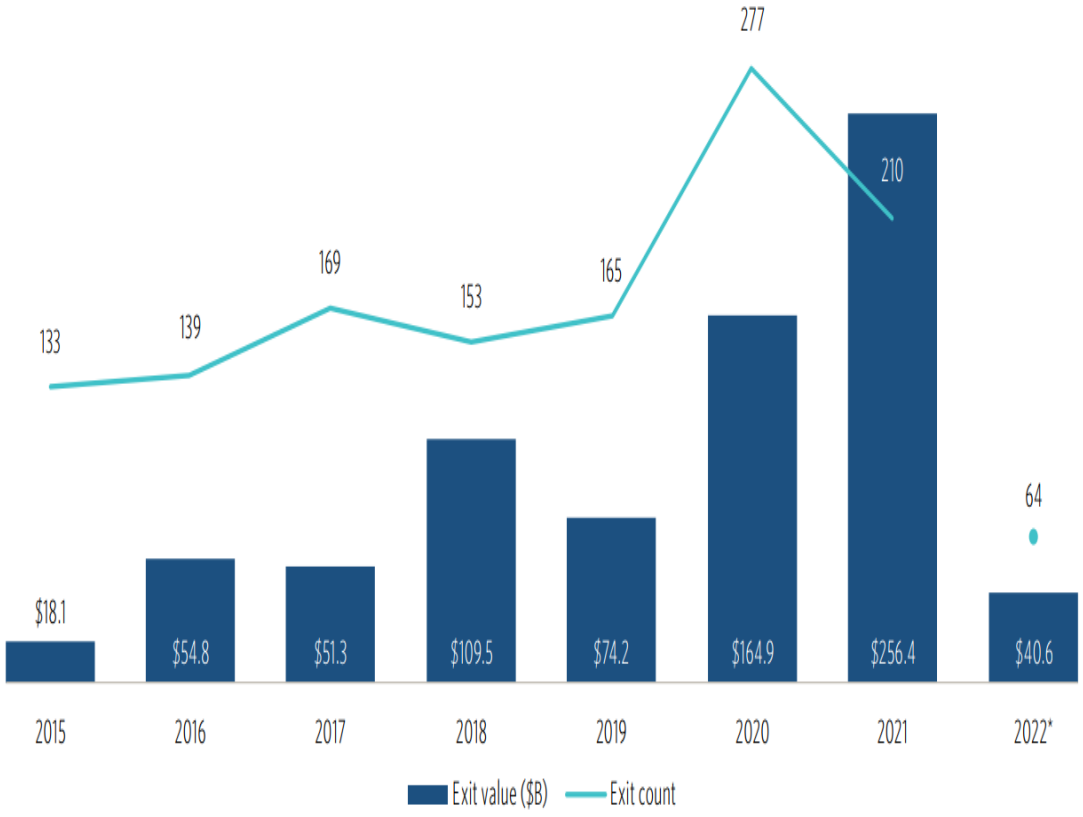


Figure 21. Exit Activity in China

Exit activity in U.S. declines to historic low

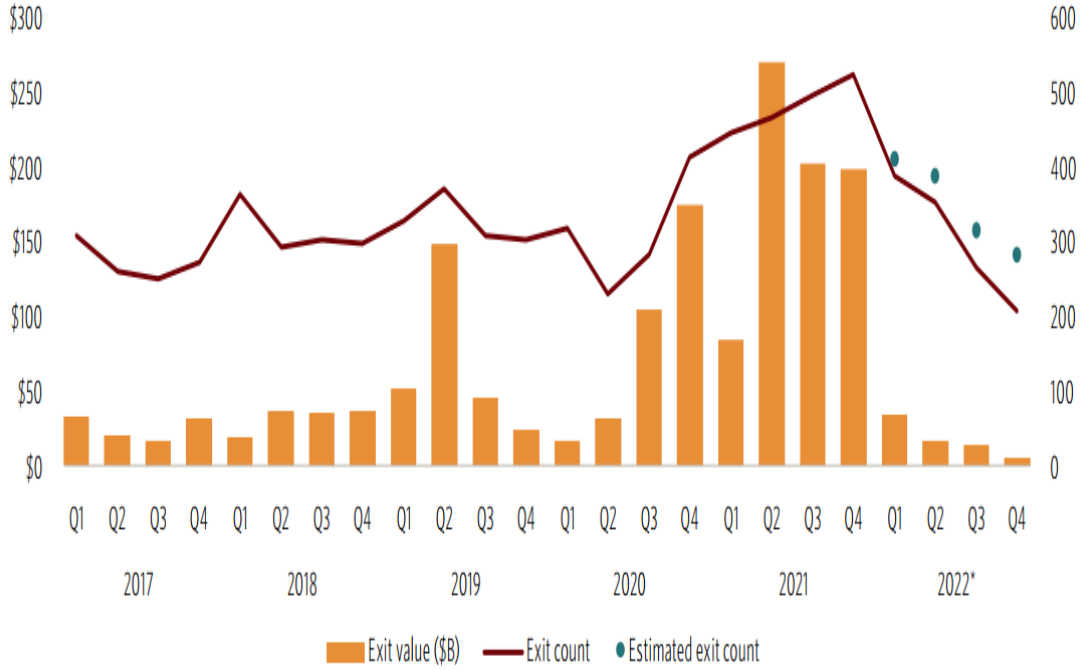


Figure 22. Exit Activity in U.S.

Source: PitchBook, Greater China Venture Report
*As of June 30, 2022

IPO dropped sharply in both China and U.S.

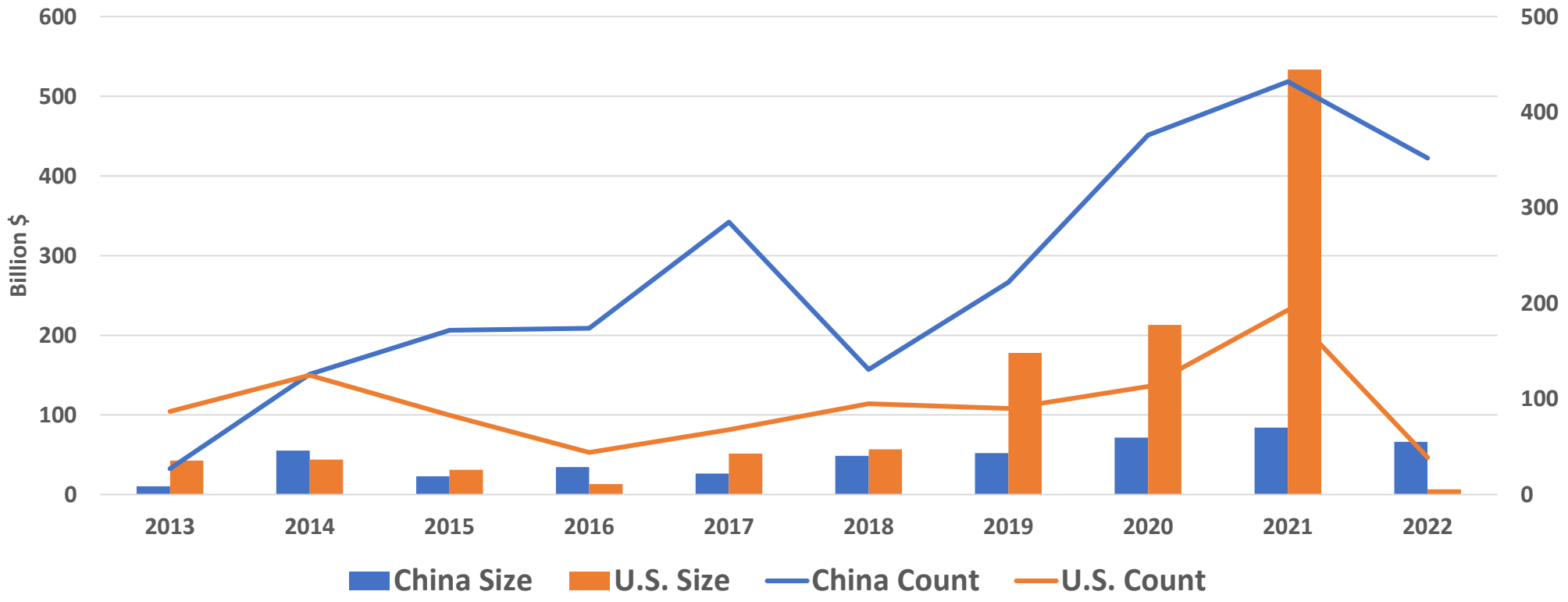


Figure 27. VC-backed IPOs

Source: PitchBook, NVCA 2024 Yearbook
Zero2IPO

Chinese Firms Listed On Major U.S. Stock Exchanges

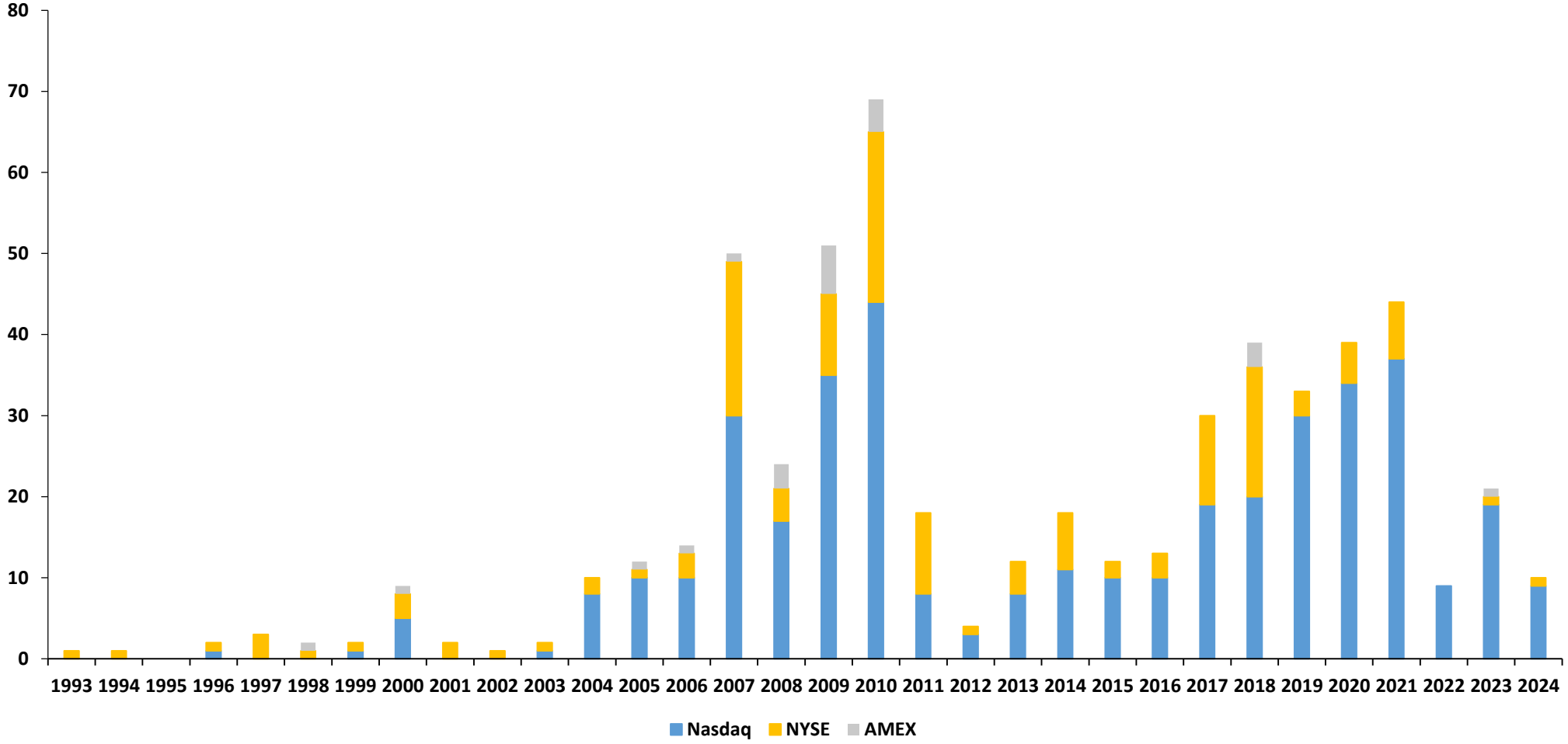


Figure 28. The IPO count on Major U.S. Stock Exchanges for Chinese mainland companies

Source: CSMAR

Chinese Firms Listed On Major U.S. Stock Exchanges

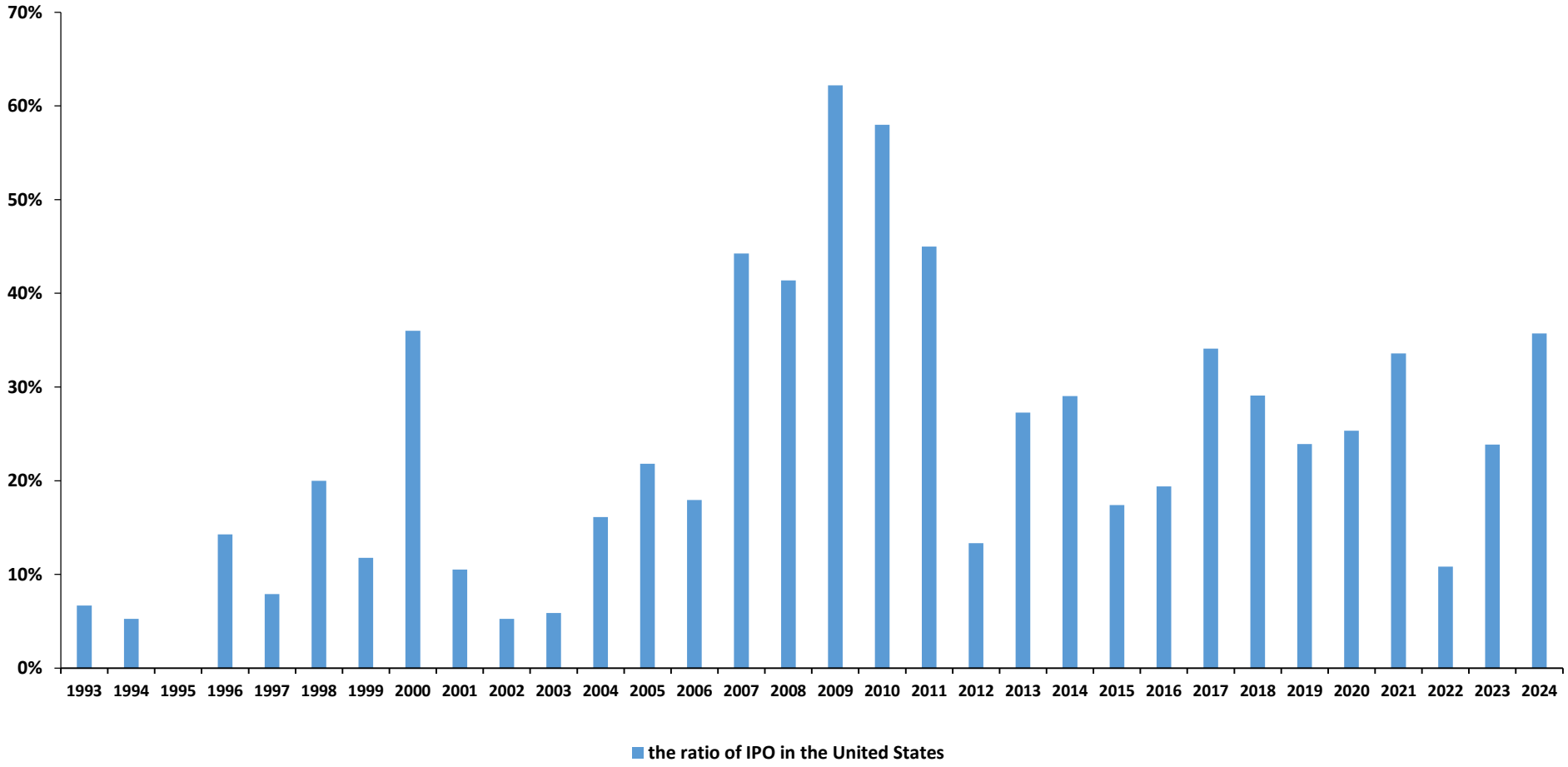


Figure 29. The ratio of IPOs on the U.S. Stock Exchanges to all Chinese overseas IPOs

Source: CSMAR

Top Chinese tech companies and U.S. venture capital investors behind them

Table 2. Chinese tech companies and U.S. venture capital investors

Name	Venture Capital investor
Alibaba	Fidelity Capital, Goldman Sachs, GGV Capital, Silver Lake
Bytedance	Sequoia Capital, Tiger Global Management, General Atlantic, KKR Private Equity
JD	Tiger Management, Sequoia Capital
PDD(PinDuoDuo)	Sequoia Capital
SHEIN	General Atlantic, Sequoia Capital, Tiger Global Management, Coatue Management
Xiaomi	Qualcomm Ventures

III. Next steps for China and U.S.

What China has done for financing innovation cooperation

Institutional opening-up

- ✓ Equal national treatment for foreign and Chinese banks and insurance institutions
  - Restrictions on foreign capital in banking and insurance institutions removed
  - Foreign capital can now have 100% of equity holdings of banking and insurance institutions
- ✓ Financial industry "Negative List for Foreign Investment Access“ completely removed
- ✓ Welcome all kinds of foreign institutions and long-term capital
- ✓ Welcome foreign institutions with professional expertise in
  - Wealth management, Asset management, Asset revitalization and disposal
  - Climate change response, Green finance, Sustainable operations

What China has done for financing innovation cooperation

Venture Capital investment

- ✓ Equal national treatment for foreign VC funds and domestic investors (April 19, 2024)

- ✓ Set up mother funds/specialized sub-funds for cooperation between foreign funds and domestic institutions and government-guided funds in:
  - new-generation information technology, AI, quantum technology, biotechnology, new energy and future energy, industrial machine tools, aviation and aerospace equipment, power equipment, new materials, core basic components and instrumentation
- ✓ Deepen global industrial supply chain cooperation
  - Support technology firms invested by foreign institutions
  - Support foreign investment in technology transfer
- ✓ Provide viable exit options for overseas investors
  - Overseas listings
  - Mergers and acquisitions
  - Share transfers

What China has done for financing innovation cooperation

Foreign investment

- ✓ Shorten the negative list for foreign investment access
  - Restrictions on the manufacturing industry removed
  - Opening-up of the telecommunications, medical care and other fields will be continuously promoted.
- ✓ Allow qualified foreign investment in pilot free trade zones (Beijing, Shanghai, Guangdong etc.) in:
  - Genetic diagnosis
  - Emerging therapies
  - Information services (limited to App stores)
- ✓ Supporting policies for the list of major and key foreign investment projects in
  - Integrated circuits
  - Biomedicine
  - High-end equipment

1 Implication for China and U.S.

- To confine and narrow the scope of **national security**
  - **Negative lists** in export and investment

2 Implications for China

- To keep promoting institutional opening up of the financial sector, and practicing the principle of fair competition.
- To keep supporting venture capital and patient capital investment
  - Esp. in emerging industries

3 Implications for U.S.

- To Remove export limitations Esp. in high-tech areas
- To Loosen restrictions on investments
  - Both from China to U.S. and from U.S. to China.
  - Venture capital and innovation are key drivers for long-term growth
- To encourage financing innovation
  - Reducing limitations of Chinese firms' IPO on U.S. Stock Exchanges
  - Reducing limitations of bilateral investments, esp. in high-tech areas

Thank you for your attention!

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Global Investment Research

US-China bilateral investment flows

HLS/PIFS/CDRF China-U.S. Symposium

June 6, 2024

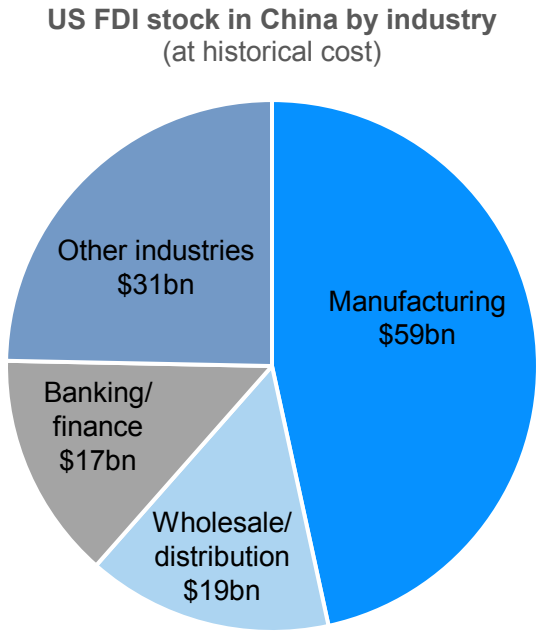
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US direct investment in China rose rapidly post-China WTO entry, particularly in the manufacturing sector

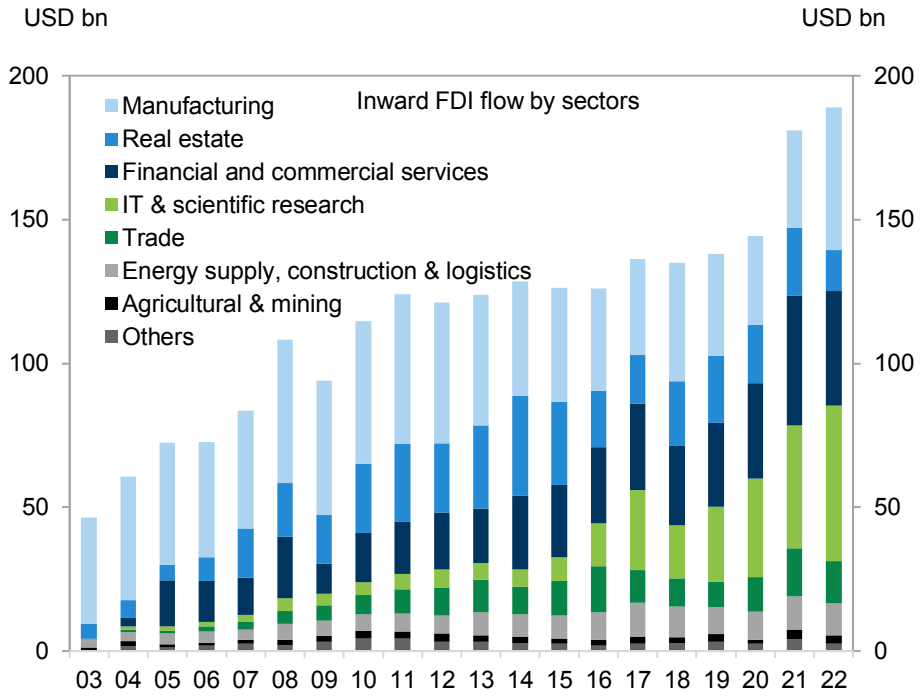


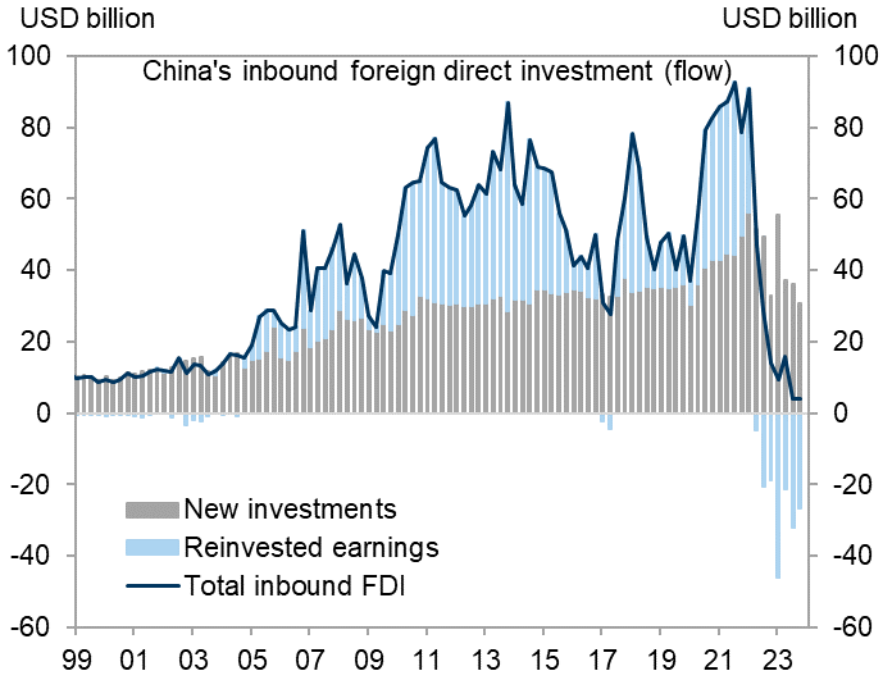
Source: US Bureau of Economic Analysis



Source: US Bureau of Economic Analysis

China's inbound FDI (from world) broadening beyond manufacturing; BOP statistics exaggerate recent decline



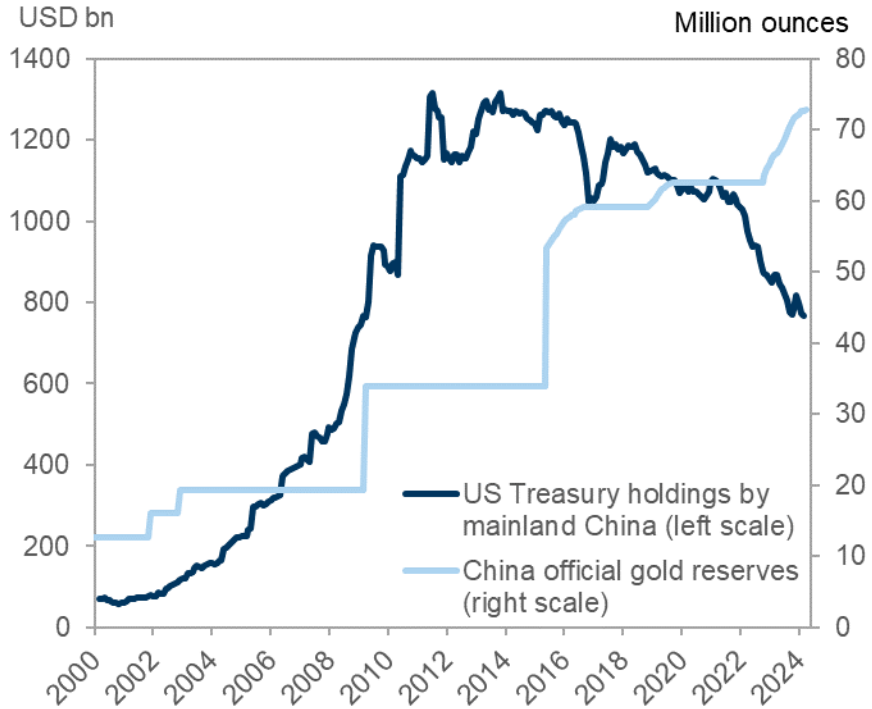


Source: MOFCOM, CEIC

Source: SAFE, MOFCOM, Goldman Sachs Global Investment Research

Bilateral US-China portfolio holdings have declined modestly over the past two years

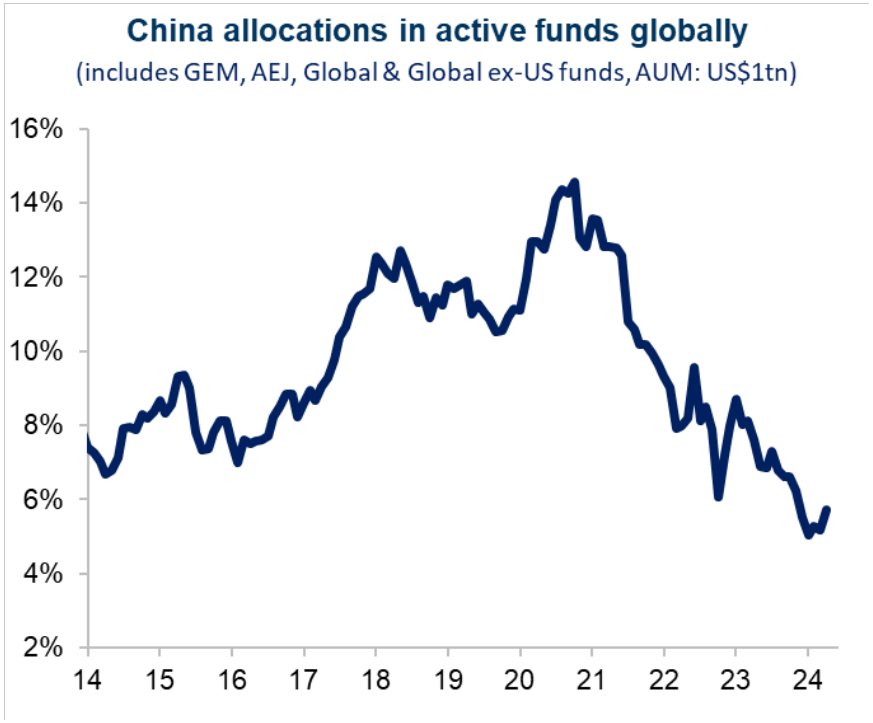




Source: US Bureau of Economic Analysis

Source: US Department of the Treasury, PBOC, Wind

Global funds, including US investors, have reduced holdings in Chinese equities





* Includes GEM, AEJ, Global & Global ex-US funds, AUM: US$1tn. As of Apr 30, 2024.

Source: EPFR, Goldman Sachs Global Investment Research

Note: Numbers in bold indicate the US holdings in each universe (as % of listed market cap). ^ captures US institutional holdings only.
As of Jan 22, 2024.

Source: Bloomberg, FactSet, Goldman Sachs Global Investment Research

Disclosure Appendix

As of June 6, 2024

Disclosure Appendix

Reg AC

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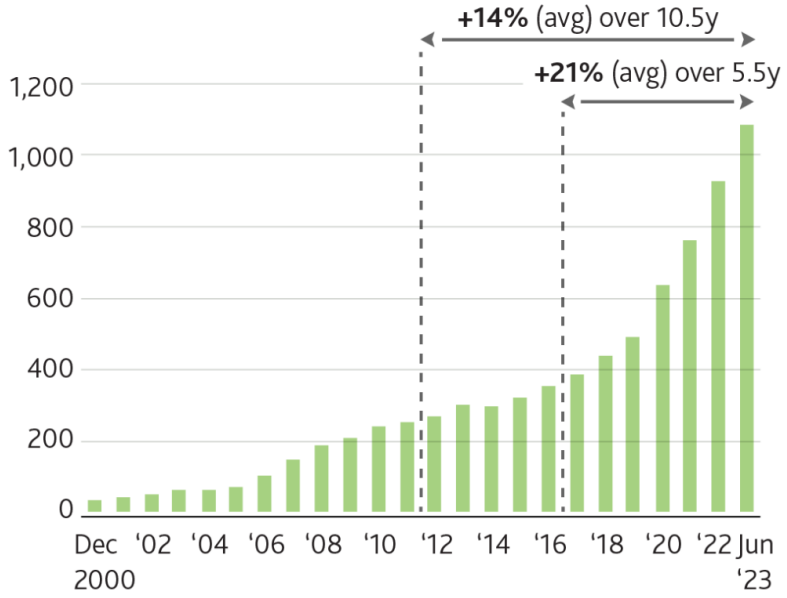
The Rise of Private Credit
June 2024

Richard Cantor

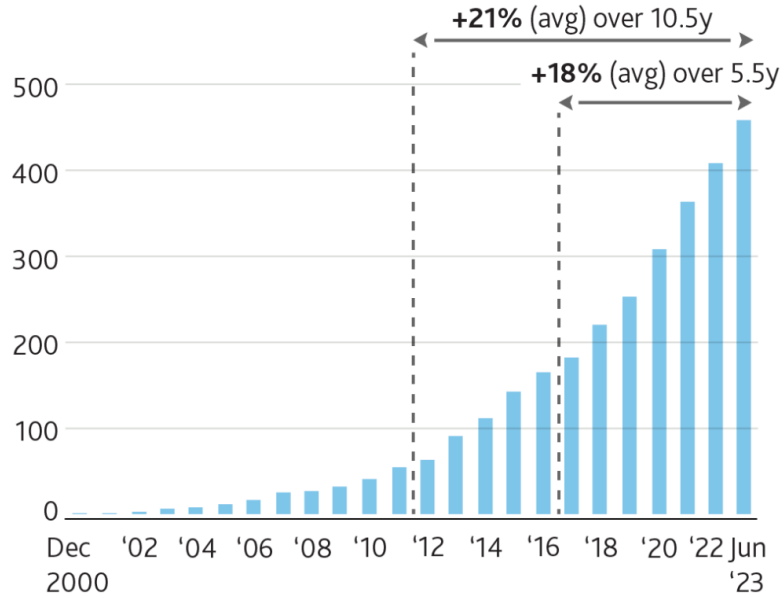
Private credit markets are taking off

PC AUM by region ($ billions)

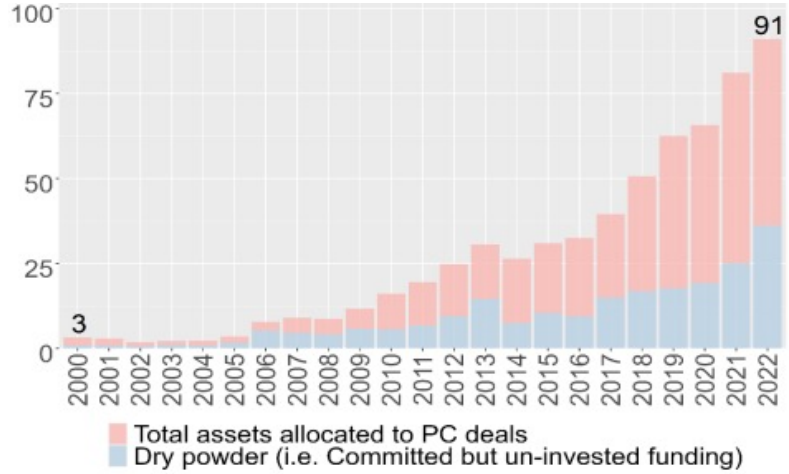
North America



Europe



APAC



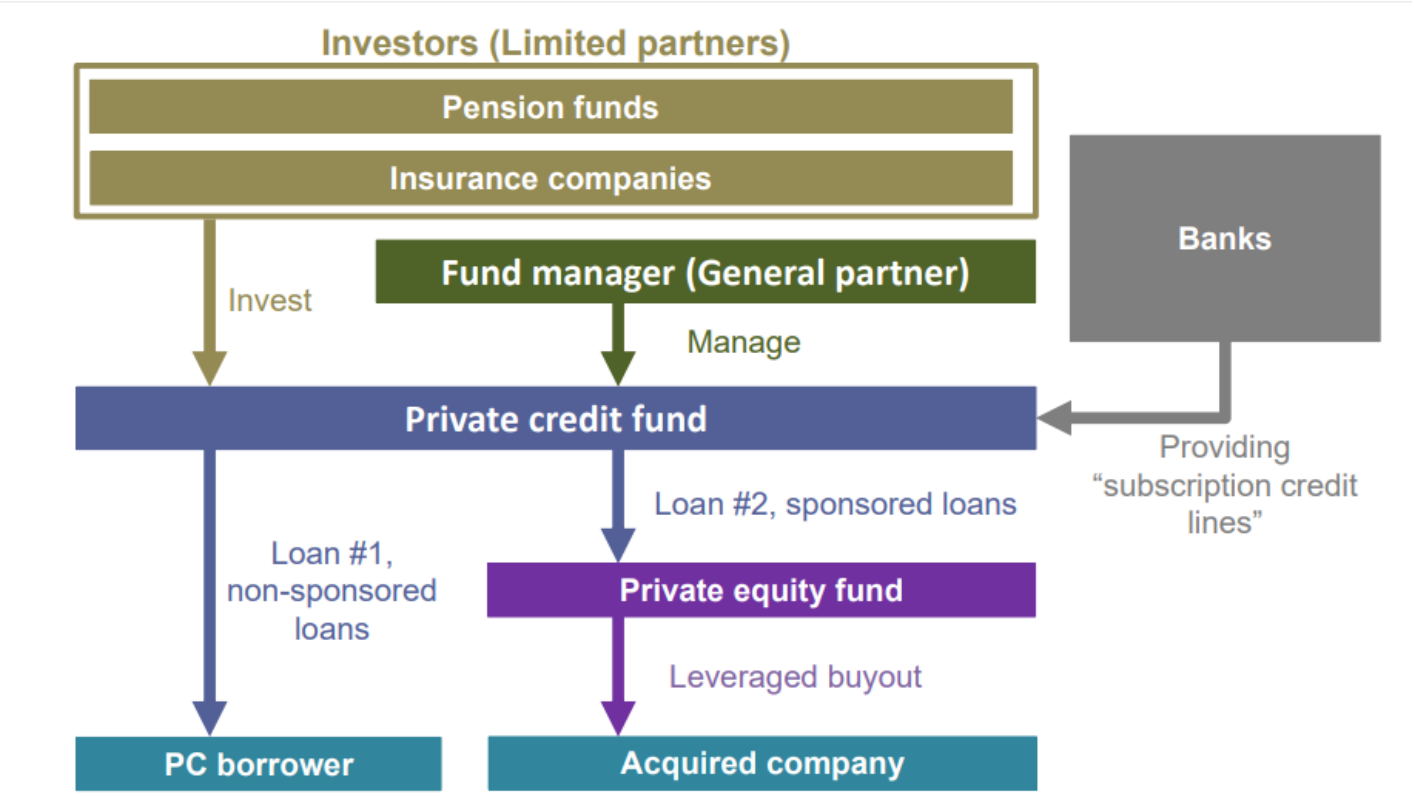
Sources: Preqin, IOSCO, and Moody's Ratings

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Private credit moving to center stage in fixed income markets

- Private-equity-style funding with bank-financed leverage
- AMs expanding funding by partnering with banks and insurers
- Retail investors participating via BDCs & retirement account offerings
- PC assets moving beyond corporates to asset-backed financings
- Regulation driving regional asset allocations across life insurers

Private credit and private equity funds use similar structures



- Bank-provided subscriptions lines can substitute for funded subscriptions
- Net Asset Valuation (NAV) bank loans can be used to fund early buyouts for limited partners

Chart source: HKMA Research Memorandum, 4/29/2024, "The Financial Stability Implications of the Private Credit Sector in the Asia-Pacific.

Insurers and banks partnering with alternative asset managers

Recent acquisitions or stakes by alternative asset managers in the insurance space

Target	Buyer	Acquisition Value ($B)	Year	% Ownership
Athene	Apollo	$8.2	2019	100%
Aspen Insurance	Apollo	$2.6	2019	100%
Fortitude	Carlyle FRL	$1.8	2019	10%
American National	Brookfield	$5.1	2021	100%
Global Atlantic	KKR	$4.7	2021	63%
Everlake (Allstate Life)	Blackstone	$4.3	2021	10%
Talcott Resolution	Sixth Street	$2.3	2021	100%
Corebridge	Blackstone	$2.2	2021	10%
Resolution	Blackstone	$3.0	2023	10%
American Equity Investment Life	Brookfield	$3.6	2023	100%

Source: SNL Financial, Morgan Stanley

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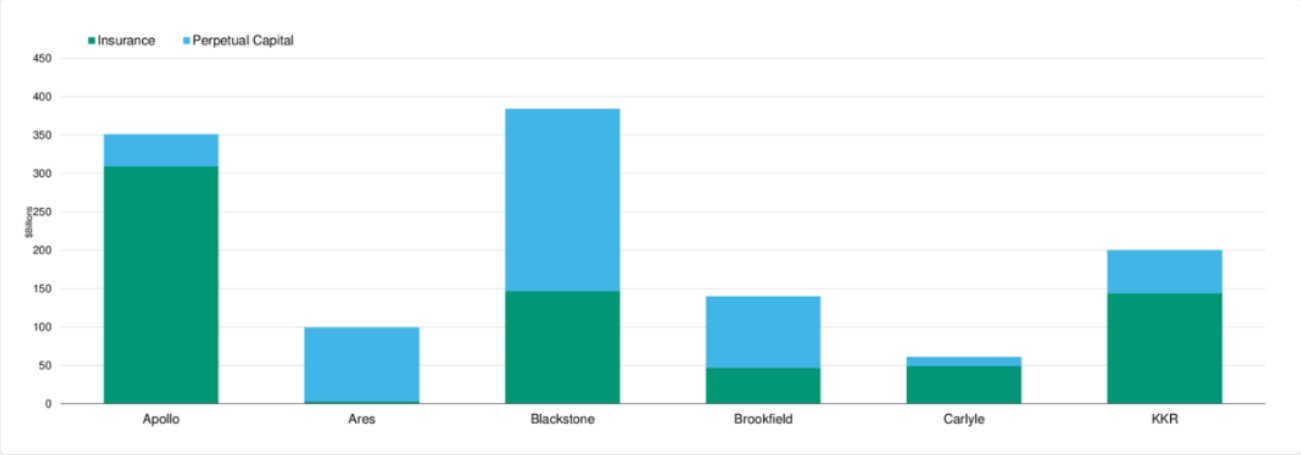
Some examples of recent partnerships between banks and private credit sponsors:

Date	Partnership	Platform description
Apr 2024	AGL Private Credit platform exclusive cooperation agreement with Barclays	Direct origination of senior secured loans to large corporate borrowers. AGL to operate as independent manager, with complete control over origination, asset selection, portfolio construction and portfolio management with exclusive access to Barclays deal flow and ability to originate transactions directly.
Mar 2024	KeyCorp and Blackstone Credit & Insurance	Forward flow origination (underwrite-to-distribute) partnership.
Sep 2023	Societe Generale and Brookfield Asset Management	Originate and distribute high-quality private credit investments through a private investment grade EUR10 billion debt fund.
Sep 2023	Centerbridge Partners and Wells Fargo	Strategic relationship focused on direct lending to non-sponsor North American middle-market companies
Some examples of banks expanding PC-focused funds and capabilities:		
Mar 2024	Goldman Sachs' Asset Management division (GSAM) growing its PC portfolio	GSAM expects to grow its private credit portfolio to $300 billion from the current $130 billion over the next five years
Jan 2024	JPMorgan reportedly raising $2.5-$3 billion for private credit fund	Capital to be supplemented by $10 billion in balance sheet capacity
Feb 2023	Morgan Stanley's Investment Management division expanding PC fund	Division currently manages $40 billion across private credit and equity (split half-and-half). Raised $12 to $13 billion in private credit over the past three years. Plans to grow private credit to around $40 billion to $50 billion in the next five years, including getting to $10 billion in Europe.

Source: Company reports and Moody's Ratings

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Insurance assets as a composition of perpetual capital (as of 2Q23)

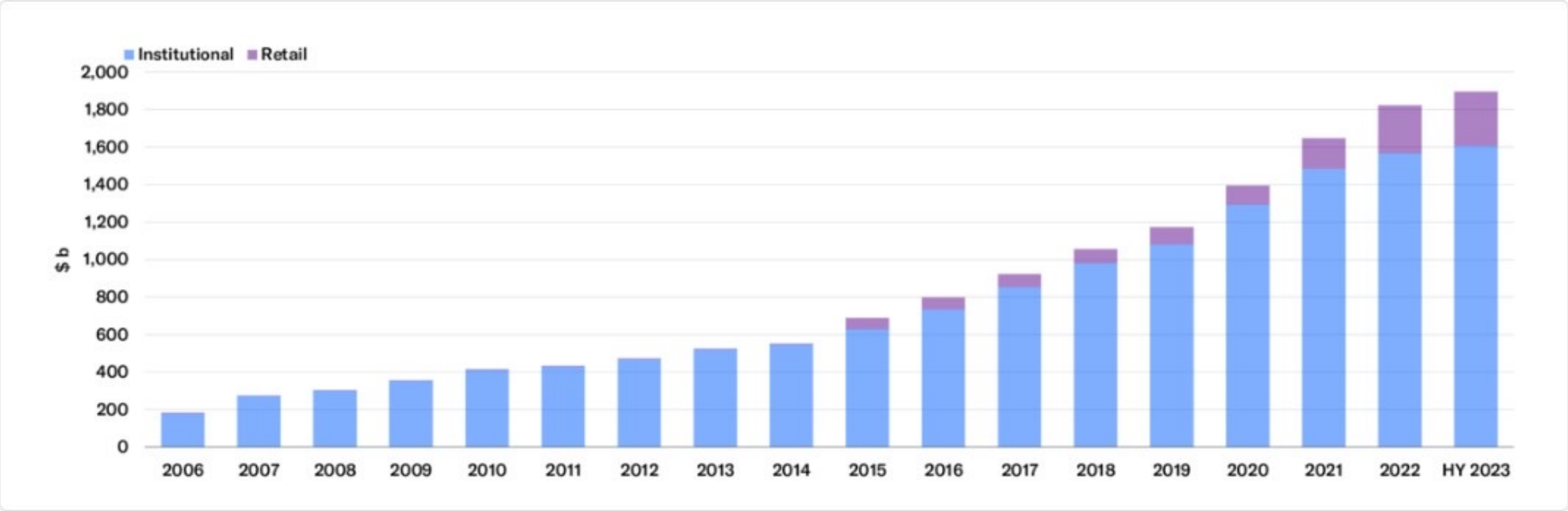


Source: Company Reports

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Retail participation is small but growing

Global private credit assets under management



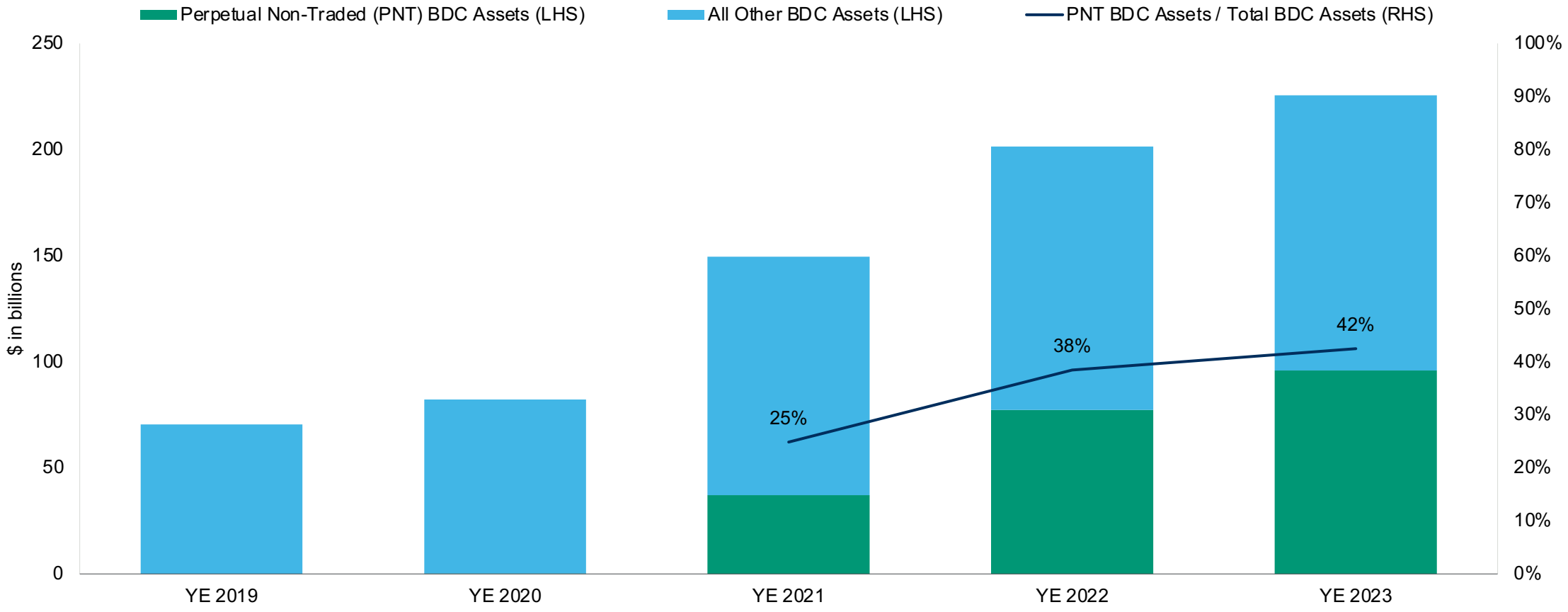
Based on PitchBook's classification. Retail is estimated based on AUM from retail-oriented credit vehicles

Source: PitchBook, Moody's Ratings

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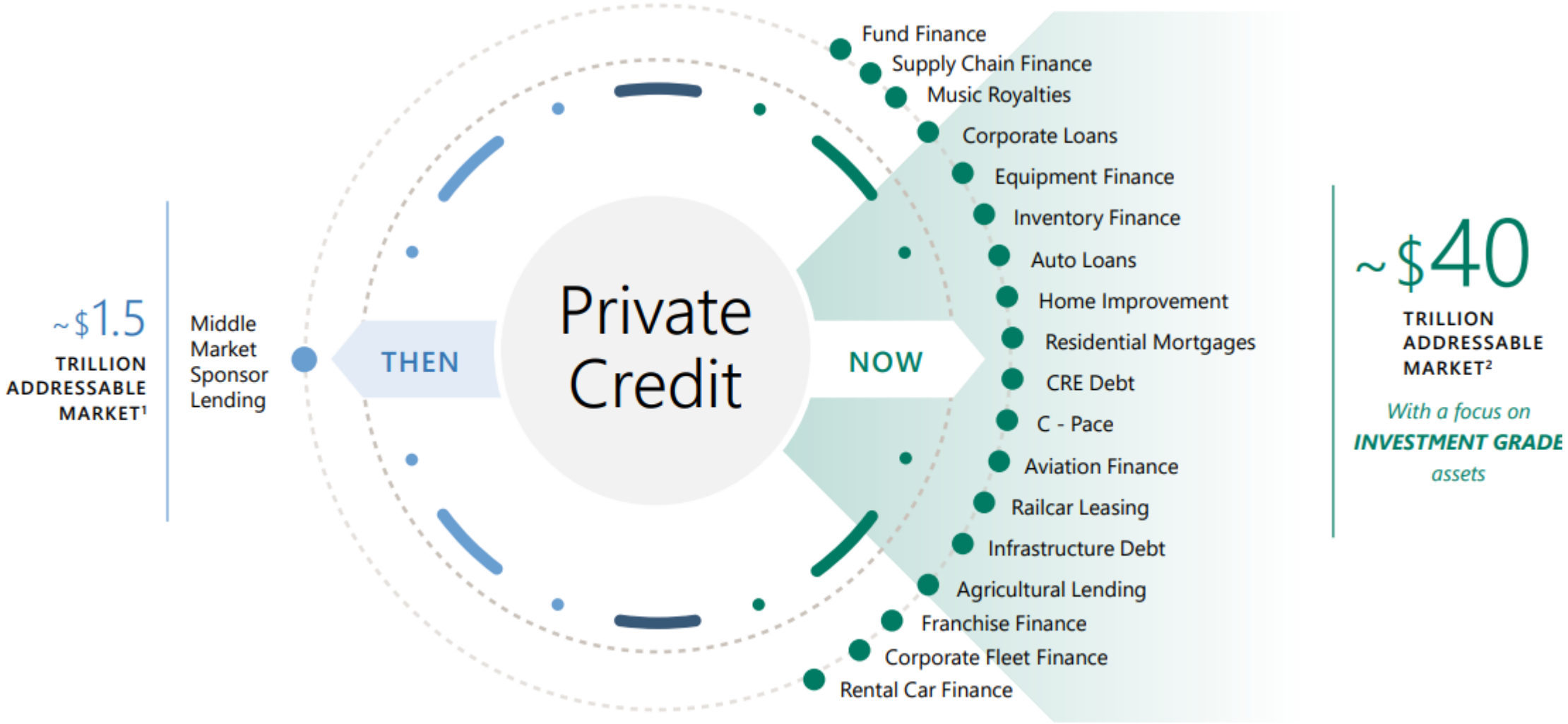
Business Development Corporations are contributing to PC growth

Perpetual non-traded BDCs facilitate entry by retail investors



Source: Moody's Ratings

Apollo envisions greater de-banking and PC expansion

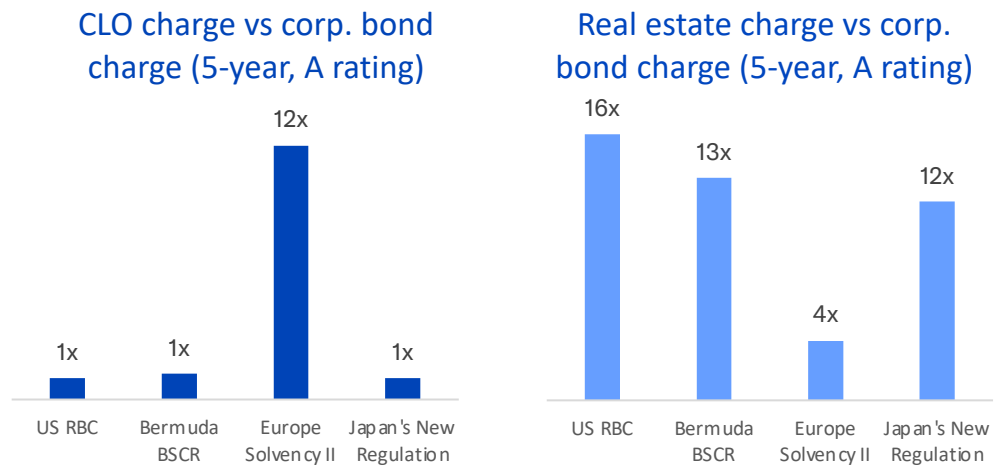


1. Preqin Private Debt AUM as of December 2022. 2. Fixed-income replacement market based on Apollo estimates as of Apollo's Investor Day on October 19, 2021. Sources: Federal Reserve Board, S&P LCD, BofA, Preqin, SIFMA, Haver Analytics, Bloomberg. Represents the views and opinions of Apollo Analysts. Not an exhaustive list. Subject to change at any time without notice. For discussion purposes only.

Regulation partly drives geographical differences in asset allocation across life insurers

Differences in capital charges

→ Cost of replacing a corporate bond with other assets varies



We assume that CLOs do not meet the Solvency II requirements to be classified as an STS (Simple, Transparent and Standardized) securitization.

Sources: NAIC, BMA, EIOPA, JFSA and Moody's Ratings

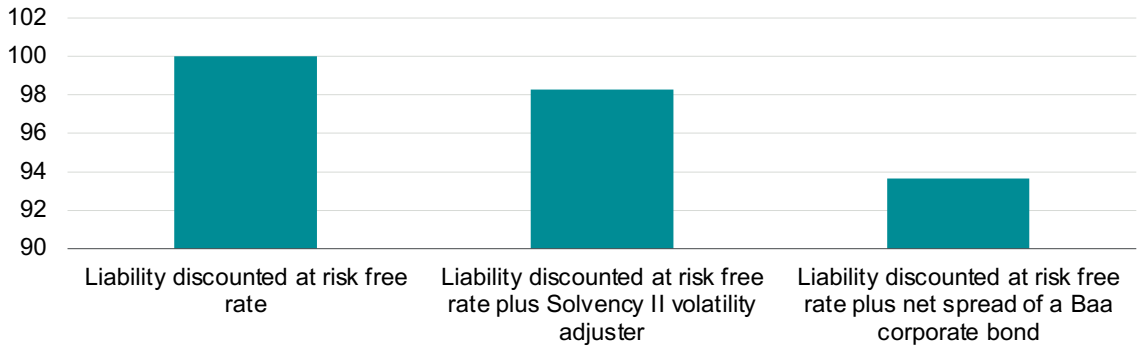
→ Higher capital charges for long duration assets in Japan and Europe (except for sovereign bonds), while in other regimes (US, Bermuda) capital charges do not vary with duration

Discount rates also matter

→ Bermuda and UK (for annuities) allow for the use of discount rates (for the computation of liabilities) based on insurers' actual investment yield, subject to good cash flow matching

→ Opportunities for insurers to invest in high yielding assets as this contributes to increasing profits and reducing liabilities, hence increasing capital

Illustration: valuation of a 10-year liability under various discount rate assumptions



Assumptions: (i) one flow of liabilities of 135.7 with a maturity of 10 years, (ii) 10-year risk-free rate of 3.10%, (iii) Solvency II volatility adjustment of 0.18%, (iv) spread of Baa corporate bonds of 1.84% and fundamental spread (cost of default and downgrade) of 1.16% (with a resulting net spread of 1.84%-1.16% = 0.68%).

Source: EIOPA monthly technical information for Solvency II Relevant Risk-Free Interest Rate Term Structures – end-December 2022 and Moody's Ratings

Private credit – the latest assault on bank balance sheets

Banks historically provided the bulk of the economy's credit and maturity transformation

- Borrower prefer to lock-in long-term funding, whereas investors prefer to stay liquid
- Bank access to deposits and central bank liquidity made such credit and maturity transformation possible

Investors are, however, willing to acquire long-term assets if the assets are sufficiently liquid

- Public debt offers standardized terms, public financials, transparent prices, and watchful "eyes", including rating agencies
- Private credit offers bespoke terms, limited financial disclosures, non-transparent pricing, and fewer watchful eyes
- Private credit is inherently less liquid than public debt and hence earns a spread premium, attractive to patient capital

Many (largely failed) attempts to displace banks as the leading providers of private credit

- Independent finance companies
- Industrial-parent-owned finance companies
- Structured finance securities
- Financial guarantors / bond insurers

Private credit markets may be better placed to disintermediate banks, relying on…

- Evolving bank capital requirements to dislodge banking assets
- Alternative asset managers' acumen for underwriting, surveillance, and distressed work-outs
- Private fund structures and retirement assets to source semi-permanent capital

Thank you

Richard Cantor

Vice Chairman

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FUDAN INTERNATIONAL SCHOOL OF FINANCE

China's Financial Markets: Further Opening Up and Opportunities for Global Investors

Professor QIAN, Jun (QJ)
International School of Finance, Fudan University

Symposium on Building the Financial System for the 21st Century

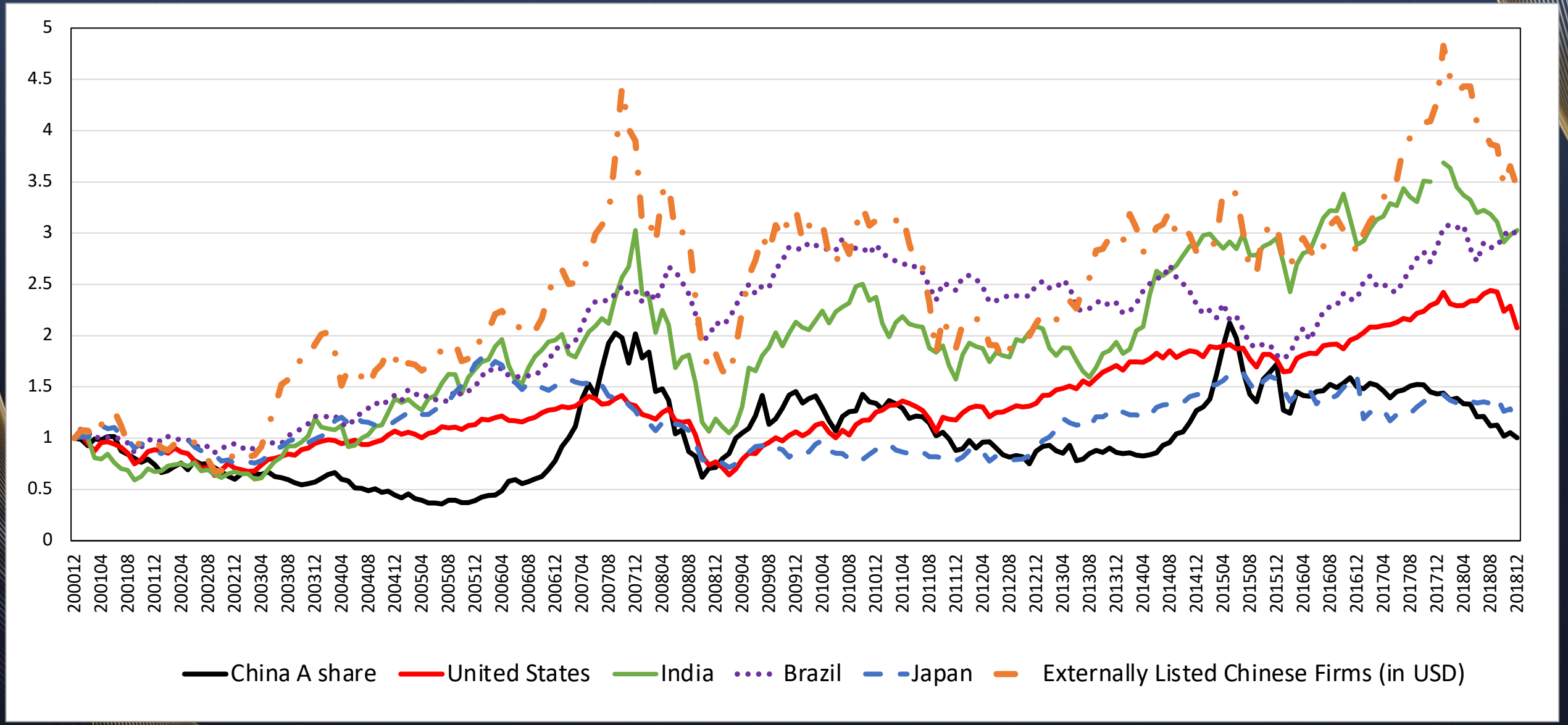
June 6, 2024

Outline

- **Foreign investors entering China's domestic markets:**
  - Early stage: strategic investment
  - Three channels: **QFII/RQFII**, **stock connects** (between A share and HK), and **WFOE** (wholly foreign-owned enterprises)
- **Investing in the stock market:**
  - **A share market**: foreign share of holdings remains low (**4%**), but recovering;
  - **HK market**: foreign investors hold nearly 40%, mainly from Asia/Europe/US
  - Long-term performance (BHRs) of A share and HK-listed Chinese firms;
  - Increase exposure to greater China markets? Valuations look quite attractive…
- **Investing in the bond market**
  - Domestic bond market: growing fast, two segments becoming more integrated
  - Investing channels: QFII/RQFII, **bond connect**; total foreign holding **2.5%**

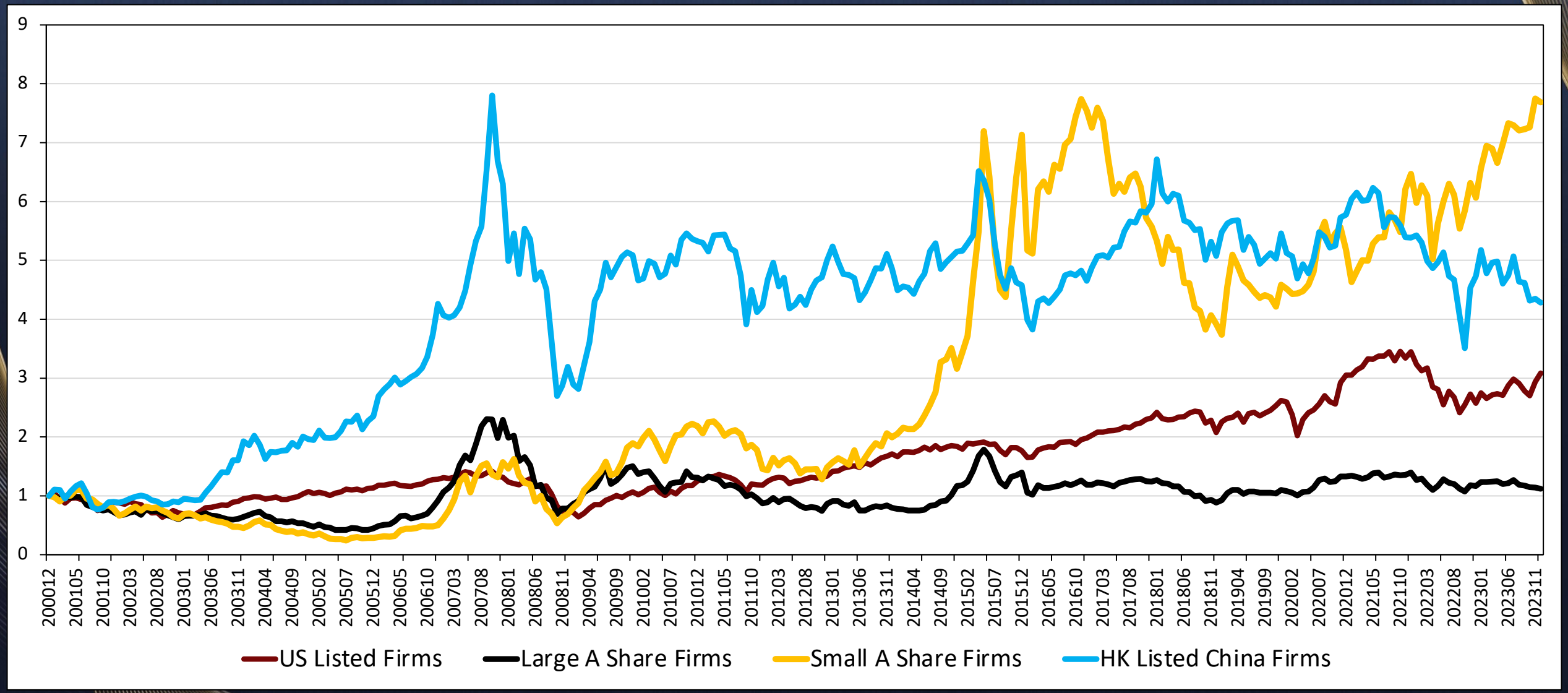
Comparing Buy-and-hold Returns (monthly BHRs) of Major Markets:

(2000-2018; inflation adjusted, cash dividends included ; AQSZ 2024 *Journal of Finance*)

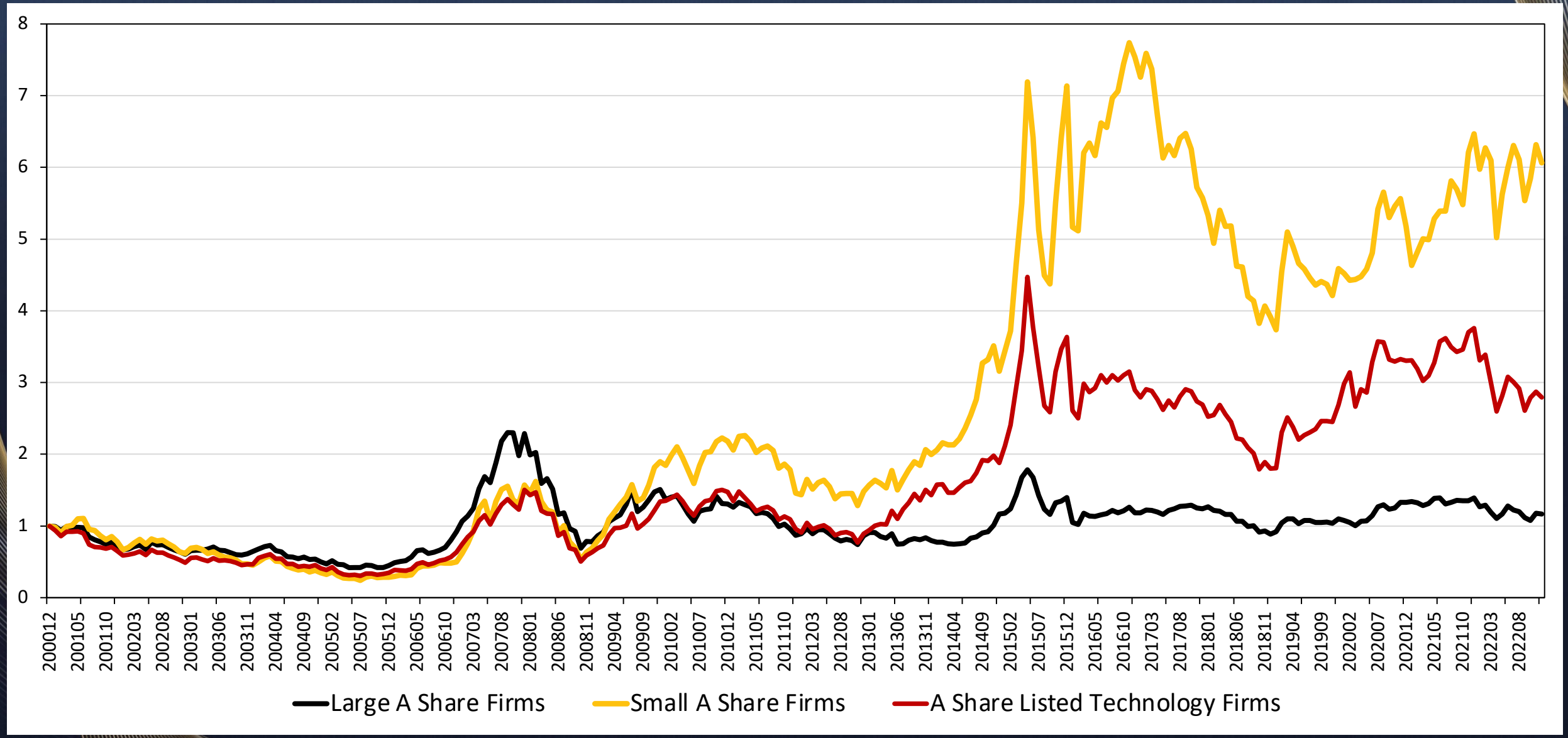


Comparing (monthly) BHRs: Large- and Small-cap A share Stocks, US listed stocks, and HK-listed Chinese stocks

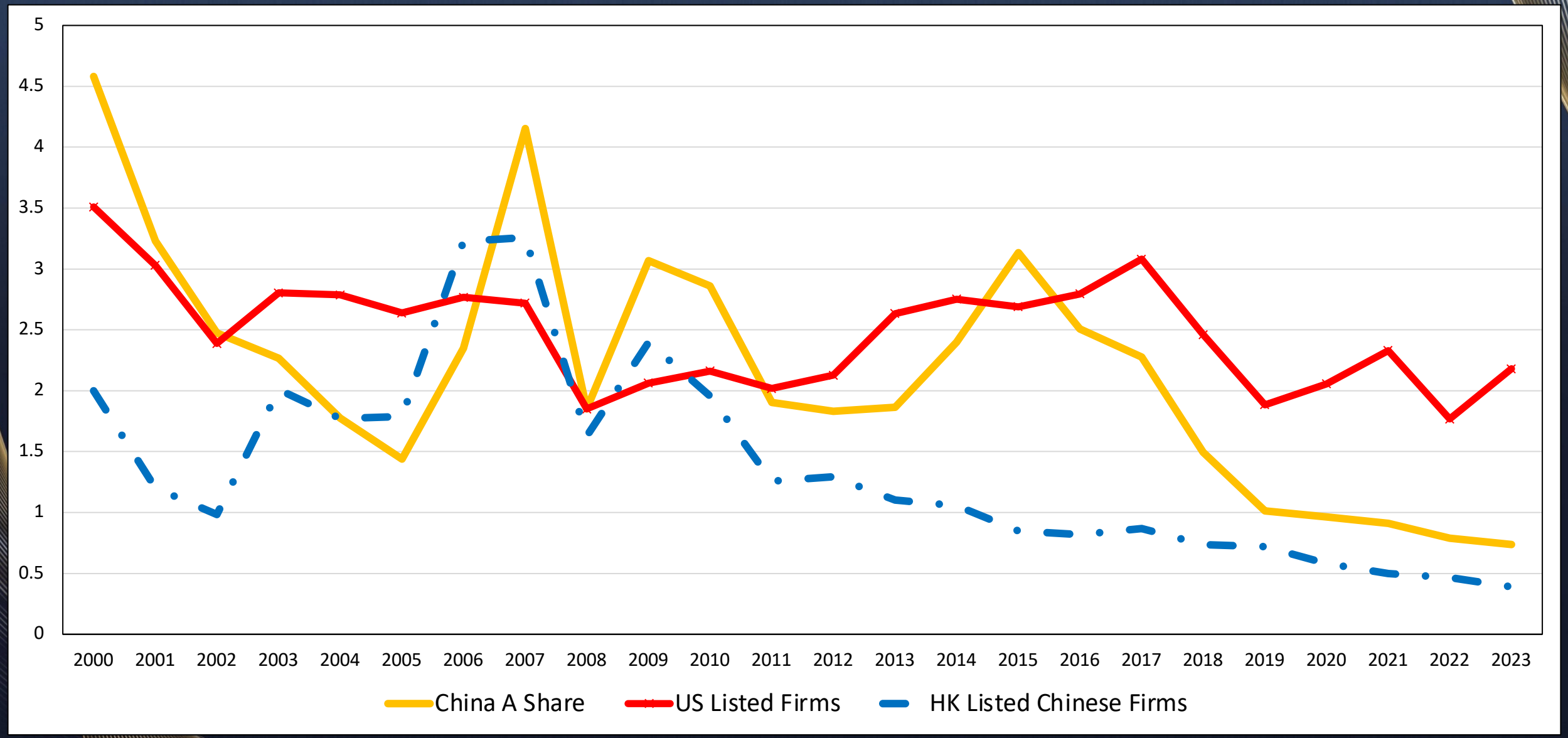
（2000-2023.12； inflation adjusted, cash dividends included; AQSZ 2024）



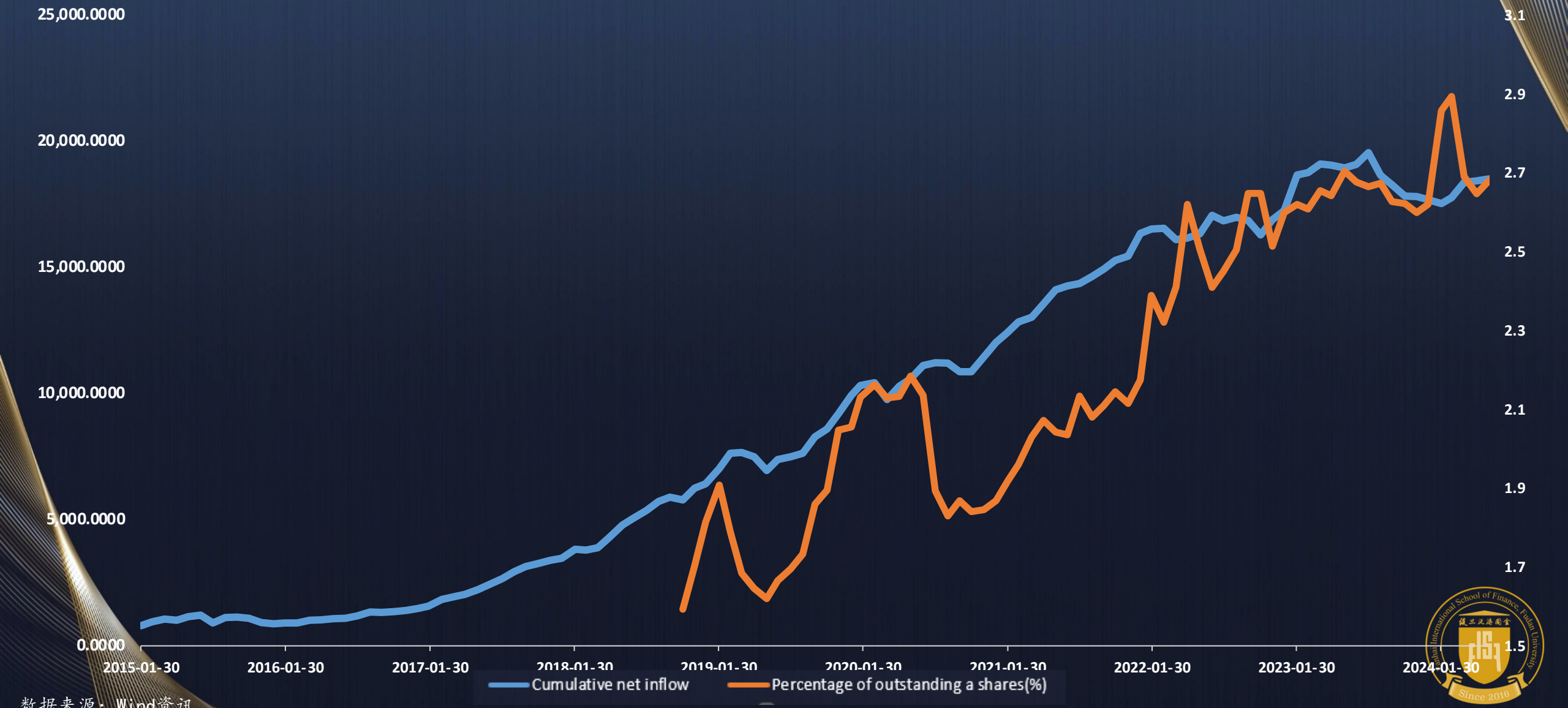
Comparing (monthly) BHRs: Large-cap, Small-cap and 'Tech' A share Stocks (2000-2022)



M/B Ratios of A Share, US Listed Firms, & HK-Listed Chinese Firms (weighted ave of all firms; weight is lagged total assets; AQSZ 2024)

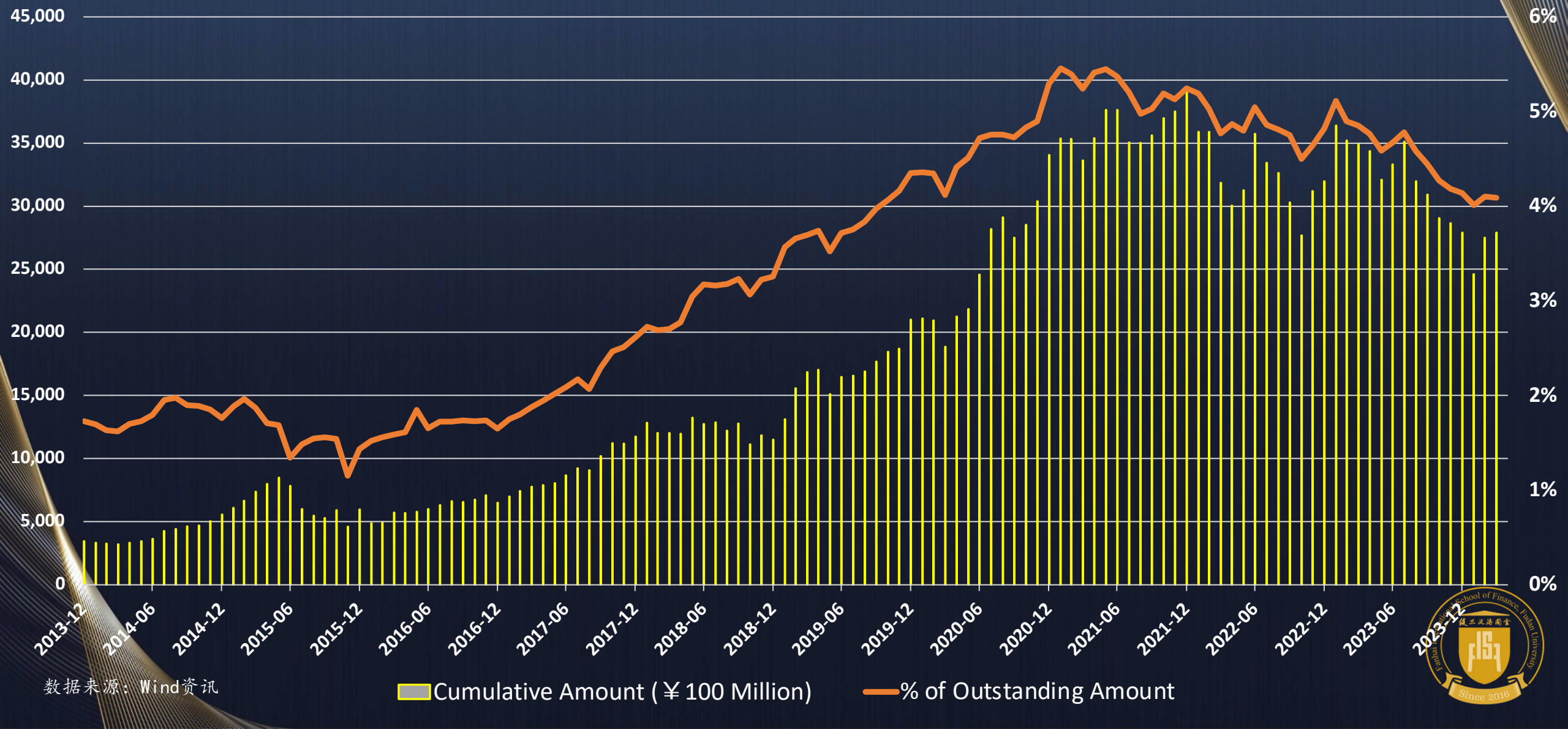


Cumulative net inflow of *northbound* trading and % of foreign holdings (2015.01-2024.5)



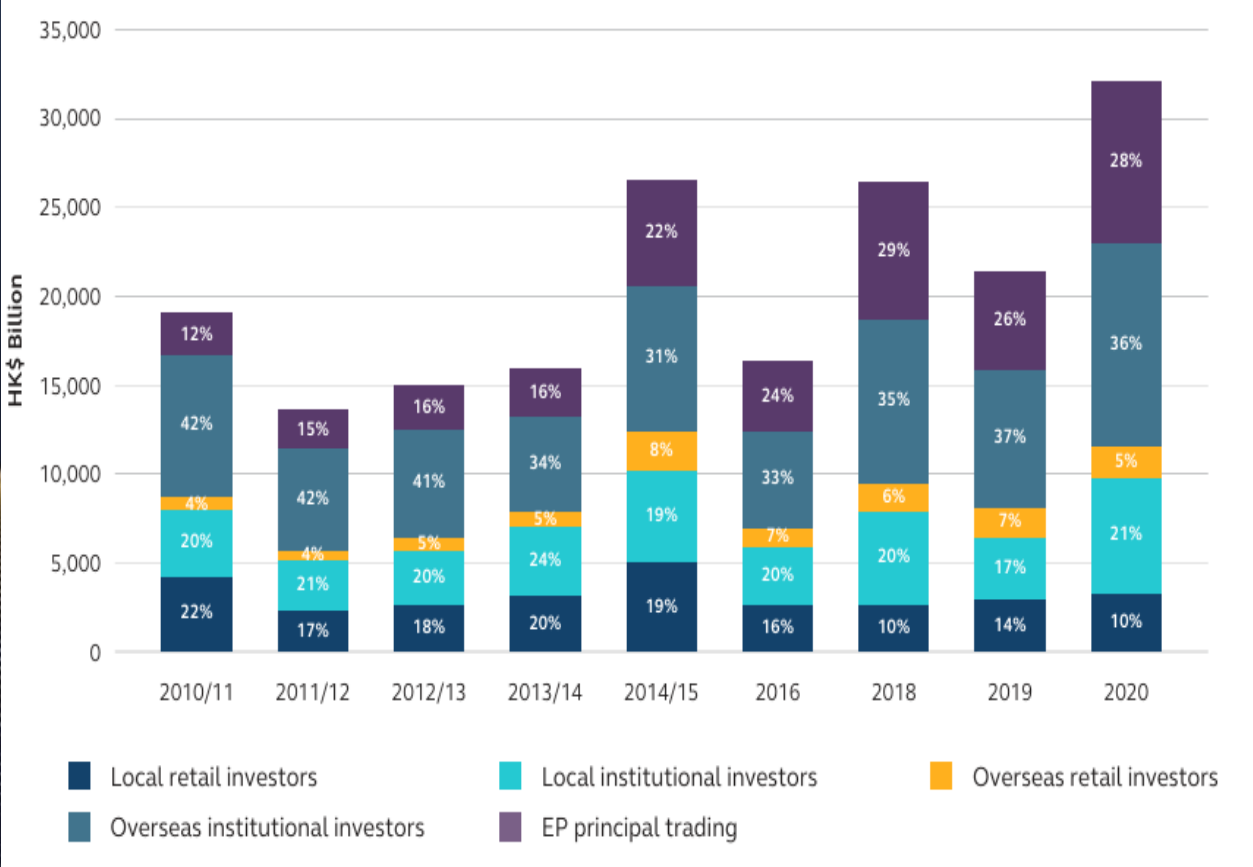
数据来源：Wind资讯

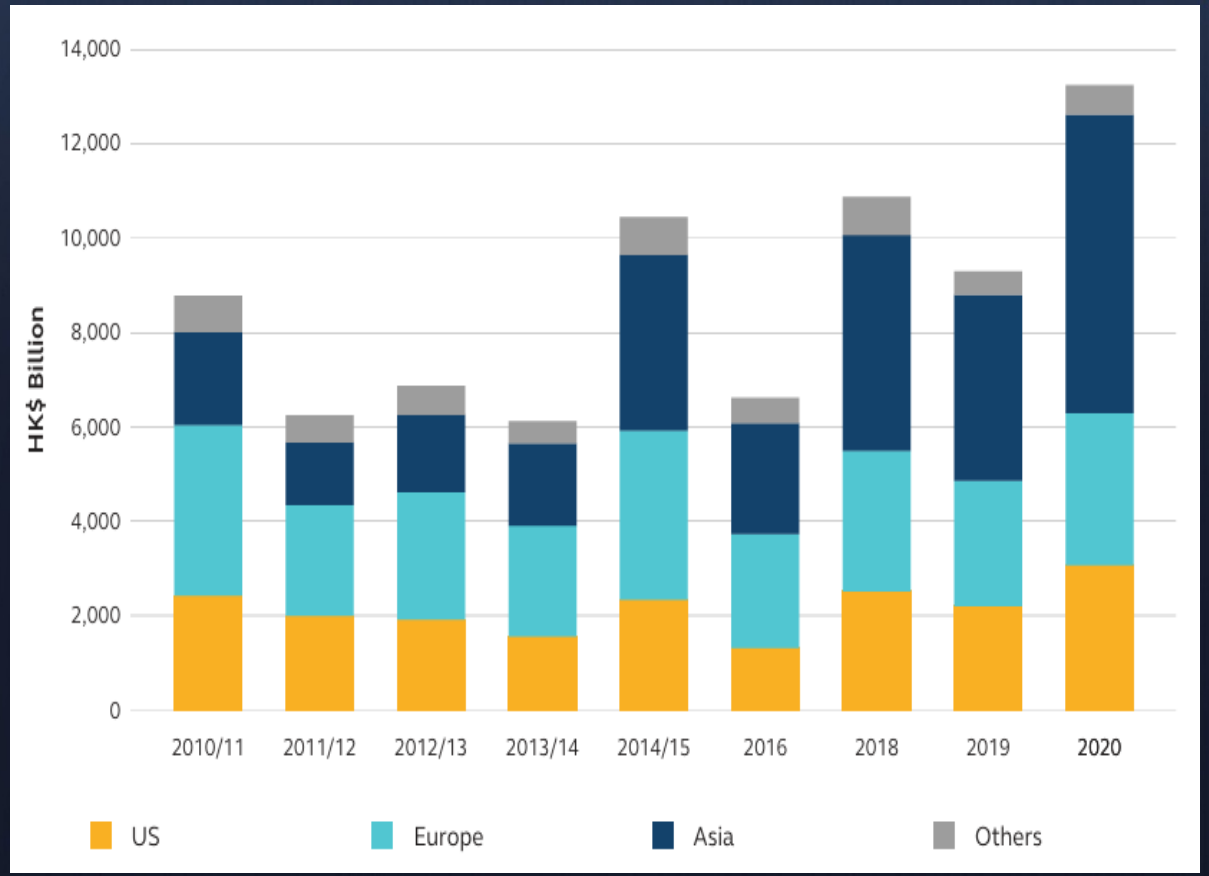
Total Foreign Investment in A Share Market: Cumulative Amount and % holdings (2013-2024.3; PBOC)



Global Investors in the HK Stock Market (2010-2020)

In 2020, foreign investors accounted for 41% of total trading, higher from a low of 39% in 2013-2014; top 3 investment capital from: Asia, Europe, and the US

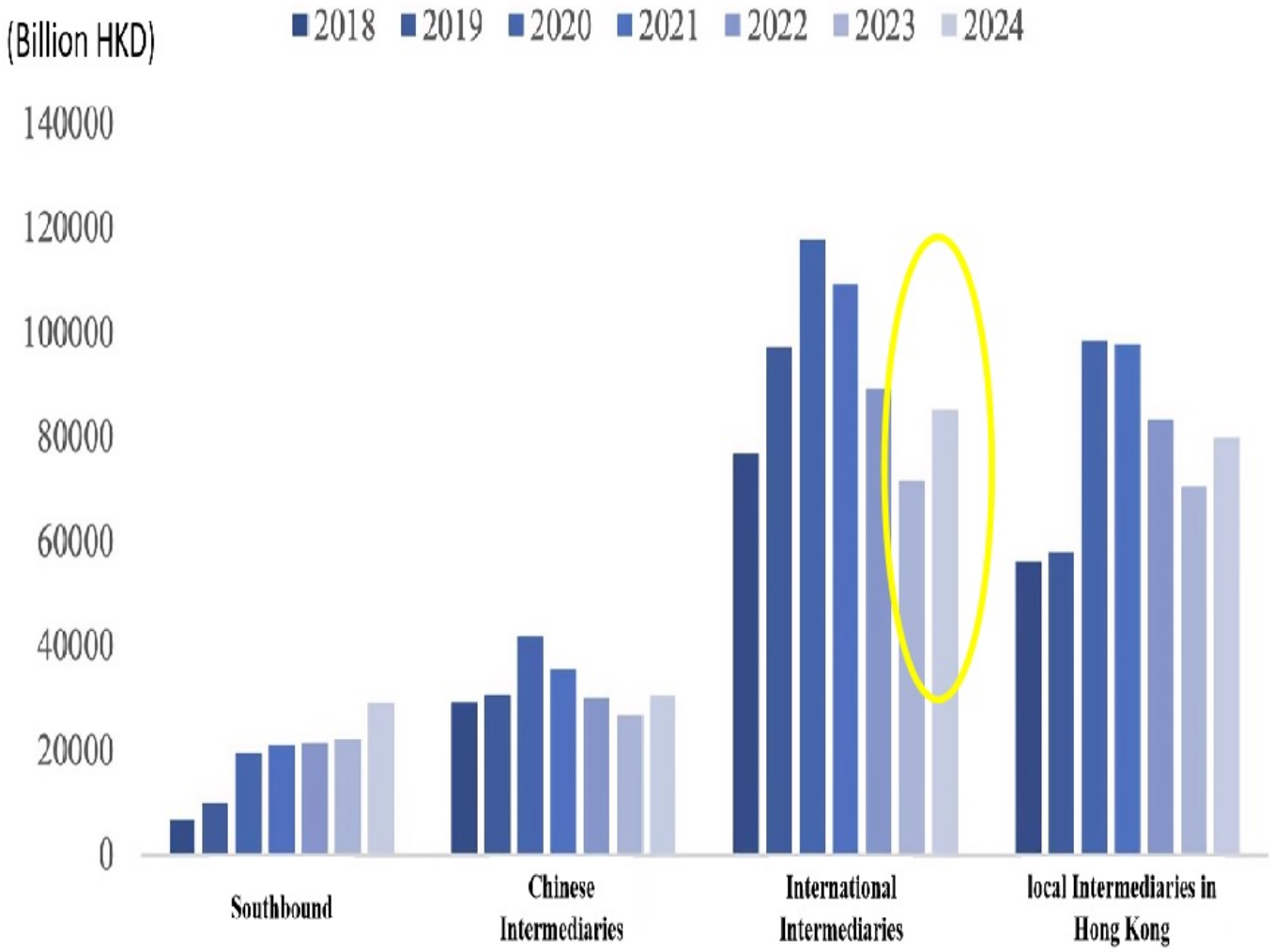


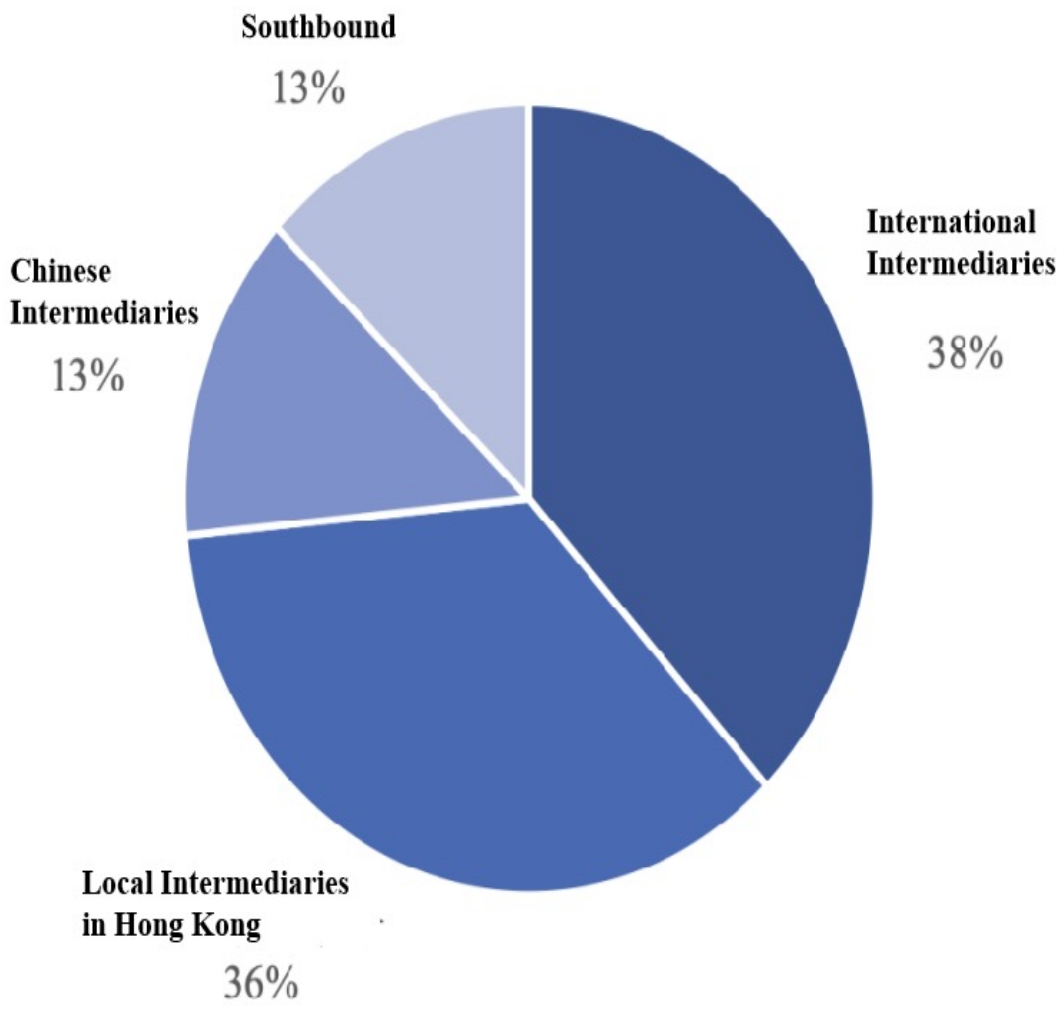


Source: HKEX《Cash Market Transaction Survey 2020》

Market Value of Foreign Holdings in the HK Stock Market

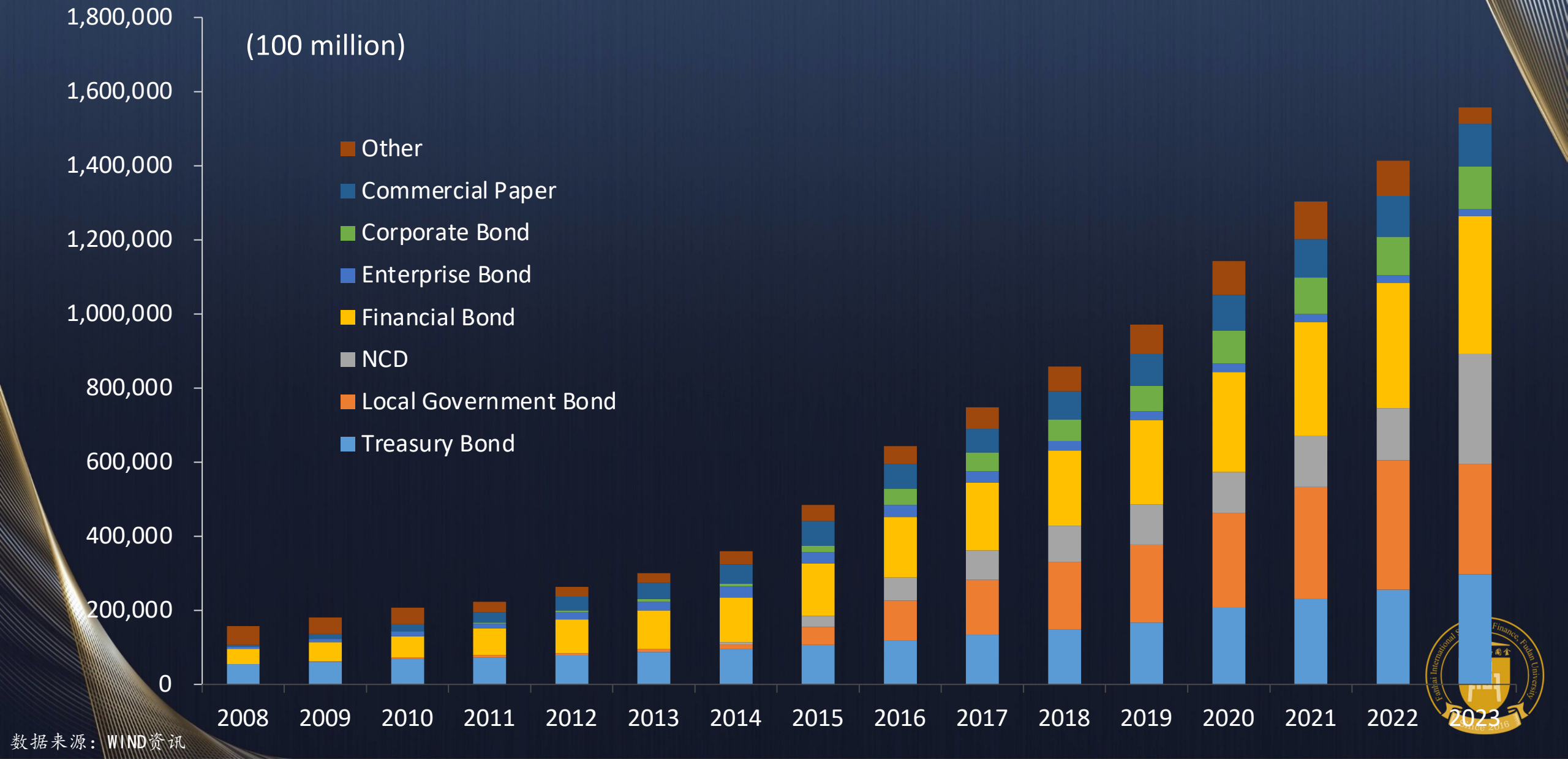
As of May 2024, the market value of international intermediaries' holdings is HKD 8.5 trillion, accounting for 38% of the total market value, representing a 19% increase compared to the end of 2023





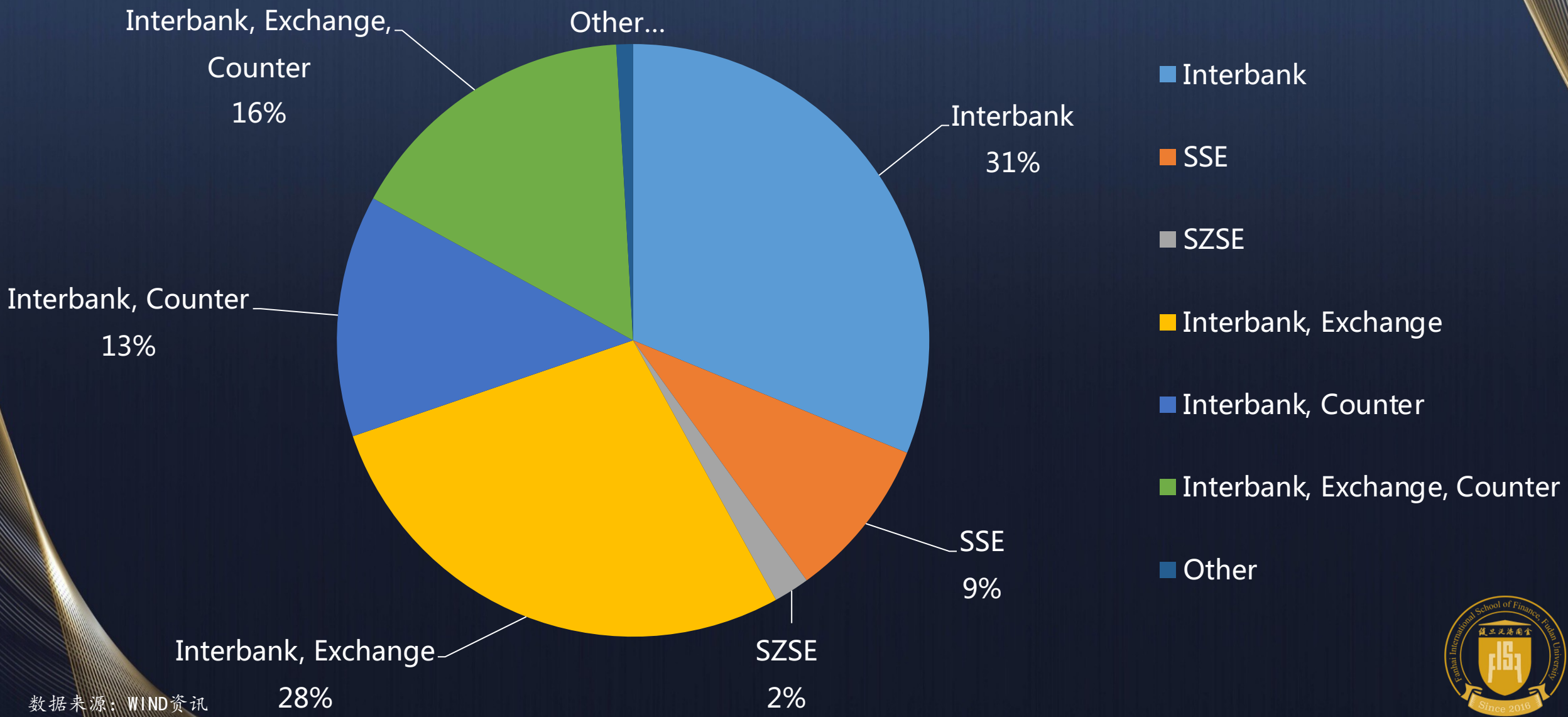
Source: HKEX CCASS, Wind

China’s Bond Market: Components and balances (2008-2023)



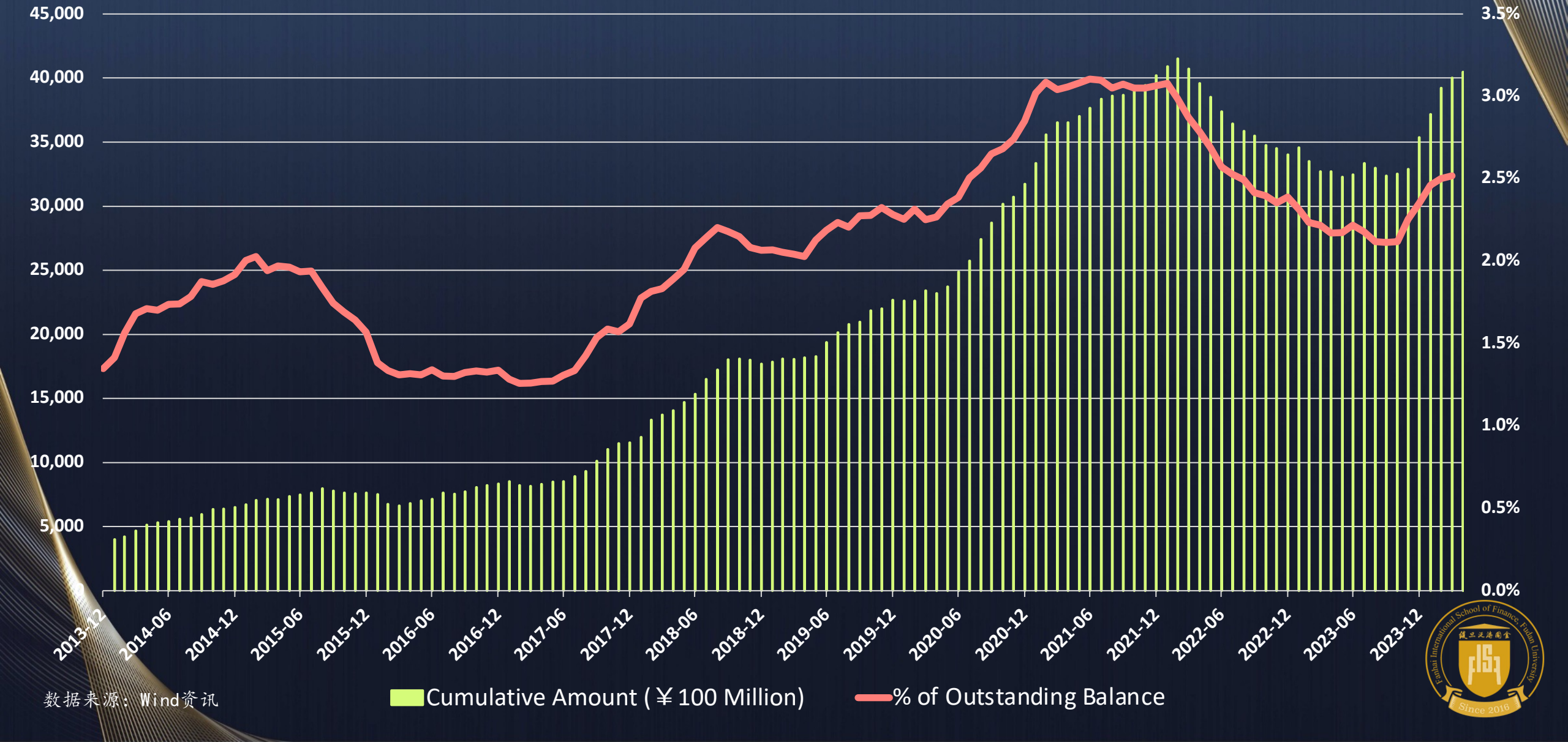
数据来源：WIND资讯

China's Bond Market: by Segments (% of total balances in 2023)



数据来源：WIND资讯

Total Foreign Investment in China's Bond Market: Cumulative Amount and % holdings (2013-2024.3; PBOC)



数据来源：Wind资讯

Foreign Issuers in Hong Kong's Bond Market (new issues and total outstanding in %, 2014-2023)

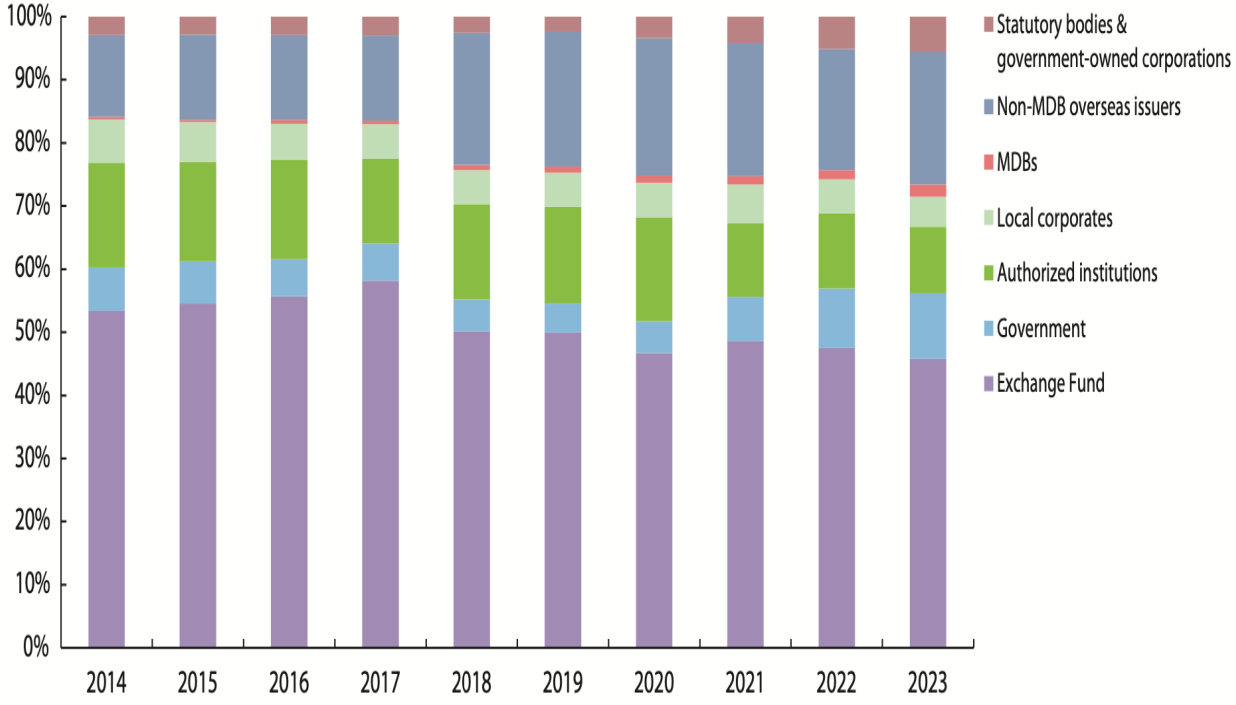
Chart A1

Proportions of Hong Kong dollar debt issuance activities, 2014–2023 (by type of issuers)



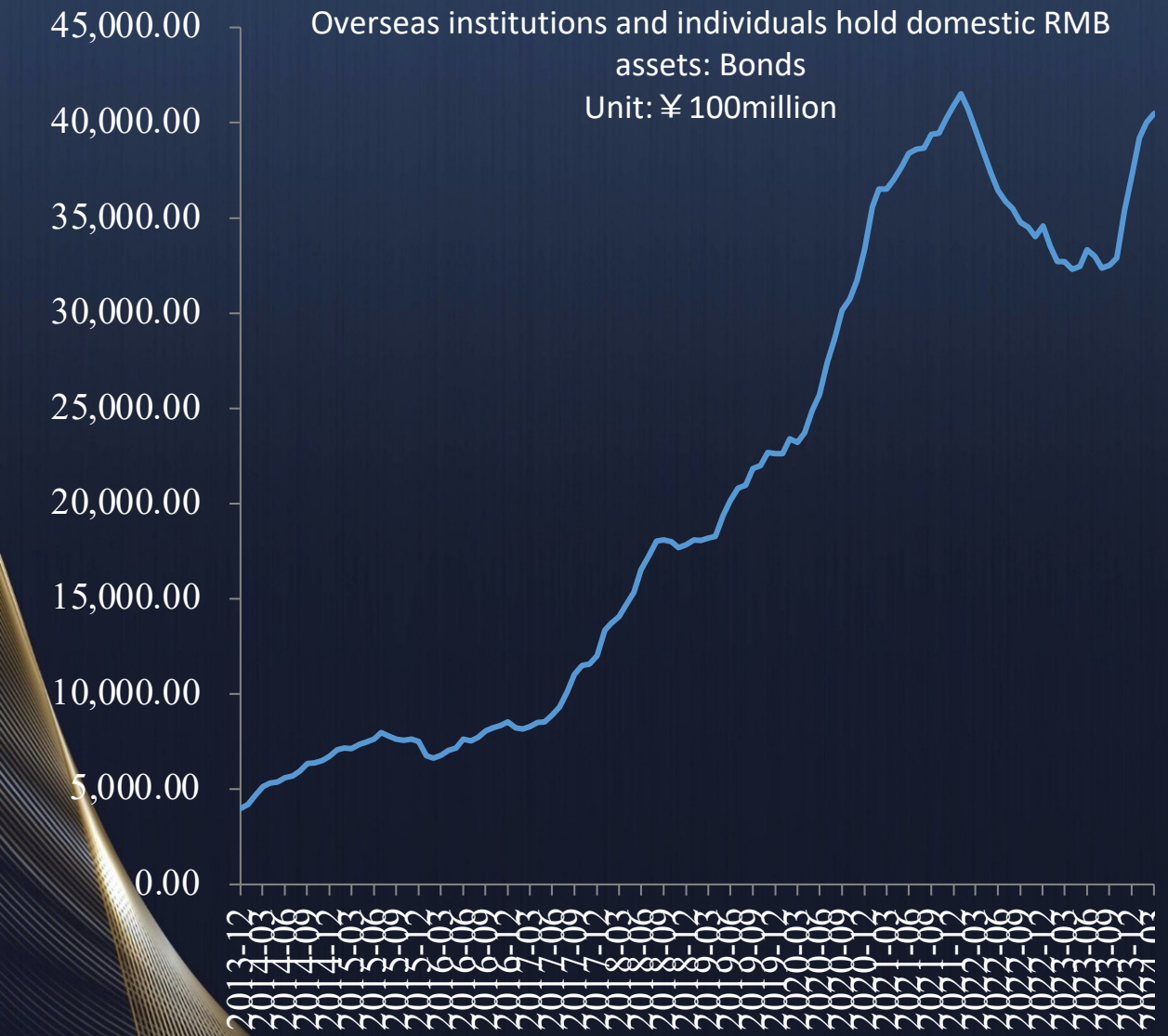
Chart A2

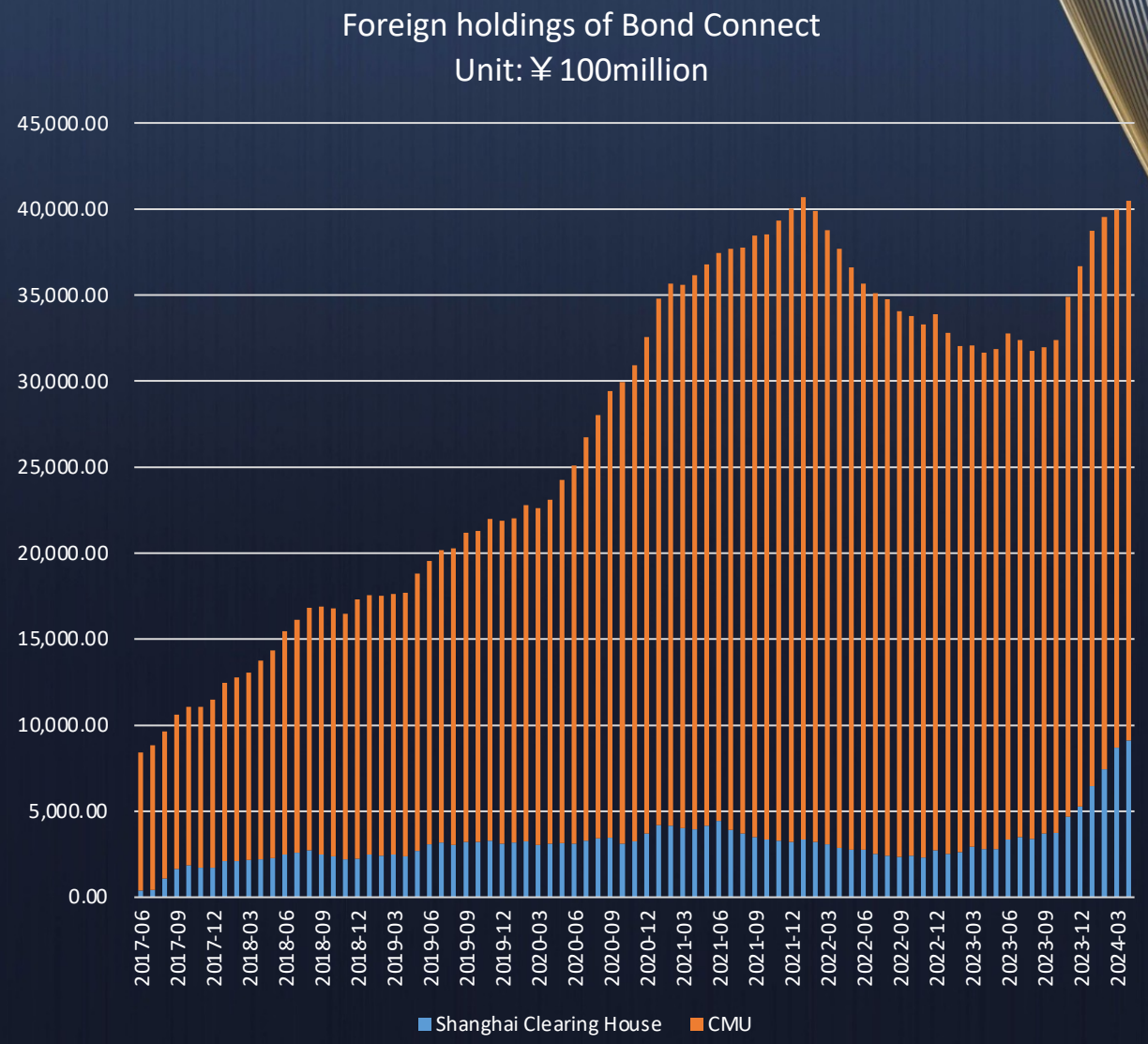
Proportions of outstanding Hong Kong dollar debt instruments, 2014–2023 (by type of issuers)



Source: Report by the External Department, Financial Infrastructure Department, Monetary Management Department, Research Department, from HKMA

Foreign investment in the Chinese bond market





外资在境内资本市场投资的主要渠道

	战略投资	QFII/RQFII	陆港通	WFOE
含义	战略投资者是指具有资金、技术、管理、市场、人才优势，能够促进产业结构升级，增强企业的可持续发展，通过与企业协调互补发展来获得长期共同战略利益的投资者。	QFII（Qualified Foreign Institutional Investors），即合格境外机构投资者制度，是一种在本国资本项目尚未完全开放的情况下，有限度地引进外国投资者的一种渐进式资本市场开放制度。 RQFII（RMB Qualified Foreign Institutional Investor），即人民币合格境外机构投资者制度，是一种境外机构投资人可将批准额度内的境外人民币投资于境内的证券市场的制度安排。	沪港通和深港通是指允许中国大陆与香港投资者通过当地证券公司（或经纪商）买卖规定范围内的对方交易所上市的股票。	WFOE（Wholly Foreign Owned Enterprise）指的是外商独资企业。外资私募基金或风险投资机构在进入中国时，首先设立WFOE，然后将注册资金结汇为人民币，再进行投资。
进程	2006年，商务部等五部委联合发布《外国投资者对上市公司战略投资管理办法》，正式允许外国投资者参与中国上市企业的战略投资过程。	2002年，证监会和央行联合发布《合格境外机构投资者境内证券投资管理暂行办法》，正式确立QFII制度出台。 2011年，央行发布《人民币合格境外机构投资者境内投资试点办法》，允许符合条件的境内基金管理公司和证券公司的香港子公司，运用其在香港募集的人民币开展境内证券投资业务，RQFII正式开始实施。	在QFII/RQFII制度之后，我国分别于2014年底和2016年底启动了沪港通和深港通制度。	2016年经中国证监会同意，中国基金业协会发布了《私募基金登记备案相关问题解答(十)》，明确了境外金融机构可以通过在中国境内设立外商独资机构的方式开展私募证券投资基金管理业务。
意义	引入外国战略投资者在初期推动了我国证券市场“摸着石头过河”探索对外开放之路，从而带动中国证券业面向国际。	通过QFII制度控制外资对于本国资本市场的参与程度，金融市场尚不发达的国家可以减缓外国投机性游资对于本国经济发展所造成的负面影响，从而促进资本市场的健康发展。	在资质认定、汇兑成本、管理成本等方面为境外投资者提供了更大的便利，标志着我国资本市场在对外开放的进程中又迈出了一步。	WFOE制度的推出体现出中国的资本市场和监管能力已经得到长足的发展。

Main Channels for Foreign Investment in the Domestic Capital Market

	Strategic Investment	QFII/RQFII	Stock Connect	WFOE
Defi	Strategic investors refer to those with capital, technology, management, market, and human resource advantages, capable of promoting industry upgrading, obtaining long-term strategic benefits and returns through strategic cooperation and supplementary development with enterprises.	QFII（Qualified Foreign Institutional Investors），a system that allows qualified foreign institutional investors to invest in China's securities market in a controlled manner under the current situation where China's capital projects are not fully open. RQFII（RMB Qualified Foreign Institutional Investor), a system that allows qualified foreign institutional investors to use RMB to conduct securities investment business in the mainland securities market within a certain quota.	Refer to the systems that allow mainland Chinese investors and Hong Kong investors to buy and sell specific stocks listed on each other's stock exchanges within certain quotas.	WFOE refers to a wholly foreign-owned enterprise. Foreign hedge funds and other high-risk investment institutions entering China can set up a WFOE, register their capital in foreign currencies, convert it to RMB, and then make investments.
Prog	In 2006, the Ministry of Commerce formally allowed foreign investors to participate in the strategic investment process of listed companies in China.	In 2002, the China Securities Regulatory Commission and the People's Bank of China officially launched the QFII system. In 2011, the People's Bank of China issued the "Trial Measures for RMB Qualified Foreign Institutional Investors", RQFII officially started implementation.	Following the establishment of the QFII/RQFII system, China separately launched the Shanghai-Hong Kong Stock Connect in late 2014 and the Shenzhen-Hong Kong Stock Connect in late 2016.	In 2016, the China Securities Regulatory Commission clarified that foreign financial institutions can establish WFOEs in China to carry out private fund management business.
Signi	Introducing foreign strategic investors has been a key driving force in the internationalization of China's securities market.	Enhances the health and stability of the capital market by increasing foreign capital's participation.	Marks a major step in China's capital market liberalization.	Signifies that China's capital market and regulatory capabilities have reached a sufficient level.

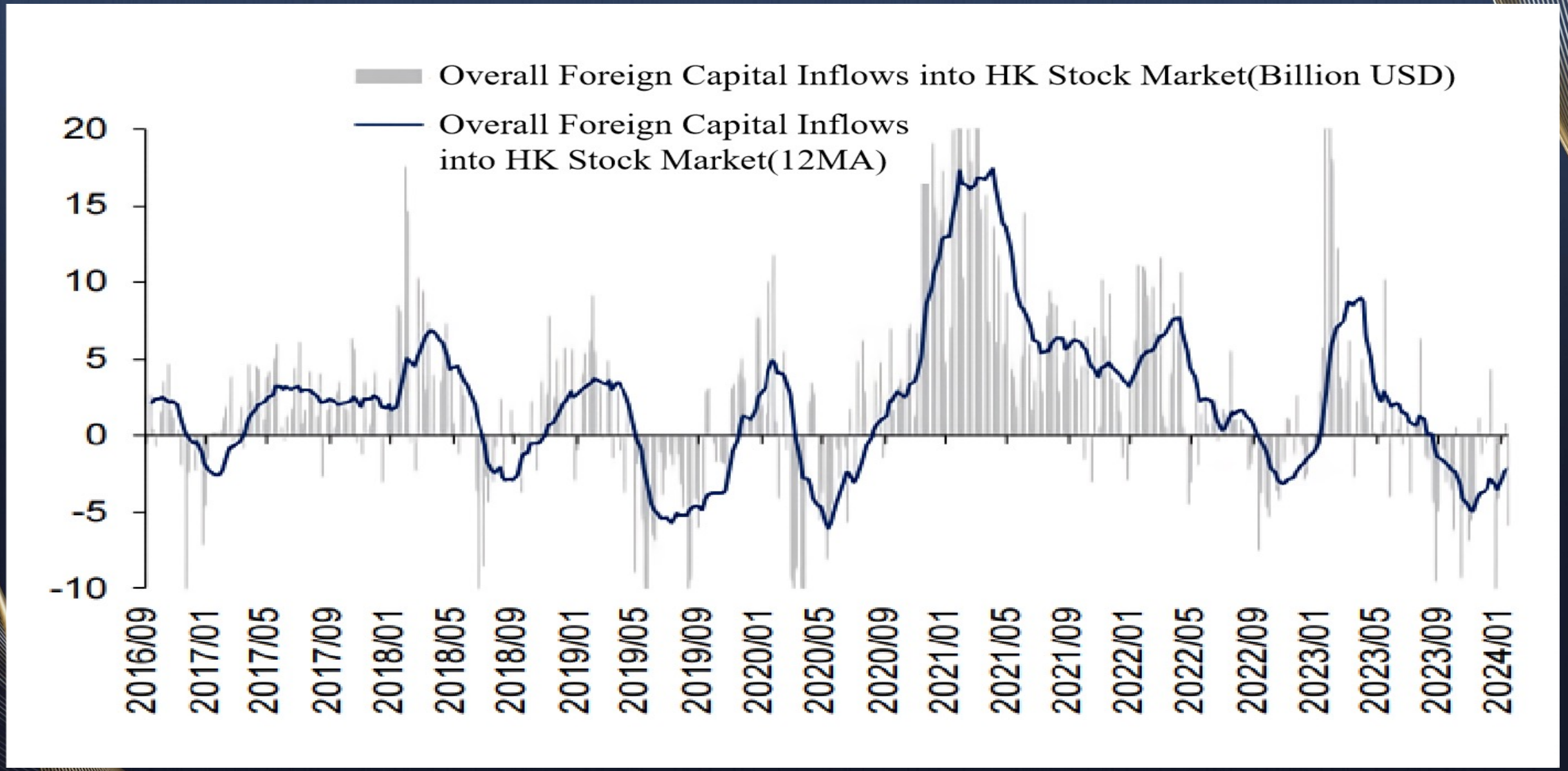
科创公司的界定

- 参考TRBC汤森路透（DataStream的行业分类）和CSRC行业分类标准，将WIND行业分类中以下行业分别定义为科技公司和传统行业公司：

科技行业
✓可选消费-耐用消费品与服装-家庭耐用消费品-消费电子产品
✓可选消费-媒体II-媒体III-有线和卫星电视
✓可选消费-零售业-互联网与售货目录零售-互联网零售
✓医疗保健-制药、生物科技与生命科技
✓金融-多元金融-多元金融服务-消费信贷
✓金融-多元金融-多元金融服务-其他多元金融服务
✓信息技术
✓电信服务
✓公用事业-公用事业II-生命科学工具和服务III-生命科学工具和服务

传统行业
✓能源（石油与天然气的开采与消费）
✓材料（化工、建材、金属、纸制品）
✓工业-资本货物-建筑产品III-建筑产品
✓工业-资本货物-建筑与工程III-建筑与工程
✓工业-资本货物-机械
✓工业-运输
✓可选消费-耐用消费品与服装-家庭耐用消费品-家用电器
✓可选消费-耐用消费品与服装-纺织品、服装与奢侈品
✓日常消费-食品、饮料与烟草
✓日常消费-家庭与个人用品
✓公用事业-公用事业II-电力III-电力
✓公用事业-公用事业II-燃气III-燃气
✓公用事业-公用事业II-复合型公用事业III-复合型公用事业
✓公用事业-公用事业II-水务III-水务
✓公用事业-公用事业II-综合消费者服务III-化纤
✓公用事业-公用事业II-综合消费者服务III-煤炭与消费用燃料
✓公用事业-公用事业II-综合消费者服务III-石油与天然气的储存和运输

Inflows of Overseas Mutual Funds into the HK Stock Market (2024.4)



Sourse: EPFR

The Adaptability of AI in the Financial System

Levin Zhu

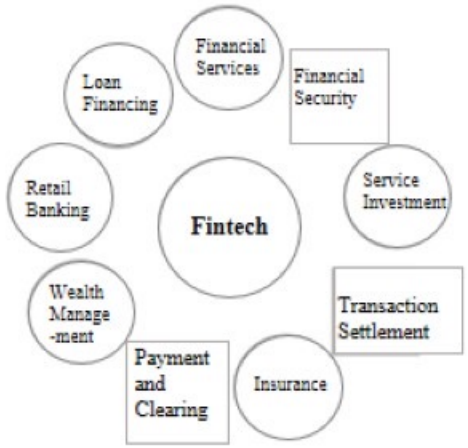
2024/06/07

Artificial Intelligence(AI) and Finance

Fintech

It mainly refers to emerging financial business models with new financial products that are driven by emerging cutting-edge technologies such as internet backing big data, cloud computing etc, and have a significant impact on the financial market and the supply of financial services.

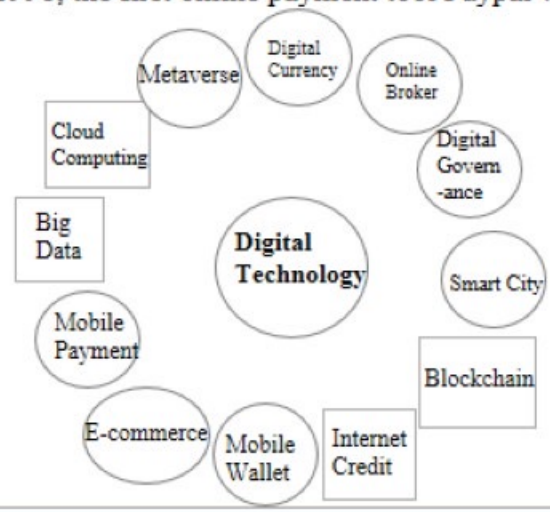
In 1993, Citibank proposed the term 'Fintech'.



Digital Finance

It mainly uses the financial data of the physical world to generate useful information and knowledge through computing power and algorithms, to build up a digital world that forms a mapping relationship with the physical world to improve the economic and financial operations of the physical world.

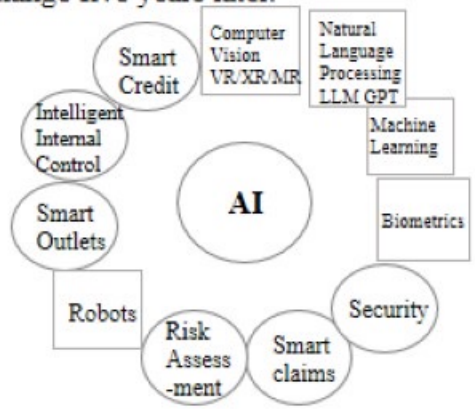
In 1998, the first online payment tool Paypal was born.



Smart Finance

The combination of discriminative AI and finance is the study of using computers to simulate certain human thinking processes and judgmental behaviors. Applications in the finance from the basic computer vision for security ID of customer bills to big data analysis, like spotting fraud in insurance claims.

In 2015, the smart property and casualty insurance company Lemonade had been registered and listed on the New York Stock Exchange five years later.



AI+ Finance

Currently, it refers to the application of generative AI to various financial business scenarios, from solving problems to boosting efficiency

Intelligent Voice and Conversational AI

To achieve human-computer voice interaction, utilize ASR (Automatic Speech Recognition), TTS (Text-to-Speech), and NLP (Natural Language Processing) technologies etc. These tools help financial business create products that are not only scenario-based but also highly interactive.

Knowledge-mapping-based generative learning

Using knowledge extraction and mapping to actively analyze historical data characteristics, predicts risk points and marketing opportunities, and even to generate action roadmaps for the frontline salespersons.

.....

- Precision marketing
- Risk control and compliance
- Operation optimization

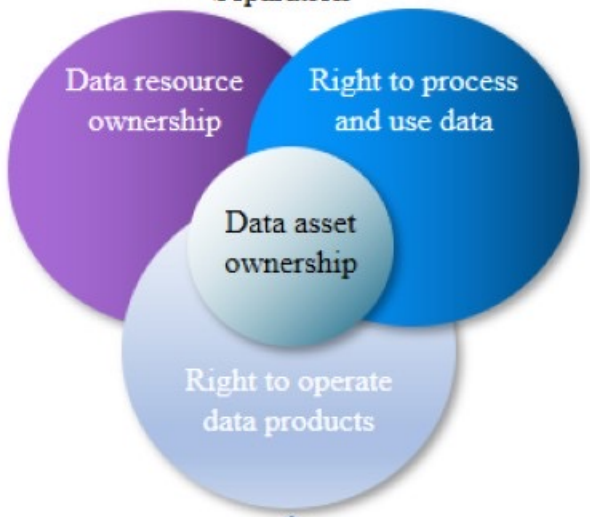
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Fundamental Issues Regarding the Adaptability of AI

- AI's enhancement on productivity may come with challenges.
- As a result, firstly the government should play a role in building a digital foundation, ensuring data ownership and security as well as Improving fairness in data analysis and decision-making.

Data Asset Ownership

Exploring Data Property Rights' Structural Separation



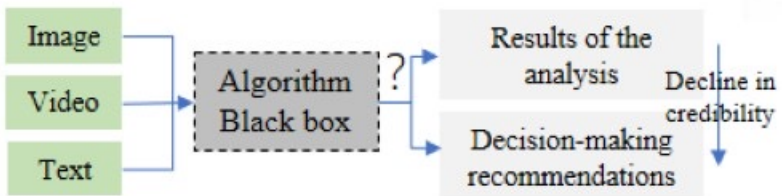
Data security

Data drives AI in finance, raising efficiency but also security risks

Excessive data collection | Data breach | Improper use of data

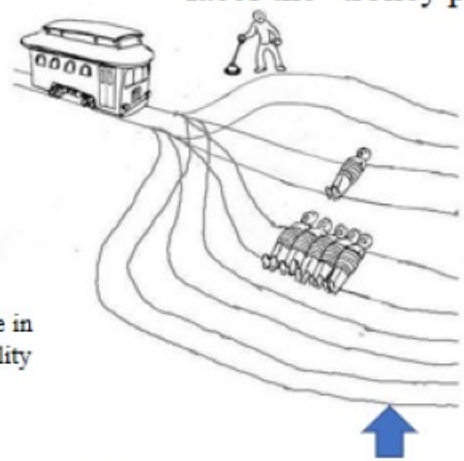
Algorithm logic transparency

GPT's logic and decisions may seem unclear, often appearing to rely on coincidence rather than clear cause and effect. This "black box" nature can make the algorithm's applications seem less credible.



Algorithm ≈ "legislation"

For example, autonomous driving faces the "trolley problem"



" Options: Pull the lever or do nothing.

Outcomes:
Do nothing: **1 dies**.
Pull the lever: **75% no one dies, 25% chance 5 die**."
"

Ethics of fairness and justice

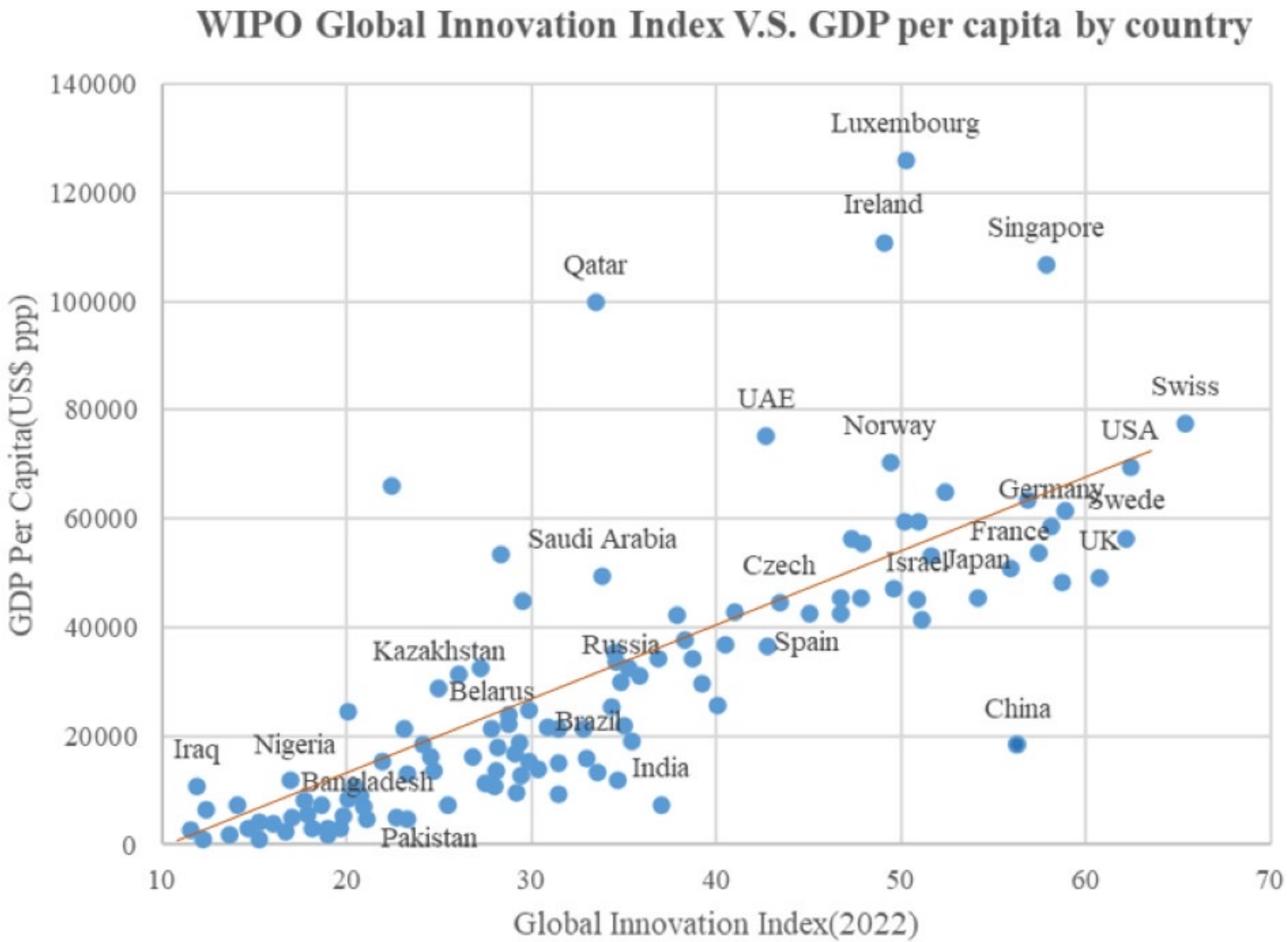
The abuse of financial AI may lead to unfair pricing for current customers, misleading advice and false info from AI, bias against specific customer groups breaking fairness in finance

Big data discrimination | Induced Investment | Service snobbery

Source: iResearch Consulting,

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Innovation/Productivity



Source: WIPO, World Bank

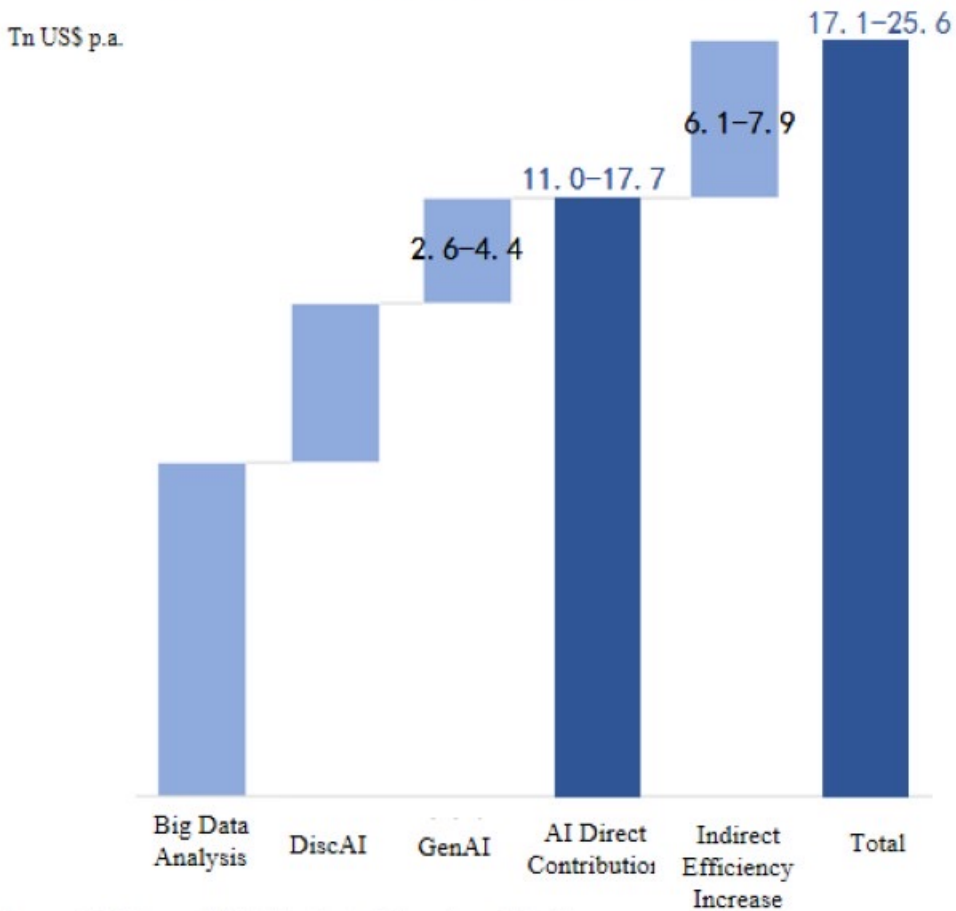
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AI: Potential Impact on the World Economy

- **According to the optimistic estimates, AI is expected to increase the annual output of the global economy by 25%:** McKinsey estimates all kinds of AI application may boost global economy by up to 25%, potentially adding $17.1-25.6 trillion.
- **Bloomberg also forecasts, the annual revenue of global generative AI (GenAI) is expected to exceed 1 trillion US dollars in 10 years:** According to Bloomberg's forecast, the related revenue* is expected to exceed $1 trillion by 2031-32, growing at an annual rate of 45.9%.

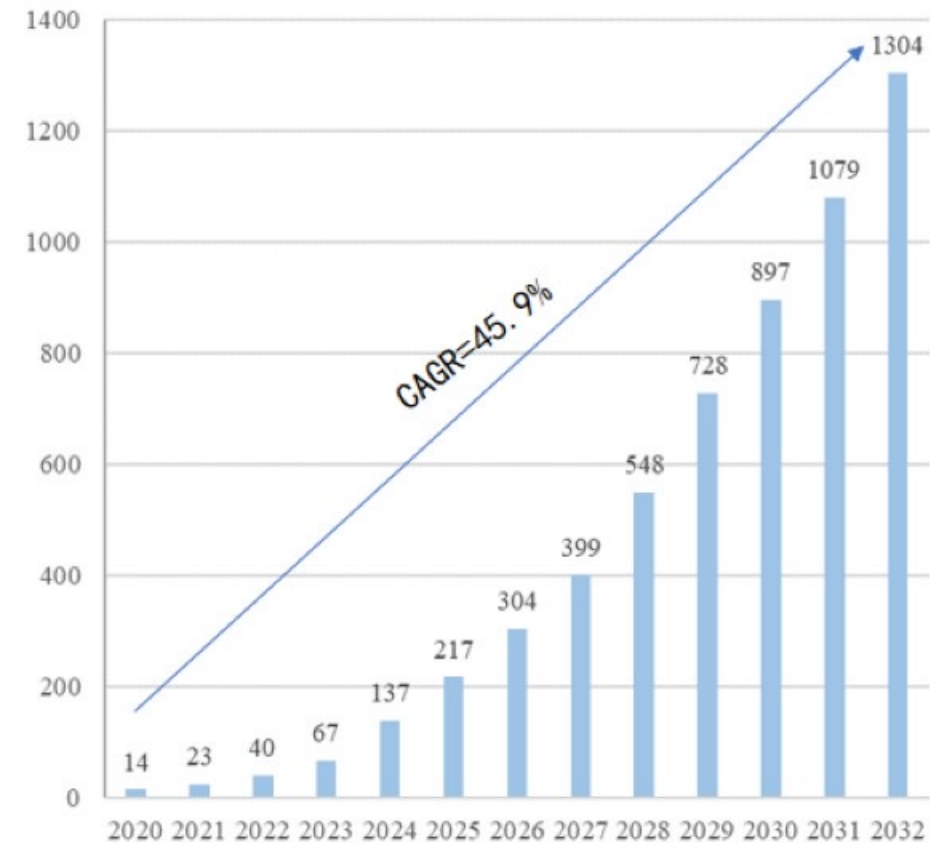
* including revenue from training and testing hardware, AI software and affiliated advertising etc.

Potential impact of AI on the global economy



Source: Mckinsey Global Institute, Bloomberg Intelligence

Global GenAI Revenue Projection



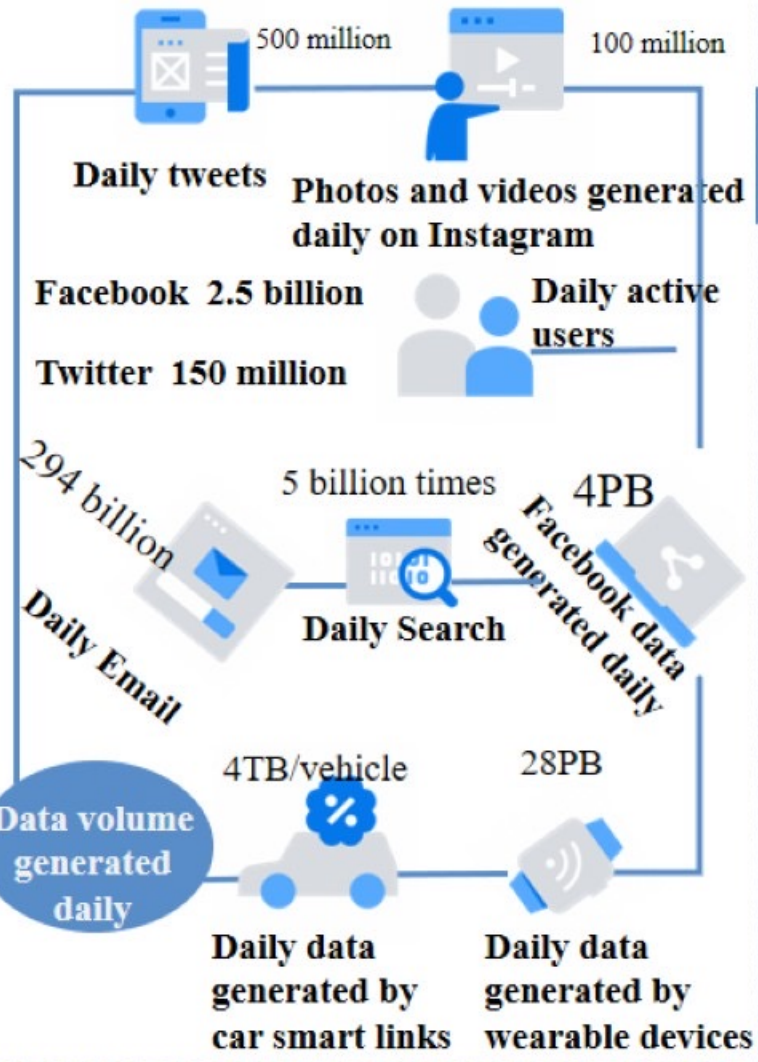
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Efficiency Enhancement Mechanism:

Analyze Massive Amounts of Data to Improve Human Productivity

- The total amount of data created, captured, copied and consumed worldwide in 2018 was 33ZB (equivalent to 33 trillion GB), reaching 59ZB in 2020 and is expected to reach 175ZB in 2025.

2020



2020 Data Volume

Total data volume :In 2020, it will reach 59 ZB

Internet users



In 2022, there will be more than 5 billion **Internet users**, accounting for 63% of the total population.

2025 Prediction

It is expected that the total annual volume will reach 175ZB in 2025

Data Storage



600-900 AD (China) Oldest printed books



1947 Transistor



1956 Integrated microchip



1996 Hard disk, CD, etc.



Terminals (IoT devices, computers, mobile phones, etc.)

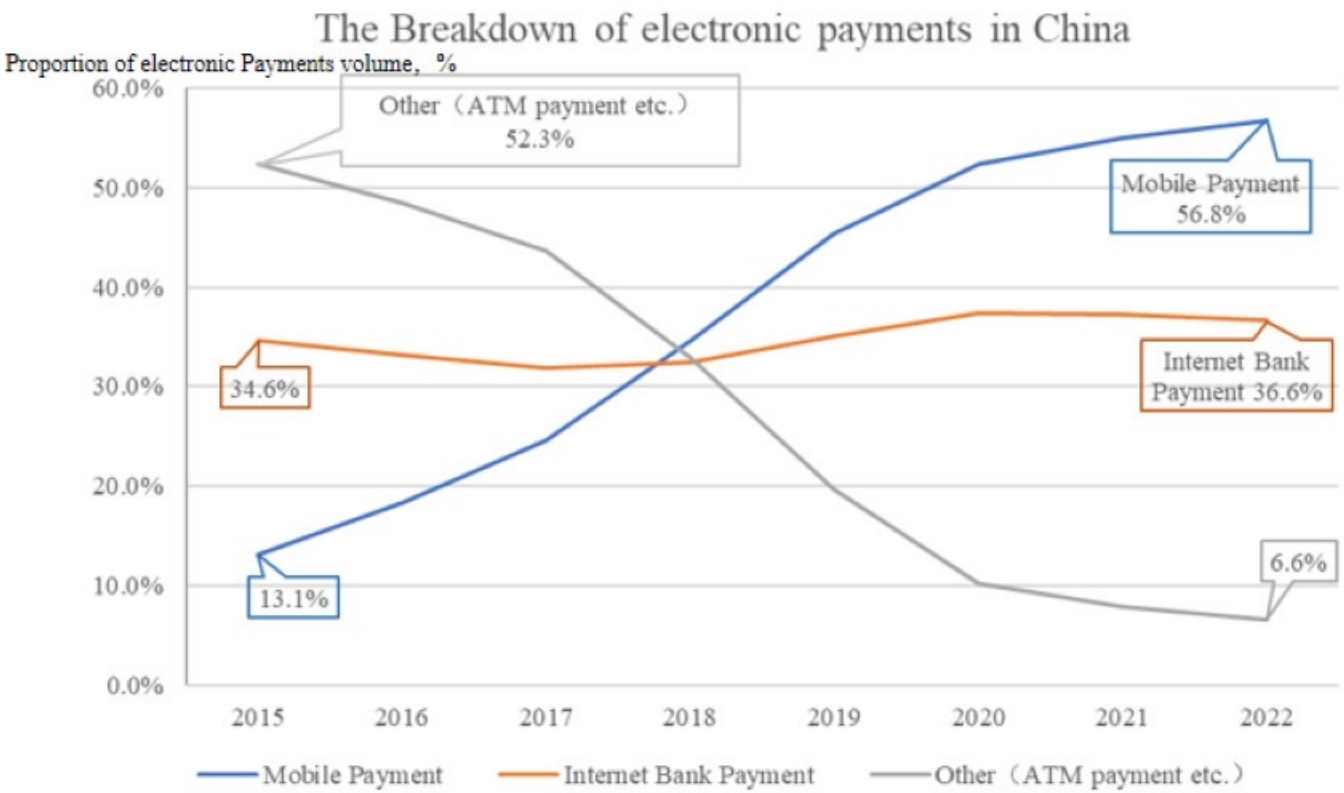


Data Center:
600 hyperscale data centers around the world, each with over 5,000 servers

b	bit	0 or1
B	byte	8 bits
K	kilo	1000 B
M	mega	1000^2 B
G	giga	1000^3 B
T	tera	1000^4 B
P	peta	1000^5 B
E	exa	1000^6 B
Z	zetta	1000^7 B
Y	yotta	1000^8 B

Financial industry: Dealing with massive data volume, Pioneering the application of new technology

- Take the fast-paced Chinese financial industry as an instance,it has historically attached importance to the application of the latest technologies, and high data processing demand leads to innovative tech applications.
- The evolution of electronic payment in China probably is a good example: mobile payment overtook internet banking payment in 2018, dominating with over half of electronic payments by 2020.
- The securities industry also pays attention to new technologies: moving individual account-openings and transactions online almost thoroughly.



In 2013, China Securities Depository and Clearing Corporation Limited (CSDC) issued the "Implementation of Off-site Opening of Securities Accounts" (Interim Version) for the first time.

Among the newly opened A-share securities accounts in the entire market in 2020, approximately **99%** of the accounts were opened through online procedure.

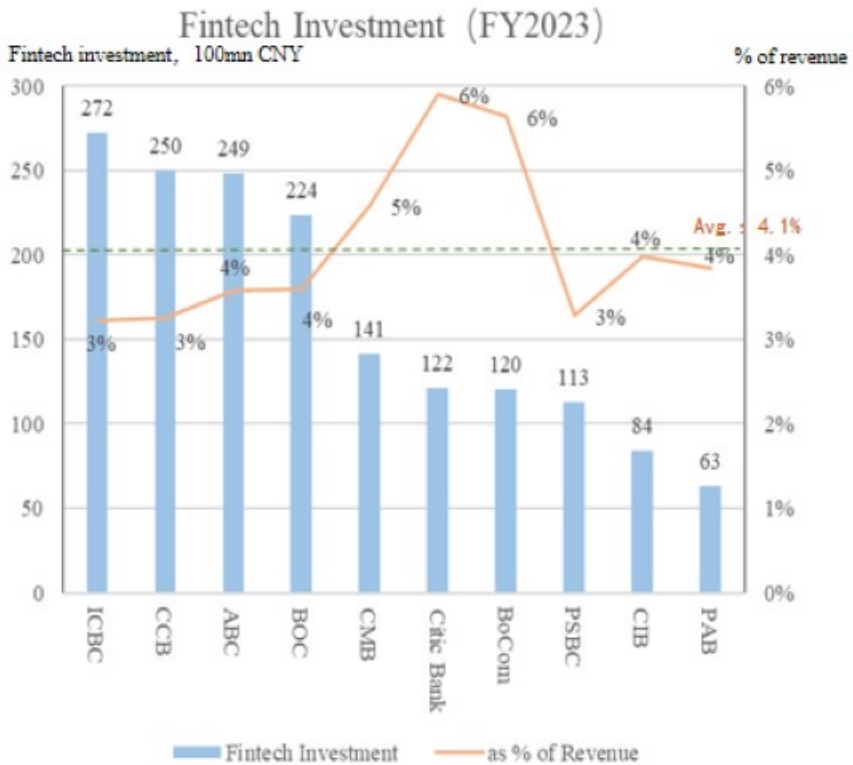
In February 2021, China Securities Depository and Clearing Corporation Limited (CSDC) revised and issued the "Implementation Rules for Off-site Opening of Securities Accounts" (final version).

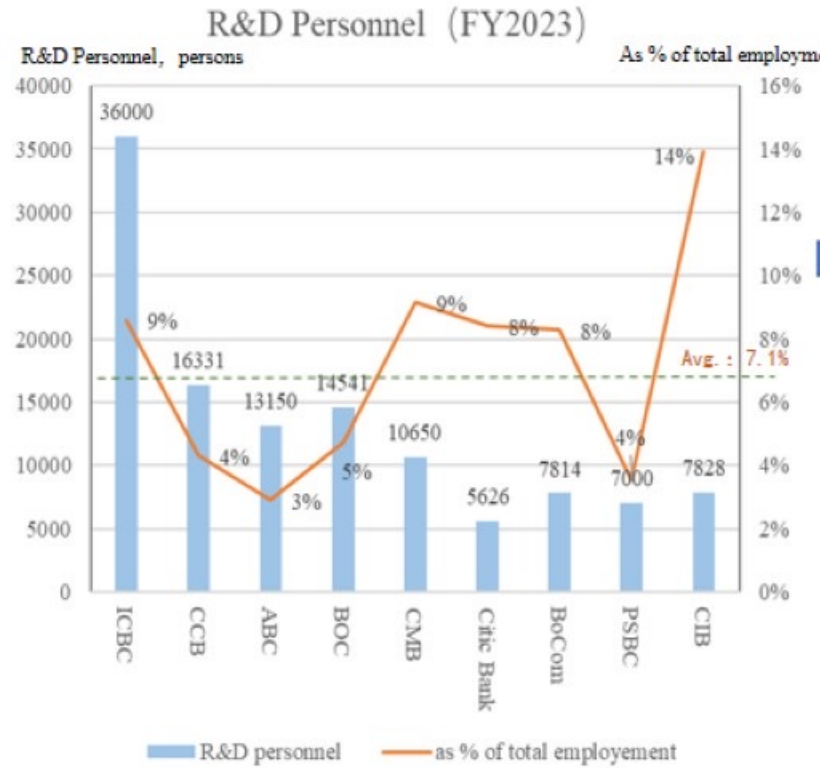
Source: People's Bank of China, China Securities Network

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Currently, China's financial industry is actively investing in generative AI

- Banks are still the backbone of China financial industry, and major domestic banks are leading in financial technology investment especially in generative AI now.
- Many Chinese banks have already launched large language models or platforms for business use.





ICBC has built a large-scale AI model technology system with hundreds of billions of parameters, and has been successfully voted as one of the "10 Major Events in Financial Informatization in 2023" by Financial Electronicization Magazine.

ABC launches **ChatABC**, the first self-developed financial AI large model application in the financial industry.

CCB launched the large-scale model **"Ark Project"**, and its AI platform has provided services 43.3 billion times in total, winning the "Best AIApplication" of 2023 by The Asian Banker.

Ping An Bank (PAB) explores self-developed **BankGPT** platform integrating with Ping An Bank's product, financial and technological capabilities through component standardization

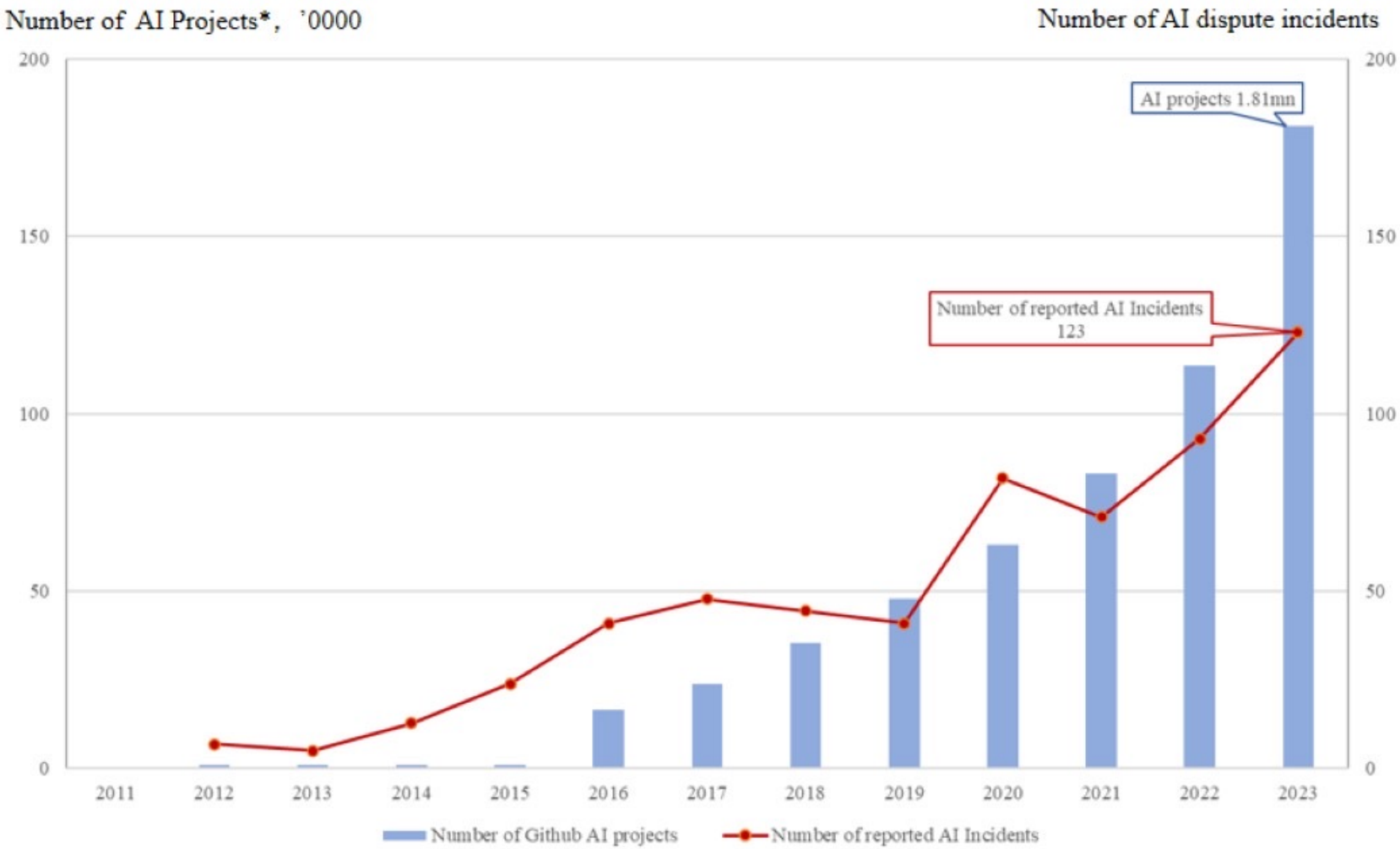
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Source: Annual reports of commercial banks, Deloitte China

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Fundamental Issues Regarding the Adaptability of AI (2)

- Secondly, algorithms should not be simply viewed as technical issues, but need broad agreement to build up social consensus.
- The Stanford University AI Index report highlights a spike in generative AI disputes in recent years, up with the popularity of generative AI.



[JPMorgan, Morgan Stanley Face Regulatory Scrutiny Over AI Use | ThinkAdvisor]

It was reported in August 2023 that Massachusetts Secretary of State William Galvin has launched an inquiry targeting financial firms over AI use, such as the algorithms' impact on anti-money laundering procedures and the fairness of wealth advice. Impacted institutions include JPMorgan, Morgan Stanley, Tradier Brokerage, US Tiger Securities, E-Trade, Savvy Advisors and Hearsay Systems.

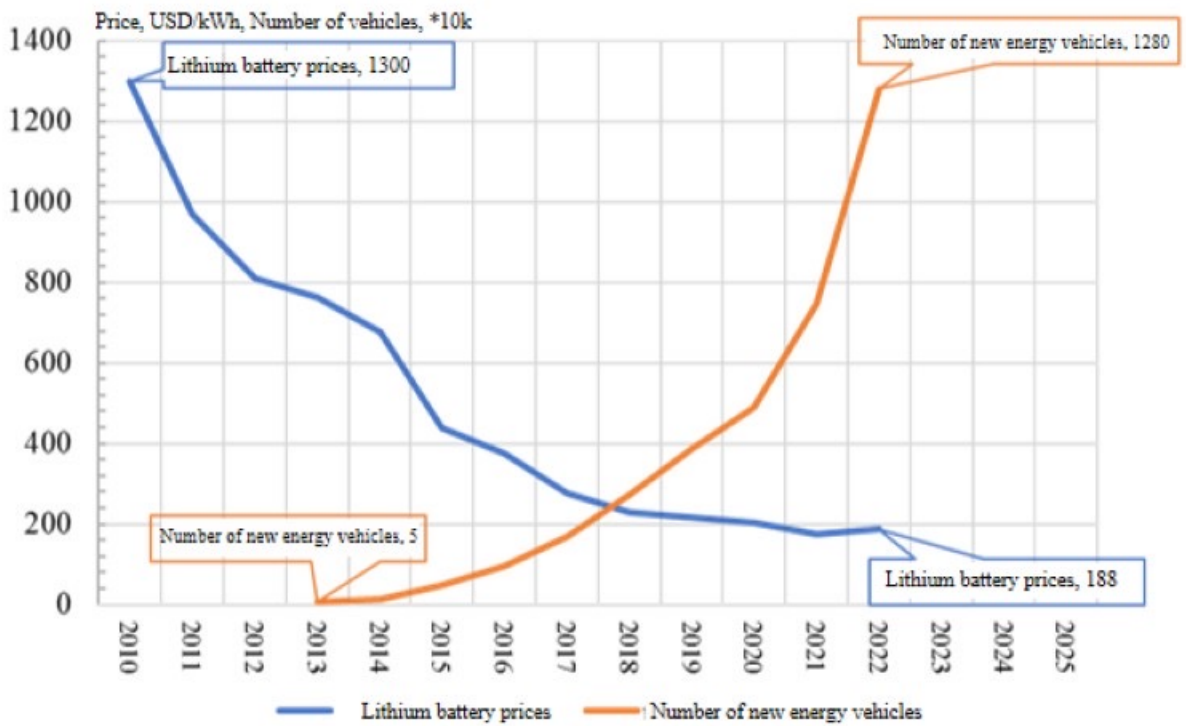
Source: Stanford AI Index Report, compiled by CGI, ThinkAdvisor* Calculated based on Github statistics

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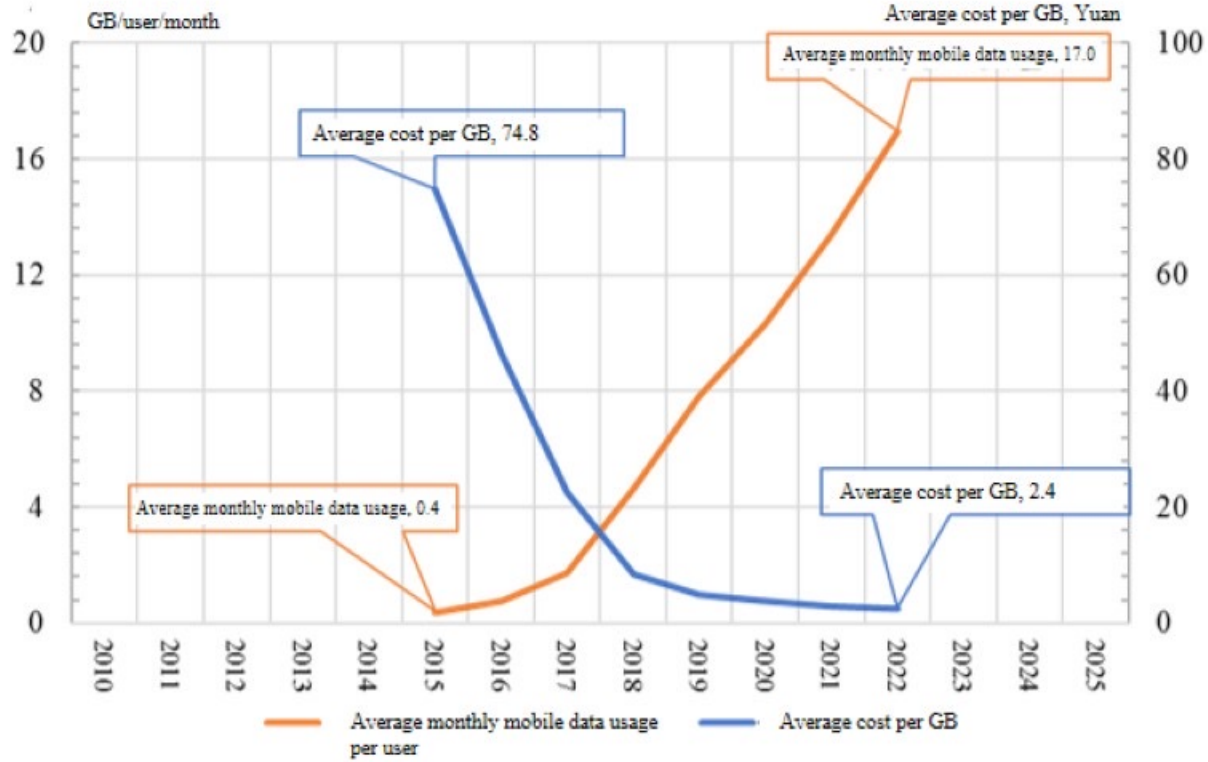
Fundamental Issues Regarding the Adaptability of AI (3)

- Previous innovations, such as mobile data or electrical vehicles, show only the drop in the cost of use drives the widespread adoption of technology, turning it into true productivity.
- So last but not least, the application of AI involves assessing model iteration benefits against costs and addressing computability and timeliness.

Lithium-ion battery prices and new energy vehicle ownership



Changes in average mobile data traffic charges in the Internet era



Source: Wind, China Automobile Association, Ministry of Industry and Information Technology

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The growth of computing power

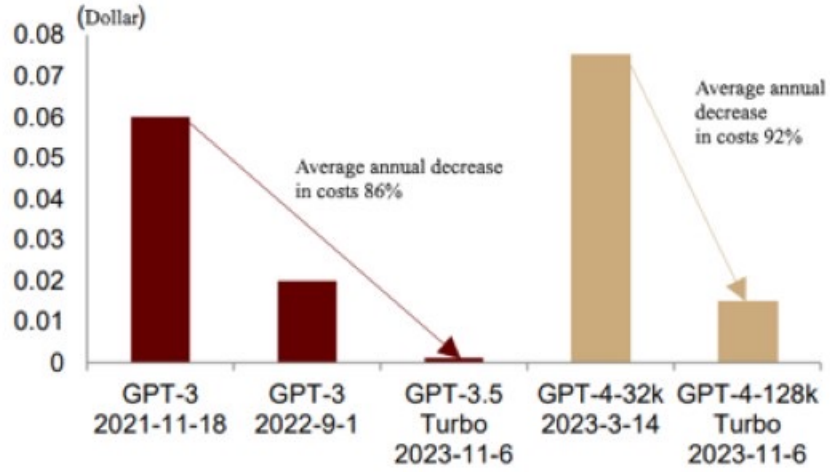
- In history, for models that handle single types of tasks, such as text generation, the computational power requirements will expand with the number of parameters brought about by model iteration and the increase of training datasets. The scale law based on the Transformer architecture breaks through the limitations of previous models that tend to converge in terms of scale expansion but performance improvement, presenting the characteristic of model scale expansion and corresponding reduction in loss.
- The trend in the table below lists the relevant time required for every 2x and 10x increase in floating-point operations on the GPU.

Trend	Original presentation	2x time	10x time	Growth rate	Reference
Moore's law	2x every 2 years	2 years	6.64 years	0.151 OOMs/year	FLOP/s
Huang's law	25x every 5 years	1.08 years	3.58 years	0.279 OOMs/year	FLOP/s
Biological anchors report (Cotra, 2020)	2x every 2.5 years	2.5 years	8.30 years	0.120 OOMs/year	FLOP/s per dollar
CPU historical (AI Impacts, 2019)	10x every 7.7 years	2.32 years	7.7 years	0.130 OOMs/year	FLOP/s per dollar
Median Group, 2018	2x every 1.5 years	1.5 years	5.0 years	0.200 OOMs/year	FLOP/s per dollar
Our data (n=470)	-	2.46 years [2.24, 2.72]	8.17 years [7.45, 9.04]	0.122 OOMs/year [0.134, 0.111]	FLOP/s per dollar
Our data (n=470)	-	2.31 years [2.14, 2.51]	7.68 years [7.12, 8.33]	0.130 OOMs/year [0.140, 0.120]	FLOP/s
Our data FP16 (n=91)	-	2.30 years [1.69, 3.62]	7.64 years [5.60, 12.03]	0.131 OOMs/year [0.179, 0.083]	FLOP/s per dollar
Our data FP16 (n=91)	-	2.91 years [1.94, 5.83]	9.68 years [6.45, 19.35]	0.103 OOMs/year [0.155, 0.052]	FLOP/s
ML GPUs (n=26)	-	2.07 years [1.54, 3.13]	6.86 years [5.12, 10.39]	0.146 OOMs/year [0.195, 0.096]	FLOP/s per dollar
ML GPUs (n=26)	-	2.00 years [1.69, 2.43]	6.63 years [5.63, 8.07]	0.151 OOMs/year [0.178, 0.124]	FLOP/s
Top GPUs (n=57)	-	2.95 years [2.54, 3.52]	9.81 years [8.45, 11.71]	0.102 OOMs/year [0.118, 0.085]	FLOP/s per dollar
Top GPUs (n=57)	-	2.69 years [2.40, 3.30]	8.92 years [7.99, 10.95]	0.112 OOMs/year [0.125, 0.091]	FLOP/s

Source: CICC CGI, OpenAI , EPOCH AI

Generative AI models represented by GPT focus on expanding parameter size and training dataset size
The parameter quantity of GPT-2 is 1.5 billion
The parameter count of GPT-3 has surged to 175 billion
GPT-4 has even reached an astonishing 18 trillion parameters
In terms of training datasets
GPT-2 uses approximately 40GB of text data
GPT-3 uses up to 570GB of text data (equivalent to 300GB tokens)
The training dataset size of GPT-4 has reached a token size of 13TB

According to estimates, the training cost of generative models at the GPT-3 level has decreased from $4.6 million in 2020 to $450000 in 2022, with an annual decrease of approximately 70%; According to OpenAI's pricing and changes for GPT-3 and GPT-4, inference costs are also accelerating their decline.

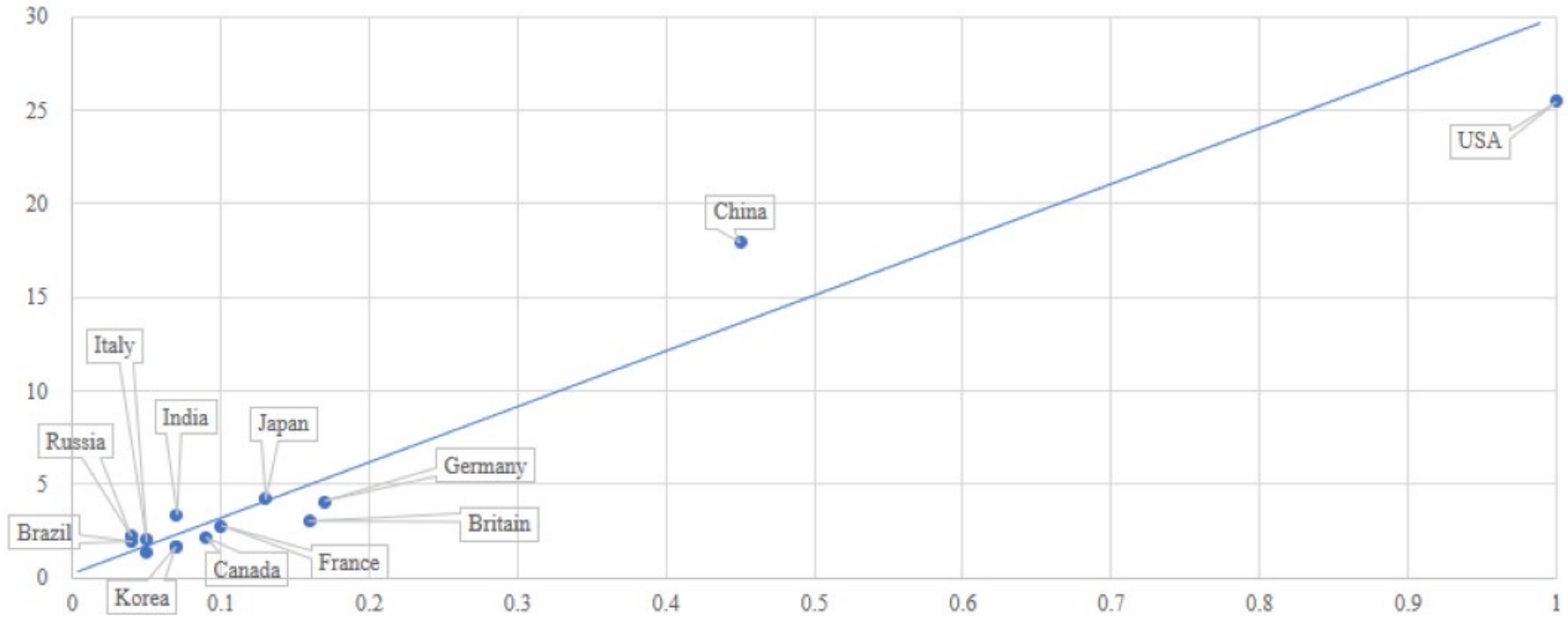


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The joint effect of technological capability and GDP

The R&D AI technology index calculated for leading global AI countries only roughly examines the country's economic scale and R&D capabilities (including computing power, algorithms, and data). It can be roughly judged that the current global AI competition pattern, with the United States and China as the first tier, each occupying R&D and application advantages, has preliminarily formed.

In terms of talent, although the United States has gathered over 50% of the world's cutting-edge AI talents to work in the United States, according to the technical accuracy required for the AI application layer, 47% of the top 20% of AI talents in the world have received undergraduate training in China, exceeding 18% in the United States. In recent years, more and more AI talents have returned to China.

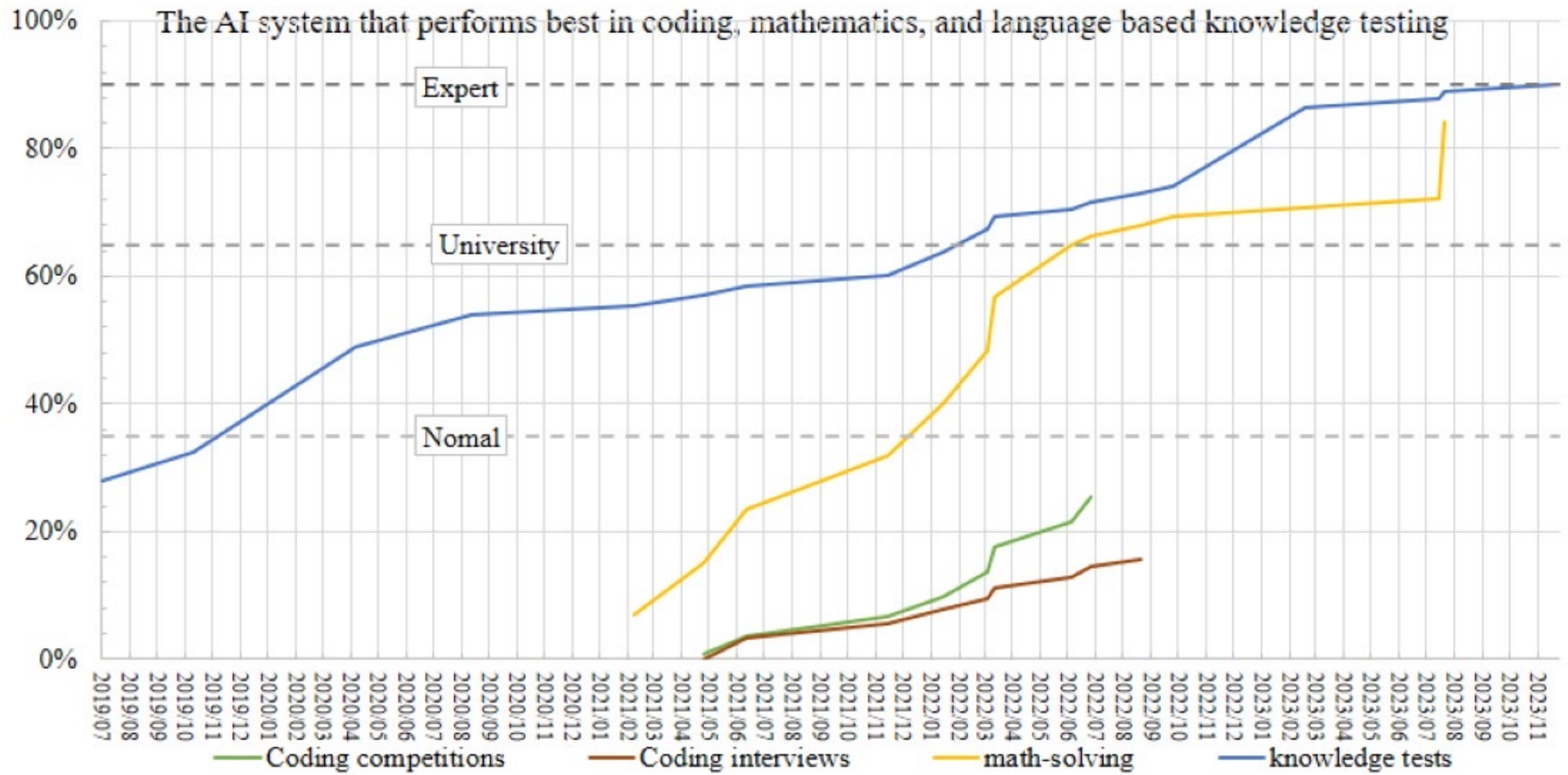


Source：CICC CGI，MacroPolo《World AI 2.0》（2024）

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The potential of AI systems

In the era of big language models, AI has shown strong comprehension capabilities for texts. Subsequent breakthroughs in Sora not only demonstrate the ability of AI to interact multimodally, but also show signs of its ability to understand the world. This means that the current development goal of AI is no longer just to simulate human "thinking", but to comprehensively achieve the interaction function between humans and the real world. From the test data, it can be seen that AI has approached the level of professionals in certain aspects



Source：CICC CGI，Our World in Data

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AI in the Future of Finance

Gordon Liao
June 6, 2024

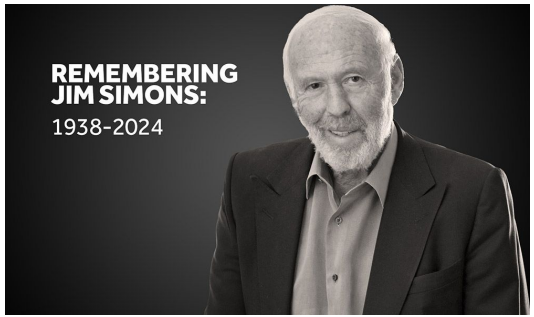
Outline

1. Current AI use in finance and what's different now?
2. Innovations in programmability of finance and payments
3. Data transparency and privacy via blockchain

Current AI Use in Finance: What's Different Now?

Definition of AI: The simulation of human intelligence in machines that are programmed to think and act like humans.

- AI is not new: statistical models using structured data used since the '80s
- Machine learning: a subset of AI, used since early 2010s, integrating non-financial data
- Today: Generative AI (transformer models and LLMs) offering reasoning, logic, and creativity

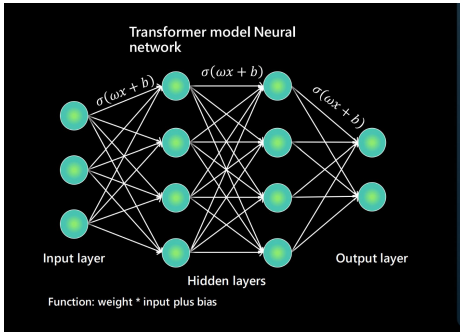


Since 1980s: models with structured data



This figure presents the parking lot satellite image of the Target store located at 4500 Macdonald Ave, Richmond CA 94805. The image was captured by RS Metrics on September 19, 2016 at 11:03am. The red line

Since 2010s: unstructured, non-financial data



Today: transformer models and language

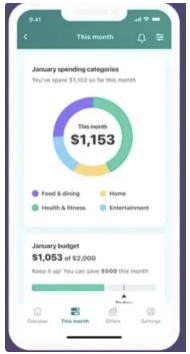
De-leveraging Finance with AI

- Finance is increasingly digital and evolving toward market-based intermediation, less reliance on intermediary balance sheets

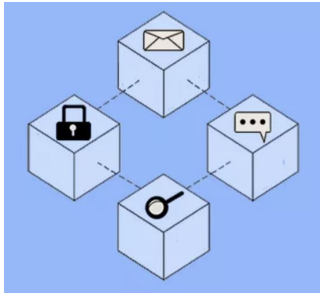
Example: Tokenized cash (stablecoin) for payment and deposit; automated market makers



Soft-information lending and frictions



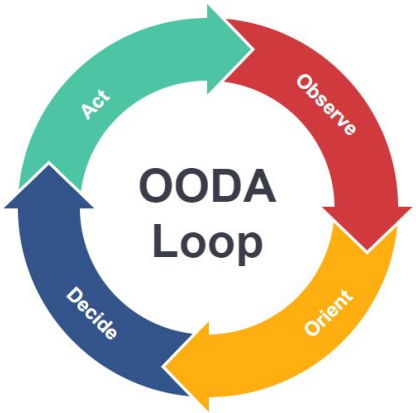
Hard-information and immediacy



Open data and programmability

AI in Programmable Financial System

- AI interacts with programmable finance (blockchain/tokenization) for broader application
- **AI can perform the financial OODA Loop**, which stands for:
  1. **Observe**: Gather data and information about the environment and the situation.
  2. **Orient**: Analyze the information, integrate it with previous knowledge, and understand the situation.
  3. **Decide**: Determine the best course of action based on the analysis.
  4. **Act**: Implement the decision and take action.



Advancements in cryptography can enable both data transparency and privacy

- Financial data remain siloed; data portability is a hurdle for AI
- Challenge: observing and sharing data without sacrificing privacy
- Blockchain enables data sharing with some level of privacy preservation
    - Cryptographic advances: zero-knowledge proof enables new algorithms
        - e.g. prove a borrower has met the income threshold for loans without revealing the borrower's income



The Future of Finance and AI

- Open data, identity, and privacy improvements needed for the future application of AI in finance
- AI and blockchain will continue to shape the financial landscape by reducing financial intermediation via levered balance sheet
- More competition and market-based price discovery over concentrated intermediaries
- Updated regulatory framework should aim at reducing risks and avoiding regulatory capture

Symposium on Building the Financial System of the 21st Century: an Agenda for China and the United States

The Applicability of Artificial Intelligence to the Financial System; an Applied AI Ethics Approach

Jeffrey Saviano
Harvard / MIT AI Ethics Appointments

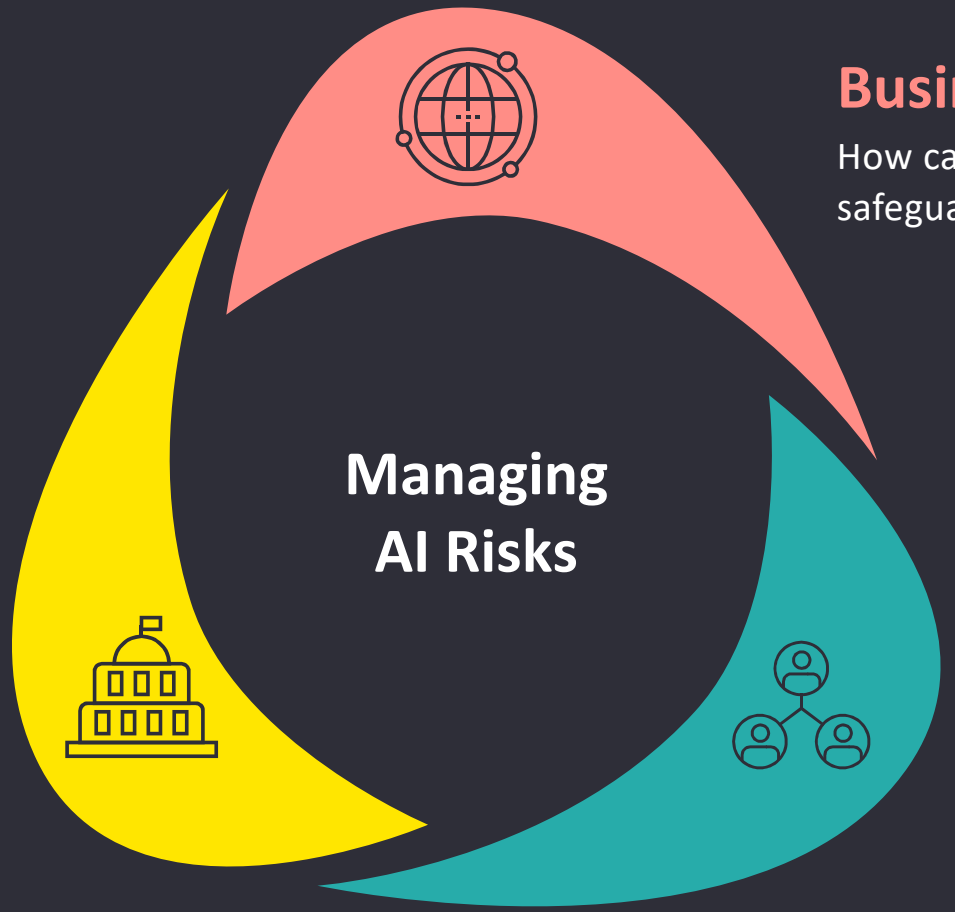
June 6, 2024



Who will be the guardians of AI in the world?

Business

How can corporate governance adapt to safeguard AI in the world?



Government

Will governments choose to heavily regulate AI?

NGOs / Civil Society

What role can they play beyond developing critical policies and standards?

Ethics, aligned to company values and purpose, can be the North Star to address multi-stakeholder interests

Societal Guardians

Promote ethical practices and safeguard human and societal interests (*e.g., regulators, policymakers, NGOs, and academia*)

Discourse Architects

Shape public perception and discourse around AI (*e.g., media/news outlets, independent journalists, and editorial boards*)



The Protectors

Protect the interests and rights of non-equity stakeholders interested in AI governance (*e.g., advocacy groups, representatives for customers and employees*)

Investor Custodians

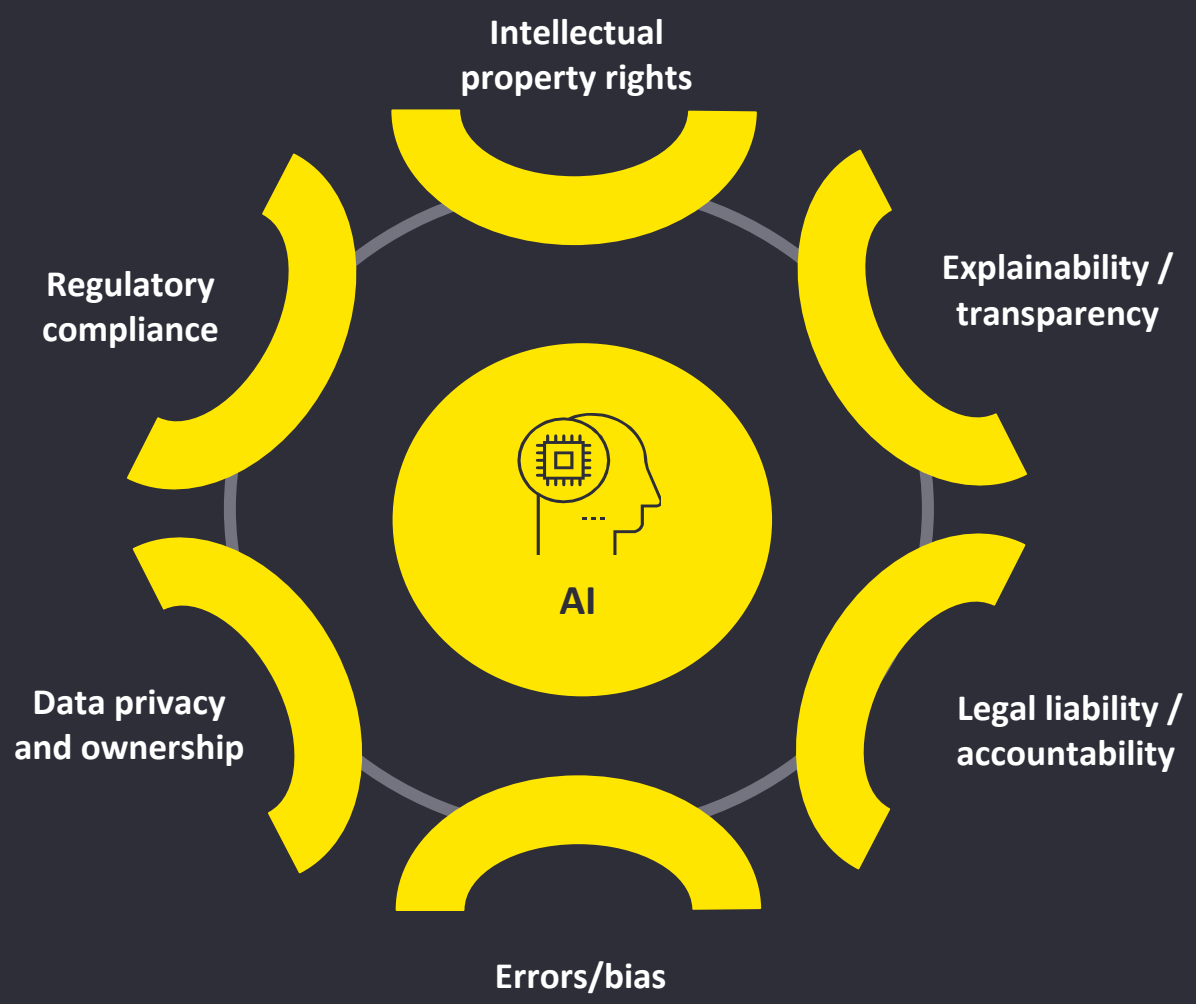
Uphold shareholder interests in AI governance, (*e.g., institutional investors, proxy advisory firms, rating agencies, and stock exchanges*)

Technology Pioneers

Entities at the forefront of innovation and technical AI development (*e.g., technology providers and industry associations/standards bodies*)

AI presents legal, regulatory and ethical considerations

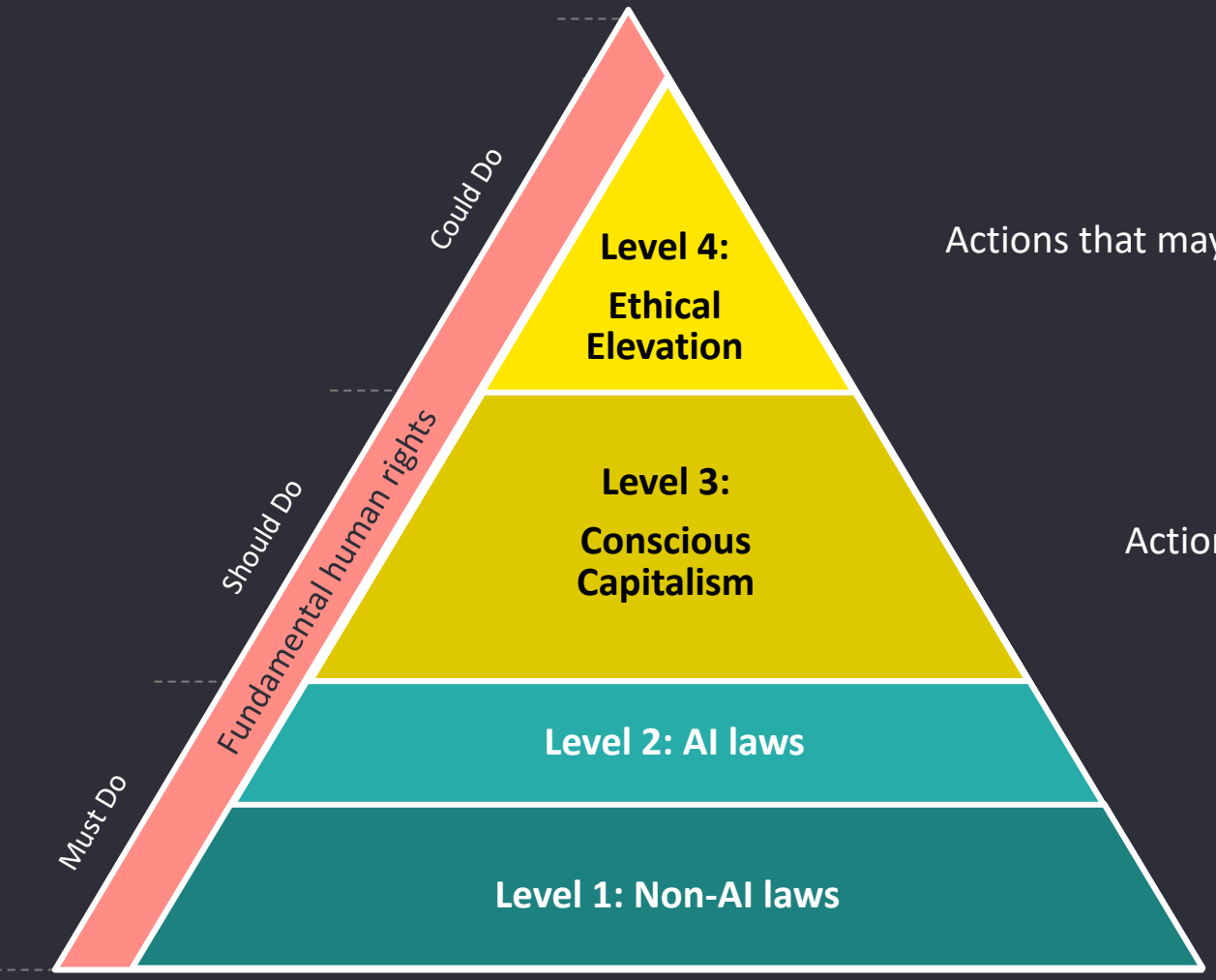
AI risk considerations



Key questions

1. What are the risks we need to care about – for the enterprise and the world? What is the optimal approach to govern and mitigate?
2. How do we best align our organization – people, processes, and technology – to our AI strategy?
3. How do we measure outcomes and improve over time?

Applied AI Ethics | A new framework



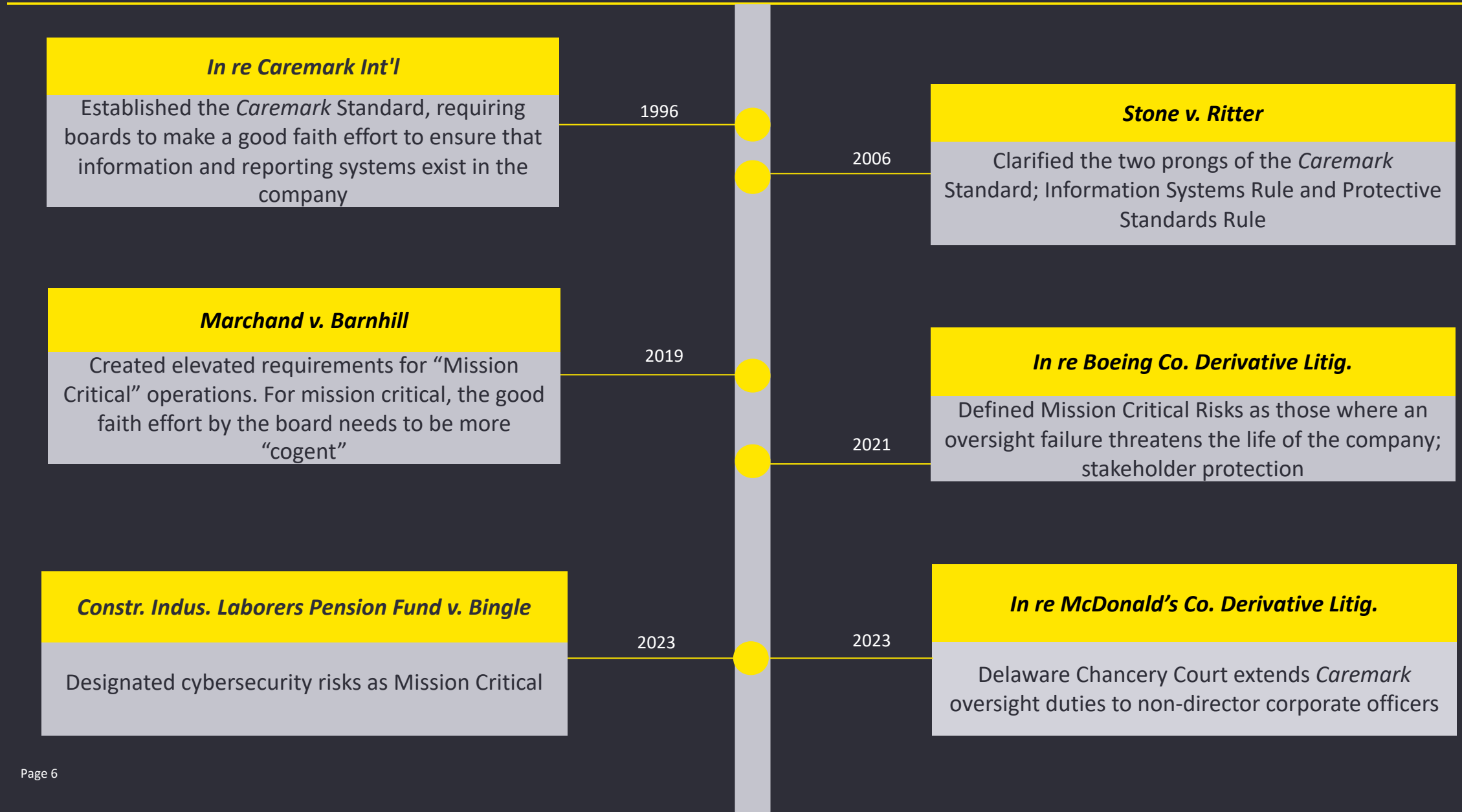
Actions that may not produce a business ROI, but produce a return for the world

Actions positively influencing business financial metrics, benefiting the world

AI specific legal mandate directly applicable to AI systems

Non-AI specific laws that apply to AI systems

Governance Case Law | *Caremark* and its progeny establish minimum oversight standards



AI Governance | Analysis of Board Technology Committees

Summary of our Findings

13% of S&P 500 companies have a Technology Committee in 2023

Concentrated in FS, healthcare, industrials, & tech sectors

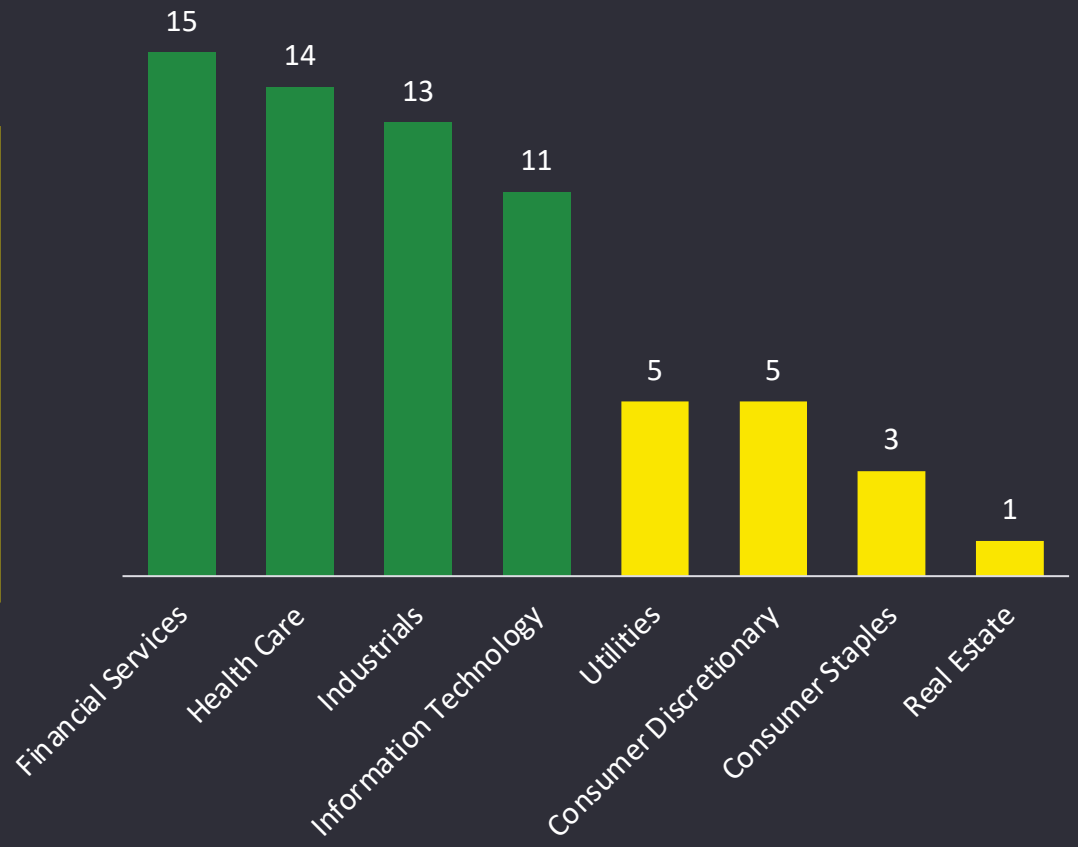
Committee Scope

- Tailored by sector
- Review the company's tech strategy
- Analyze tech trends and competitiveness
- Oversee tech-based risks

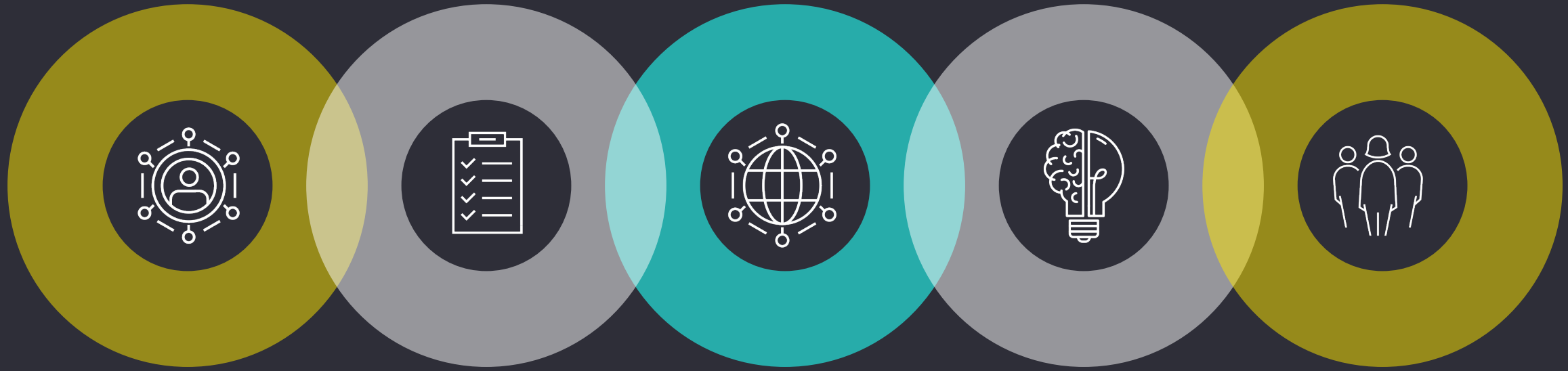
Structure

- Reports to the board
- Led by a Director with tech expertise
- May include reps from management and / or outside experts

Technology Committees in S&P 500, by Sector



Best practices | Five actions you can take today



Leader

Designate a single leader from management with overarching responsibility for managing AI risks

Cadence

Regular and systematic updates from management on AI opportunities and risks; act on any red flags

Ethics

Apply new AI ethics framework, consider an AI Ethics Council or an AI Advisory Council; employee AI ethics training

Experiment

Lead by example – get your hands dirty with GenAI applications

Committee

We see a clear trend developing of Boards establishing tech focused committees

AI Ethics for Business Leaders - OpEd / Essays

OpEd / Essays	Questions Raised
* Fortune Op-Ed: *Politicians and nonprofits will struggle to keep AI in check – but corporate boards can't afford to fail*	▸ Why should corporate directors deeply engage in AI program oversight at their companies?
1 Essay #1: *Applied AI Ethics for corporate leaders*	▸ Why should corporate leaders consider an ethics- based approach to AI governance?
2 Essay #2: *Why we're embarking on this business AI ethics journey*	▸ What are the gaps in the market that prompted this business AI ethics initiative?
3 Essay #3: *The AI ethics landscape: government, academia, and business approaches*	▸ Who are the stakeholders engaged in AI governance and how are business interests aligned?
4 Essay #4: *The state of global AI regulation*	▸ What is the state of AI regulation in key jurisdictions across the globe?

AI Ethics for Business Leaders - OpEd / Essays *(cont.)*

	OpEd / Essays	Questions Raised
5	Essay #5: *Reimagining AI ethics, moving beyond principles to organizational values*	▸ What are the inherent problems with a principles-based approach to AI governance and why is it critical to align to organizational values?
6	Essay #6: *The Caremark rule and board level AI risk management*	▸ How has the Delaware Chancery Court defined minimum legal requirements for board level governance and how can it inform ethical AI oversight?
7	Essay #7: *The external forces influencing business AI governance*	▸ What are the external forces influencing board level AI governance and how can directors appropriately address conflicting priorities from these influencers?
8	Essay #8: *Into the abyss: examining AI failures and lessons learned*	▸ What are the key lessons learned from AI failures and challenges and how may these lessons inform appropriate AI system development?
9	Essay #9: *How bioethics can inform ethical AI governance*	▸ What are the key bioethics practices and how could they inform AI governance models?

AI Ethics for Business Leaders – future research topics | *DRAFT*

Future Research Topics

1. *How can bioethical principles and practice inform AI governance?*
2. *How will the Boeing decision – extending board duties to non-equity stakeholders – impact board level AI governance?*
3. *What are the implications of the McDonalds decision, extending Caremark oversight to the C-Suite?*
4. *How will the 'mission critical' board oversight standard applicable to cyber risks inform AI governance?*
5. *How could the creative corporate governance protocols in public benefit corps influence C corp. governance?*
6. *Continue development of the Applied AI Ethics framework for senior business leaders*
7. *How could corporate sustainability practices (stakeholder capitalism) inform AI governance?*
8. *Whether and how the US SEC is considering corporate AI governance rules and regulations; compare to other jurisdictions.*
9. *Develop an AI ethical governance Exec-Ed training course / certification for corporate directors / C-Suite*
10. *As a follow-up to the June Directors' AI Ethics Forum, consider inviting a full corporate board to Harvard for a 1-2 day AI ethics workshop; build the program*

Harvard University Edmond & Lily Safra Center for Ethics

Engagement

Policymaker readouts

Digital Minister of Mongolia — Jan 26

U.S. Dept. of Commerce — Feb 12

U.S. Naval War College – Feb 28

World Bank Group — Apr 11

Government DX Summit – Apr 19

Research community

Aligned to the Harvard GETTING-Plurality research network

AI Ethics Directors' Forum

Will be held on June 18 at Harvard Business School

Business AI ethics essays

Updated periodically on the Harvard Safra Center website:

https://ethics.harvard.edu/blog

Board/C-suite readouts

We're also conducting readouts/ education sessions for boards, audit committees, C-suite, and NACD Director Forums (Denver, Boston, Nashville)

Contact info

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Applicability of AI in Finance



Chuanwei Zou

Jun 6th, 2024

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1. **Information Processing in Finance**
2. Considerations for AI Application in Finance
3. Policy Issues of AI Application in Finance



Information Processing in Finance

- **Finance is a highly information-driven field.**

- **Key areas:**



Structured Data Analysis in Finance

Finance primarily handles structured data, using models based on explicit formulas and limited parameters:

- ✓Financial derivative valuation
- ✓Portfolio optimization
- ✓Algorithmic trading
- ✓Quantitative risk management (e.g., internal credit rating, value-at-risk calculations)

Explainability hierarchy:

- ✓Structured > Reduced-form models
- ✓Linear > Non-linear models
- ✓Explicit formulas > Neural network models
- ✓Fewer parameters > More parameters

Special Characteristics of AI in Finance

01

AI extensively uses unstructured data (e.g., text, photo, voice, video).

02

Based on multilayer artificial neural network models with a huge number of parameters (e.g., GPT-4 with up to 1.76 trillion parameters).

03

Evolution from specific-purpose models to general-purpose AI models.

Analytical AI in Finance

- **Biometric-based user identity verification and recognition.**
- **Credit rating and investor risk preference assessment based on big data.**
- **Usage-based actuarial pricing for car insurance.**
- **Anomaly transaction and fraud detection.**

Generative AI in Finance

- **Not Artificial General Intelligence (AGI)**
- **Based on statistical modeling, not understanding natural language like humans**
- **Lacks human consciousness, critical thinking, imagination, innovation**
- **Not based on causality, lacks genuine logical reasoning abilities**

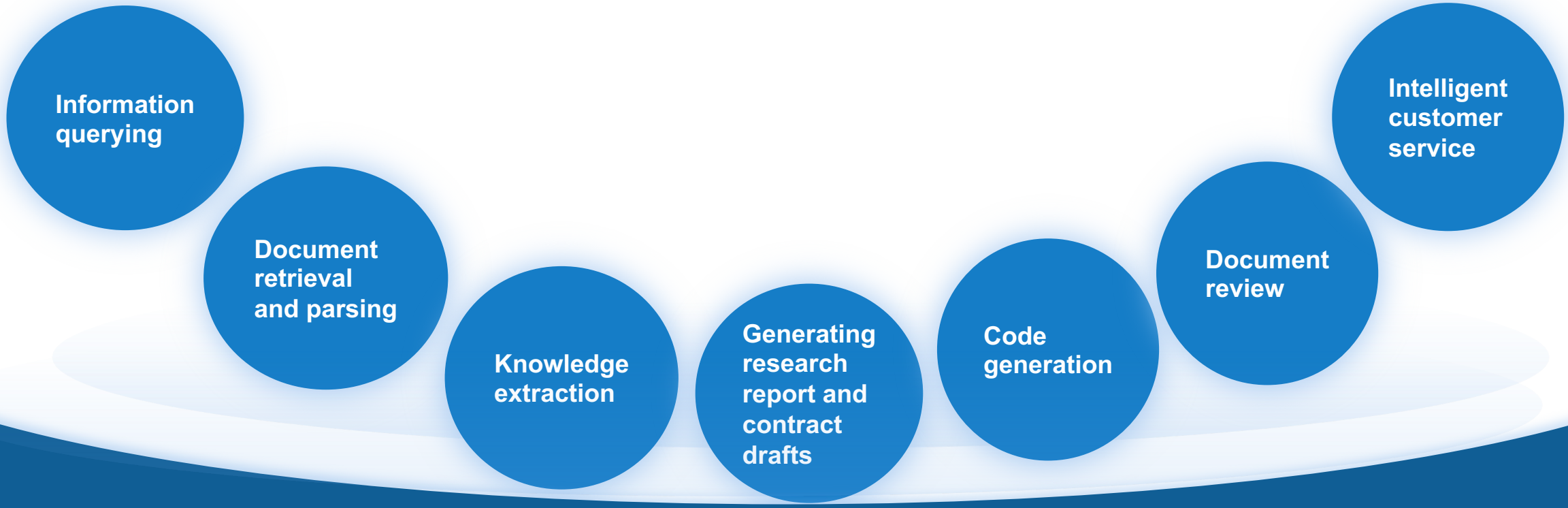
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1. Information Processing in Finance
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Benefits of Large Language Models

- **Enhances textual information entry into financial markets and improves market efficiency**
- **Functions as intelligent assistants:**



Challenges of AI in Finance

"Hallucinations" in large language models

- **Can be false or misleading in finance**
- **Mitigation through knowledge graphs and human-machine dialogue**

Black box nature

- **Lacks explainability, auditability, accountability**
- **Reduces user trust**

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1. Information Processing in Finance
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3. **Policy Issues of AI Application in Finance**



Policy Issues in AI Application

Market concentration

- Few companies can develop foundational models
- Potential systemic risk if many institutions use the same model
- Need for strict regulation of systemically important AI service providers

Training data quality

- Biases and discrimination in training data
- False information and sample selection bias
- Risk of market manipulation via generative AI and social media

Policy Issues in AI Application (Contd.)

- **Data security**
  - Risk of leaking commercial secrets or user privacy
  - Common practice of local deployment
- **Model integration**
  - Balance between large language models, quantitative "small models" and Analytical AI
  - Large language models have high computational costs and are not strong in mathematics
- **Digital divide**
- **Potential negative impact on employment in finance**



Thank you

Chuanwei Zou

Jun 6th, 2024

PIIE PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS

Misconceptions about China's Economy

Nicholas R. Lardy

Nonresident Senior Fellow

CDRF-PIFS China-US Financial Symposium, Cambridge, June 7, 2024

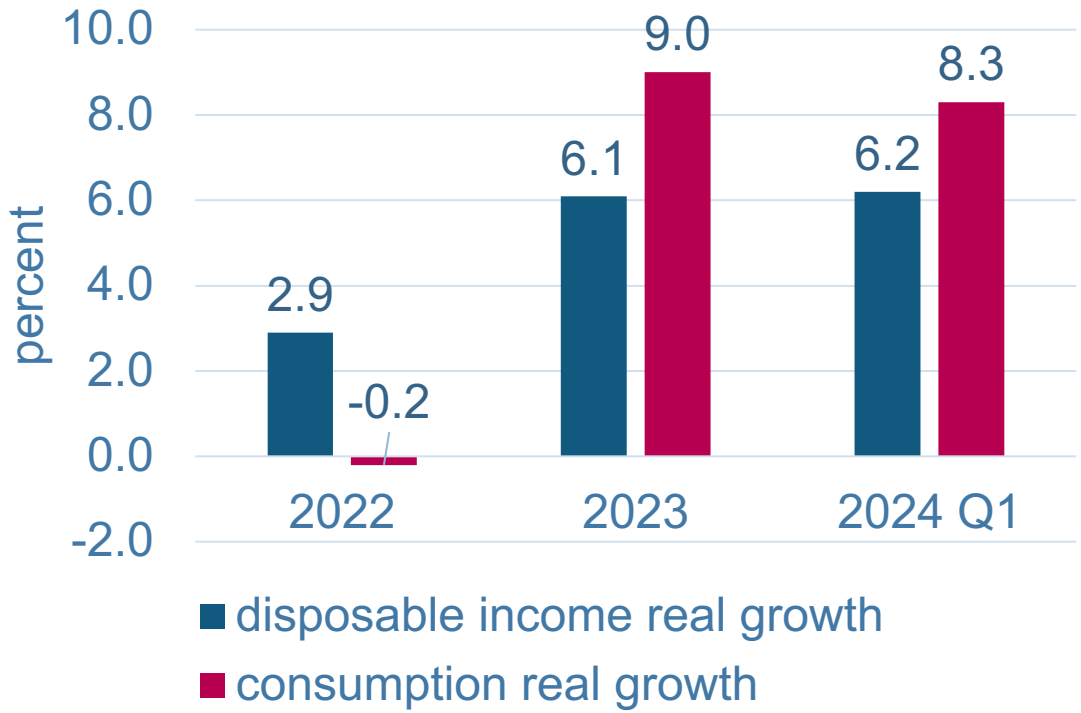
1750 Massachusetts Avenue, NW | Washington, DC 20036 | www.piie.com

Five Misconceptions

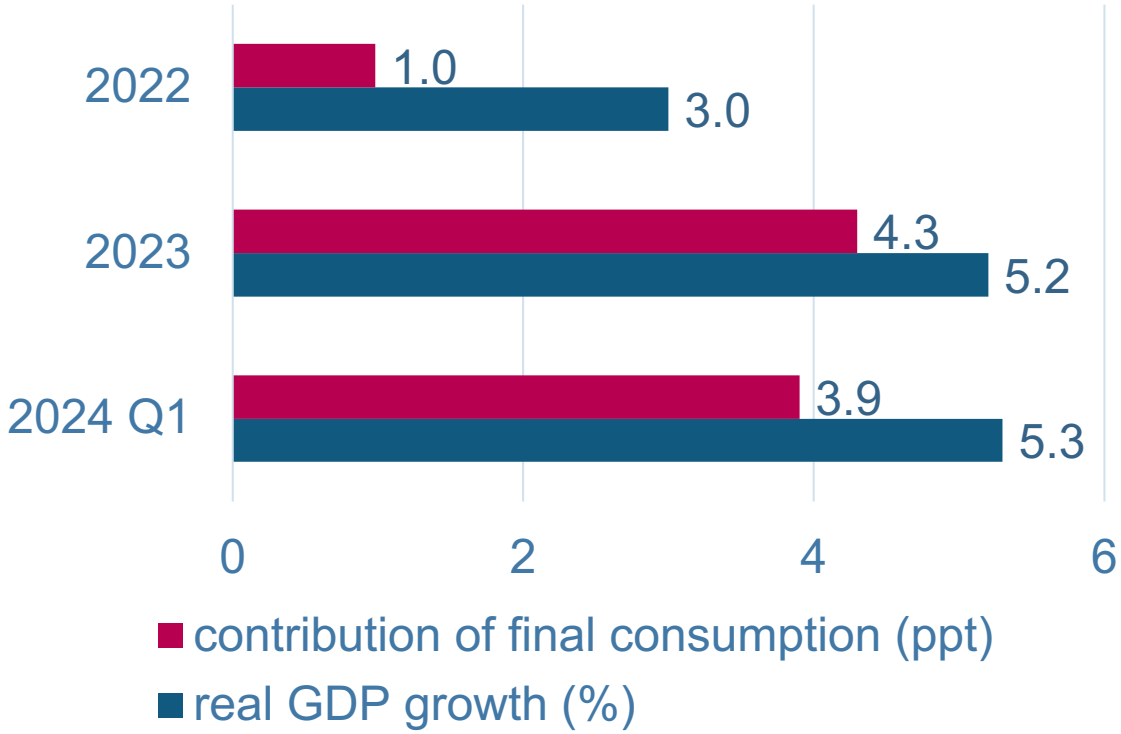
1. Convergence of GDP to advanced economy levels has stalled
2. Household income and spending remain weak post-pandemic
3. China faces a Japanese-style balance sheet recession
4. Property investment in China has collapsed
5. Government policy has depressed private investment

Misconception #2: Household income and spending remain weak post-pandemic

a. Per capita growth of household disposable income and consumption



b. Contribution of consumption to GDP growth

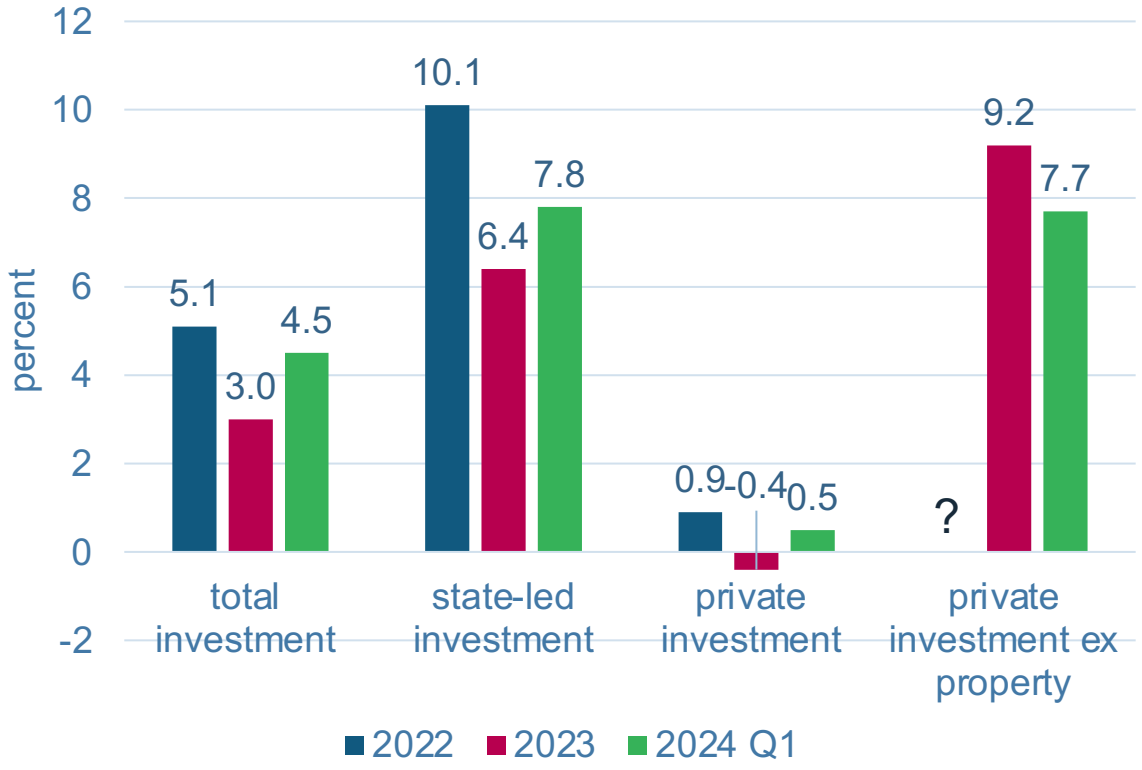


Source: National Bureau of Statistics of China

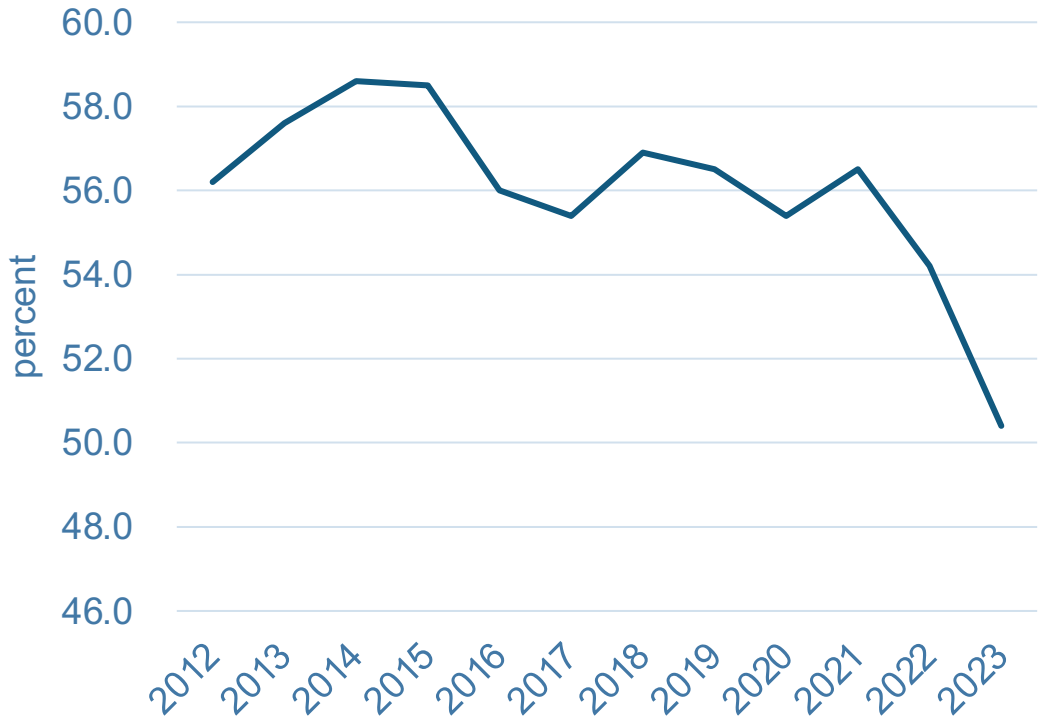
PIIE

Misconception #5: Private sector remains discouraged, family offices fleeing to Singapore

a. Fixed-asset investment growth, 2022-24Q1



b. Private share in total fixed-asset investment



Source: National Bureau of Statistics of China

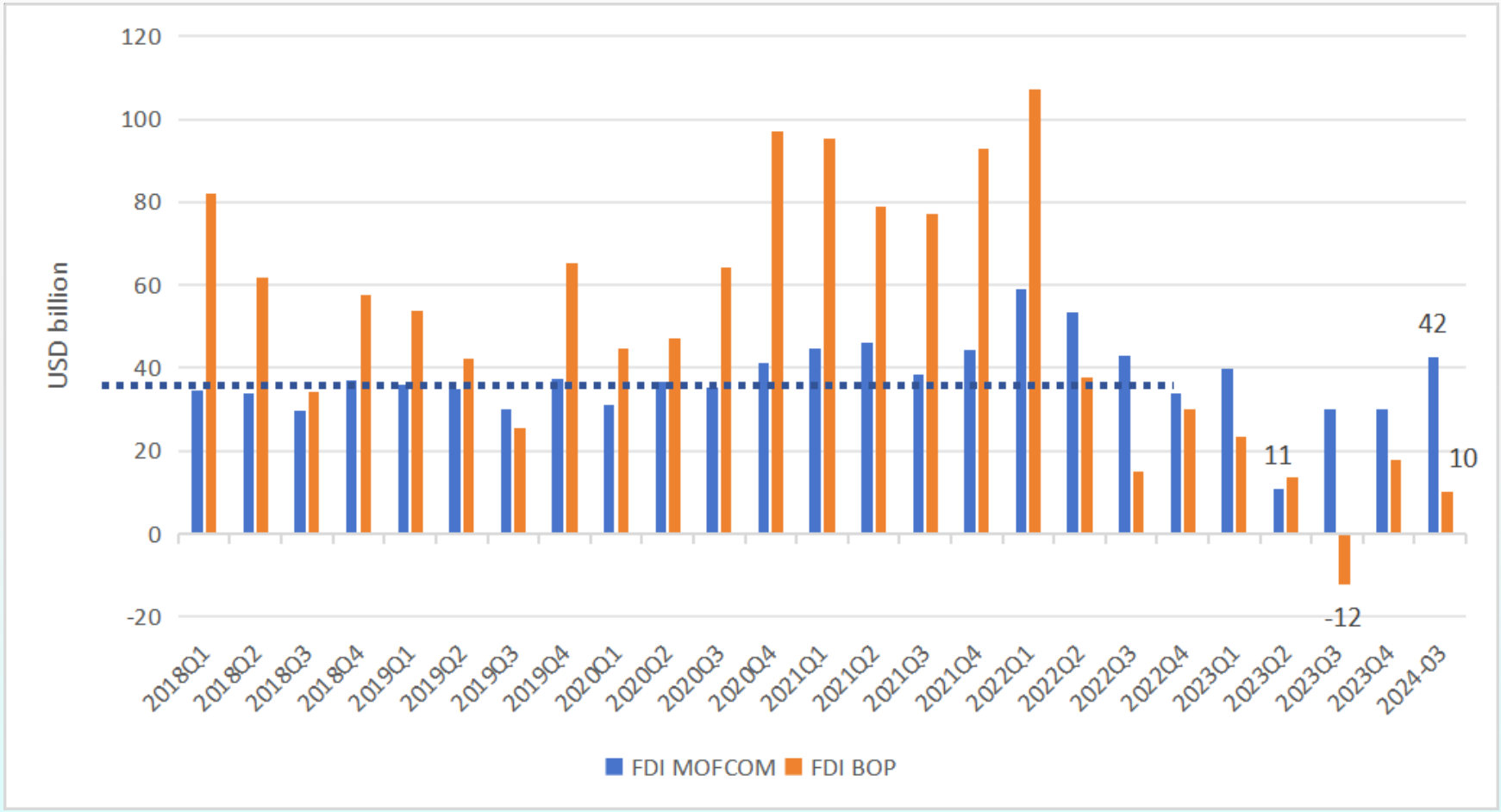
DRC 国务院发展研究中心
Development Research Center of the State Council

Recent Trends of China' s FDI inflows in the background of US interest rate hike

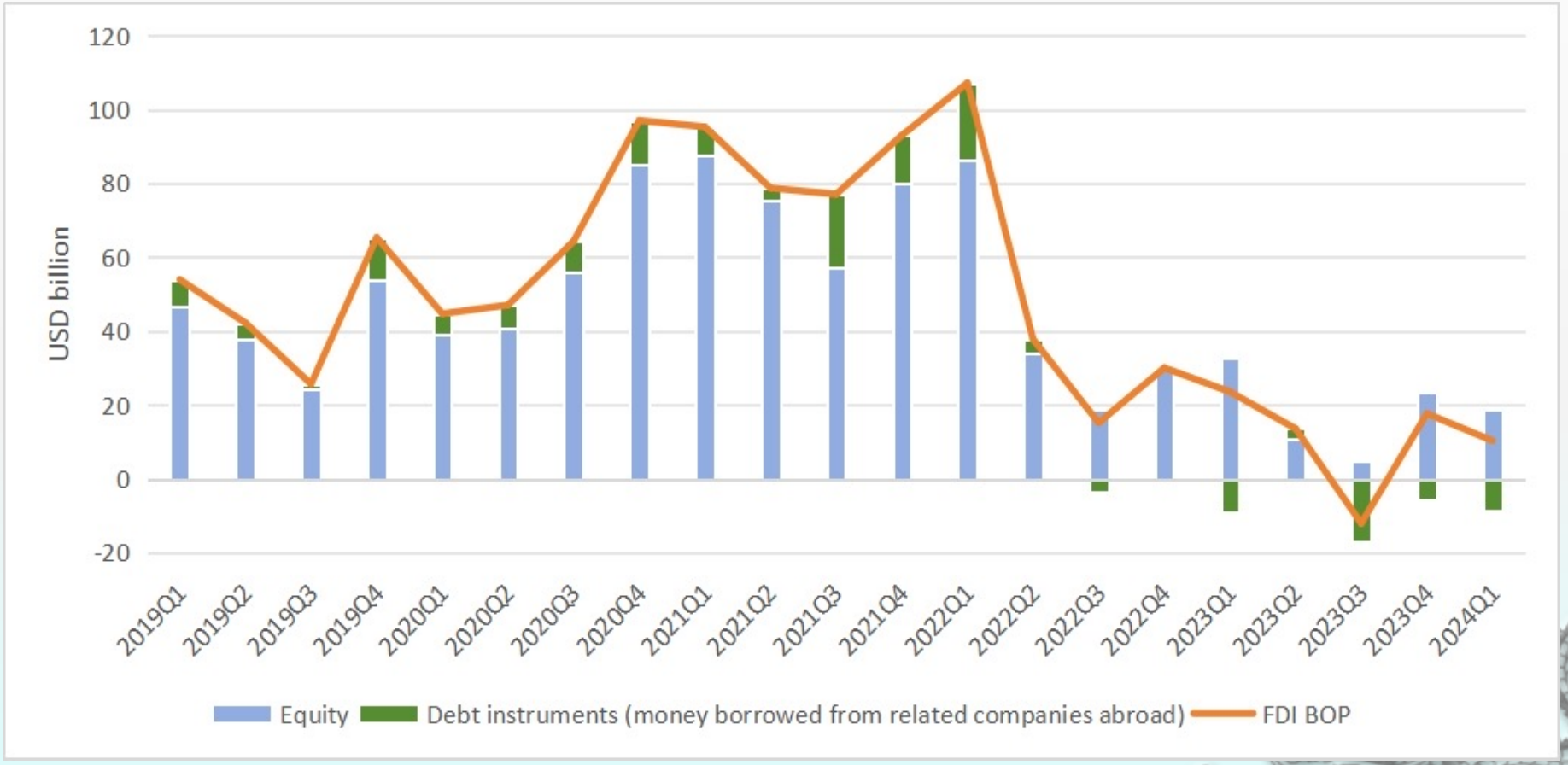
LYU Gang
Development Research Center of the State Council (DRC)

21st Symposium on Building the Financial System
Cambridge, June 7, 2024

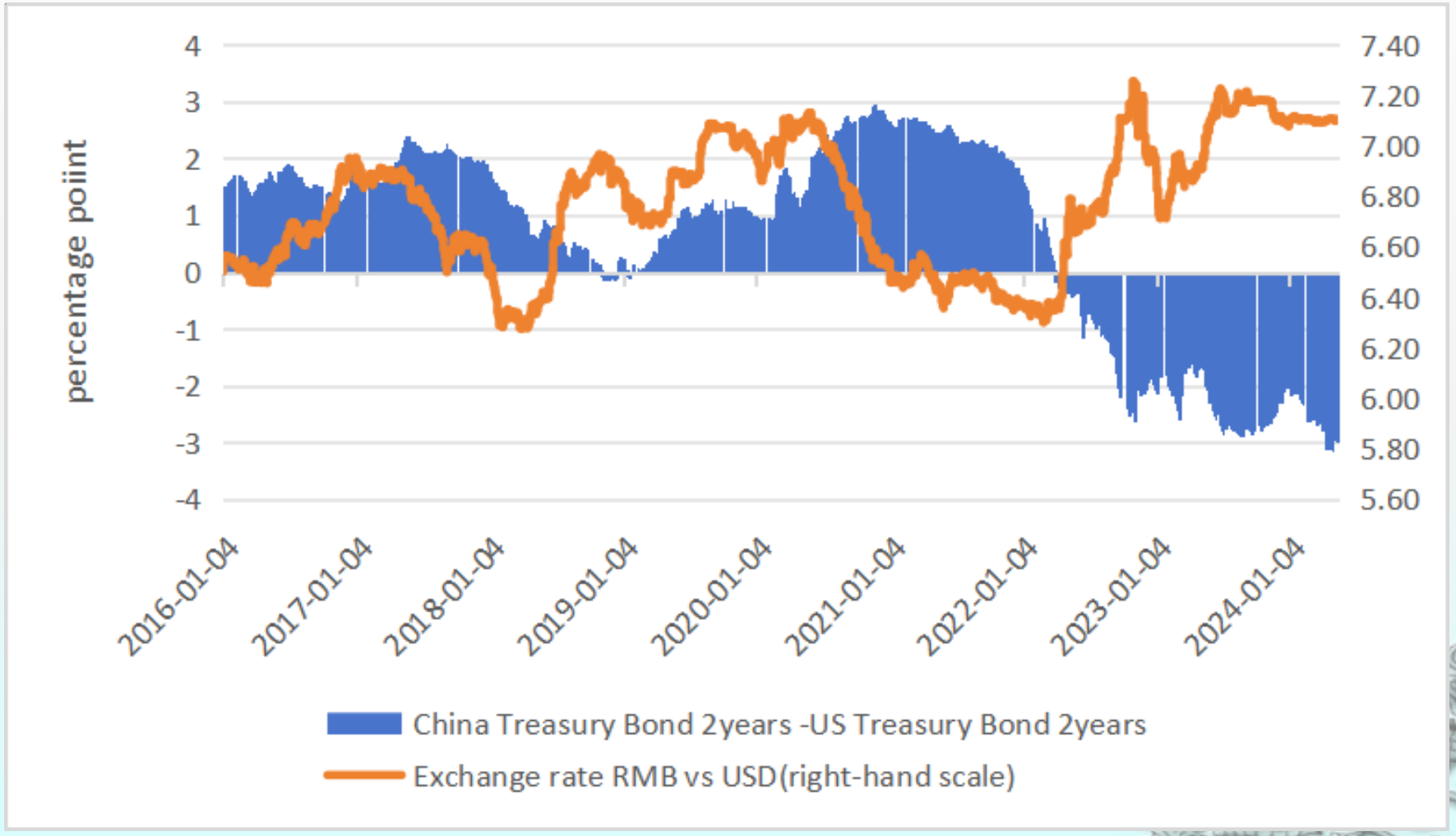
Quarterly data on China's FDI



Structure of China's FDI (BOP)



Difference between interest rates of China and US



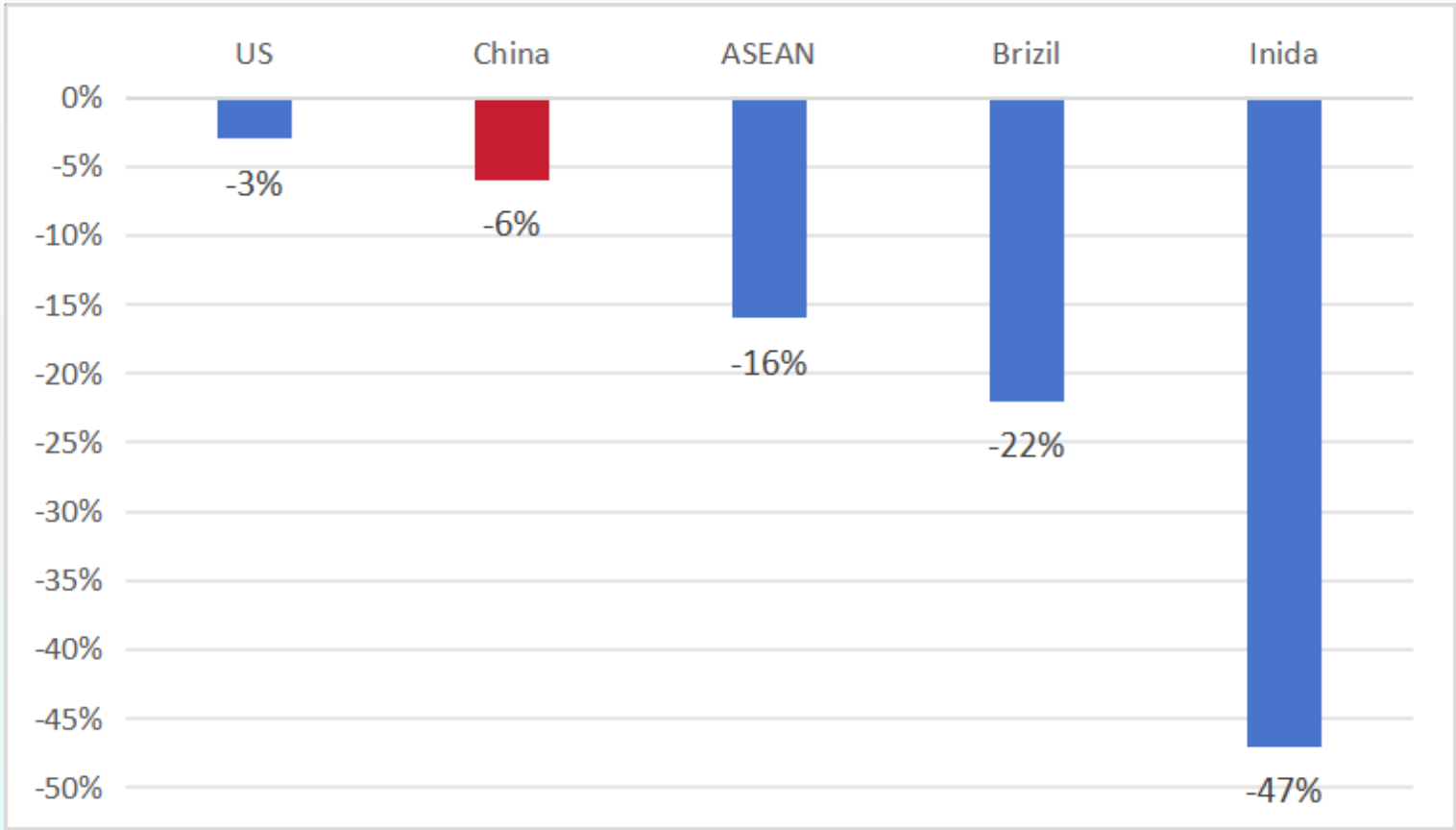
Debt instruments (FDI BOP) of major economies

(money borrowed from related companies abroad)

	Q1-3 2022	Q1-3 2023
US	60	43
Japan	11	−6
Germany	51	−9
France	48	−23
UK	11	−88
Sum of 95 economies	426	−138
China	133	39

IMF, billion USD

FDI growth rates of major economies



UNCTAD

Thank you!

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