



The Blob: Capital, China, Chips, Chicago and Chilliwack

I saw a great movie recently so I thought I would share.

INDESTRUCTIBLE...INDESCRIBABLE...IT CANNOT BE STOPPED!

THE DATA CENTER BLOB!



STRAINED POWER GRIDS!

HIGHER NIGHTTIME LOADS!

HARMONIC DISTORTION DAMAGING EQUIPMENT AND APPLIANCES!

HIGHER POWER PRICES!

SOARING PJM CAPACITY PAYMENTS!

RAPID DEPRECIATION OF CHIPS AND INTERCONNECTS!

Starring **AMAZON WEB SERVICES MICROSOFT AZURE GOOGLE CLOUD META**

Produced by **EQUINIX DIGITAL REALTY TURNER CONSTRUCTION DPR CONSTRUCTION**

Directed by **OPENAI ANTHROPIC XAI** Financed by **BLACKSTONE DIGITAL BRIDGE SAUDI INVESTMENT FUND**

Based on an original 2017 paper **"ATTENTION IS ALL YOU NEED"** by **GOOGLE BRAIN RESEARCH**

In this piece, we look at the AI and data center takeover, and the OpenAI-Oracle deal; the US government equity investments in Intel and MP Materials, the origins of TSMC and how many countries support national champions via industrial policy; efforts in China to reduce excess capacity and consequences for equity investors; crime and municipal solvency in Chicago and Illinois; how tight net new equity supply has been supporting US equity markets since 2011; and pictures from Chilliwack, Canada.

Michael Cembalest
JP Morgan Asset Management



The Blob: the AI and data center takeover

I think this is well understood, but just to reinforce the point: AI related stocks¹ have accounted for 75% of S&P 500 returns, 80% of earnings growth and 90% of capital spending growth since ChatGPT launched in November 2022. AI is showing up other places as well. Data centers are eclipsing office construction spending and are coming under increased scrutiny for their impact on power grids and rising electricity prices. Specialized power rates for most data centers aren't enough to cover costs of a new natural gas plant (leaving other customers to foot part of the bill), and in the PJM region, 70% of last year's increased electricity cost was the result of data center demand; more to come in our next energy paper. The biggest medium-term risk I can think of for top-heavy US equity markets: China's Huawei and SMIC pierce the \$6.3 trillion NVIDIA-TSMC-ASML moat by creating their own supernode computing clusters and deep-ultraviolet lithography machines of comparable quality.

Other recent AI news: Oracle's stock jumped by 25% after being promised \$60 billion a year from OpenAI, an amount of money OpenAI doesn't earn yet, to provide cloud computing facilities that Oracle hasn't built yet, and which will require 4.5 GW of power (the equivalent of 2.25 Hoover Dams or four nuclear plants), as well as increased borrowing by Oracle whose debt to equity ratio is already 500% compared to 50% for Amazon, 30% for Microsoft and even less at Meta and Google. In other words, the tech capital cycle may be about to change.

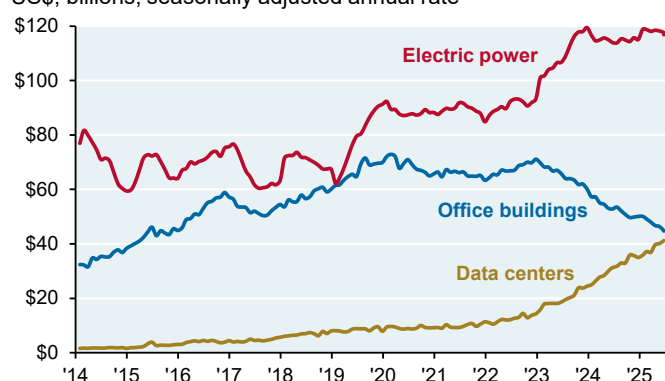
Returns, earnings, capex/R&D growth and contributions of AI-related stocks in the S&P 500 since ChatGPT launch

	AI: Direct	AI: Utilities	AI: CapEquip	S&P 500 ex-AI
Performance since November 2022				
Price return	181%	65%	138%	25%
Earnings growth	124%	15%	58%	9%
EBIT growth	98%	11%	71%	16%
Capex + R&D growth	63%	21%	-14%	4%
Contributions to S&P 500 since November 2022				
Price return	75%	0.9%	0.9%	23%
Earnings growth	79%	0.5%	0.8%	20%
EBIT growth	62%	0.4%	0.9%	36%
Capex + R&D growth	90%	2%	-0.1%	8%

Source: Bloomberg, JPMAM, September 22, 2025

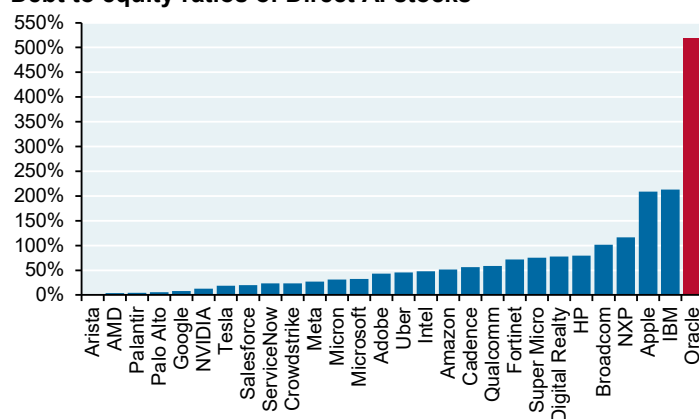
US construction spending

US\$, billions, seasonally adjusted annual rate



Source: Census Bureau, JPMAM, July 2025

Debt to equity ratios of Direct AI stocks



Source: Bloomberg, JPMAM, September 16, 2025

On OpenAI/Oracle and the capital cycle:

"There is no way for Oracle to pay for this with cash flow. They must raise equity or debt to fund their ambitions. Until now, the AI infrastructure boom has been almost entirely self-funded by the cash flows of a select few hyperscalers. Oracle has broken the pattern. It is willing to leverage up to hundreds of billions to seize a share. The stable oligopoly is cracking...The implications are profound. Amazon, Microsoft and Google can no longer treat AI infrastructure as a discretionary investment. They must defend their turf. What had been a disciplined, cash-flow-funded race may now turn into a debt-fueled arms race". Dan O'Laughlin, *Fabricated Knowledge*, Sept 2025

¹ Our S&P 500 AI universe is composed of 41 stocks from three categories, based on analyses of earnings transcripts conducted by Dubravko's JP Morgan Global Market Strategy Team and by Empirical Research

Direct AI (29): NVIDIA, Microsoft, Apple, Alphabet, Amazon, Meta, Broadcom, Tesla, Oracle, Palantir, AMD, Salesforce, IBM, Uber, ServiceNow, Qualcomm, Arista, Adobe, Micron, Palo Alto, Intel, CrowdStrike, Cadence Design, Dell, NXP, Fortinet, Digital Realty Trust, HP and Super Micro Computer. **AI utilities (8):** NGR, Vistra, NextEra, Southern, Constellation, Public Service Enterprise, Entergy, NiSource. **AI capital equipment (4):** Eaton, Trane, Johnson Controls, Quanta

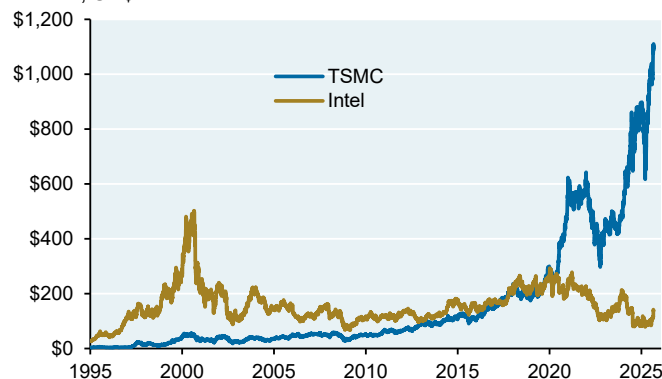
**Chips: the US government equity investment in Intel, TSMC and a world of mercantilist industrial policy**

One of the stocks in our direct AI basket is **Intel**, a company which is decidedly NOT part of the reason that AI stocks have performed so well since 2022. Intel's earnings and market cap have actually *declined* since GPT was launched. There are plenty of critics of the US government's 10% stake in Intel, but I'm not one of them. It strikes me as way too late in the game for the US to rely primarily on market forces to support US domestic chip fabrication. Intel needs an anchor of demand to make its chip foundry viable, but what customer would elect to go with Intel if there's a chance its foundry won't survive? With the US gov't anchor investment in place, NVIDIA followed with a \$5 billion partnership in Intel and other fabless chip companies may follow.

When the US Department of Defense took a 15% stake in **MP Materials** recently², I felt the same way: the US needs critical mineral mining and processing capabilities, and MP Materials has to compete with critical minerals companies in China, 40% of which are not even regulated³. Surviving in a world of mercantile adversaries playing by a different set of rules can only be sustained for so long when national security interests are involved.

TSMC vs Intel market cap

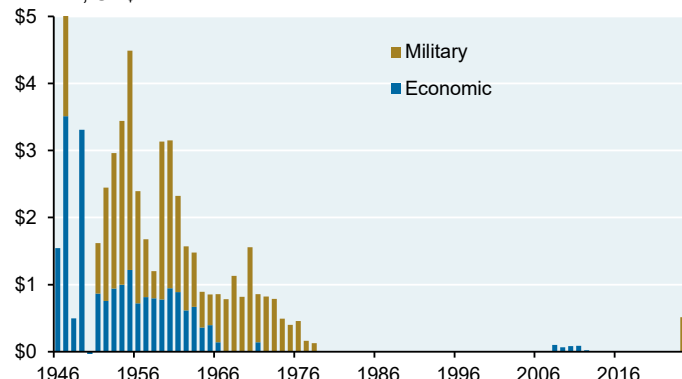
Billions, US\$



Source: Bloomberg, JPMAM, September 22, 2025

US military and economic aid to Taiwan

Billions, US\$



Source: Council on Foreign Relations, September 2024

Let's also remember how TSMC, Taiwan's "Guardian Sacred Mountain", became what it now is:

- In the 1970's, Taiwan faced the end of US military and economic aid, UN expulsion and an energy crisis
- Semiconductors were chosen as a lifeline to sustain Taiwan's economy using a pure-play foundry model given Taiwan's limited capabilities in circuit design or intellectual property
- The US company RCA was the only one willing to license its semiconductor design technology to Taiwan's Industrial Technology Research Institute. This led to TSMC being founded by Taiwanese-American Morris Chang with **\$100 million in seed money from the Taiwanese government, which took a 49% stake**
- While the Taiwanese government's share in TSMC has declined since the 1970's, its National Development Fund is still the largest shareholder with 6%-7% and maintains a seat on the company's board
- **The Taiwanese government continues to support TSMC** via subsidized water and electricity prices, tax credits and creation of industrial parks and research centers. The result: "TSMC doesn't have to spend a penny to get the best talent from Taiwan"⁴. TSMC's market cap is now greater than Taiwanese GDP

The history of **South Korea and Samsung** is similar: billions in Korean government tax incentives, infrastructure development for semiconductor clusters, R&D support and streamlined regulations. The **Dutch government has also supported ASML**, Europe's most valuable tech company, with billions in infrastructure, housing and education funding for the Brainport Eindhoven innovation technology region.

² Gov't support doesn't always have to be expensive. Purchasing all of the output from a Tennessee plant that produces gallium (critical in high tech and defense industries) could cost as little as \$15 mm per year and provide 200% of US gallium consumption (Colorado School of Mines Payne Institute)

³ "China's public policies toward rare earths, 1975 -2018", Yuzhou Shen et al in *Mineral Economics*, 2020, and "The impact of unregulated ionic clay rare earth mining in China", Packey and Kingsnorth, *Resources Policy*, 2016

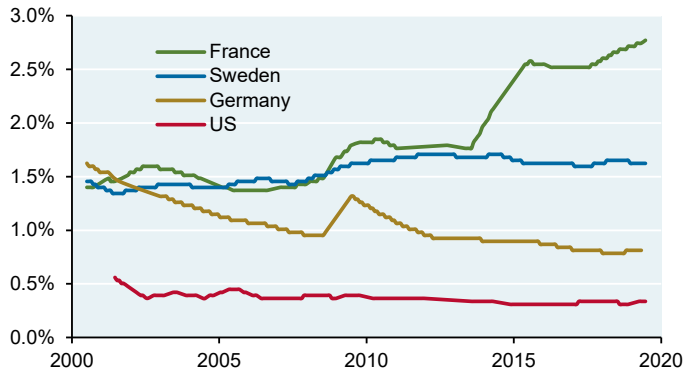
⁴ Shih-Chang Hung, professor of technology and innovation management at National Tsing Hua University



Bottom line: it's a really mercantile world out there. While the US has a stellar track record in creating new companies compared to Europe (see bubble chart), the rest of the world often provides a lot more in the way of tax, loan, grant and other subsidies to its manufacturing industries than the US⁵. In China, the world's most mercantile country, such subsidies can reach 15%-35% of industry profits. **Providing a Federal government lifeline to Intel may have been the least bad option in the world illustrated below.**

Government expenditures on subsidies

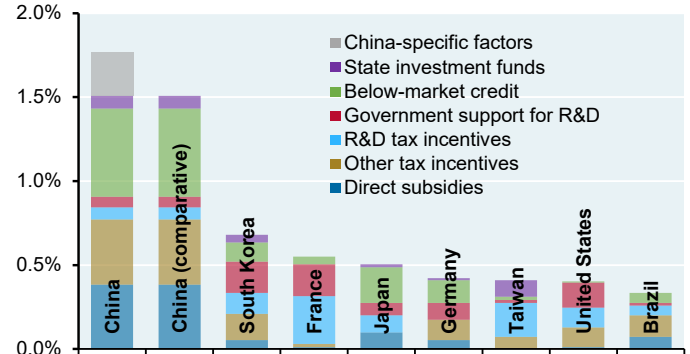
Share of GDP



Source: Sweden Board of Trade, 2019

Industrial policy spending in key economies

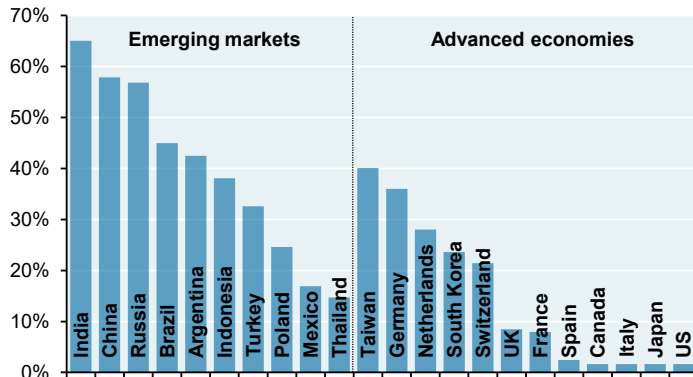
Percent of GDP



Source: CSIS, 2022

State-owned banks share of banking system assets

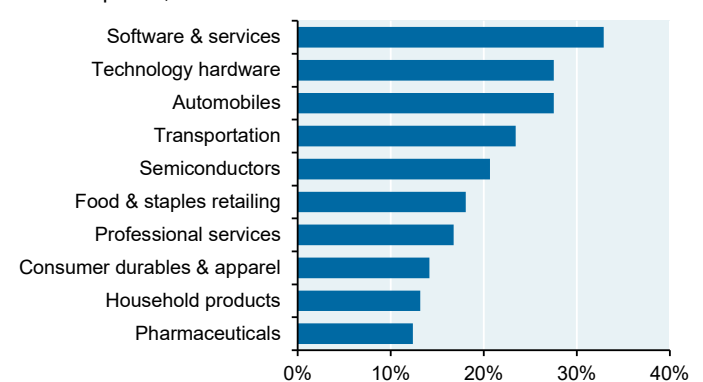
Percent



Source: CSIS, 2022

China direct subsidies for listed firms by subsector

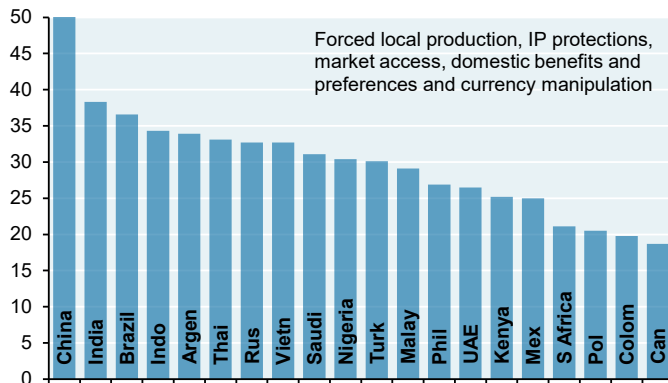
Share of profits, 2017-2020



Source: CSIS, 2022

20 most mercantilist countries

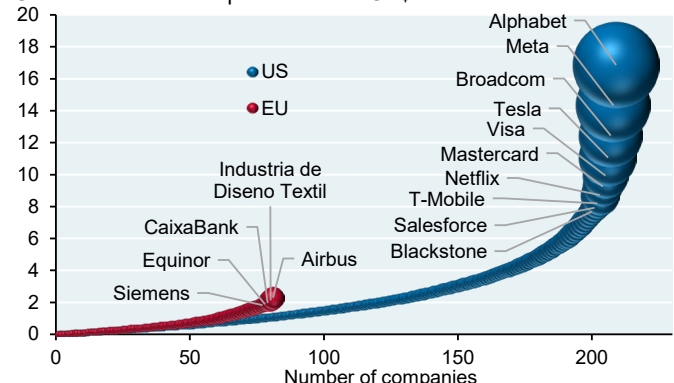
ITIF Global Mercantilist Index score



Source: Information Technology & Innovation Foundation, 2019

Creation of new public companies in the 21st century

Cumulative market cap in trillions of US\$



Source: Bloomberg, JPMAM, August 25, 2025

⁵ Sources include "Government subsidies in manufacturing sectors", Sweden National Board of Trade, June 2023 and "Red ink: estimating Chinese industrial policy spending in comparative perspective", CSIS, May 2022

**Chicago, crime and municipal solvency**

The President has highlighted the crime situation in Chicago but has reportedly opted to send the National Guard to Memphis instead. **How bad is crime in Chicago?** Based on data from the Council on Criminal Justice, Chicago ranks at the high end of some crime statistics on a per capita basis and lower on others. To be clear, per capita comparisons at a city level can be affected by different ways of measuring urban populations within the city's outer limits. And like most cities, Chicago crime rates are very heterogenous by district: the 20 most dangerous communities have a homicide rate that's 68x higher than in the 20 safest communities.

Crime rates per capita, 2024-2025

	# of cities reporting	City rank										
		Chi	NYC	Meph	Balt	DC	St L	Phi	Minn	SF	Denv	Dal
Aggravated assault	23	6	dnr	dnr	4	21	3	8	dnr	14	dnr	dnr
Carjacking	9	4	dnr	3	1	2	dnr	dnr	dnr	6	5	dnr
Gun assaults	11	3	dnr	dnr	4	8	dnr	5	dnr	10	dnr	6
Homicide	30	11	26	2	4	6	1	13	dnr	dnr	23	dnr
Larceny	36	22	25	1	13	10	5	6	16	15	14	23
Motor vehicle theft	36	17	35	2	8	18	4	dnr	3	21	6	1
Nonresidential burglary	18	11	dnr	3	dnr	dnr	dnr	15	10	1	7	6
Robbery	36	5	14	2	1	6	9	8	3	7	16	dnr
Residential burglary	18	11	dnr	1	dnr	dnr	dnr	8	2	6	4	13

Source: Council on Criminal Justice, mid-year 2025 update. DNR = does not report

Key cities missing from CCJ data: Los Angeles, Houston and San Diego

If one were using this data to think about possible Federal intervention, Memphis-Baltimore-Philadelphia-St. Louis seem as dangerous as Chicago if not more so. That said, Chicago's homicide rate is 5x higher than NYC, and if we narrow the universe to the few mega-cities with more than 750,000 people, Chicago ranks #1 in aggravated assault, gun assaults, homicide and robbery.

Chicago's mayor recently cited improvements in crime-fighting and homicide "clearance rates" of 52%, the highest in Chicago since 2019. **Not so fast**⁶...

- Of 319 murders cleared (i.e., resolved) in 2023, only 140 occurred in 2023...some were so old they occurred when Nixon was still President. Even more important: "cleared" also doesn't always mean someone was arrested or indicted, it just means the police consider the crime "solved"; sometimes prosecutors don't move to trial, and sometimes presumed perpetrators die of old age. Of the 140 Chicago murders that were cleared and that occurred in 2023, charges were only filed in 18% of cases
- Broadening the time frame to 2013 – 2022, the percentage of murders actually cleared by an arrest was ~20% in Chicago compared to over 50% in NYC and a national average of 45%. The gap between perception and reality in Chicago is so great that Illinois legislators introduced a bill to require law enforcement to disclose the number of people arrested and charged, rather than cases cleared
- Since 2018, of 19k people wounded in non-fatal Chicago shootings, arrests were only made in 6% of cases. In Chicago, 80% of nonfatal shooting investigations are suspended each year, meaning assigned officers no longer actively investigate them. Slightly fewer than half of all cases are suspended within just 30 days
- More stats on Chicago crime policies: over 70% of arrested and charged individuals are released before trial; from 2020 to 2024, nearly 400 individuals arrested for murder or attempted murder were out on bail for a prior felony at the time of arrest; more than 75% of orders of protection go unenforced; and more than half of all high-priority 911 calls receive no immediate police response compared to 19% in 2019

Chicago, My Kind of Town: a photo from September 2025 shows Governor Pritzker posing with a community violence intervention worker who officials say was later charged with murder and other crimes after a smash-and-grab burglary of a Louis Vuitton store on the Magnificent Mile (WSJ). **Chicago could opt to spend more on public safety initiatives but may be constrained by a topic we've written about several times over the years: municipal solvency constraints, which we discuss next.**

⁶ Sources include CWB Chicago, CBS Chicago, Chicago Sun Times, TheTrace.org, Illinois Policy Institute and the University of Chicago Crime Lab

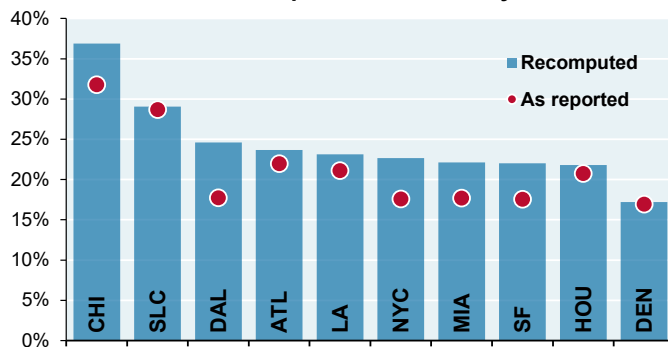


In 2014, I began a project to track total indebtedness of states and cities incorporating general obligation debt and underfunded pension and retiree healthcare plans. It's called the "ARC and the Covenants" project; ARC stands for the Annual Required Contribution that municipal actuaries determine as amounts needed to amortize underfunded plans, and the Covenant refers to promises made to employees. It requires us to pore through 400+ page Consolidated Annual Financial Reports for each plan; states and cities can have 10 or more single employer and multi-employer plans; and disclosures can be poorly explained and inconsistently provided.

In our prior updates for cities (2023) and states (2021), Chicago and Illinois showed up as having the highest ratios of required payments as a share of their respective revenues. We updated the ten cities and states with the highest ratios and little has changed. Let's start with Chicago:

- **Chicago still has the highest ratio**, requiring a staggering 35% of all city revenue collections to fully amortize its underfunded plans over a 30-year period. Chicago faces a more difficult challenge than other cities since almost all of its underfunded obligations are contractual pensions, compared to retiree healthcare plans (OPEB) whose deductibles, copays and other terms & conditions can be revised
- The Chicago Police Department which would be responsible for any changes in law enforcement policies has a woefully underfunded pension. The Chicago Police Annuity Benefits Fund has just a 24% funding ratio, the 2nd lowest of all pension plans in our universe only behind the California Judges Retirement Fund
- **Our Chicago figures may be understated** since they do not reflect pension enhancements made in July 2025 which reportedly took funding ratios below 20%, a level considered "technically insolvent"
- **Watch for tax increases in Chicago to deal with this and with the city's \$1.15 bn budget shortfall**

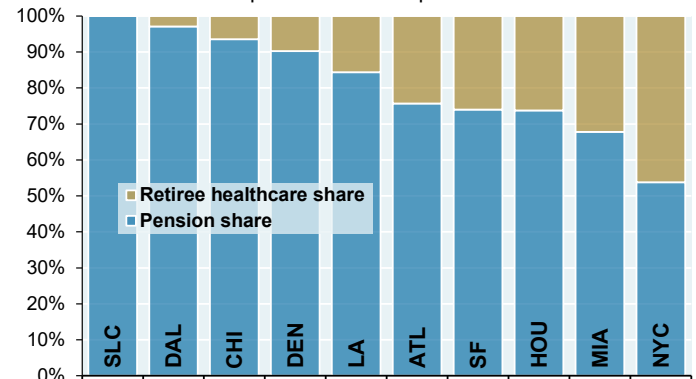
Cities: cost of pension and retiree healthcare plans (including amortization of unfunded amounts), gov debt and defined contribution plans as a % of city revenues



Source: Individual city CAFRs, Moody's, JPMAM, FY 2024

City split: pension & retiree healthcare obligations

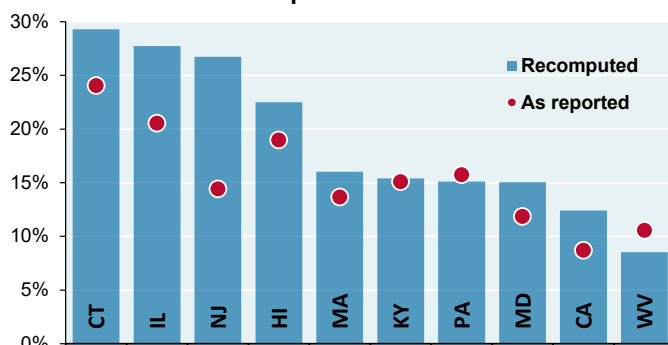
Percent of annual recomputed Annual Required Contribution



Source: Individual city CAFRs, Moody's, JPMAM, FY 2024

A similar story for the state of Illinois, which was edged out by Connecticut this time but which (like Chicago) has greater burdens linked to contractually obligated pensions vs more flexible OPEB. Illinois keeps showing up as #1, #2 or #3 on analyses of state migration outflow rates, which isn't going to make any of this easier.

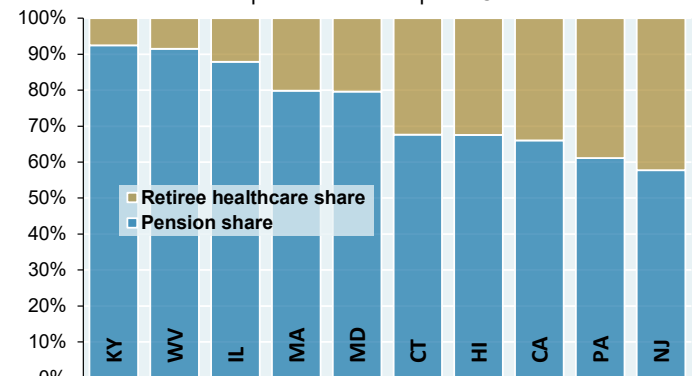
States: cost of pension and retiree healthcare plans (including amortization of unfunded amounts), gov debt and defined contribution plans as a % of state revenues



Source: Individual state CAFRs, Moody's, JPMAM, FY 2024

State split: pension & retiree healthcare obligations

Percent of annual recomputed Annual Required Contribution



Source: Individual state CAFRs, Moody's, JPMAM, FY 2024

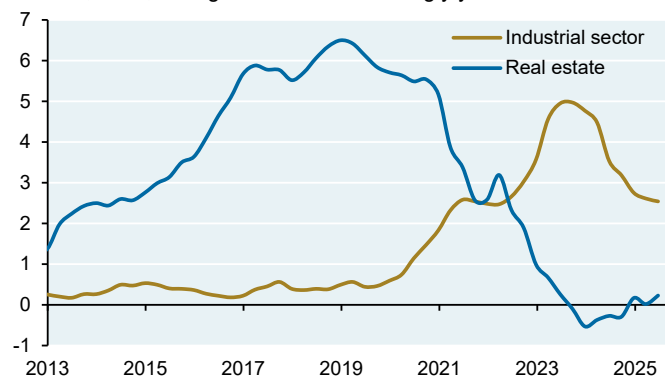


China, “involution” and the export of surplus production

The buzzword of the day in China is “involution”, which refers to excess capacity and oversupply which has led to the longest period of Chinese deflation since 1998 and weak industrial profits. Rather than continuing to try to stimulate domestic demand to absorb excess production, China now claims it will push banks to reduce lending to oversupplied industries solely for meeting GDP targets. This will be a tough ask for the Chinese corporate sector which has been exporting excess production to the rest of the world, as shown below.

Chinese bank loans to industry vs real estate

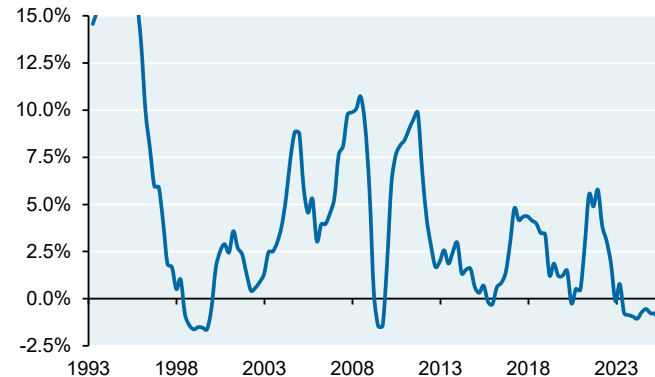
Trillions, RMB, change in loans outstanding y/y



Source: The People's Bank of China, Bloomberg, JPMAM, Q2 2025

China GDP deflator

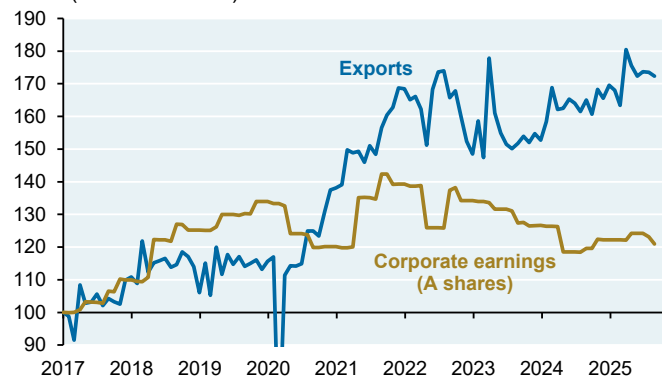
Percent



Source: Bloomberg Economics, JPMAM, Q2 2025

China exports and corporate earnings

Index (100 = Jan 2017)



Source: Haver, China Customs, Bloomberg, JPMAM, August 2025

China vehicle production vs domestic sales

Million vehicles, 6 month average, seasonally adjusted annual rate



Source: China Association of Auto Manufacturers, China General Administration of Customs, JPMAM, August 2025

China mercantilism and oversupply

The US is not the only country using tariffs to deal with Chinese oversupply. Mexico, Turkey, Indonesia, Brazil, South Africa, Thailand and Vietnam are among the countries that have imposed tariffs on Chinese industrial or consumer exports.

While president Xi refers to the need for integration and dismantling trade walls rather than erecting them, China has been the world's most mercantile country since its early 2000s acceptance into the WTO. Its tools of the trade: special status for state enterprises, subsidies, direct grants and loans, below-market borrowing, state-directed credit, technology transfer and special procurement policies.

According to economist George Magnus, this is nothing new. A trade war or “shangzhan” was also a key feature during the latter years of the Qing Dynasty (1644-1912) and the early years of the Chinese Republic. One of the leading advocates for a mercantilist political economy was Zheng Guanying (1842-1922) who argued for state involvement in the revival of domestic tea and silk industries, domestic cultivation of opium, subsidies for modern textile factories and import substitution.



At a July 2025 meeting of China's Central Commission on Economic and Financial Affairs, President Xi devoted a session to "disorderly low-price competition," and the need for an "orderly exit of outdated production capacity". Since then, Chinese equities have rallied at a faster pace than the rest of the world. Has China followed through? In July, there was a noticeable decline in fixed investment as shown on the right. But it's not clear how long this will last, and it's also unclear what the balance of winners and losers will be among Chinese industrial companies, since some will have to cut production. **The safer play: focus instead on OECD industrial companies which would benefit from any reduction in Chinese oversupply**, particularly since our real time growth monitors for China still point to weak overall economic activity (outside exports).

China vs world equity total returns in US\$

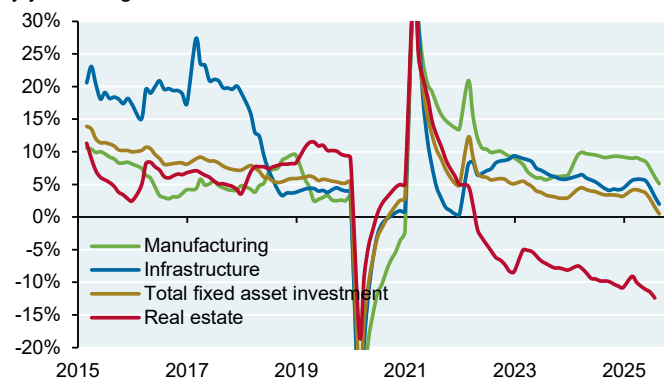
Index (100 = 12/31/2024)



Source: Bloomberg, JPMAM, September 23, 2025

China monthly fixed asset investment by sector

y/y % change



Source: Bloomberg, National Bureau of Statistics of China, August 2025

Developed world industrials total return vs the market

MSCI World Industrials / MSCI World, Index (100 = January 2001)



Source: Bloomberg, JPMAM, September 12, 2025

Shifting Chinese exports in 2025

Index (100 = January 2023), 3 mo moving avg, seasonally adjusted



Source: China General Administration of Customs, JPMAM, July 2025

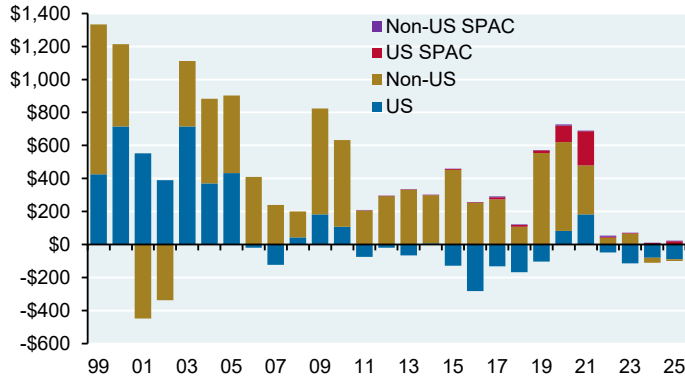


This chart might be the simplest explanation for US equity market resilience since 2011: limited supply

From time to time I ask my colleagues in the Investment Bank to update their analysis on net equity supply. I'm not a market technician but I do believe that declining net equity supply conditions since 2011 have contributed to US equity market resilience in the face of various shocks. If you believe that supply and demand conditions affect the price of goods and labor, there's every reason to believe such conditions can affect financial asset prices as well. At the end of the day, \$1.5 trillion in annual defined benefit and defined contribution payments into qualified plans by households and employers has to end up invested someplace. While such contributions have declined as a share of market cap from their 2009 peak, they're still running at 3%-4% per year while the supply of US equities continues to shrink (blue series in first chart).

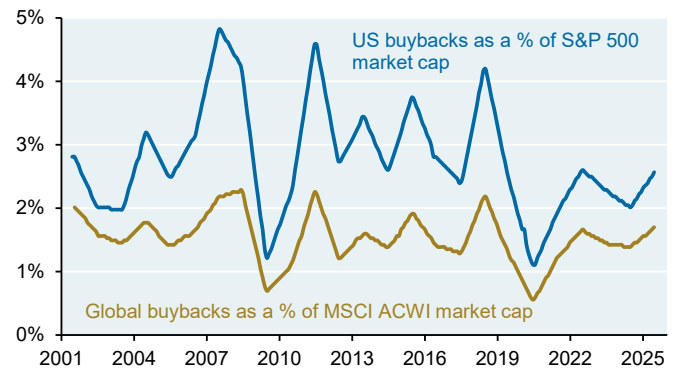
Global net equity supply

Billions, US\$



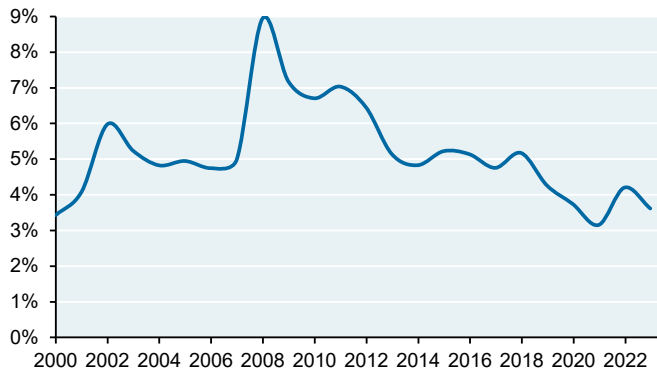
Source: JPM Flows & Liquidity, September 2025

Announced buybacks as a share of equity market cap



Source: JPM Flows and Liquidity, September 2025

Defined benefit & defined contribution plan household and employer contributions as share of S&P 500 market cap



Source: Bloomberg, FRED, JPMAM, 2023

Chilliwack, British Columbia, August 2025



Sturgeon Instagram reel: <https://www.instagram.com/reel/DOUBigeiefC/?igsh=MWhlb3liOXhxbXd3cw==>

**IMPORTANT INFORMATION**

This material is for information purposes only. The views, opinions, estimates and strategies expressed herein constitutes Michael Cembalest's judgment based on current market conditions and are subject to change without notice, and may differ from those expressed by other areas of JPMorgan Chase & Co. ("JPM"). **This information in no way constitutes J.P. Morgan Research and should not be treated as such.** Any companies referenced are shown for illustrative purposes only, and are not intended as a recommendation or endorsement by J.P. Morgan in this context.

GENERAL RISKS & CONSIDERATIONS Any views, strategies or products discussed in this material may not be appropriate for all individuals and are subject to risks. Investors may get back less than they invested, and **past performance is not a reliable indicator of future results.** Asset allocation/diversification does not guarantee a profit or protect against loss. Nothing in this material should be relied upon in isolation for the purpose of making an investment decision.

NON-RELIANCE Certain information contained in this material is believed to be reliable; however, JPM does not represent or warrant its accuracy, reliability or completeness, or accept any liability for any loss or damage (whether direct or indirect) arising out of the use of all or any part of this material. No representation or warranty should be made with regard to any computations, graphs, tables, diagrams or commentary in this material, which are provided for illustration/ reference purposes only. Any projected results and risks are based solely on hypothetical examples cited, and actual results and risks will vary depending on specific circumstances. Forward-looking statements should not be considered as guarantees or predictions of future events. Nothing in this document shall be construed as giving rise to any duty of care owed to, or advisory relationship with, you or any third party. Nothing in this document shall be regarded as an offer, solicitation, recommendation or advice (whether financial, accounting, legal, tax or other) given by J.P. Morgan and/or its officers or employees; J.P. Morgan and its affiliates and employees do not provide tax, legal or accounting advice. You should consult your own tax, legal and accounting advisors before engaging in any financial transactions.

For J.P. Morgan Asset Management Clients:

J.P. Morgan Asset Management is the brand for the asset management business of JPMorgan Chase & Co. and its affiliates worldwide.

To the extent permitted by applicable law, we may record telephone calls and monitor electronic communications to comply with our legal and regulatory obligations and internal policies. Personal data will be collected, stored and processed by J.P. Morgan Asset Management in accordance with our privacy policies at <https://am.jpmorgan.com/global/privacy>.

ACCESSIBILITY

For U.S. only: If you are a person with a disability and need additional support in viewing the material, please call us at 1-800-343-1113 for assistance.

This communication is issued by the following entities: In the United States, by J.P. Morgan Investment Management Inc. or J.P. Morgan Alternative Asset Management, Inc., both regulated by the Securities and Exchange Commission; in Latin America, for intended recipients' use only, by local J.P. Morgan entities, as the case may be.; in Canada, for institutional clients' use only, by JPMorgan Asset Management (Canada) Inc., which is a registered Portfolio Manager and Exempt Market Dealer in all Canadian provinces and territories except the Yukon and is also registered as an Investment Fund Manager in British Columbia, Ontario, Quebec and Newfoundland and Labrador. In the United Kingdom, by JPMorgan Asset Management (UK) Limited, which is authorized and regulated by the Financial Conduct Authority; in other European jurisdictions, by JPMorgan Asset Management (Europe) S.à r.l. In Asia Pacific ("APAC"), by the following issuing entities and in the respective jurisdictions in which they are primarily regulated: JPMorgan Asset Management (Asia Pacific) Limited, or JPMorgan Funds (Asia) Limited, or JPMorgan Asset Management Real Assets (Asia) Limited, each of which is regulated by the Securities and Futures Commission of Hong Kong; JPMorgan Asset Management (Singapore) Limited (Co. Reg. No. 197601586K), which this advertisement or publication has not been reviewed by the Monetary Authority of Singapore; JPMorgan Asset Management (Taiwan) Limited; JPMorgan Asset Management (Japan) Limited, which is a member of the Investment Trusts Association, Japan, the Japan Investment Advisers Association, Type II Financial Instruments Firms Association and the Japan Securities Dealers Association and is regulated by the Financial Services Agency (registration number "Kanto Local Finance Bureau (Financial Instruments Firm) No. 330"); in Australia, to wholesale clients only as defined in section 761A and 761G of the Corporations Act 2001 (Commonwealth), by JPMorgan Asset Management (Australia) Limited (ABN 55143832080) (AFSL 376919). For all other markets in APAC, to intended recipients only.

For J.P. Morgan Private Bank Clients:**ACCESSIBILITY**

J.P. Morgan is committed to making our products and services accessible to meet the financial services needs of all our clients. Please direct any accessibility issues to the Private Bank Client Service Center at 1-866-265-1727

LEGAL ENTITY, BRAND & REGULATORY INFORMATION

In the **United States**, **JPMorgan Chase Bank, N.A.** and its affiliates (collectively "**JPMCB**") offer investment products, which may include bank managed investment accounts and custody, as part of its trust and fiduciary services. Other investment products and services, such as brokerage and advisory accounts, are offered through **J.P. Morgan Securities LLC ("JPMS")**, a member of **FINRA** and **SIPC**. JPMCB and JPMS are affiliated companies under the common control of JPM.

In **Germany**, this material is issued by **J.P. Morgan SE**, with its registered office at Taunustor 1 (TaunusTurm), 60310 Frankfurt am Main, Germany, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB). In **Luxembourg**, this material is issued by **J.P. Morgan SE – Luxembourg Branch**, with registered office at European Bank and Business Centre, 6 route de Treves, L-2633, Senningerberg, Luxembourg, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Luxembourg Branch is also supervised by the Commission de Surveillance du Secteur Financier (CSSF); registered under R.C.S Luxembourg B255938. In the **United Kingdom**, this material is issued by **J.P. Morgan SE – London Branch**, registered office at 25 Bank Street, Canary Wharf, London E14 5JP, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – London Branch is also supervised by the Financial Conduct Authority and Prudential Regulation Authority. In **Spain**, this material is distributed by **J.P. Morgan SE, Sucursal en España**, with registered office at Paseo de la Castellana, 31, 28046 Madrid, Spain, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE, Sucursal en España is also supervised by the Spanish Securities Market Commission (CNMV); registered with Bank of Spain as a branch of J.P. Morgan SE under code 1567. In **Italy**, this material is distributed by **J.P. Morgan SE – Milan Branch**, with its registered office at Via Cordusio, n.3, Milan 20123, Italy, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Milan Branch is also supervised by Bank of Italy and the Commissione Nazionale per le Società e la Borsa (CONSOB); registered with Bank of Italy as a branch of J.P. Morgan SE under code 8076; Milan Chamber of Commerce Registered Number: REA MI



2536325. In the **Netherlands**, this material is distributed by **J.P. Morgan SE – Amsterdam Branch**, with registered office at World Trade Centre, Tower B, Strawinskylaan 1135, 1077 XX, Amsterdam, The Netherlands, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Amsterdam Branch is also supervised by De Nederlandsche Bank (DNB) and the Autoriteit Financiële Markten (AFM) in the Netherlands. Registered with the Kamer van Koophandel as a branch of J.P. Morgan SE under registration number 72610220. In **Denmark**, this material is distributed by **J.P. Morgan SE – Copenhagen Branch, filial af J.P. Morgan SE, Tyskland**, with registered office at Kalvebod Brygge 39-41, 1560 København V, Denmark, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Copenhagen Branch, filial af J.P. Morgan SE, Tyskland is also supervised by Finanstilsynet (Danish FSA) and is registered with Finanstilsynet as a branch of J.P. Morgan SE under code 29010. In **Sweden**, this material is distributed by **J.P. Morgan SE – Stockholm Bankfilial**, with registered office at Hamngatan 15, Stockholm, 11147, Sweden, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Stockholm Bankfilial is also supervised by Finansinspektionen (Swedish FSA); registered with Finansinspektionen as a branch of J.P. Morgan SE. In **Belgium**, this material is distributed by **J.P. Morgan SE – Brussels Branch** with registered office at 35 Boulevard du Régent, 1000, Brussels, Belgium, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE Brussels Branch is also supervised by the National Bank of Belgium (NBB) and the Financial Services and Markets Authority (FSMA) in Belgium; registered with the NBB under registration number 0715.622.844. In **Greece**, this material is distributed by **J.P. Morgan SE – Athens Branch**, with its registered office at 3 Haritos Street, Athens, 10675, Greece, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB); J.P. Morgan SE – Athens Branch is also supervised by Bank of Greece; registered with Bank of Greece as a branch of J.P. Morgan SE under code 124; Athens Chamber of Commerce Registered Number 158683760001; VAT Number 99676577. In **France**, this material is distributed by **J.P. Morgan SE – Paris Branch**, with its registered office at 14, Place Vendôme 75001 Paris, France, authorized by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) and jointly supervised by the BaFin, the German Central Bank (Deutsche Bundesbank) and the European Central Bank (ECB) under code 842 422 972; J.P. Morgan SE – Paris Branch is also supervised by the French banking authorities the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and the Autorité des Marchés Financiers (AMF). In **Switzerland**, this material is distributed by **J.P. Morgan (Suisse) SA**, with registered address at rue du Rhône, 35, 1204, Geneva, Switzerland, which is authorised and supervised by the Swiss Financial Market Supervisory Authority (FINMA) as a bank and a securities dealer in Switzerland.

In **Hong Kong**, this material is distributed by **JPMCB, Hong Kong branch**. JPMCB, Hong Kong branch is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission of Hong Kong. In Hong Kong, we will cease to use your personal data for our marketing purposes without charge if you so request. In **Singapore**, this material is distributed by **JPMCB, Singapore branch**. JPMCB, Singapore branch is regulated by the Monetary Authority of Singapore. Dealing and advisory services and discretionary investment management services are provided to you by JPMCB, Hong Kong/Singapore branch (as notified to you). Banking and custody services are provided to you by JPMCB Singapore Branch. The contents of this document have not been reviewed by any regulatory authority in Hong Kong, Singapore or any other jurisdictions. You are advised to exercise caution in relation to this document. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice. For materials which constitute product advertisement under the Securities and Futures Act and the Financial Advisers Act, this advertisement has not been reviewed by the Monetary Authority of Singapore. JPMorgan Chase Bank, N.A., a national banking association chartered under the laws of the United States, and as a body corporate, its shareholder's liability is limited.

With respect to countries in **Latin America**, the distribution of this material may be restricted in certain jurisdictions.

*Issued in **Australia** by JPMorgan Chase Bank, N.A. (ABN 43 074 112 011/AFS Licence No: 238367) and J.P. Morgan Securities LLC (ARBN 109293610).*

References to "J.P. Morgan" are to JPM, its subsidiaries and affiliates worldwide. "J.P. Morgan Private Bank" is the brand name for the private banking business conducted by JPM. This material is intended for your personal use and should not be circulated to or used by any other person, or duplicated for non-personal use, without our permission. If you have any questions or no longer wish to receive these communications, please contact your J.P. Morgan team.