



EYE ON THE MARKET | OUTLOOK 2025

The Alchemists

Deregulation, deportations, tariffs, tax cuts, cost cutting, crypto, oil & gas, medical freedom and Agency purges: What could possibly go wrong?

Sections include the AI Golden Goose, the invisible nuclear renaissance, DOGE Quixote, the two China traps, Dr. Seuss goes to Europe, a crypto update and the 2025 Top Ten list.

By **Michael Cembalest** | Chairman of Market and Investment Strategy for J.P. Morgan Asset & Wealth Management

MARY CALLAHAN ERDOES
Chief Executive Officer
J.P. Morgan Asset & Wealth Management

As we head into 2025, I want to share with you our much-anticipated outlook from my investment partner of nearly three decades, Michael Cembalest. This year marks the twentieth anniversary of Michael's important work, and as always, this edition is full of deep thinking and often controversial perspectives. "The Alchemists" will not disappoint, as it is one of his best ever—and be sure to pay special attention to the cover art as it is a roadmap for everything that you will find throughout the seven deep dives and the top ten list for 2025 at the end.

On behalf of all of our partners here at J.P. Morgan, we thank you for your continued trust and confidence in all of us. We will continue to work tirelessly to earn it every day.

Wishing you a peaceful, healthy and prosperous new year.

A handwritten signature in black ink that reads "Mary C. Erdoes". The signature is fluid and cursive, with "Mary" having a large loop over the "y".

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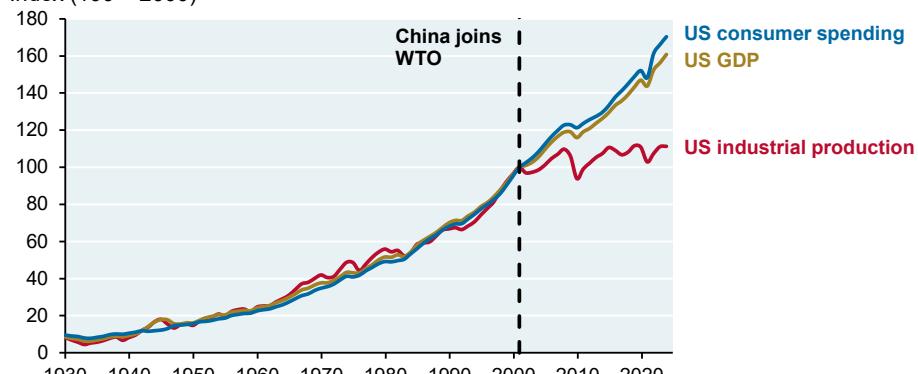


The Alchemists: deregulation, deportations, tariffs, tax cuts, cost cutting, oil & gas, crypto, medical freedom and Agency purges. What could possibly go wrong?

White House Alchemists aim to reverse some negative consequences of China's entry into the World Trade Organization, best illustrated by stagnant US industrial production and the other trends listed below...

The Silence of the Plants

Index (100 = 2000)



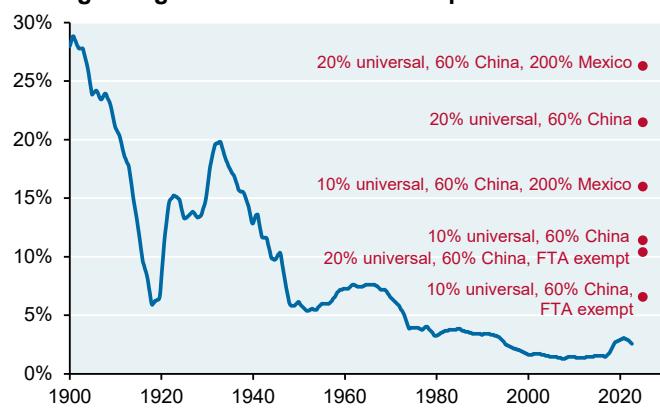
Source: BEA, Federal Reserve, JPMAM, 2024

Other US data with sharp inflection points around the year 2000:

- Rising manufacturing job losses
 - Falling labor share of gross profits
 - Rising suicide rates
 - Rising non-metro poverty rates
- See page 13 for details

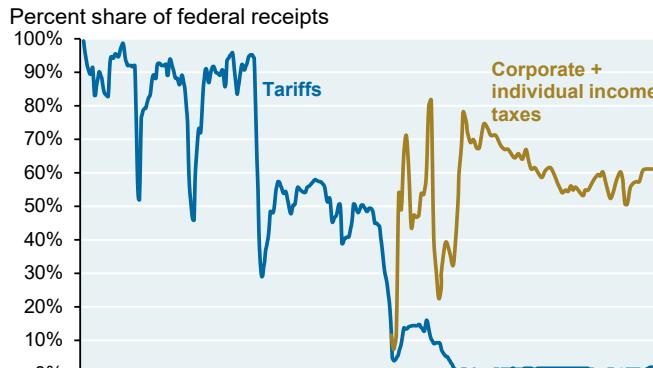
...by increasing tariffs while lowering income tax receipts, a Federal revenue mix reminiscent of the 1930's...

Average weighted tariff rate on US imports



Source: Yale Budget Lab, October 2024

Sources of federal revenues since 1790

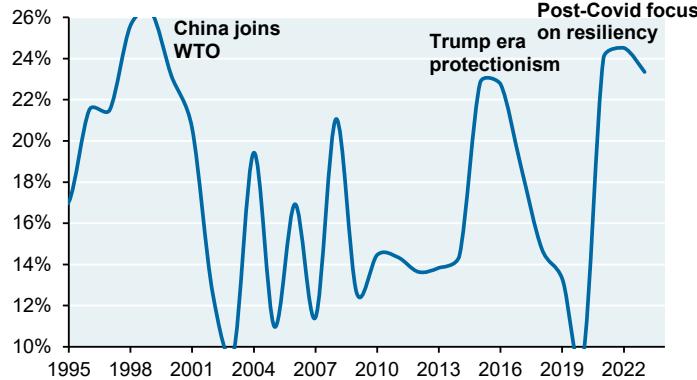


Source: Council of Economic Advisors, Tax Foundation, JPMAM, 2024

...and by strong-arming other countries to invest in the US instead of selling to it, a trend that's already underway

US share of inward global Foreign Direct Investment (FDI)

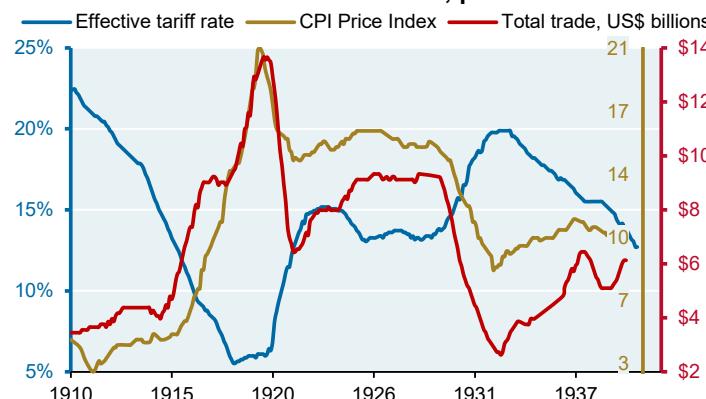
Percent



Source: UNCTAD, JPMAM, 2024

The US tariffs of the 1920's and 1930's were not inflationary in any broad sense...

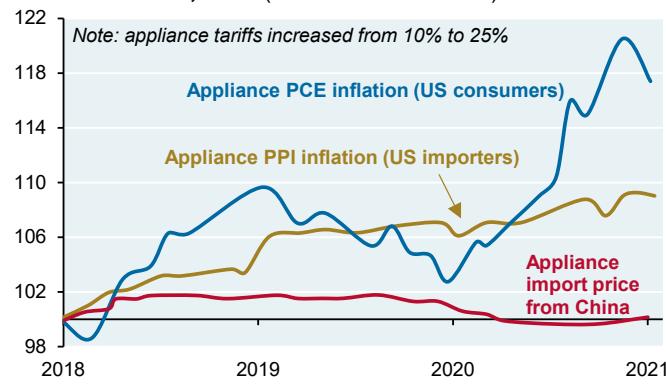
When tariffs rose in the 1920's/1930's, prices and trade fell



Source: Alpine Macro, Peterson Institute, JPMAM, 2024

...but they were inflationary in 2018...

US importers/consumers absorbed cost of 2018 appliance tariffs on China, Index (100 = December 2017)



Source: JP Morgan Global Economic Research, November 18, 2024

...which is why some economists believe new tariffs would be inflationary this time around...

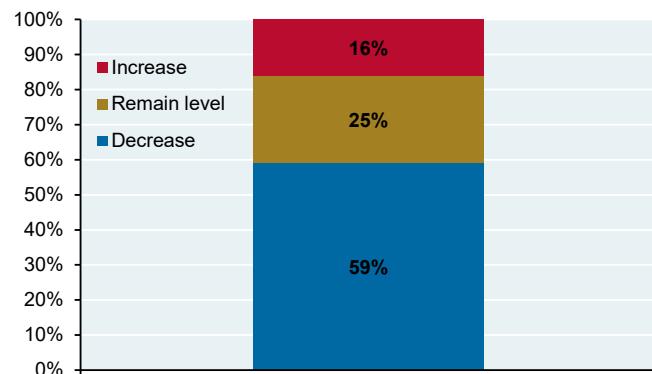
Tariff GDP & inflation estimates

Policy	Short run GDP % Chg	Long run GDP % Chg	Boost to PCE infl	
60% China Tariff w Retaliation	-1.4%	-0.2%	N/A	R
10% Universal Tariff, No Retaliation	-1.2%	N/A	N/A	R
10% Universal Tariff, Retaliation	-2.2%	-0.1%	N/A	R
60% China & 10% Universal, No Retaliation	N/A	-0.8%	N/A	T
60% China & 10% Universal, No Retaliation	N/A	-0.5%	1.0%	Y
60% China & 10% Universal, Retaliation	N/A	-1.2%	N/A	T
60% China & 10% Universal, Retaliation	-3.3%	-0.3%	N/A	R
60% China & 10% Universal, Retaliation	N/A	-0.6%	0.9%	Y

Sources: Piper Sandler, Robinson et al. (R), Yale Budget Lab (Y), Tax Foundation (T), 2024

... with the potential to reduce US manufacturing jobs as well, particularly in red states

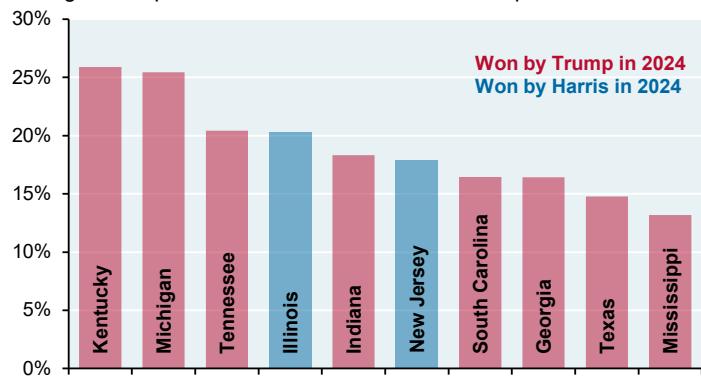
Survey of economists on the effect of Trump tariffs on manufacturing employment, 44 economists surveyed



Source: WSJ, JPMAM, October 2024

Import share of GDP: top 10 US states

2023 goods imports as a share of 2023 state GDP, percent



Source: Census Bureau, BEA, JPMAM, 2024

The US has several options regarding tariffs, and so does China regarding retaliation

Possible tariff options under consideration

Country		Current tariff	Possible tariff	Authority
China	Lists 1-2	25.0%	85.0%	Sec 301
China	List 3	25.0%	60.0%	Sec 301
China	List 4a	7.5%	17.5%	Sec 301
China	List 4b	0.0%	5.0%	Sec 301
Mexico	Auto imports*	2.5%	100.0%	Sec 232
EU	Auto imports	2.5%	25.0%	Sec 232
Global	All imports	2.7%	12.7%	IEEPA or Sec 122
China	All imports	13.7%	53.7%	Legislation
Global	All imports	2.7%	??	Legislation

Source: GS, JPMAM. 2024 * = Chinese EVs assembled in Mexico.

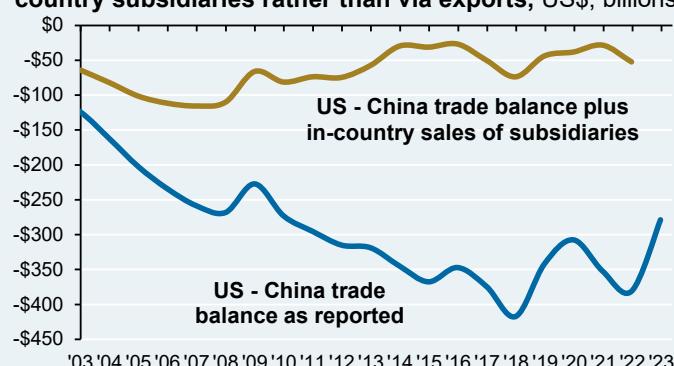
Lists 1-2 are non-consumer goods; Lists 4a and 4b are mostly consumer goods

Options for Chinese retaliation

- Tariffs on imports of US agriculture, chemical products and aircraft parts
- Exchange rate depreciation and export tax rebates
- Export bans on rare earth elements; China just banned exports of gallium, germanium and antimony to the US, cutting off half of US supply
- Antitrust, national security and other penalties on US companies operating in China (see below)
- Sales of US Treasuries and Agencies
- Diversify trade relationships as with RCEP (the largest free trade area by market size) and its application to join CPTPP, neither of which include the US

Trade deficits mask a lot of business that US companies do in China. While the US runs a large trade deficit with China, after accounting for subsidiary sales in both countries, the bilateral trade balance is closer to flat. In other words, Chinese companies export a lot **TO** the US while US companies sell a lot **IN** China

The US does a lot of business in China, but through its in-country subsidiaries rather than via exports, US\$, billions

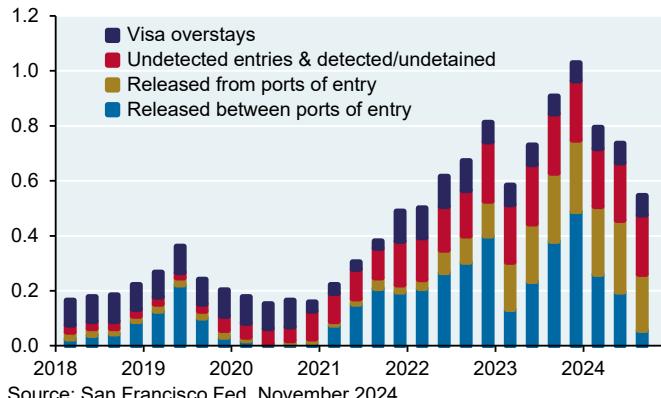


Source: Deutsche Bank, Census, JPMAM, 2023

Biden immigration policies directly led to the largest unchecked, uncontrolled and unmanaged migrant surge on record which will negatively impact major urban fiscal positions for many years¹. Even the Brookings Institute recommended in February 2024 that the US border be temporarily closed to deal with the immigration backlog. If in response, Alchemist border controls and deportations substantially reduce the labor supply...

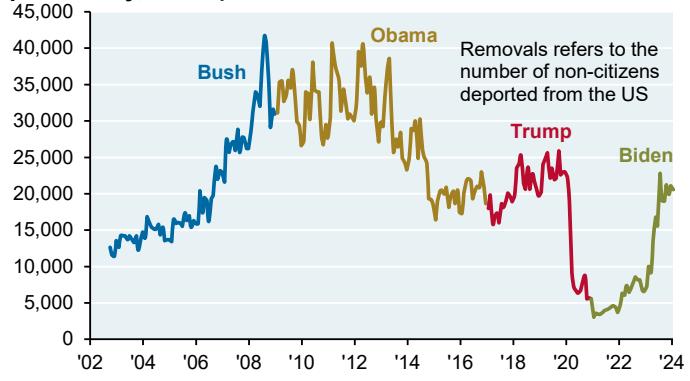
Inflow of undocumented immigrants to the US

Millions of people per quarter



Source: San Francisco Fed, November 2024

Immigration and Customs Enforcement (ICE) removals by presidency, Monthly removals

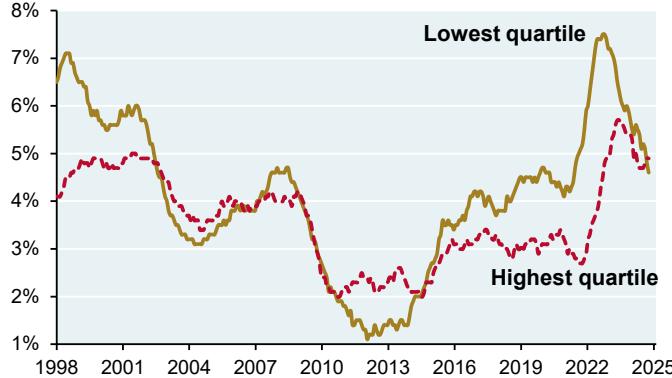


Source: TRAC, JPMAM, September 2024

...which could reverse the rollover in the lowest quartile of wage growth...

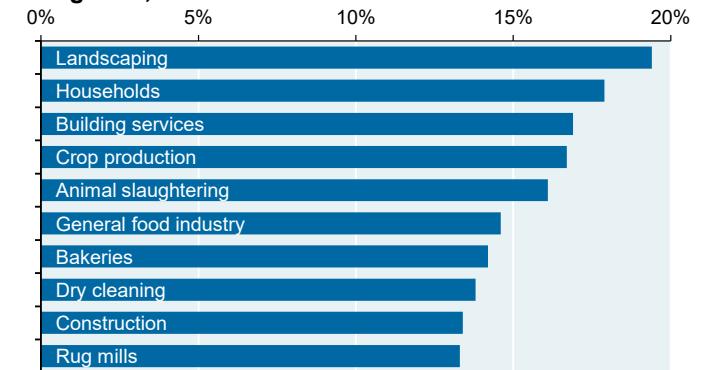
Atlanta Fed Wage Growth Tracker

Percent



Source: Bloomberg, JPMAM, November 30, 2024

Share of employees who are likely unauthorized immigrants, Percent

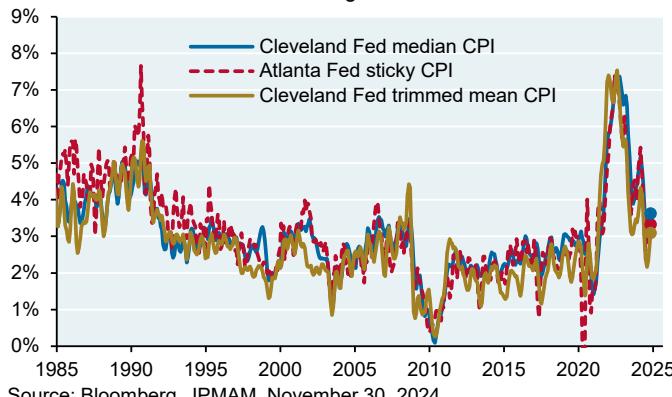


Source: 2023 Census American Community Survey, Goldman Sachs

...would the combination of tighter labor markets and tariffs drive consumer price inflation higher again?

US consumer price inflation measures

Percent, 3 month annualized change



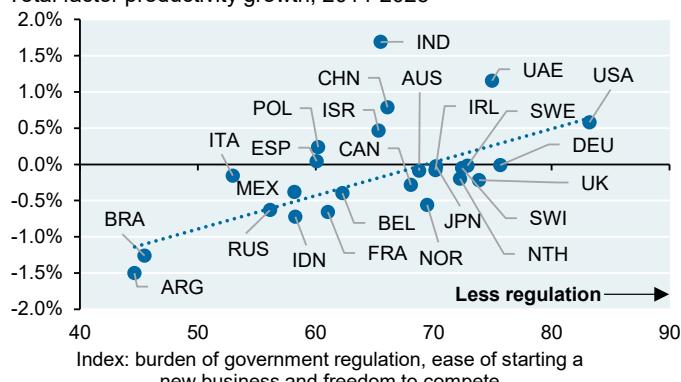
Source: Bloomberg, JPMAM, November 30, 2024

¹ "Migrants and asylum seekers pose budgetary challenges", S&P Global Ratings, February 13, 2024

Or would the Alchemists be able to offset the inflationary shocks of tighter labor supply and tariffs with a positive productivity shock from **deregulation**, which would be consistent with evidence that less regulation is correlated with higher productivity and other favorable economic outcomes...

Regulation and productivity

Total factor productivity growth, 2014-2025

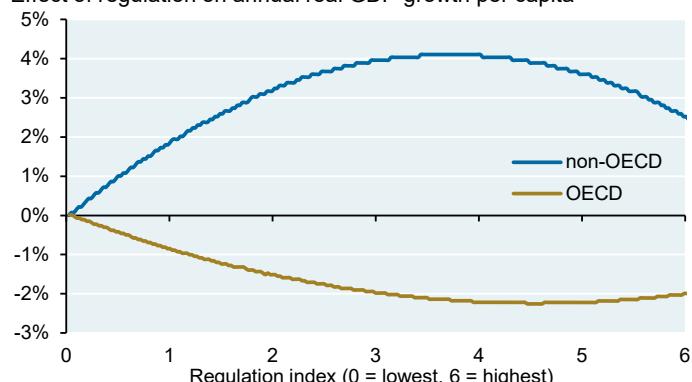


Index: burden of government regulation, ease of starting a new business and freedom to compete

Source: Conference Board, World Bank, Fraser Institute, WEF, JPMAM, 2024

Regulation slows growth in the OECD, helps in non-OECD

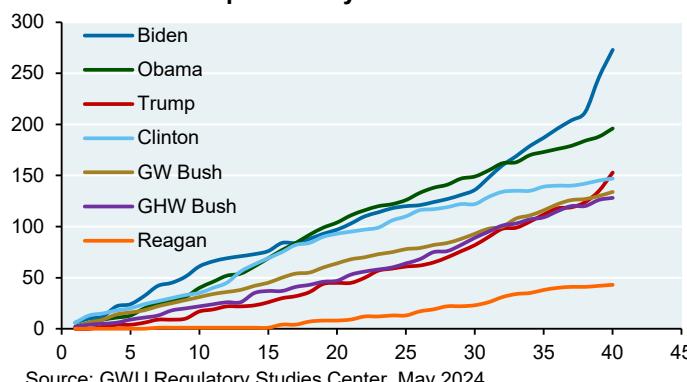
Effect of regulation on annual real GDP growth per capita



Source: Heckelman (Wake Forest), 2019; JPMAM

...particularly when compared to the regulatory surge that took place under the Biden administration?

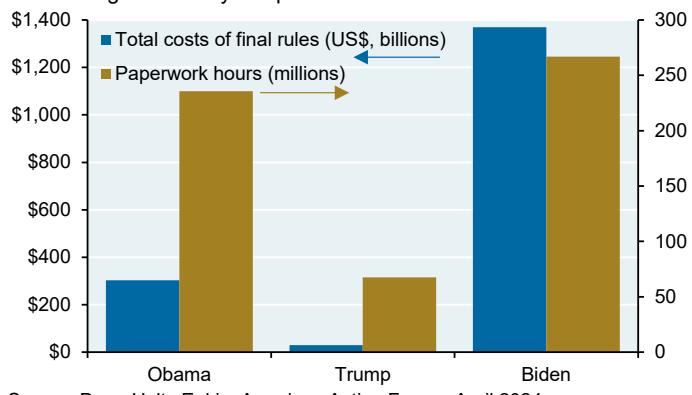
Cumulative # of economically significant rules by month 40 of each presidency



Source: GWU Regulatory Studies Center, May 2024

Regulatory activity by administration

From Inauguration Day to April 19th of Year 4

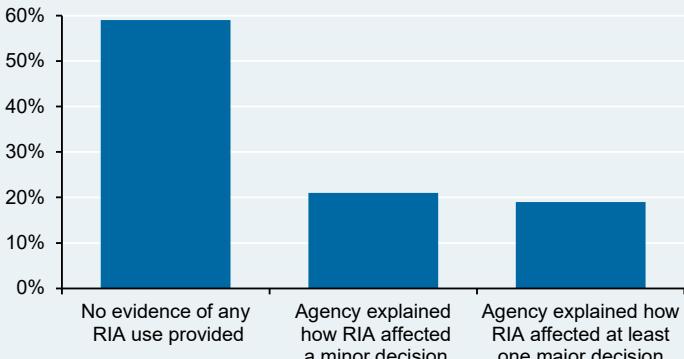


Source: Doug Holtz Eakin, American Action Forum, April 2024

From the Eye on the Market archives: US regulations tend to pass with little oversight or review. According to the George Mason University Mercatus Center, for 80% of all new regulations passed from 2008-2012, there was either no regulatory impact analysis (RIA) prepared by the sponsoring agency or the RIA only covered a minor part of the proposal. Second, of all Federal rules finalized from 2003 to 2012, OIRA only reported cost-benefit information on a very small fraction of them.

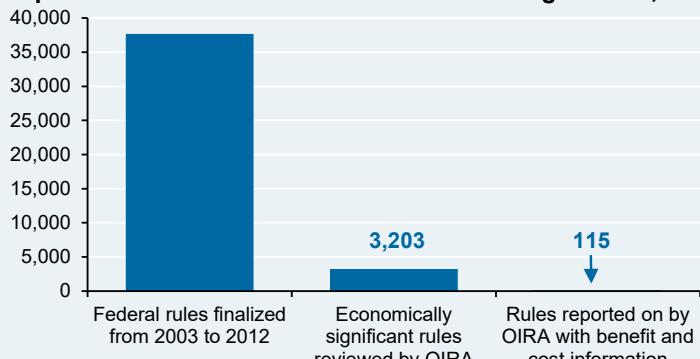
Agency use of Regulatory Impact Analysis (RIA)

% of regulations from 2008 - 2012



Source: Mercatus Center at George Mason University, March 2015

Office of Information and Regulatory Affairs (OIRA) only reports cost/benefits on a small fraction of regulations, #



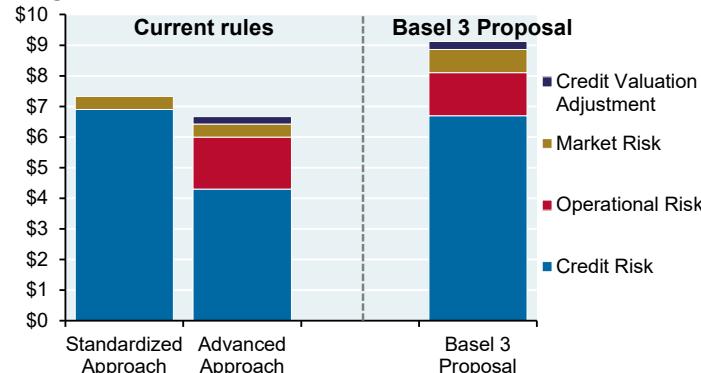
Source: Mercatus Center at George Mason University, April 2013

2025 OUTLOOK

Executive Summary

And could expansion of bank capital from a probable end to Basel III discussions boost US credit growth, assuming that Basel III-affected US banks had already begun to accumulate excess capital that new rules would have required (~\$200 billion, assuming 10% on \$2 trillion in additional risk weighted assets)?

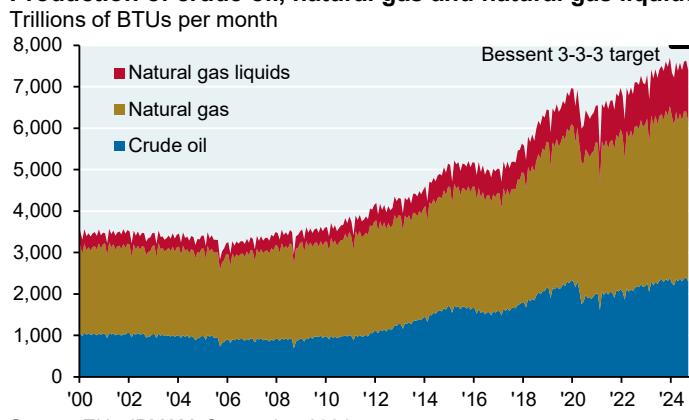
Projected increase in Category I and II US bank risk weighted assets due to proposed Basel rules, US\$, trillions



Source: Morgan Stanley, Oliver Wyman, November 2023

Since oil & gas production levels are already high, and since the Bessent 3-3-3 production increase targets are rather modest², would fossil fuel production rise enough to bring energy prices down...

Production of crude oil, natural gas and natural gas liquids



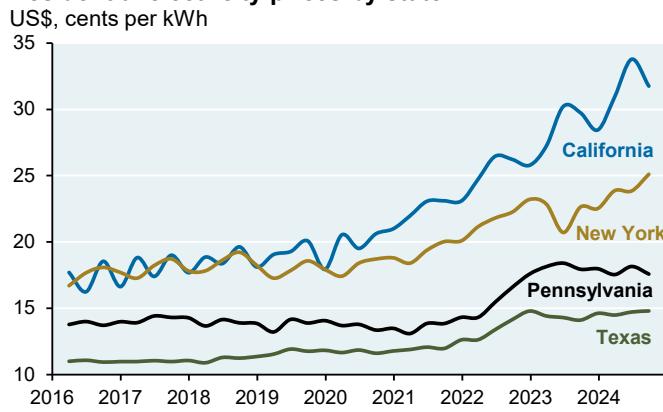
Source: EIA, JPMAM, September 2024

On US oil & gas production

The Biden administration did not meaningfully curtail US oil & gas production; even LNG export restrictions didn't have much of an impact given limited scope. The Biden approach was more geared to subsidizing renewables to the tune of \$1-\$3 trillion (the final price tag is not clear yet). Maybe Arctic drilling picks up, but I'm not sure how much scope there is for more US oil & gas production to bring down US energy prices, particularly if incremental gas production is exported, and since gas is currently around \$3.5 per mmbtu

...or are the inflationary consequences of the energy bill too entrenched at this point to reverse?

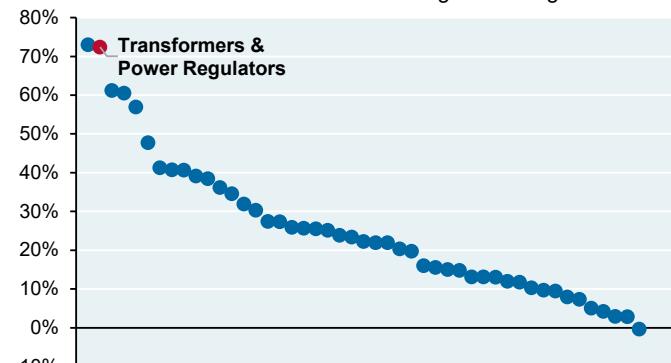
Residential electricity prices by state



Source: EIA, JPMAM, Q3 2024

Core goods PPI component inflation

% increase vs 2018 for each of the 47 core goods categories



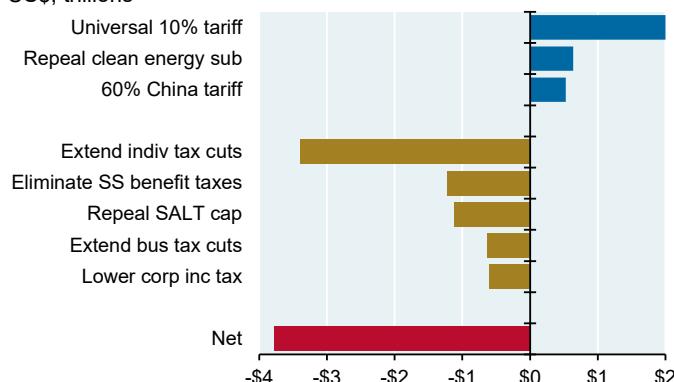
Source: Bloomberg, JPMAM, November 30, 2024

² Bessent's proposed oil and gas increase of 3 mm barrels of oil equivalent per day is equal to 529 trillion BTUs per month, a roughly 7% increase vs average monthly US production of oil, gas and NGLs in 2024

And if the Alchemists cannot find enough government expenditures to cut (see DOGE Quixote section beginning on page 26) to offset the impact of any tax cuts they are able to pass, would they increase the budget deficit...

Trump: 10-year budget deficit effect of proposed policies

US\$, trillions



Source: Wharton, Peterson Institute, PSC, CFRB, JPMAM, 2024

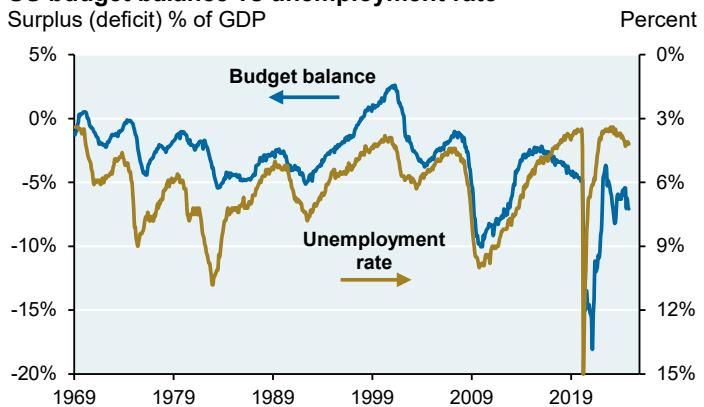
What exactly will Congress allow?

This chart is not meant as a projection of Trump's impact on the deficit since Congress would be unlikely to pass all the tax cuts shown without more revenue offsets. When the TCJA passed in 2017, the SALT cap was introduced for this very reason. But the chart is useful in highlighting the probable *direction* of the deficit under Trump. I expect most GOP fiscal hawks to go into hibernation like they always do and wait for the next Democratic administration before reappearing

...at a time when budget deficits are already very large despite almost full employment...

US budget balance vs unemployment rate

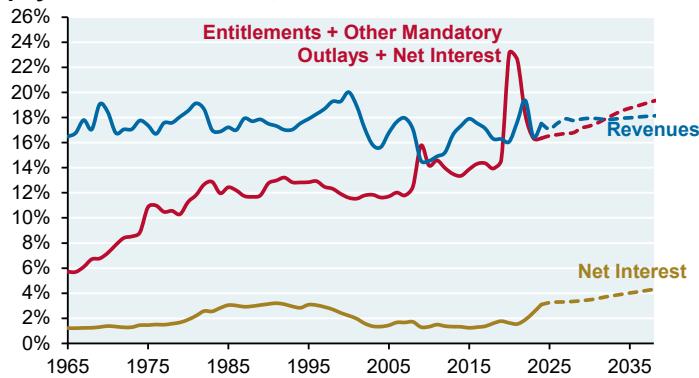
Surplus (deficit) % of GDP



Source: Bloomberg, JPMAM, November 30, 2024

...within a decade of the crossover point when entitlements plus interest are projected to permanently exceed Federal tax revenues?

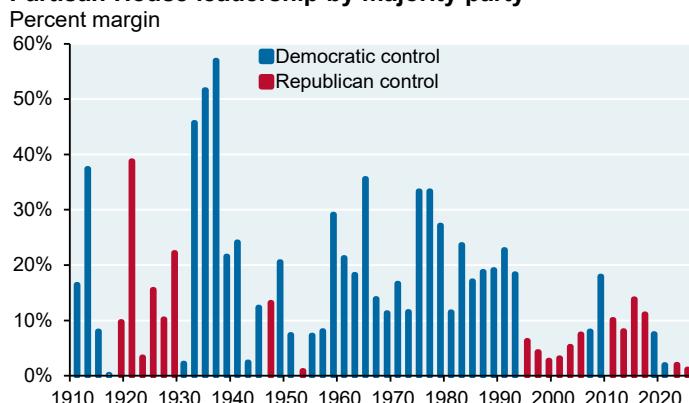
Entitlement spending, mandatory outlays and net interest payments vs revenues, % of GDP



Source: Congressional Budget Office, JPMAM, March 2024

And if very tight governing margins in the House do not materially constrain the Alchemist fiscal agenda...

Partisan House leadership by majority party



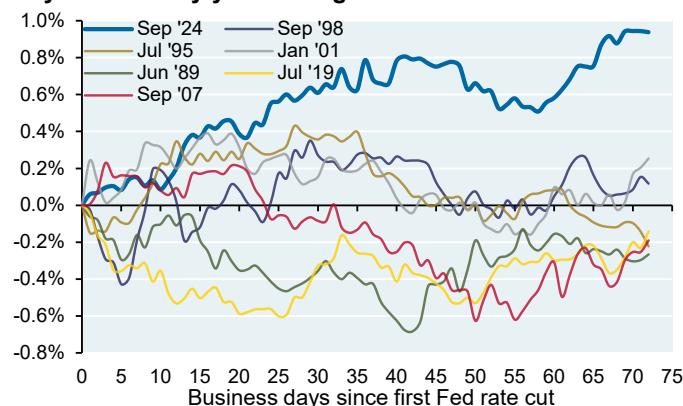
Source: VoteView Roll Call Votes database, New York Times, JPMAM, 2024

Razor-thin GOP margins in the House

The GOP begins the year with a 219-215 majority with one vacant seat after the Gaetz resignation. Stefanik (R-NY) and Waltz (R-FL) are expected to join the Trump Administration, putting the GOP margin at 217-215 with zero room for defections. A special election for the Gaetz seat has been called for April 1 and the other two special elections will probably occur in May. If the GOP wins all three, it would put them back at a 220-215 margin, almost the tightest margin on record going back to 1910

...how will the bond markets respond at a time when the 10 year Treasury has risen despite Fed easing...

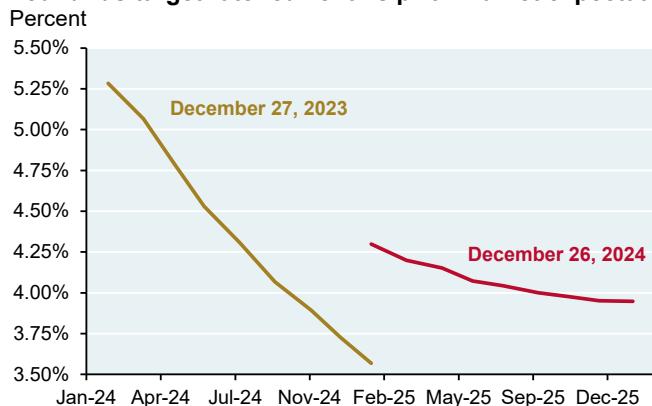
10 year Treasury yield change after the first Fed cut



Source: Bloomberg, JPMAM, December 26, 2024

...and will the Fed be able to ease further as markets are now pricing in?

Fed funds target rate: current vs prior market expectations



Source: Bloomberg, JPMAM, December 26, 2024

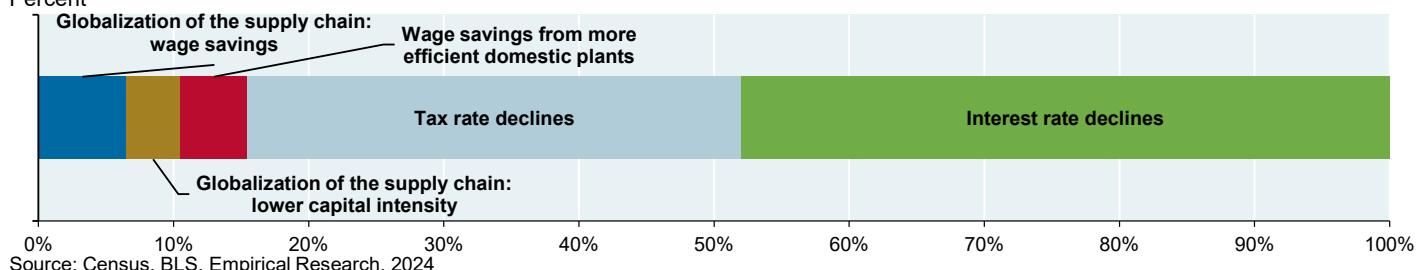
2025 OUTLOOK

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And if long term interest rates rose over 5%, what would that do to equity P/E multiples since falling interest rates account for the largest share of S&P margin increases over the last two decades?

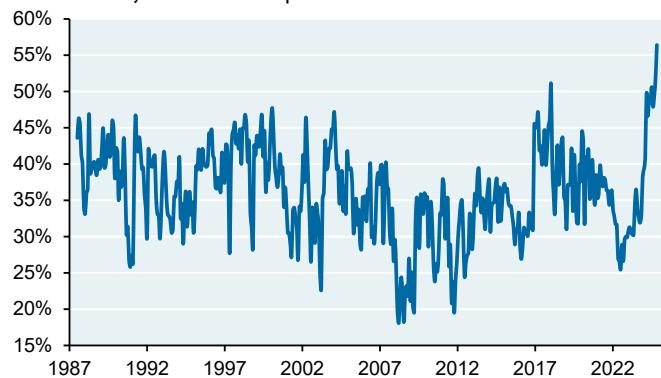
Largest contributors of S&P 500 margin expansion from 2000 to 2019

Percent



Investors are inclined to give the Alchemists the benefit of the doubt that this will all work out, and very tight supply conditions of US equity markets argue in their favor...

Share of US households expecting higher stock prices in 12 months, Percent of respondents

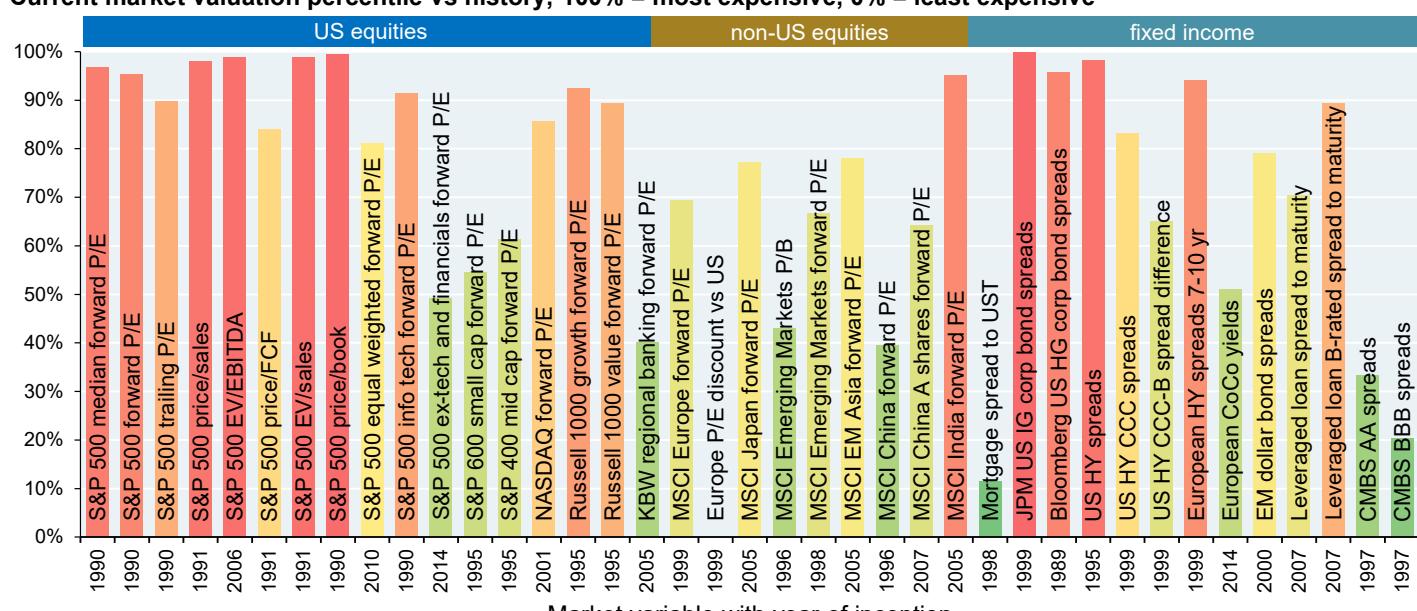


Net equity supply globally



...but the Alchemists don't have much room for error given the expensiveness of most US financial markets

Current market valuation percentile vs history; 100% = most expensive, 0% = least expensive



Source: Bloomberg, JPMAM, December 27, 2024

The Alchemists appear to want to break things: I'm going to take them at their word

If the current soft landing endures, it would be one of few times in the last 60 years that the Fed raised rates to stem inflation without triggering a recession. What the “recessionistas” missed: the unusually strong position of the corporate sector heading into Fed tightening in 2022. That was different this time, as shown below.

Other good news: labor market conditions are easing but not cratering, and consumer spending and business capital spending are growing at a pace consistent with ~2.5% GDP growth. Single family and multifamily housing supply should continue to grow, dampening real estate inflation. On credit, spreads are tight and both high yield and leveraged loan delinquency rates are low. M&A activity should benefit from \$750 billion of private equity dry powder and the departure of an FTC chair who according to the WSJ, “would not be missed, except perhaps by corporate lawyers racking up billable hours defending against her antitrust revanchism”³.

I also believe that deregulation can boost growth for reasons cited earlier. The deregulation trend began during the Carter Administration when it was applied to trucking, airlines, natural gas and banking. During the Reagan and Clinton Administrations, deregulation was extended to telecom and electricity markets. In a retrospective of 1990’s US economic policy, Peter Orszag at Brookings concluded that despite bumps in the road, deregulation had made the US economy more efficient in the long run⁴. A light-touch regulatory approach combined with a Venture Capital recovery which is already underway (see page 14) could keep animal spirits going. As shown in the last chart, small business capital spending surveys surged after the election.

US corporate sector financial balance

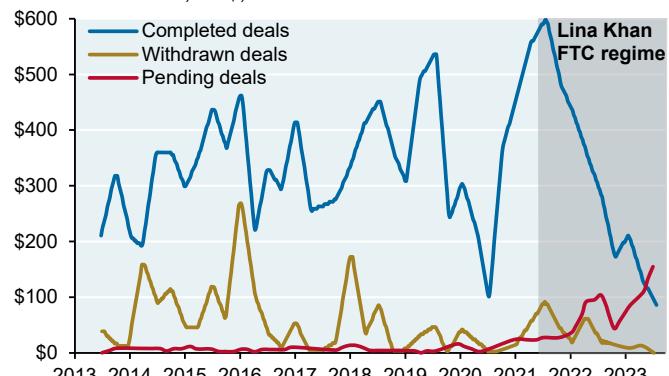
% of corporate gross value added, 4-quarter average



Source: Federal Reserve, BEA, JPMAM, Q3 2024

The FTC vs M&A

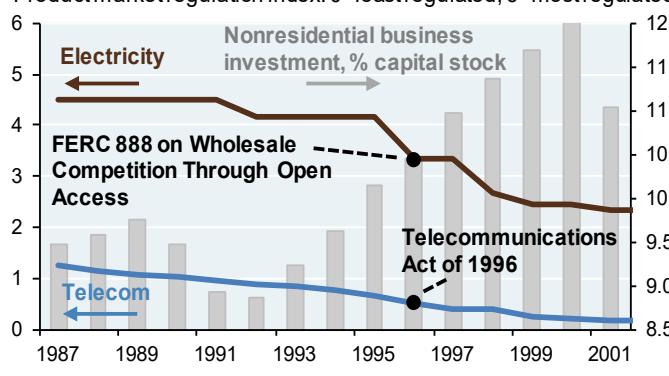
M&A deal volume, US\$, billions



Source: Marquette Associates, June 2023

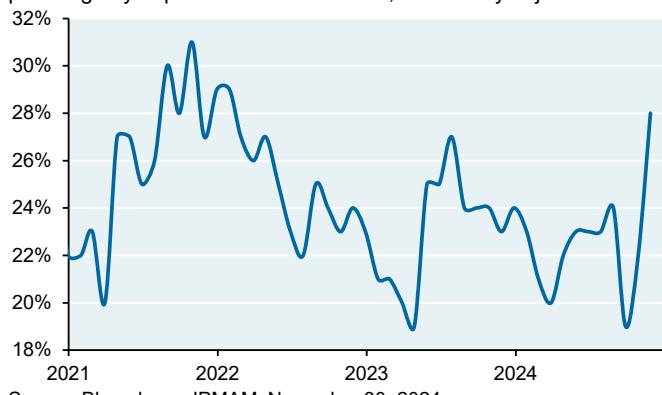
Deregulation and business capital spending

Product market regulation index: 0=least regulated, 6=most regulated



Source: OECD ETCR database, BEA.

Small business capex plans, % of NFIB Survey respondents planning any capex in next 3-6 months, seasonally adjusted



Source: Bloomberg, JPMAM, November 30, 2024

³ In a departing gesture, Lina Khan resurrected a dormant 1936 Act which hadn’t been litigated by the FTC for over 30 years in order to sue a liquor distributor for price discrimination. I would like to commend the WSJ for resurrecting a word like “revanchism” which dates back to the Franco-Prussian War

⁴ “Retrospective on American Economic Policy in the 1990s”, Jeffrey Frankel and Peter Orszag, Nov 2, 2001

That said, policies and statements from Trump nominees (both cabinet-level and those not requiring Senate confirmation) indicate that the Alchemists aim to “break” something, whether it’s globalization, the Federal bureaucracy, the IRS, the FBI, Medicare, US vaccine policy (see page 15), lax US border policies, its “Deep State” opponents or something else. Whatever the goals, I take the Alchemists at their word: they are going to break something, I just don’t know what.

For investors, there’s little room for error with valuations this high and since valuations are now driving markets just as much as earnings growth. Also: the S&P 500 just registered two 20%+ years in a row, something which occurred just ten times since 1871. Only during the 1990’s bull market and the Roaring Twenties did the good times continue for another two years. I expect a 10%-15% correction at some point in 2025 as the Alchemists apply their elixirs to the US economy⁵. Plan accordingly: US equity markets should end the year higher than they began but be sure to have plenty of liquidity to take advantage of what might be a volatile year.

Ultimately, the 10-year Treasury will be the best barometer of the new administration. If the supply side benefits from deregulation and tax cuts overpower the inflationary impacts of tariffs, a shrinking labor supply and large budget deficits, the 10-year Treasury should remain in the range of 4.5% to 5.0%. But if the 10-year rises meaningfully above 5.0% and stays there, something will have gone very wrong.

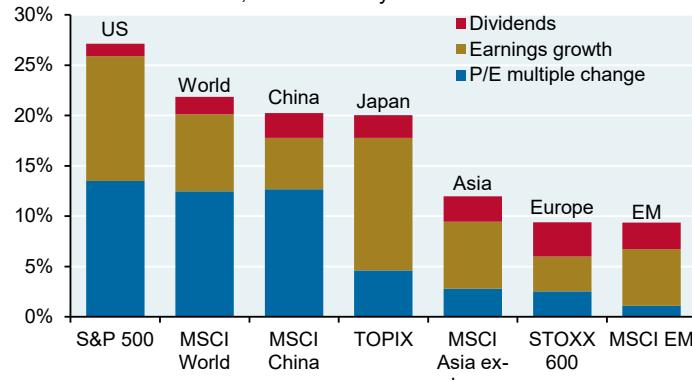
This Outlook marks 20 years of the Eye on the Market, which I launched in early 2005 as a text-only monthly email designed for clients using a Blackberry or Palm Pilot. It has been a privilege to work on this effort for that long, and I have learned quite a lot through the process. I would like to thank Jamie and Mary for their steadfast support, even when I write about controversial topics...and this year is no exception. Happy New Year.

Michael Cembalest

JP Morgan Asset Management

Global index return decomposition, 2024

YTD return contribution, local currency



S&P 500: Two consecutive years of 20%+ total returns and what followed

1879	1880	1881	1882
48%	24%	8%	2%
1924	1925	1926	1927
25%	29%	14%	35%
1927	1928	1929	1930
35%	37%	-3%	-23%
1935	1936	1937	1938
46%	36%	-31%	20%
1950	1951	1952	1953
28%	26%	17%	1%
1954	1955	1956	1957
47%	34%	6%	-9%
1975	1976	1977	1978
38%	23%	-6%	8%
1985	1986	1987	1988
31%	24%	0%	19%
1995	1996	1997	1998
38%	23%	33%	29%
2023	2024	2025	2026
26%	27%	??	??

Source: Shiller, BBG, JPMAM, December 30, 2024

⁵ Intra-year stock market corrections: in 60% of the last 100 years there’s been at least a 10% correction, and in 40% of all years at least a 15% correction

Executive Summary Figures 1a-1d: China joining the WTO coincides with highly negative US inflection points**US manufacturing job losses**

10-year percent change



Source: BLS, JPMAM, November 2024

US labor's share of corporate profits

Percent of non-financial gross profits



Source: BEA, JPMAM, November 2024

US suicide rate

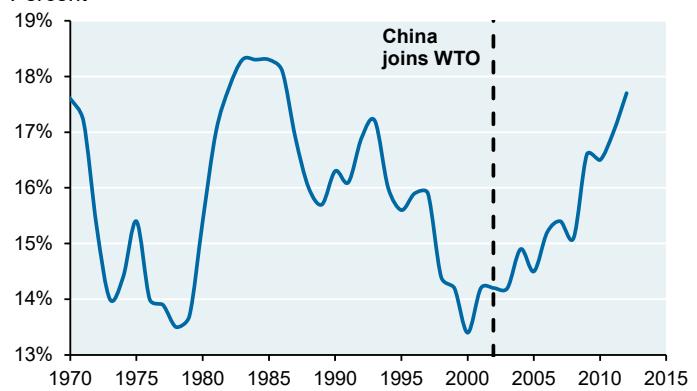
Rate per 100,000, age adjusted, year 2000 standard



Source: National Center for Health Statistics, CDC, Kevin Drum, 2023

US non-metro poverty rates

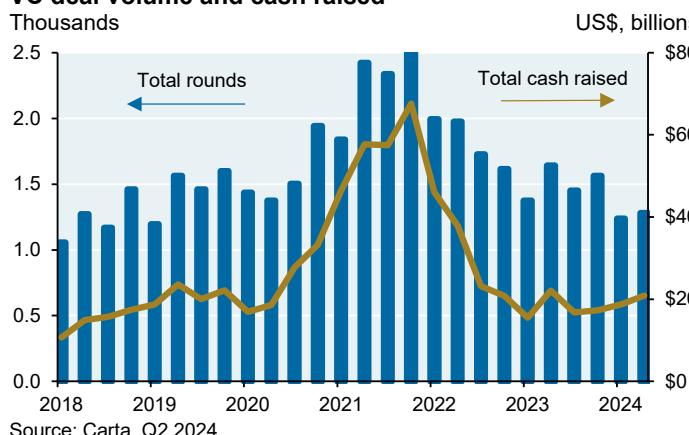
Percent



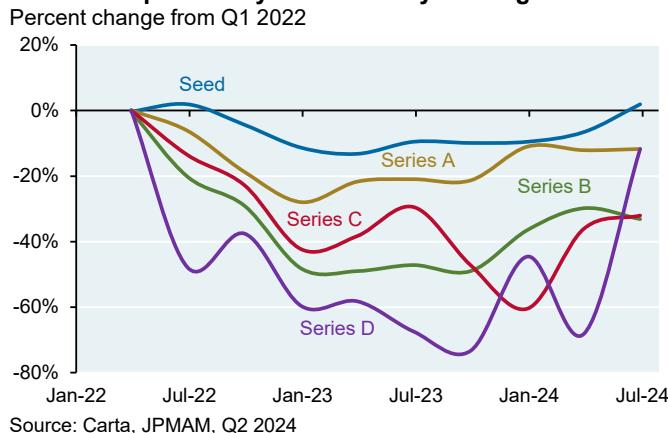
Source: Census Current Population Survey, 2024

Executive Summary Figures 2a-2f: Second derivative improvements in Venture Capital

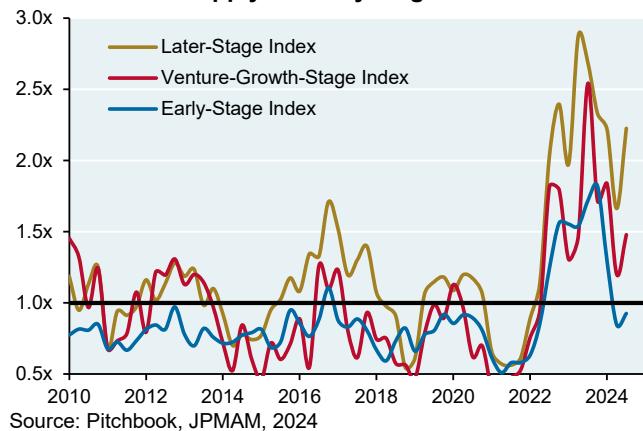
After the Metaverse/SPAC/hydrogen debacles of 2021-2022, Venture Capital dynamics weakened. In 2024, conditions stabilized with second derivative improvements in cash raised, the number of down rounds, changes in pre-money valuations from seed rounds to Series D, and a dealmaking index which incorporates dividend catch-up policies, liquidation preferences, anti-dilution terms, voting rights and valuation step-ups.

VC deal volume and cash raised

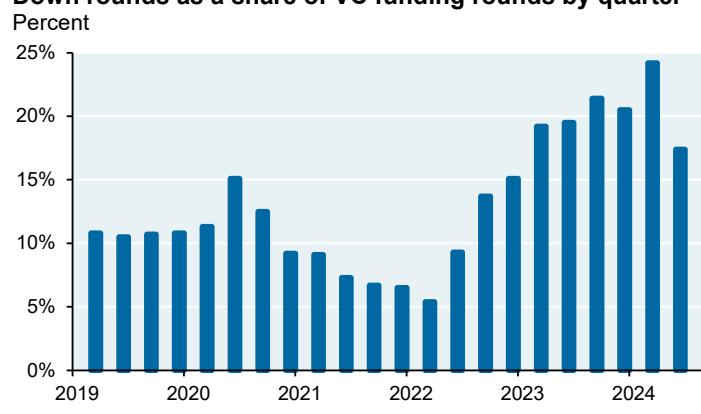
Source: Carta, Q2 2024

VC median pre-money valuations by funding round

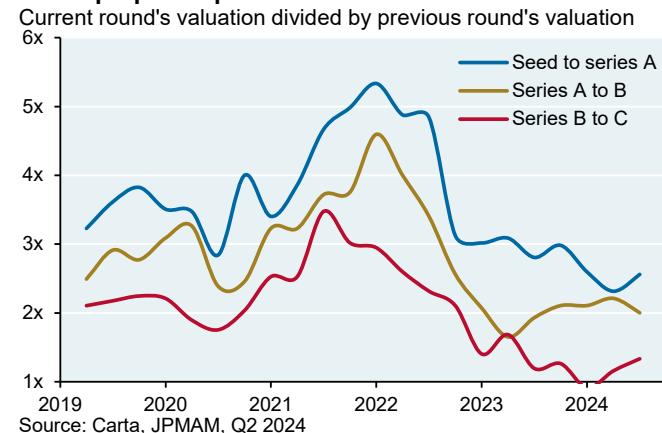
Source: Carta, JPMAM, Q2 2024

VC demand vs supply index by stage

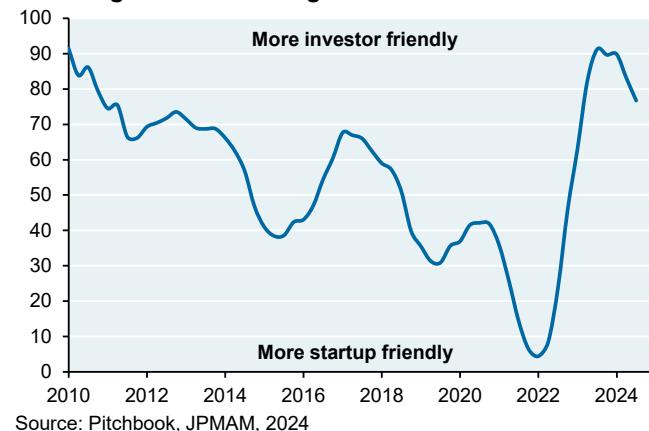
Source: Pitchbook, JPMAM, 2024

Down rounds as a share of VC funding rounds by quarter

Source: Carta, Q2 2024

VC step-up multiples

Source: Carta, JPMAM, Q2 2024

Late-stage VC dealmaking index

Source: Pitchbook, JPMAM, 2024

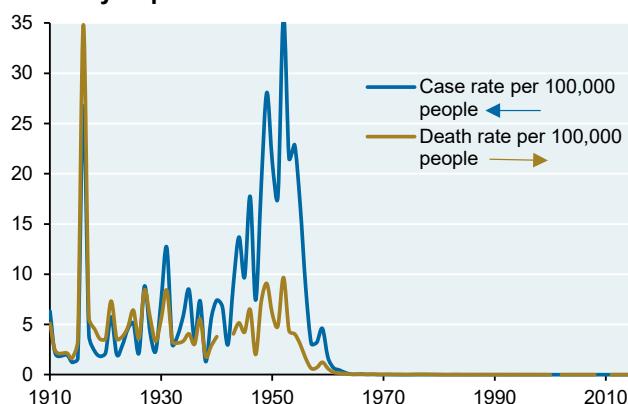
Executive Summary Figures 3a-3d: The Medical Freedom movement

Aaron Siri, RFK's personal lawyer during his Presidential campaign, has petitioned the FDA to revoke approval of the US polio vaccine. Siri filed the petition on behalf of a nonprofit that's also challenging diphtheria, tetanus and Hepatitis A vaccines. RFK on Mr. Siri: "There's nobody who's been a greater asset to the medical freedom movement than him"⁶. While RFK now reportedly supports the polio vaccine in statements made to US Senators as he attempts to be confirmed⁷, he has also stated that contaminated polio vaccines might have killed more people than they saved⁸. RFK says a lot of different things, depending on the audience.

One consequence of the Medical Freedom movement: declining vaccination rates for measles, mumps and rubella and a rising number of states with exemptions⁹. In 2023-2024, two thirds of US states fell below the HHS target vaccination rate of 95%.

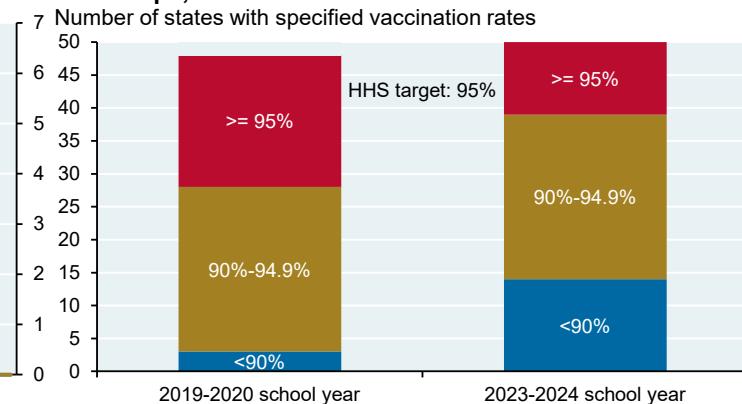
I'm not surprised that Pharma, Biotech and Life Sciences is one of the worst performing industry groups in the S&P 500 since markets began pricing in a Trump victory last fall (10/1/2024).

A history of polio in the US



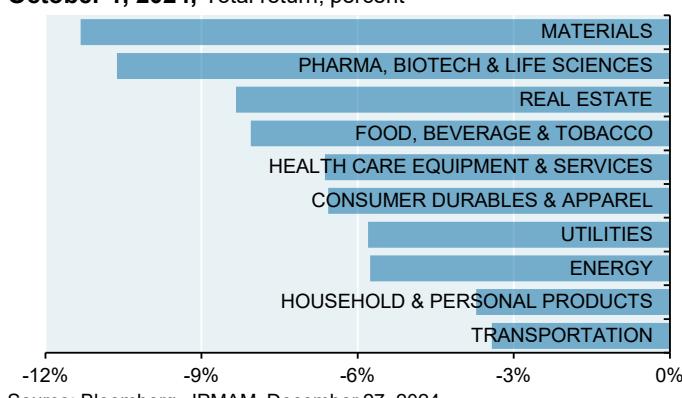
Source: US Public Health Reports, US Census, OWID, 2019

US Mumps, Measles and Rubella vaccination rates



Source: KFF, 2024. In 2019-2020, AK and DE did not report

Ten worst performing S&P 500 Industry Groups since October 1, 2024, Total return, percent



Source: Bloomberg, JPMAM, December 27, 2024

RFK Jr: A Bibliography

- ["Paul Offit, Children's Hospital in Philadelphia: Conversation with RFK Jr"](#)
- ["How RFK Jr distorted vaccine science" \[Scientific American\]](#)
- ["How RFK Jr Falsey Denied His Connection to a Deadly Measles Outbreak in Samoa \[Mother Jones\]"](#)
- ["RFK Jr spent years stoking fear and mistrust of vaccines. These people were hurt by his work \[AP News\]"](#)
- ["The Anti-Vaccine Propaganda of RFK Jr \[McGill University\]"](#)
- ["RFK's error-ridden piece on vaccine-autism links \[Nation\]"](#)

⁶ New York Times, December 15, 2024

⁷ "Trump's pick for health secretary, RFK Jr, supports polio vaccination, US senator says", Reuters, Dec 16, 2024

⁸ See "RFK Jr's vaccine half-truths tell a great, dangerous lie", Washington Post, December 19, 2024 and "RFK Jr Incorrectly Denies Past Remarks on Vaccine Safety and Effectiveness", August 24, 2024

⁹ "Childhood Vaccination Rates Continue to Decline as Trump Heads for a Second Term", KFF, November 18, 2024

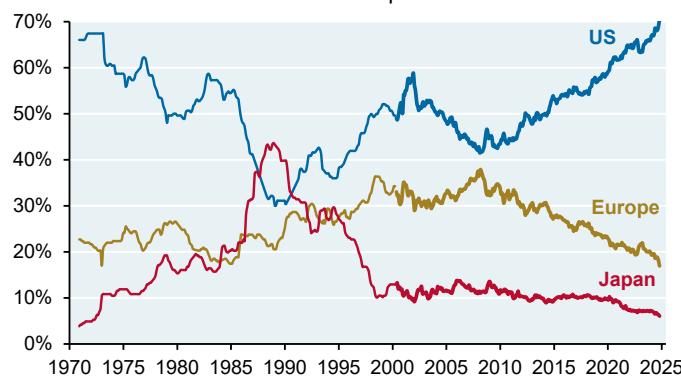
The Golden Goose: AI adoption, trends and milestones

It would be difficult to overstate the importance of the Mag 7 stocks to US equity market returns:

- Mag 7 stocks and the tech sector more broadly account for most of the recent outperformance of the US vs Europe and Japan. Mag 7: 14% of S&P sales, 31% of sales growth, 33% of earnings growth
- The ten largest US stocks have higher profitability than market leaders of prior decades going back to 1950
- Mag 7 profit margins, earnings growth and returns dwarf the rest of the US equity market. Note how S&P 500 ex-Mag 7 earnings growth has been flat for the last year
- The share of S&P 500 stocks outperforming the index is close to its post-1990 low at ~30%
- Market concentration has blown through the year 2000 peak

Regions as a share of MSCI World market capitalization

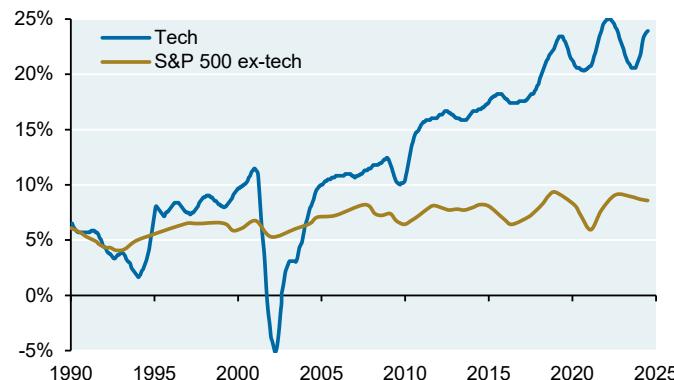
Percent of total MSCI World market capitalization



Source: Bloomberg, JPMAM, November 29, 2024

S&P 500 tech net profit margins vs rest of market

Percent



Source: Empirical Research, JPMAM, November 2024

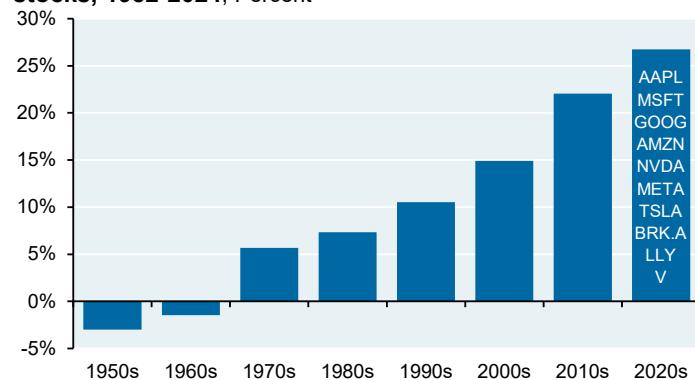
Earnings per share growth

Rolling 2 year growth



Source: Bloomberg, JPMAM, September 30, 2024

Free cash flow margins by decade for the ten largest stocks, 1952-2024, Percent



Source: Empirical Research, September 2024

S&P 500 and Mag 7 cumulative total return

Cumulative total return, Jan 2023 = 0



Source: Bloomberg, JPMAM, December 27, 2024

Market cap of largest 7 companies in S&P 500

Percent of total index market cap



Source: FactSet, JPMAM, November 30, 2024

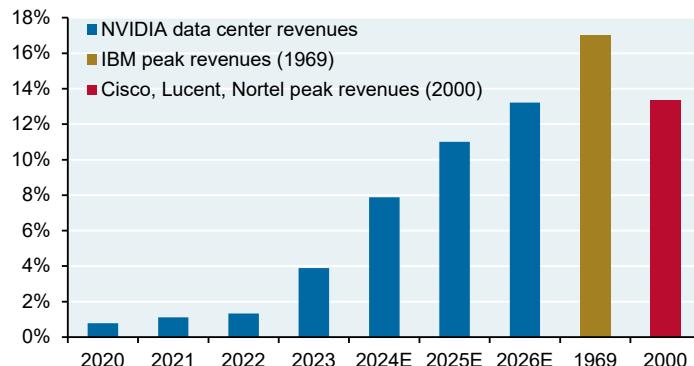
2025 OUTLOOK

AI adoption

That's why it's so important to understand how AI adoption pans out. As shown below, by 2026 NVIDIA's share of all US capital spending will be close to the two 20th century peaks. Just as notable: the hyperscalers (Google, Meta, Amazon, Microsoft etc) would need \$400-\$500 billion in new revenues to earn their traditional 50% gross margin on ~\$250 billion of annual data center spending¹⁰.

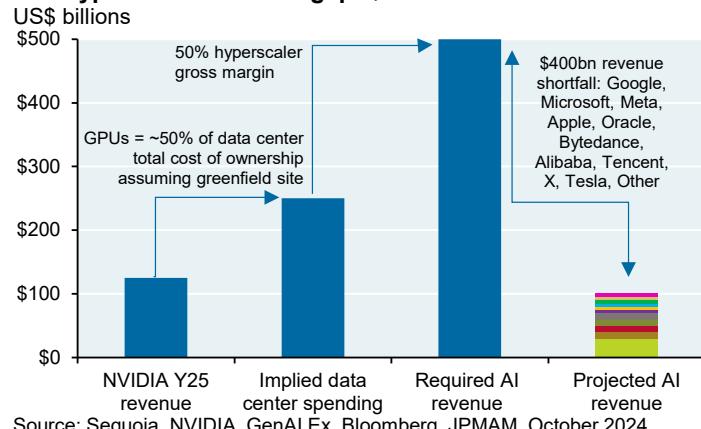
AI capital spending in context

Share of market-wide capital spending



Source: Empirical Research, August 2024

The hyperscaler revenue gap: \$400 billion



Source: Sequoia, NVIDIA, GenAI Ex, Bloomberg, JPMAM, October 2024

How much AI infrastructure is being built? Two rough estimates in “GPT” terms

- The inference of **12,000 Chat GPTs** could be powered by current hyperscaler capex investment
- The training of **1,000 computationally intensive GPT-5s** could be powered by NVIDIA's est. 2026 GPU sales

The impact on data center growth

- The colocation data center market has doubled in just 4 years with vacancy at just 3% due to soaring demand. Occupancy has increased by 30% since 2020, construction has jumped 7x in 2 years, project preleasing rates are at 84% and data center asking rents have increased by 13%-37%

AI's adherents believe that all of this investment will create a radically different world:

Due to AGI, most diseases could be cured over the next decade or two¹¹

Demis Hassabis, Google Deep Mind

Superintelligence could make fixing the climate and establishing a space colony a reality

Sam Altman, OpenAI

AI will end disease and poverty and bring about a renaissance of liberal democracy and human rights; many will be moved to tears as they behold these accomplishments; AI is a thing of transcendent beauty

Dario Amodei, Anthropic, a company in which Amazon has invested \$8 billion

80% of jobs will be automated with AI in three to five years

Richard Socher, Salesforce and You.com

By 2030, over 100,000 humanoid robots will be deployed in the real world

Rob Toews, Radical Ventures

Hundreds of millions of AGIs could automate AI research, compressing a decade of algorithmic progress (5+ orders of magnitude) into 1 year. We would rapidly go from human-level to vastly superhuman AI systems

Leopold Aschenbrenner in “Situational Awareness”

¹⁰ Derived from “AI’s \$600 billion question”, David Cahn, Sequoia Capital, June 20, 2024

¹¹ Some of the most remarkable machine learning/AI achievements are taking place in biomedicine. One example is EVO, a large language model that has been trained on the genomes of 2.7 million microbes rather than on words. The goal: decode and design DNA, RNA and protein sequences from the molecular to genomic scale with high degrees of accuracy. The ARC Research Institute where it was developed describes EVO as the Rosetta Stone of biology given its potential for diagnostic and therapeutic treatment of disease

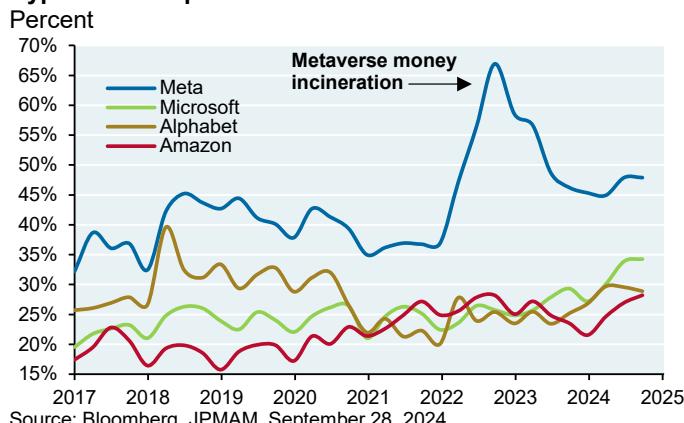
2025 OUTLOOK

AI adoption

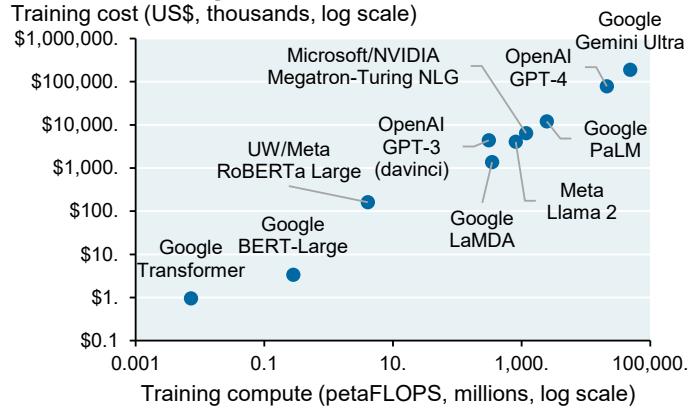
Let's return to earth for a moment. While the hyperscalers are immensely profitable, their capital spending and R&D outlays as a share of revenues have been creeping up over the last year, something that our large cap US growth managers are paying close attention to. Note how AI models with greater parameter intensity cost a lot more to train.

The stakes are high. As a sign of what can go wrong after an era of excessive investment **even when resulting infrastructure is eventually utilized in full**, consider Corning and its fiber optic business. Corning earned ~\$4 billion in the year 2000 in this segment, but after the dot-com collapse Corning didn't surpass that revenue level again until 2018 in *nominal* terms, and revenues are still below year 2000 levels in *real* terms. Similarly, the number of undersea fiber optic cables deployed globally each year did not surpass year 2000 levels until 2020.

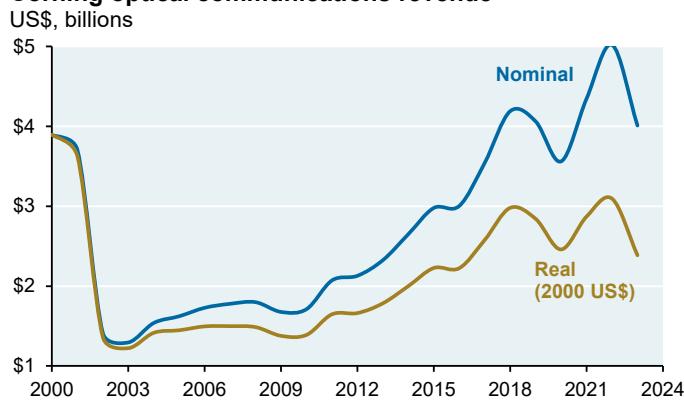
So: while NVIDIA had yet another blowout quarter of earnings in Q3 (up 94% vs the same quarter in 2023, gross margins of 73%), I'm more focused on what happens to the hyperscalers responsible for NVIDIA's growth.

Hyperscaler capex and R&D as a share of revenues

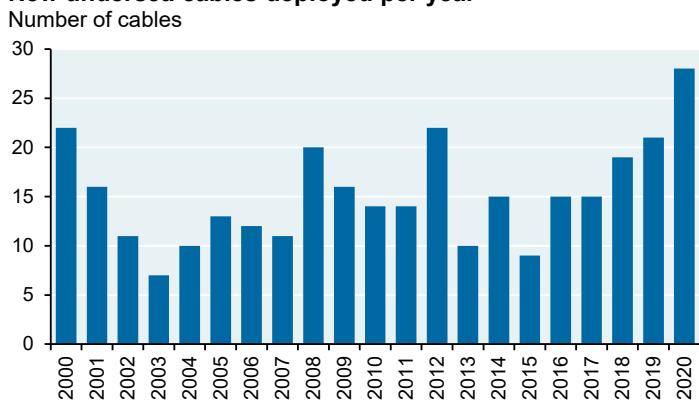
Source: Bloomberg, JPMAM, September 28, 2024

Estimated training cost and compute of select AI models

Source: Stanford Human-Centered Artificial Intelligence, Epoch, 2024

Corning optical communications revenue

Source: Bloomberg, company filings, JPMAM, 2024

New undersea cables deployed per year

Source: TeleGeography, September 2021

2025 OUTLOOK

AI adoption

AI adoption trends. There's a lot of positive news from surveys of adoption levels and return on AI investment, but surveys are not a proxy for the actual amount of money companies will be willing to pay for inference-based models in their daily operations. The most striking figures: practically every surveyed CIO plans to adopt AI applications in the near future; more than 80% of existing AI applications have met or exceeded expectations; larger companies reported the highest success rates; and AI adoption appears to be at or above internet and computer adoption rate curves. **So: AI adoption is on track; I just think investors will be increasingly sensitive to whether hyperscalers are earning a positive ROI on their capex outlays.**

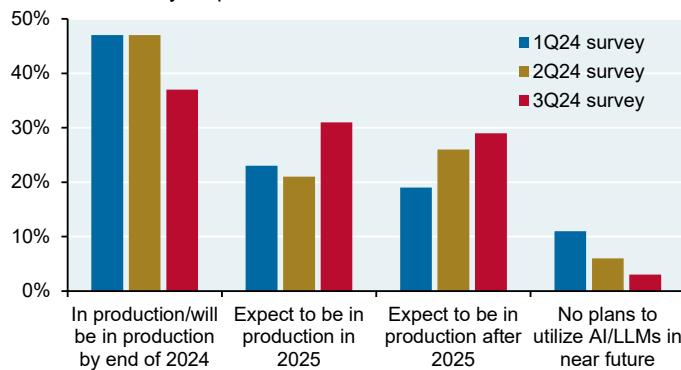
Surveys on the Return on Investment from Generative AI applications

Publisher	Date	Geography	Respondents	Conclusion
Morgan Stanley	June 2024	Global	~400, \$500mm-\$20bn revenue	~50% of companies report ROI meeting expectations. ~40% exceeding expectations
Ernst & Young	May 2024	US	~500 decision makers	Senior leaders see positive ROI in: operational efficiencies (77%), employee productivity (74%) and customer satisfaction (72%)
Enterprise Technology Research	October 2024	Global	~1,800 (varied by question)	97% of leading GenAI adopters report achieving tangible benefits from deployments
Google Cloud	April 2024	Global	~2,500, 100+ employees, \$10mm+ revenue	74% are seeing positive ROI from GenAI investments. 84% successfully transformed a GenAI use case idea into production within a six month timeframe

Source: Morgan Stanley Research, Ernst & Young, ETR, Google, JPMAM, 2024

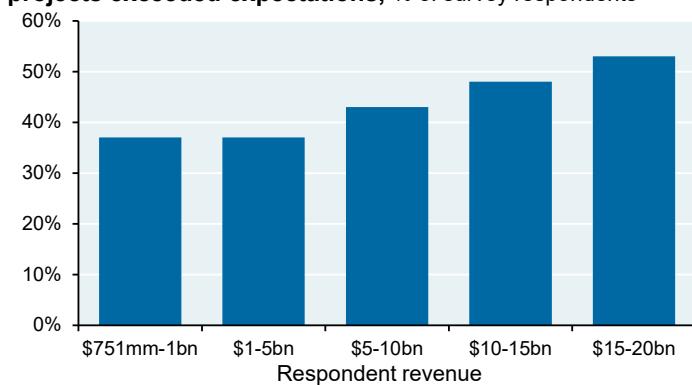
Estimated production timeline of GenAI applications

Percent of survey respondents, 100 US and EU CIOs



Source: AlphaWise, Morgan Stanley Research, 2024

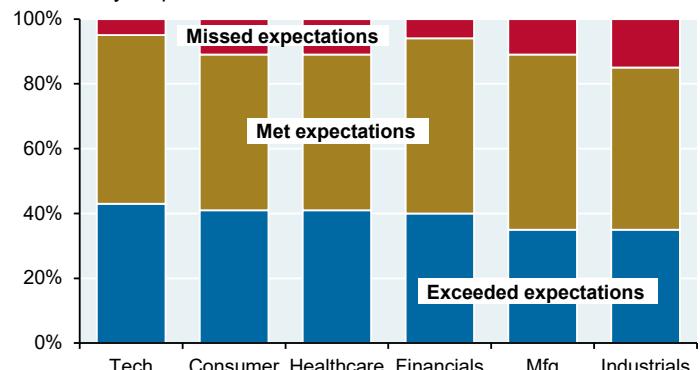
Companies reporting that return on investment of GenAI projects exceeded expectations, % of survey respondents



Source: AlphaWise, Morgan Stanley Research, 2024

GenAI projects: return on investment vs expectations

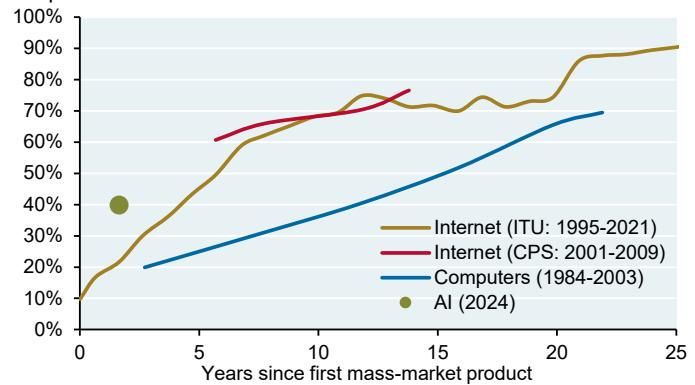
% of survey respondents



Source: AlphaWise, Morgan Stanley Research, 2024

AI adoption relative to other major technologies

Adoption rate



Source: Bick et al (NBER), 2024

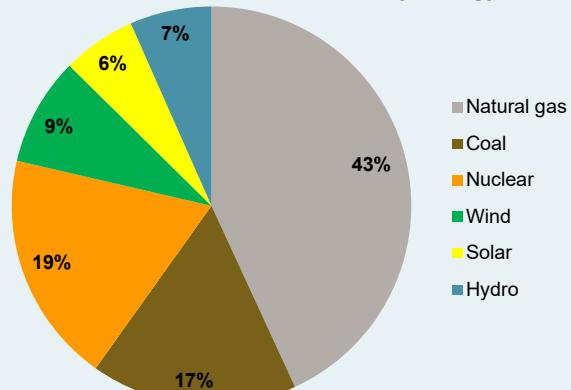
2025 OUTLOOK

AI adoption

Other AI issues: energy. On data center energy demand, markets are way ahead of themselves regarding potential for nuclear power to represent a greater share of data center energy consumption by 2030 or beyond, whether grid-based or behind the meter (see next section). The hyperscalers will probably have to hyperscale back their commitments for green power consumption and rely heavily on natural gas, as they have been. The pie chart shows power consumption of US data centers based on their respective locations, their MW of maximum power consumption and the grid mix in that state.

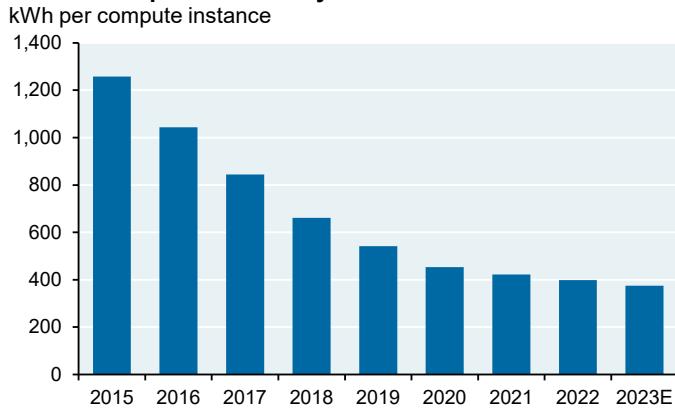
US data center power demand was actually flat from 2015 to 2019 despite a tripling in workload. The primary reason: efficiency gains as data center workloads shifted from traditional centers to more efficient cloud and hyperscale centers. **This transition has mostly run its course** now that the cloud/hyperscale share of compute instances has reached ~95%, leading to slower improvements in data center power intensity (bar chart) and projections of rising US power demand to 2030 and beyond (line chart).

US data center power consumption by energy source



Source: EIA, Aterio, JPMAM, 2024

Data center power intensity

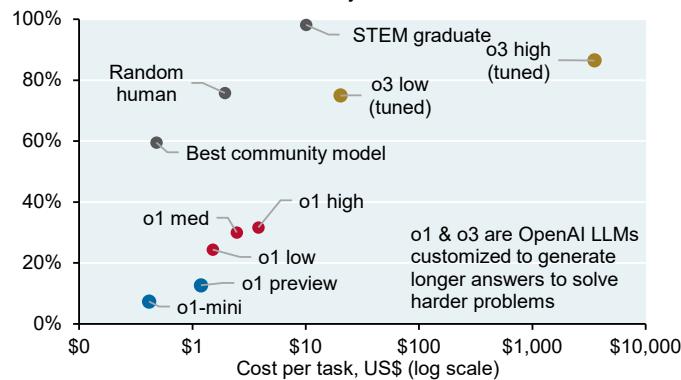


Source: GS Global Investment Research, 2024

Are language models getting better? There's a lot of debate about this, but I care a lot more about the adoption and satisfaction rates on the prior page than model scoring since the former is more indicative of whether today's models meet the needs of companies who actually pay for them. If you're interested in model scoring, there are several benchmarks (Multitask Language Understanding MMLU or the Google-Proof Q&A benchmark), and the usual suspects hopscotch each other with higher scores over time. The challenge: better performance generally comes at a cost in terms of compute time. Note on the left how much better OpenAI is getting at solving pattern extrapolation problems, but at a higher cost per task¹².

OpenAI advanced pattern extrapolation scores

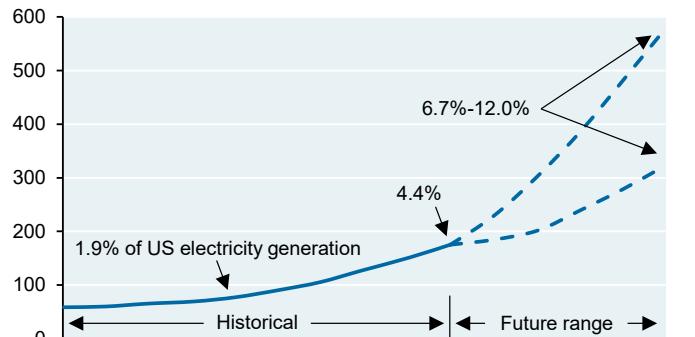
ARC-AGI-1 evaluation set accuracy score



Source: ARC Prize competition, December 20, 2024

US data center electricity use with projections

TWh

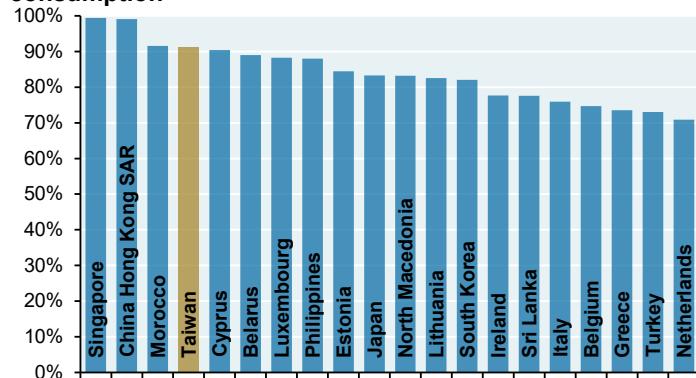


Source: LBNL 2024 US Data Center Energy Usage Report

¹² "OpenAI o3 Breakthrough High Score on ARC-AGI-Pub", Francois Chollet (Google), Dec 20, 2024. I prefer ARC to MMLU or GPQA since ARC is not multiple choice and requires solving of higher order abstract problems

Other AI issues: semiconductor supply chains. Last fall, China deployed a record 125 aircraft in drills simulating a blockade of key Taiwan ports, along with Liaoning aircraft carrier and ships¹³. How sensitive is Taiwan to a naval blockade? **Very**. As shown on the left, Taiwan's reliance on energy imports is practically the highest in the world, ranking alongside islands like Singapore, Hong Kong and Cyprus, microstates like Luxembourg and energy-poor nations like Belarus. Which brings me to this: why did Taiwan shift away from nuclear power, its only source of energy independence? By doing so, Taiwan has effectively increased its sensitivity to a Chinese naval blockade. Reducing nuclear's share of electricity generation from 50% in the 1980's to 5% today is one of the most baffling geopolitical decisions I have ever seen.

Net imports of fossil fuels as a share of primary energy consumption



Source: EI Statistical Review of World Energy, JPMAM, 2024

Taiwan nuclear share of electricity generation

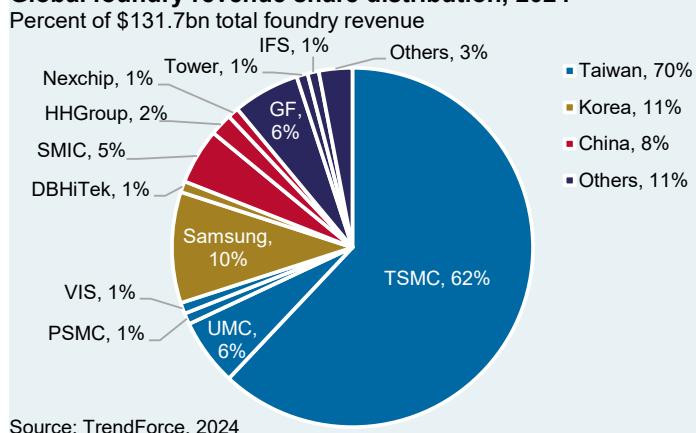


Source: EI Statistical Review of World Energy, Taiwan Power, JPMAM, 2024

NVIDIA and TSMC

- According to TechInsights, NVIDIA controls 95% of the market for GPUs that accelerate AI tasks while TSMC has a 92% share in advanced AI chip production according to BCG, including NVIDIA's chip designs that TSMC produces in its foundries. An argument can be made that TSMC-NVIDIA is the most important symbiotic relationship in the tech sector when looking at current valuations
- NVIDIA is TSMC's second largest customer after Apple at 10% of TSMC revenues
- NVIDIA is reportedly pushing TSMC to deliver new chip architecture every year instead of every two years
- While redesign issues related to overheating has delayed NVIDIA's Blackwell chip rollout to 2025, the product is apparently sold out for the next 12 months with NVIDIA's CEO describing demand as "insane". Blackwell GPUs will have more than 2x the memory of NVIDIA's current Hopper GPU, >10x the interconnection speed measured in terabytes per second and 25x greater energy efficiency

Global foundry revenue share distribution, 2024



Source: TrendForce, 2024

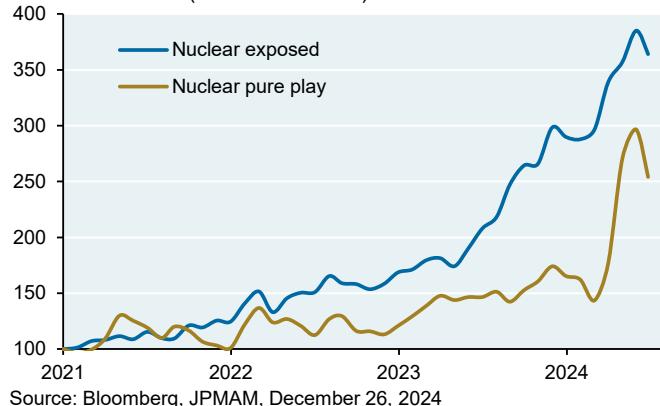
¹³ See NYT ("With Jets and Ships, China is Honing its Ability to Choke Taiwan", 10/16/2024) and WSJ ("China Test Drives a Taiwan Blockade", 10/16/2024)

What nuclear renaissance? Wake me when we get there

Investors have gotten excited about prospects for additional nuclear power in the US, driving shares of nuclear pure play and nuclear-exposed shares higher. There are several factors driving this enthusiasm: new US government regulations designed to speed up nuclear power development; the restart of decommissioned nuclear plants; the gaggle of companies competing to deliver next-gen nuclear plants and small modular reactors; and the Gates Terrapower project. Let's take a look with more to follow in our annual energy paper in March.

Nuclear pure play and exposed stock returns

Total return index (100 = June 2021)



Source: Bloomberg, JPMAM, December 26, 2024

Nuclear exposed: Constellation Energy, Silex Systems, Vistra, GE Vernova, Rolls-Royce, Honeywell, Lockheed Martin, Fluor, Mitsubishi, Duke Energy, Dominion Energy, Quanta Services, Fortum Oyj

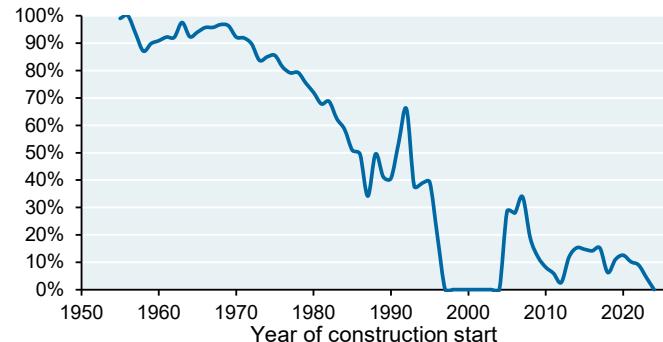
Nuclear pure play: Cameco, Oklo, Centrus Energy, NuScale, BWX

Traditional nuclear plant development

While the developed world dominated nuclear additions from 1950 to 1980, a combination of factors led OECD nuclear additions to collapse. Since the 1990's, almost all nuclear additions take place in the developing world.

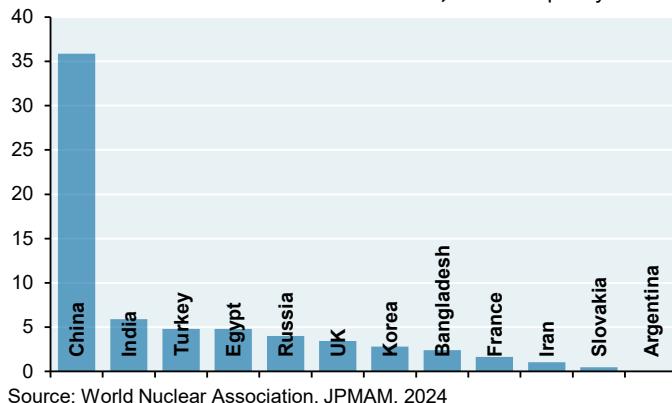
During the 1980's, nuclear development shifted from developed to developing countries

Developed market share of global MW of nuclear starts, 5yr avg.



Source: Power Reactor System Database, JPMAM, September 2024

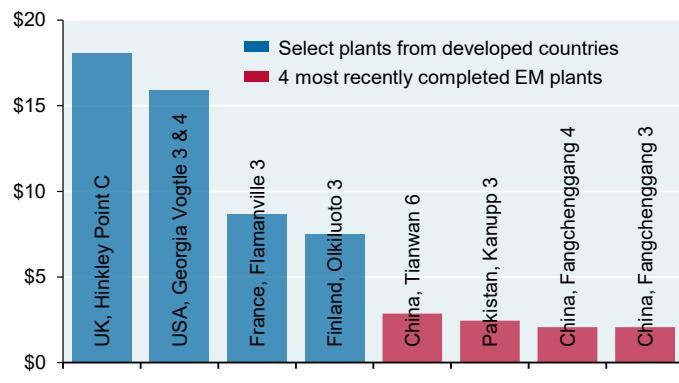
Nuclear plants under development with estimated grid connection dates between 2024-2030, GW of capacity



As shown at the top of the next page, the cost per MW of developing economy nuclear plants is a fraction of the four most recent OECD plant completions. Developing economy plants are also generally completed in 6-8 years; the few completions in the OECD in this century have taken a lot longer than that. There are efforts underway to address this: in June 2024, Congress passed the Advance Act (Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy) on a bipartisan basis. The act streamlines permitting for advanced reactors, reduces regulatory fees for companies licensing advanced reactor technologies and updates outdated rules that limit international investment. It also requires the Nuclear Regulatory Commission to develop a pathway to license nuclear facilities at the sites of shuttered coal plants that already have a connection to the grid.

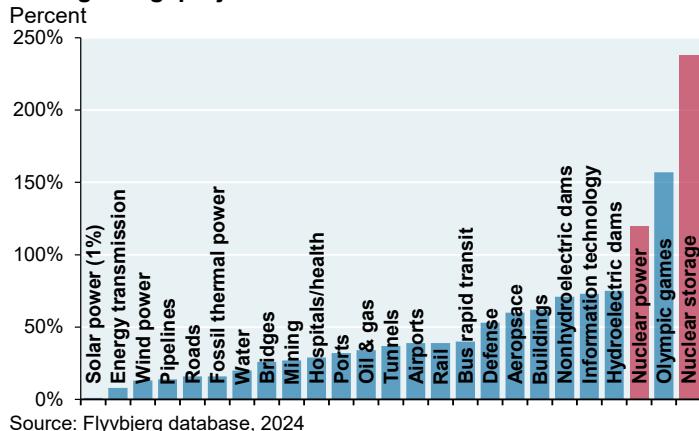
Will new US regulations make a difference? Too soon to tell. The industry has a lot to prove to investors and regulators: as shown in the third chart, nuclear projects are associated with the largest cost overruns of all megaprojects. Vogtle 3, completed in Georgia in 2023 after extensive delays and cost overruns, was offline for 9.5 out of its first 48 weeks in 2024 according to the NRC due to feedwater pump blockages or failed heat exchangers. Note that the US is also reliant on imported uranium, needs more enrichment capacity and has practically no domestic supply of high assay low enriched uranium, which is the kind needed for the Gates Terrapower project (its reactor in Wyoming has been delayed to 2030 at the earliest for this reason).

Capital cost of nuclear plants in developed countries vs emerging markets, US\$ millions / MW



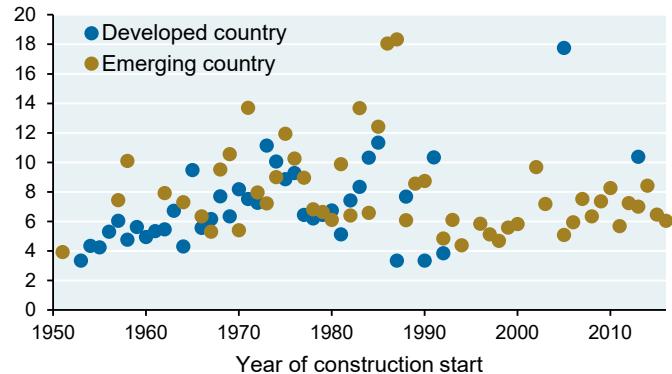
Source: JPMAM, 2024

Average megaproject cost overruns



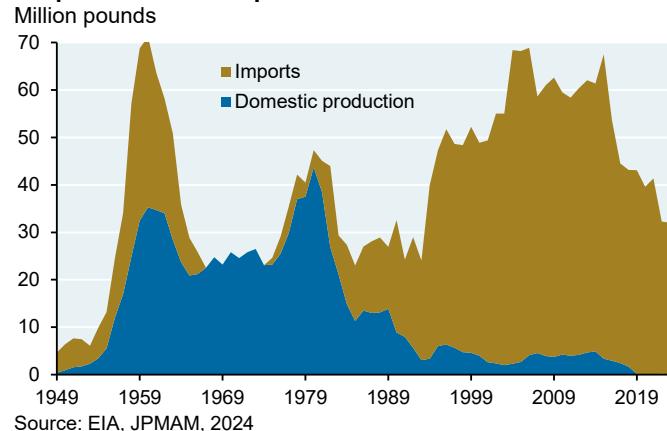
Source: Flyvbjerg database, 2024

Average nuclear plant completion time by year and region



Source: Power Reactor System Database, JPMAM, September 2024

US production vs imports of uranium oxide



Source: EIA, JPMAM, 2024

Nuclear plant reopenings

In the US, Holtec plans to reopen the 53-year old Palisades plant in Michigan that was closed two years ago. Palisades would be the first plant to begin decommissioning, stop the process and then restart. In addition, Microsoft and Constellation Energy announced a plan to reopen 50-year old Three Mile Island reactor #1 in 2028 for power @~\$100 per MWh, and NextEra is considering a restart of the 45-year old Duane Arnold plant in Iowa that was shut in 2020 after a fire. While it's possible to reopen older plants, most would probably not receive an operating license as a *new* facility given evolving safety standards. Skeptics of the reopening approach include Palisades' own director of engineering from 2006 to 2013 who cites Holtec's inexperience with nuclear plant operations¹⁴. While these projects have attracted a lot of attention from power market customers, the cost and timing of their reopening is far from certain.

The big picture: once a plant's decommissioning begins, it would probably be too expensive to restart it; as a result, restart attempts will most likely be confined to the three plants cited above and at most a handful of reactors whose decommissioning has barely begun (San Onofre in California) or uncompleted plants whose construction was halted midstream (V.C. Summer in South Carolina).

Next-gen nuclear designs

- **Most next-gen nuclear designs are based on sodium-cooled fast reactors, high-temperature gas-cooled reactors (HTGR) or molten salt.** Adherents typically claim that their designs can lower costs, be built quickly, reduce accumulation of nuclear waste, use uranium more efficiently via waste recycling, improve safety (passive shutdown and cooling) and reduce risk of nuclear proliferation
- **But:** approaches like molten salt and HTGR were attempted in the past and abandoned due to poor performance. Water-moderated/cooled reactors have proven superior in terms of reliability, operational ease, maintenance and economics: they have logged over 17,000 plant-years in operation with capacity factors of 80%-90% vs ~500 years for sodium cooled plants, 40 years for HTGR and 4 years for molten salt
- **While research into HTGR, fast reactors and molten salt reactors may one day yield dividends, few plants are commercially viable yet.** The International Atomic Energy Agency believes that at least another decade is needed to commercialize molten salt reactors¹⁵, and no country/company has constructed a reliable pebble-bed HTGR. China's small modular HTGR, currently the only operational facility of its type in the world, was completed 11 years behind schedule and is operating well below capacity (in 2022 it only operated for 27 out of 8,760 hours; this improved slightly in the subsequent three months when it operated at a still very low capacity factor of just 10%¹⁶). The DOE's Liftoff report acknowledges that these designs require a long "burn-in" period before achieving technological readiness¹⁷
- **While Russia and India are building sodium-cooled fast breeder reactors (FBRs), the US has avoided them due to safety and cost concerns.** FBRs "breed" more fuel than they consume, allowing the excess to be used as fuel by light water reactors (LWRs); spent fuel from LWRs can then be used as fuel by FBRs. Despite the elegance of this circularity, the US abandoned sodium-cooled FBRs due to concerns about higher cost, safety in case of fire, nuclear proliferation and shorter service lives

¹⁴ "Can a closed nuclear plant from the '70s be brought back to life?", WSJ, August 2024

¹⁵ "Molten Salt Reactor Technology Development Continues", IAEA, April 2024

¹⁶ "The World Nuclear Industry Status Report 2023", Mycle Schneider Consulting, December 2023

¹⁷ "Pathways to Commercial Liftoff: Advanced Nuclear", DOE, September 2024

What about small modular reactors?

SMRs can be designed as smaller versions of traditional light water reactors, or using next-gen designs. More than three dozen companies are working on plans to deliver SMRs, and there's a 6.5 GW SMR pipeline in the US with aggregate project costs of \$176 billion. However, there's not a single SMR project under construction in the US and only NuScale has had its design approved by the NRC, a process that ended up costing ~\$500 million over six years (and that's for a light water reactor design, not a next-gen).

- Google signed a deal with **Kairos** for 500 MW from several SMRs to be delivered in the 2030-2035 timeframe. Kairos is still working on its demonstration reactor which it aims to be complete by 2027. Kairos still needs to get construction and design permits from the NRC as well as permits from local agencies to develop the reactors
- **Oklo** intends to build liquid metal-cooled SMRs. It's very early stage: in Sept 2024, Oklo was approved by the DoE to conduct site investigations (geotechnical assessments, surveys, infrastructure planning). Oklo has also been granted access to used nuclear fuel from a retired experimental breeder reactor operated by the DoE for 30 years, and approval to build its own fuel fabrication facility. While its order book is reportedly ~1,350 MW, it is comprised of non-binding agreements that will be subject to customer offtake approval based on the ultimate cost of completing the project (just NuScale's aborted efforts in Utah)
- **Ultrasafe Nuclear Corporation** filed for bankruptcy last year a year after signing a JV with a French company that designs and produces nuclear components, burning through \$200 mm in the process
- Construction of the first SMR built in a Western country has begun in Canada by Ontario Power Generation (BWRX-300, a **GE-Hitachi** design), if you count land grading and retaining walls as construction¹⁸. US utilities are reportedly cautious and waiting to see its ultimate price tag before proceeding. GE-Hitachi designers are attempting to reduce the volume of the building housing the reactor by 90%. Their methods: a more simplified design that eliminates the need for certain safety systems, steel plates reducing the need for steel rebar and a required staff of 75 people compared to 1,000 at large pressurized water reactors. That said, some third party estimates of the plant's possible cost are still way above the \$2,000 per kW figure that the US National Academy of Sciences cites as necessary for nuclear to compete with other generation sources

SMRs are still lottery tickets and will probably remain that way until the end of the decade at the earliest; and I am still very skeptical of the ability to modularize and shrink the world's most capital-intensive projects.

¹⁸ "As construction of first small modular reactor looms, prospective buyers wait for the final tally", Globe and Mail, December 27, 2024

DOGE Quixote: the billionaires quest to reduce US government spending

Like Don Quixote and Sancho Panza, Vivek Ramaswamy and Elon Musk have set out on a quest to cut US government spending. The goals: reduce \$500 bn in Federal spending that Musk cited in a WSJ piece as being unauthorized by Congress, and cut as much as \$2 trillion from \$6.75 trillion in FY 2024 government spending, a figure Musk mentioned at an October rally at Madison Square Garden. [Note: as per my Top Ten List prediction on page 43, I don't think DOGE will get anywhere close]. According to the Washington Post, other billionaires drafted into the DOGE effort include Palantir co-founder Joe Lonsdale, investor Marc Andreessen, hedge fund manager Bill Ackman and former Uber CEO Travis Kalanick.

In this section we examine what lies ahead for DOGE, the Department of Government Efficiency. In the original Cervantes novel *Don Quixote*, the concept of wisdom differs from intelligence and entails universality, pragmatism and humility. Do Vivek and Elon qualify? I don't think so but your mileage may vary.



"*Don Quixote and Sancho Panza*", Honoré Daumier, 1865-1867

Getting started: reversing Biden executive actions. The Committee for a Responsible Federal Budget recently cited possible savings from reversing certain Biden executive actions, a process which would not require any Congressional approval¹⁹. On an annual basis, the executive action repeals identified below would save ~\$100 billion per year; but to the extent that these are reductions in *future* planned additional spending, it's not the same as cutting existing programs. Regarding student loans, potential savings would have been higher but the Biden administration withdrew two of its proposed deficit-increasing student cancellation rules last month.

Savings from Reversing President Biden's Executive Actions, billions of US\$

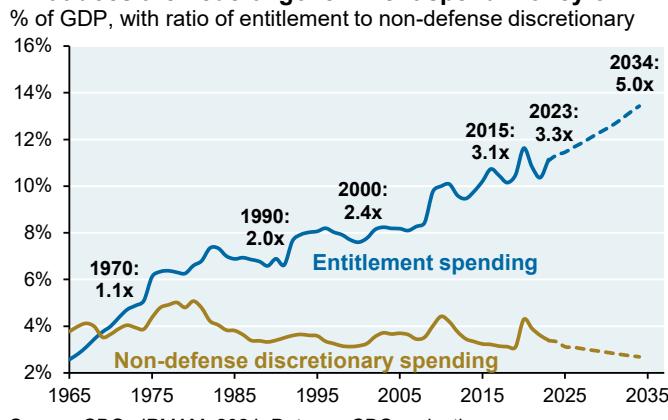
Healthcare executive action repeals	\$ bn	Other executive action repeals	\$ bn
Medicaid financing	140	SNAP Thrifty Food Plan	180
Medicaid eligibility	75	Vehicle carbon emissions/EV credits	150
Medicare Part D rebates	65	SSDI past work period	20
ACA self-only coverage ("family glitch fix")	40	SSI expansion	20
Medicaid nursing home staffing	25	IRS enforcement restrictions on <\$400k	20
Student debt executive action repeals			
SAVE program	275	Total 10-year savings	1,025
Closed school rules	15	Annual savings	103

Source: Committee for a Responsible Federal Budget, November 26, 2024. ACA Affordable Care Act; SSDI Social Security Disability Insurance; SSI Supplemental Security Income

¹⁹ "Reversing Biden Executive Actions Could Save up to \$1.4 Trillion", CRFB, November 26, 2024

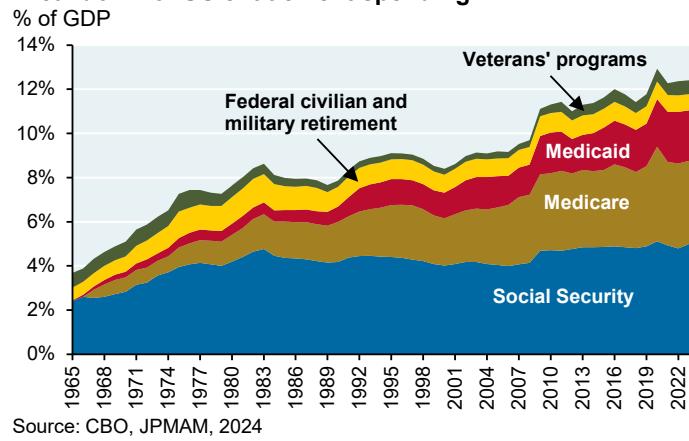
The table above highlights an important aspect of government outlays: entitlements dominate government spending rather than non-defense discretionary items, which have been cut by prior agreements such as the Budget Control Act of 2011. Is there still wasteful non-defense discretionary spending to cut? Certainly; the question is how much, particularly when its largest categories are politically sensitive veterans benefits and infrastructure funding for highways.

What does the Federal government spend money on?



Source: CBO, JPMAM, 2024. Dots are CBO projections

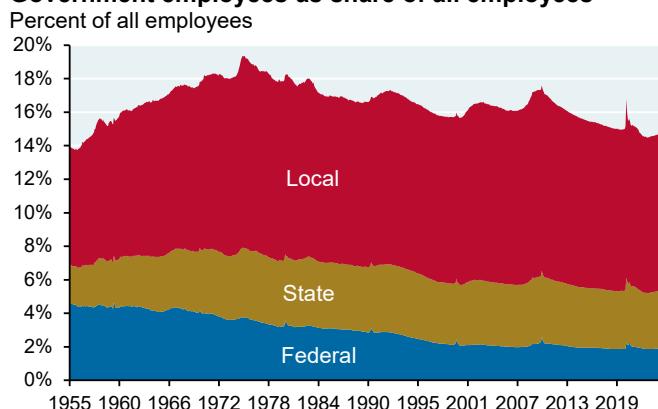
Breakdown of US entitlement spending



Source: CBO, JPMAM, 2024

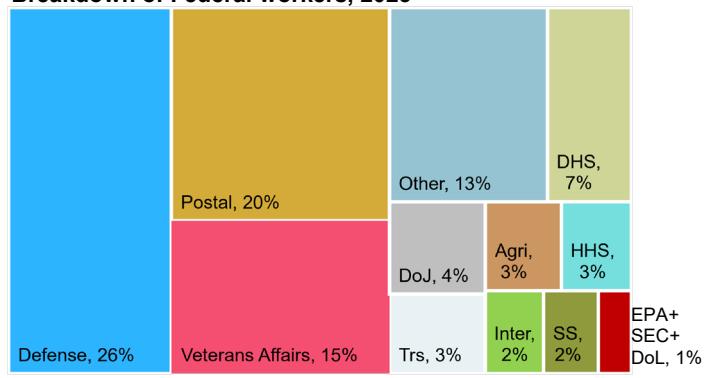
Firing federal workers. DOGE reportedly intends to close government agencies, compel voluntary departures by requiring full-time office work and move certain functions outside of Washington DC to places that are closer to where the services are provided. That said, Federal employment of 3 mm people is at its lowest level as a share of US employment in 85 years (~2%). Within Federal workers, the largest employer is the Dep't of Defense (excluding active military) followed by the Postal Service and Veterans Affairs. As for agencies in DOGE crosshairs: the Environmental Protection Agency, Securities and Exchange Commission and Department of Labor when combined account for less than 1% of federal workers, while the Department of Education accounts for just 0.14%. Higher government worker figures often cited include 5.5 mm state and 15 mm local government workers, the largest share of which are 7 mm teachers and 2.4 mm police, fire and correctional officers.

Government employees as share of all employees



Source: FRED, JPMAM, October 2024

Breakdown of Federal workers, 2023



Source: Bloomberg, JPMAM, November 2024

While Trump might reclassify some career civil servants as at-will Schedule F political appointees that can be fired, this might affect just 50k people and wouldn't move the needle much. To achieve \$50 billion in savings on Federal employees, Trump's administration would have to fire over 500,000 people. The last large-scale Federal workforce reduction of that magnitude: when Clinton reduced the Defense department by 350,000 during the 1990's peace dividend era.

Restrictions on Presidential impoundment of revenues raised by Congress. The Impoundment Control Act of 1974 limits a President's ability to decline to spend funds that Congress appropriates for a particular purpose, or to use those funds in ways other than what Congress specified. Trump nevertheless stated that he intends to impound funds Congress appropriates for certain agencies and programs, arguing that restrictions on the President's discretion in this regard are unconstitutional. Trump's former OMB Director Russell Vought (who Trump announced will be re-appointed) laid out an expansive view of Presidential authority to decline to spend appropriated funds in a letter to the House Budget Committee at the end of Trump's last term. Trump may also attempt to use "pocket rescissions" to shrink federal agencies or programs. **Either way, any impoundment will almost certainly be challenged in the courts**, a process that could take months or years to resolve.

Weight loss drugs (GLPs) and Medicare coverage. Government outlays for coverage of weight loss drugs may increase just as DOGE is trying to cut other government spending. Medicare now covers GLPs like Ozempic and Wegovy for 11 million out of the 14 million obese and overweight people in the Medicare pool, either because they have Type II Diabetes, and/or (since early 2024) they have a combination of cardiovascular disease and obesity²⁰. Then in November, Biden proposed having Medicare and Medicaid cover GLPs for those with obesity alone which would add coverage for another 7.4 million people²¹. Cost estimates differ: \$20-\$30 billion over 10 years according to the CBO, and \$140 billion according to the Penn Wharton Budget Model²². If GLP coverage expanded to those with obesity OR cardiovascular disease, that could expand the Medicare eligibility pool by 10 million people according to estimates from KFF and CMS.

In other words: rising GLP coverage would offset DOGE cost-cutting in other areas, even if semaglutide (the active ingredient in GLPs) is included in the government's price negotiations with the drug industry in 2025.

Elon Musk is not a constitutional lawyer. In a November 2024 WSJ Op-Ed, Musk claimed that the Administrative Procedures Act ("APA") would not constrain a President from making deep cuts to federal agencies or turning many career civil service positions into political appointments so that those federal employees may be fired at will. Musk stated that the President is not bound by the APA; on that point, I believe that he is largely correct. The Supreme Court has held that the President is not an "agency" under that statute, even when his actions involve agencies. However, the President still remains subject to a range of other restrictions:

- Federal statutes establish and require the existence of cabinet-level departments and many other federal agencies. Some laws go further, establishing offices/divisions and imposing requirements concerning their structure, and also spell out explicit functions that such offices must carry out and/or disbursements they must make. Example: the Department of Education Organization Act of 1979 requires the creation of offices within the Department of Education such as the Office of Civil Rights and Office of Correctional Education; it requires the Department to approve state plans for federal grants under the Elementary and Secondary Education Act, and explicitly prohibits the Secretary from eliminating any such statutorily established units
- Collective bargaining agreements with unionized federal employees may also limit an Administration's ability to materially alter terms of employment, for example, by reducing or eliminating telework policies

In other words: attempts to eliminate agencies or their related functions, or to refuse to spend their appropriations, would generally be subject to substantial legal challenges

End of Chevron Deference. After Trump's majority on the Supreme Court tossed out the Chevron Deference standard last year, Trump administration agencies may ironically be subject to more judicial challenges of their decisions and interpretations, reducing their ability to unilaterally promulgate rules.

²⁰ "A New Use for Wegovy", KFF, April 2024

²¹ Such a step would be prohibited by the Medicare Modernization Act of 2003. A change would require formal Agency rulemaking whose comment period and ultimate approval would extend into the Trump Administration. If the rule were successfully challenged and overturned, Congress could still pass legislation approving it. A key feature of any GLP rule or legislation: would coverage be permanent or temporary?

²² "Authorizing Medicare and Medicaid to Cover Anti-Obesity Medication", Wharton, November 27, 2024

Defense procurement costs. Defense spending inflation has risen 25% faster than overall inflation since WWII. One possible contributor: the prevalence of directly negotiated non-competitive defense contracts is roughly the same as competitive contracts²³. While evidence that competitive contracts consistently result in lower costs is mixed, their broad use raises questions about the non-competitive process and cost outcomes.

The relative price of defense spending

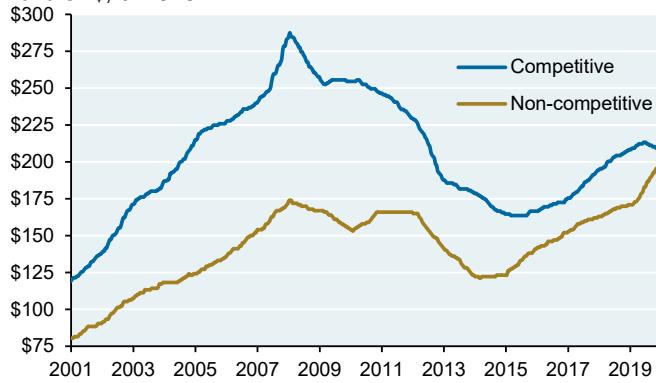
Relative price: growth in defense deflator vs overall GDP deflator



Source: BEA, JPMAM, 2023

Defense contract obligations by solicitation procedure

2020 US\$, billions

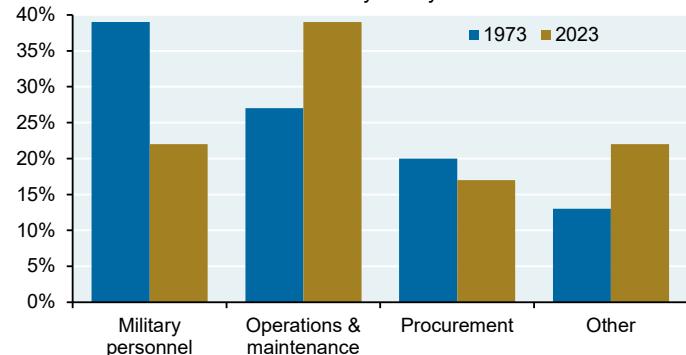


Source: Reilly (George Mason University), 2023

Defense procurements (weapons systems) only represent 15%-20% of the total military budget, with personnel and operations/maintenance representing a much larger combined share. Procurement cost overruns are common across all branches; are highest for DoD-wide programs like the F-35 Joint Strike Fighter; and are higher for cost-plus contract types compared to fixed price.

US defense spending by category

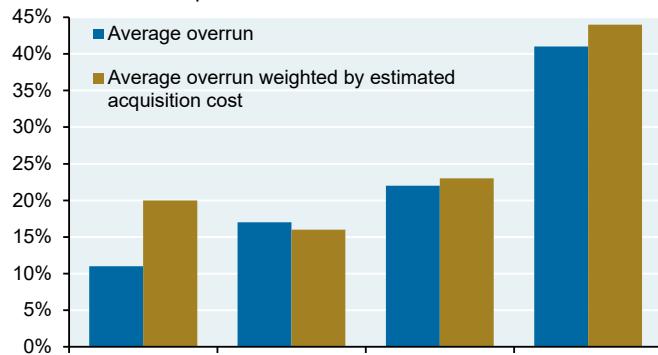
Percent of total defense discretionary outlays



Source: OMB, Peterson Foundation, 2023. Other mostly includes R&D, military construction and family housing

Cost overruns by lead service

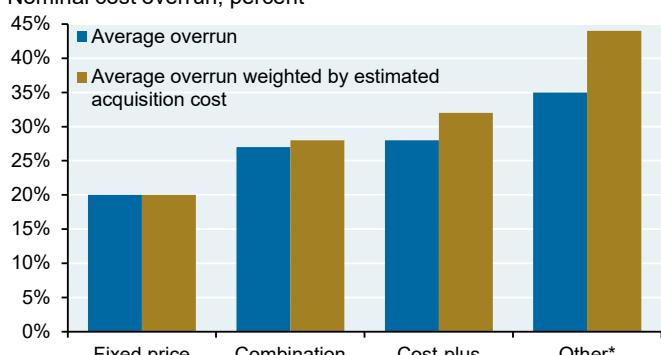
Real cost overrun, percent



Source: CSIS, JPMAM, April 2011

Cost overruns by contract type

Nominal cost overrun, percent



Source: CSIS, JPMAM, April 2011. *Other includes time and materials contracts and labor hours contracts

On competitive bidding for weapons procurement: the Federal government faces a high degree of both concentration and specialization. After the Clinton era reduction in military spending, the number of prime defense contractors fell from 51 to five (Lockheed, GD, RTX, Northrup, Boeing)

Also: any savings from competitive bidding might end up being plowed back into new weapons programs rather than reducing the defense budget

²³ "The political economy of rising defense costs", Reilly (George Mason University), 2023

Some of the largest cost overruns are shown below by category and program. For example: 50% of all helicopter programs breached significant or critical cost overrun thresholds. On “cost breach rates”: the 1982 Nunn-McCurdy Act requires the Department of Defense to alert Congress if a major project has cost growth above certain thresholds vs baseline (30% = significant overrun, 50% = critical overrun) and perform an in-depth project review and restructuring. In the table on the right, we show the largest 10 cost overruns vs baseline over the last decade. While the DoD reports a lower rate of Nunn-McCurdy breaches in recent years, the DoD has failed its last several audits with no improvement in the number of material weaknesses from 2018 to 2024.

Nunn-McCurdy cost breach rates, 1997-2021

	Total # of programs	# of programs that ever breached	Breach rate
Chem demilitarization	4	4	100%
Space launch	1	1	100%
Helicopter	20	10	50%
Fixed-wing aircraft	29	10	34%
Satellite	16	5	31%
UAV	7	2	29%
Ship/submarine	24	6	25%
C4ISR	57	13	23%
Ground vehicle	14	3	21%
Munition/missile	34	10	29%
Missile defense	9	1	11%
Total	215	65	30%

Source: DoD 2023 Defense Acquisition Report

Cumulative cost growth vs baseline, top ten from 2010-2021

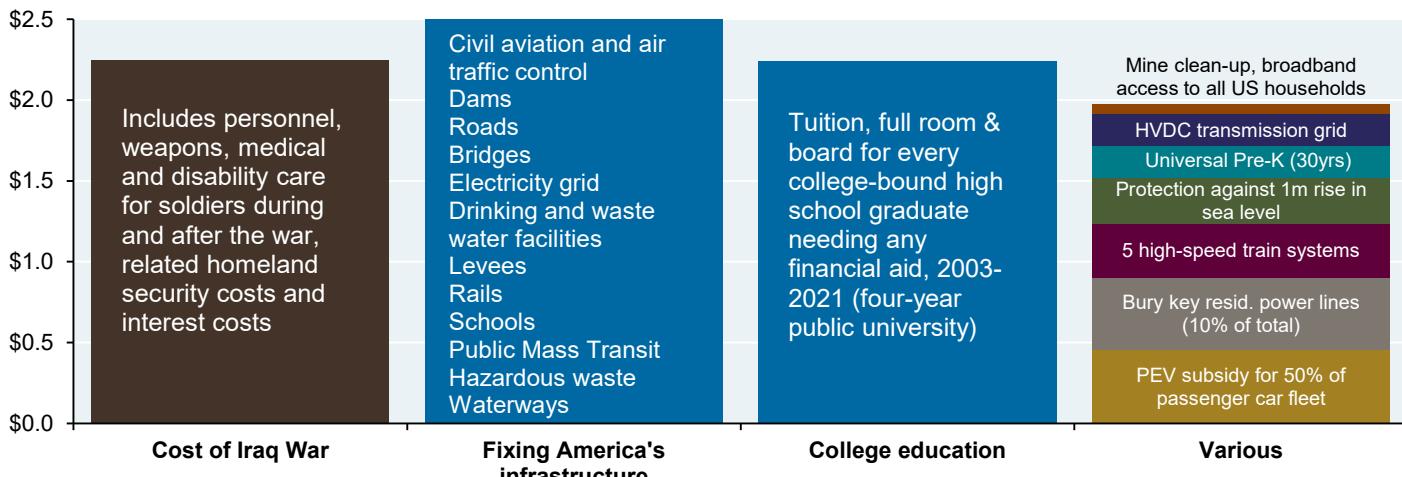
Project	Description	Cost growth
C-130J	Hercules transport aircraft	3267%
GMLRS/GMLRS AW	Guided rocket launch system	1086%
MH-60S	Fleet combat support helicopter	871%
AIM-9X Blk II	Air Intercept Missile	335%
SBIRS High	Space-Based Infrared System	229%
EFV	Expeditionary Fighting Vehicle	213%
MIDS	Information distribution system	211%
F-35	F-35 joint strike fighter jet	193%
DDG 1000	Guided missile	191%
NSSL	National Security Space Launch	187%

Source: DoD 2023 Defense Acquisition Report

One last comment on US military spending. I prepared this chart in 2015 on the cost of the Iraq War and what \$2.2 trillion could have been spent on instead. **The best way to reduce outlays on military expenditures and allocate more money to domestic growth: avoid unnecessary foreign wars.**

The staggering financial opportunity cost of the Iraq War

2014 USD trillions



Source: Brown University Watson Institute for International and Public Affairs; Neta Crawford, Boston University (cost of Iraq War); College Board; US Dept. of Education; Edison Electric Institute; American Society of Civil Engineers; Earthworks; Hall Energy Consulting; Next Big Future; Northwestern University; FCC; Vrije Universiteit; US Dept. of Transportation; National Affairs; US Dept. of the Interior; Scientific American; US Dept. of Energy; EIA; JPMAM. 2015.

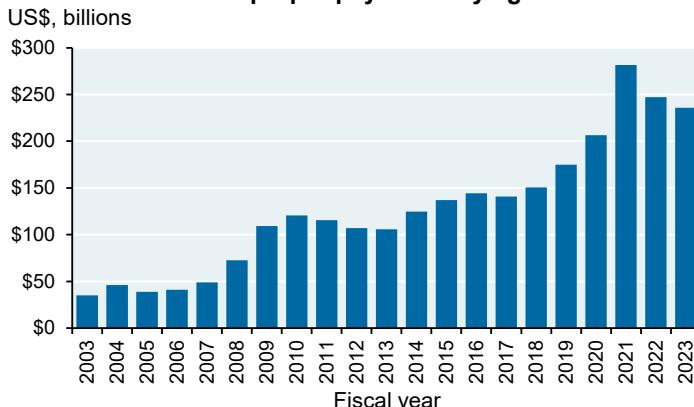
The Festivus of government overpayments. Whenever I see Senator Rand Paul's annual Festivus report on wasteful government spending, I roll my eyes since \$659 billion out of the \$900 billion of waste that Paul cites is interest on the Federal debt. In other words, not something you can just cut. However, his report does highlight something notable: **\$2.7 trillion of Federal government agency “improper payments” since 2003 and \$236 billion in 2023 alone**, according to a General Accounting Office (GAO) annual report²⁴.

Improper payments are defined by the GAO as those that should not have been made or were made in the incorrect amount. The two most common causes: failure of agencies to determine whether a recipient should receive the payment, and information access restrictions that prevent verification that a payment is proper. While this might seem easy to remedy and be an easy source of savings, there are some caveats:

- *New investment.* The systems required to prevent improper payments in advance are more sophisticated and costly than the systems required to identify and estimate them *after the fact*
- *Federal vs state/local.* Some Federal programs are implemented locally by states where any improper payment reductions would have to take place
- *Audits.* To reduce improper payments to Earned Income Tax recipients, the IRS would need to perform mass audits of low-income families, which could be very politically unpopular; and require more resources

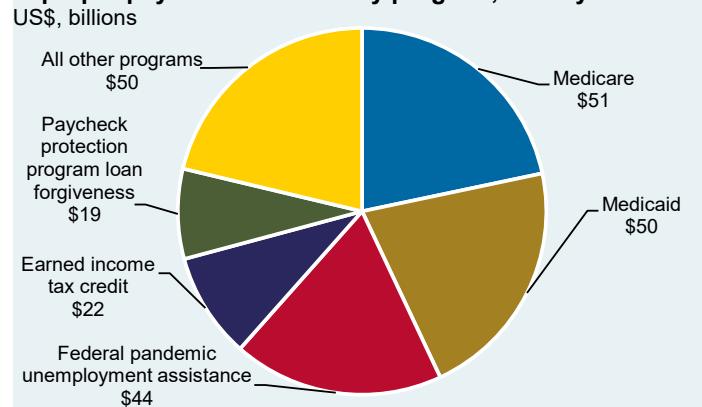
My contacts in DC including at the Committee for a Responsible Federal Budget don't have enormous confidence in the process used to create these estimates; and also believe that a 10%-20% reduction in improper payments would be a huge achievement.

GAO estimates of improper payments by agencies



Source: US Government Accountability Office, March 2024

Improper payment estimates by program, fiscal year 2023



Source: US Government Accountability Office, March 2024

The bottom line for DOGE:

- There are savings to be had from reversing Biden executive actions but they wouldn't count towards DOGE targets for reducing current spending
- Non-defense discretionary spending has already been cut, and is at its lowest level in decades
- Entitlements are a political third rail, as DOGE billionaires are now finding out
- SEC, DOL, Education and EPA staff is very small at less than 2% of all Federal workers
- Expanding weight loss drug coverage may offset DOGE savings elsewhere
- Impounding or redirecting Congressionally appropriated spending will face judicial challenges
- Most defense spending is people and operations rather than weapons procurements
- Concentration of defense contractors makes it difficult to cut procurement costs
- Reducing improper/fraudulent payments will take substantial investment in systems and people

Vaya con Dios, DOGE Quixote!

²⁴ "Improper Payments: Information on Agencies Fiscal Year 2023 Estimates", GAO, March 26, 2024

China: the liquidity trap and the Thucydides trap

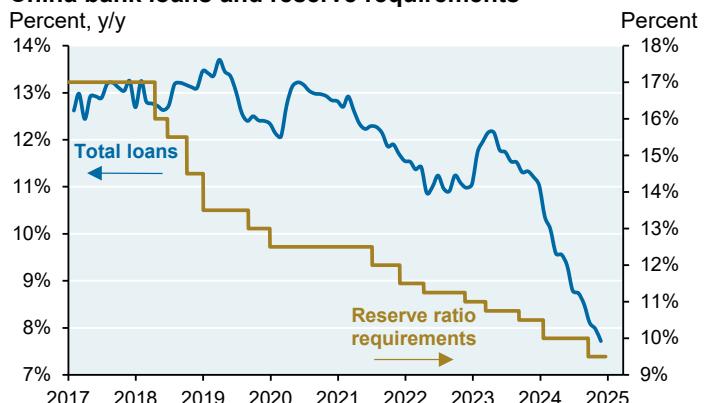
China is experiencing some kind of liquidity trap: money supply growth is declining; despite cutting bank reserve requirements, loan demand is falling; interest rates are plummeting; and there's no sign of a bottom yet in residential real estate. Barclays actually reported that China has surpassed Japan on its Japanification Index²⁵, which measures actual vs real growth, natural real rates of interest, real interest rates, nominal interest rates and deflation. That explains the aggressive stimulus program China announced last year. Bridgewater estimates that current and future expected stimulus in China will offset roughly half of the ongoing drag in Chinese economic conditions.

China's M2 money supply



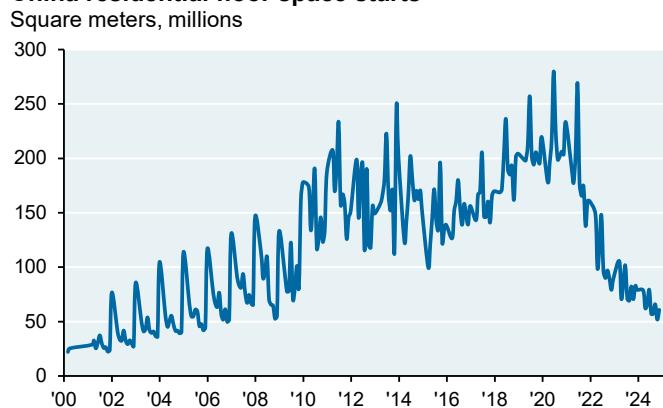
Source: Bloomberg, JPMAM, November 30, 2024

China bank loans and reserve requirements



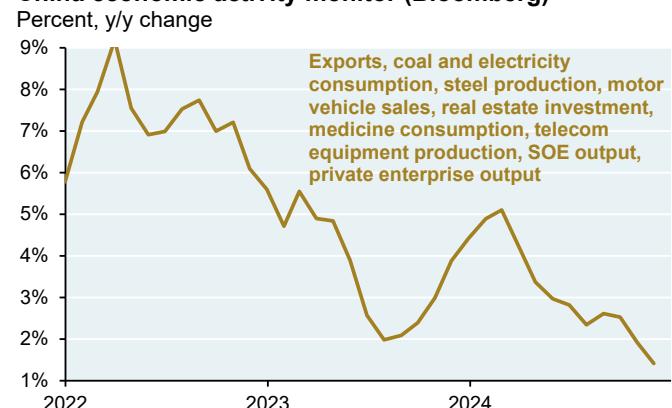
Source: Bloomberg, JPMAM, December 27, 2024

China residential floor space starts



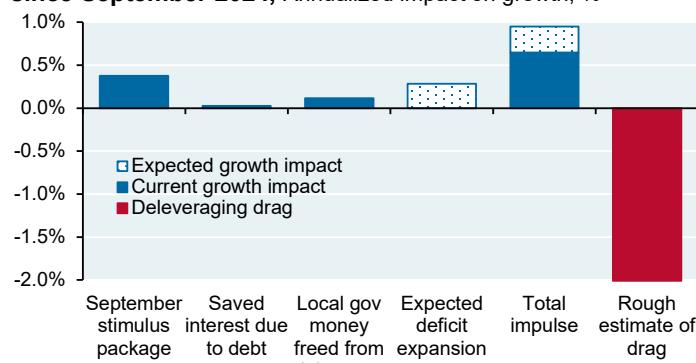
Source: Bloomberg, JPMAM, November 30, 2024

China economic activity monitor (Bloomberg)



Source: Bloomberg, November 30, 2024

Impact on growth of major policies China has announced since September 2024, Annualized impact on growth, %



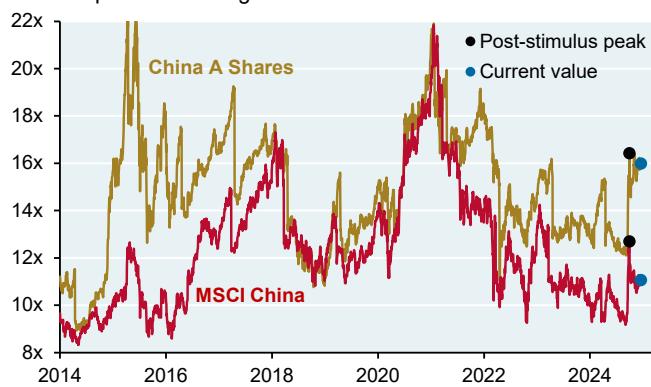
Source: Bridgewater, November 2024

²⁵ "Is China having its 'big bazooka' moment?", Barclays, November 2024

The stimulus plan gave a large boost to Chinese equities when it was announced. Onshore China A shares soared and have retained most of their gains so far, while the MSCI China Index has given back roughly half of its initial gains. I believe that China intends to follow through with monetary and fiscal stimulus commitments, if for no other reason that it may seek to dampen the impact of whatever tariffs the US imposes. Even before the stimulus was announced, Chinese bank stocks had been recovering from rock bottom valuations.

China equity valuations

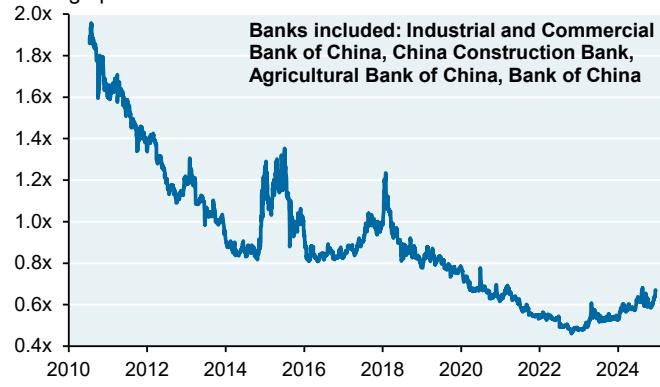
Forward price-to-earnings ratio



Source: Bloomberg, JPMAM, December 27, 2024

Chinese bank valuations

Average price to book ratio



Source: Bloomberg, JPMAM, December 27, 2024

China's equity alphabet soup

MSCI China: A/H/B shares, Red Chips, P Chips and ADRs

A shares: incorporated in China, trading on Shanghai and Shenzhen exchanges, accessible through Stock Connect

H shares: large/mid caps incorporated in China, listing in HK

B shares: incorporated in China trading on the Shanghai and Shenzhen exchanges in foreign currency

Red Chips: large/mid cap Chinese companies incorporated outside China, listed on HK exchange; generally SOEs

P Chips: same as Red Chips, not state-owned

ADRs: trading on NYSE/NASDAQ

However, as I explained last October²⁶, investors in China have to deal not only with a liquidity trap but also with a Thucydides Trap. The latter refers to the ongoing political tensions between the US and China which have been exacerbated by intensification of Chinese espionage. I have listed some excerpts from our October piece below but just to keep you updated on how ridiculous this is getting, on December 30th 2024 the US Treasury disclosed that a Chinese “state sponsored actor” hacked into classified documents at the Treasury, breaking into a system regrettably called “BeyondTrust”²⁷.

Here are excerpts from October’s piece on the rising frequency and severity of Chinese espionage:

- In 2024, the FBI revealed that a Chinese state-linked firm hacked 260,000 internet-connected cameras, routers and other devices; systems the US government uses for court-authorized network wiretapping requests; and the US Office of Personnel Management database (sensitive information obtained during high level government security clearances, exposing 22 million current and former officials to extortion)
- Chinese “Volt Typhoon” hackers have hijacked hundreds of routers and used them to infiltrate US transport, telecom, water and electricity networks, and Chinese cargo cranes used at US ports have embedded technology that could allow Beijing to secretly control them. FBI Director Wray: “China’s hackers are positioning on US infrastructure in preparation to wreak havoc and cause real-world harm to American citizens and communities, if and when China decides the time has come to strike”

²⁶ “The Thucydides Trap on the China Equity Trade”, Eye on the Market, October 17, 2024. The citations above from our October piece were obtained from public sources including Foreign Policy, NPR, WSJ, Wired, BBC, CSIS, Georgetown Security Review and the US Congressional Committee on Oversight and Accountability

²⁷ “China hacked Treasury Department in Major Breach”, NYT, December 30, 2024

- Also from Wray: China has made economic espionage a central component of its national strategy, has a bigger hacking program than that of every other major nation combined, and has stolen more of Americans' personal and corporate data than every nation combined
- Chinese cyberattacks now target virtually every sector: healthcare, financial services, defense, energy, government facilities, chemicals, automotive, aerospace, communications, IT (including managed service providers), international trade, education, video gaming, faith-based organizations and law firms
- Between 1987 and 2021, at least 162 Chinese scientists that had worked at Los Alamos (home to US military R&D on hypersonics, deep-earth penetrating warheads, unmanned autonomous vehicles and submarine noise reduction) returned to China to support its own military R&D
- Many Chinese airpower systems share similarities with US platforms such as the F-16, F-22 and F-35 fighters, the MQ-9 Reaper drone and the C-17 Globemaster III. Beyond aircraft, China has also stolen information on the Patriot missile system, the Littoral Combat Ship, nanotechnology, directed energy systems, space surveillance telescopes, tactical data links and drone video systems, all of which Chinese hackers reached through networks of private defense companies working with the Pentagon
- Since 2000, China has been associated with 90 cyber espionage campaigns, 30% more than Russia. The actual number is likely higher and each instance sees multiple businesses targeted that overlap priority industries specified in China's "Made in China 2025" plan
- At a recent gathering of US, UK, Australia Canada and New Zealand security chiefs, the head of the UK MI5 stated that China has been engaging in sustained espionage on "an epic scale", contacting over 20,000 UK individuals online including those at companies linked to military supply chains
- According to Harvard historian Calder Walton, Chinese businesses are required to work with its intelligence services when requested; these intelligence services are now "effectively silent partners in Chinese commerce with the outside world". Even Chinese companies that are not state-owned enterprises are in practice subject to laws that compel them to provide open access and information to the Chinese government. Foreign companies in JVs are required to allow Communist Party cells to be established inside them, enabling theft of technology, IP and data through the worldwide reach of the company's networks

While Trump might not ratchet US tariffs on China to maximum levels, I find it difficult to believe that a rapprochement between the US and China will occur anytime soon. Instead, frictions related to trade, foreign direct investment and rare earth metals may continue. As one example, after US officials visited Taiwan last November, TSMC notified its advanced AI chip customers in China that it would no longer produce 7 nanometer or lower chips for them²⁸. Since 70% of TSMC sales go to US buyers, the US tariff threat is substantial. This all follows the discovery last October that advanced TSMC chips were still found in Huawei Ascend 910B processors.

If so, such frictions may result in an effective cap on MSCI China equity multiples somewhere around 12x; the days of 14x-16x multiples on China equities may be a thing of the past.

MSCI China valuations

Forward price-to-earnings ratio



²⁸ "US ordered TSMC to halt shipments to China of chips used in AI applications", Reuters, November 10, 2024

Dr. Seuss Goes to Europe**I do not like them near the Seine, or in the forest of Ardennes...****Labor productivity based on output**

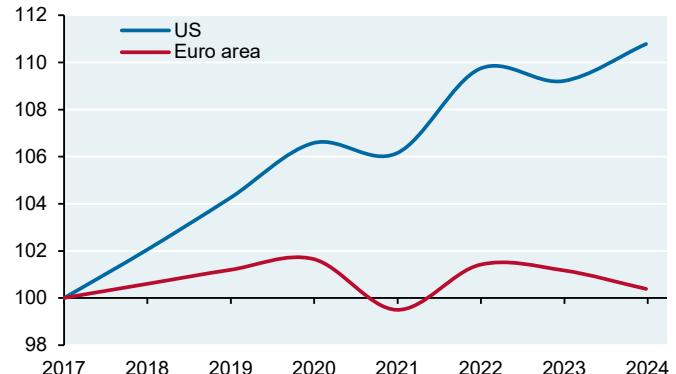
Index (100 = 12/31/2016)



Source: BLS, EU Statistical Office, Bloomberg, JPMAM, September 2024

Labor productivity based on employee compensation

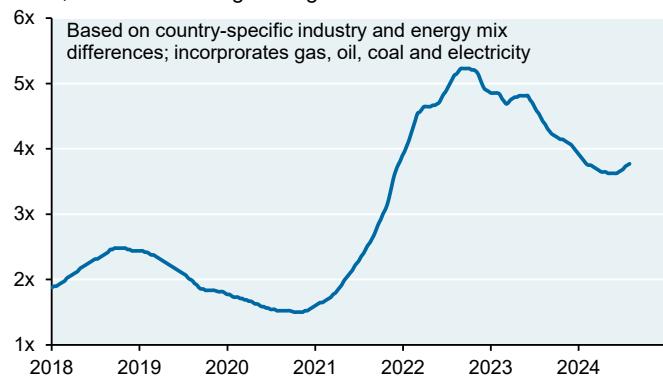
Index (100 = 12/31/2016)



Source: BEA, European Commission, Bloomberg, JPMAM, 2024

I do not like them near Alsace, or Boulevard de Montparnasse²⁹ ...**Energy prices in the Euro area relative to the US**

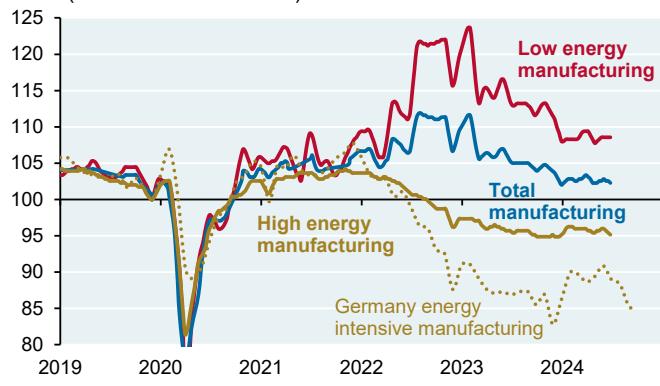
Ratio, 12 month moving average



Source: ECB Monetary Policy Report, 2024

European manufacturing output by energy intensity

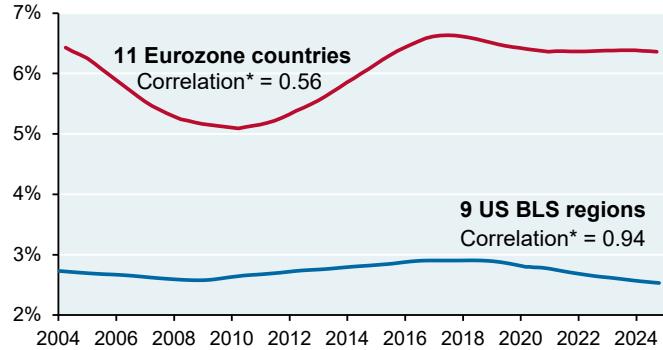
Index (100 = December 2019)



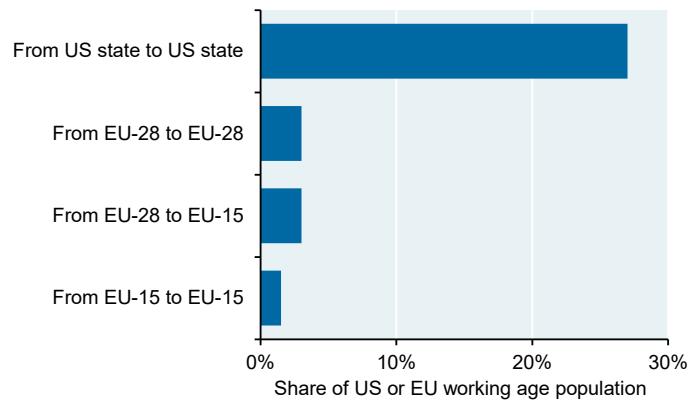
Source: ECB, German Federal Statistical Office, October 2024

Not anywhere near Neuschwanstein, or in a boat atop the Rhine...**One-size-fits-all policy not well suited for Eurozone**

Standard deviation of business cycle proxy (employment to population ratio) across countries/regions



Source: OECD, BLS, JPMAM, October 2024. *Avg pairwise correlation

Labor mobility, US vs Europe

Source: IZA Journal of Migration, 2016

²⁹ **Green Regs and Hamburg.** The new EU Corporate Sustainability Due Diligence Directive requires large companies operating in the EU to comply with its rules on carbon emissions and labor/human rights or face EU fines as high as 5% of the company's global revenues. Qatar has already threatened to halt all LNG exports to the EU if it is fined under the new law. I'm sure this is all going to work out fine for Europe.

Not at the Baths of Caracalla, or at Teatro alla Scala...

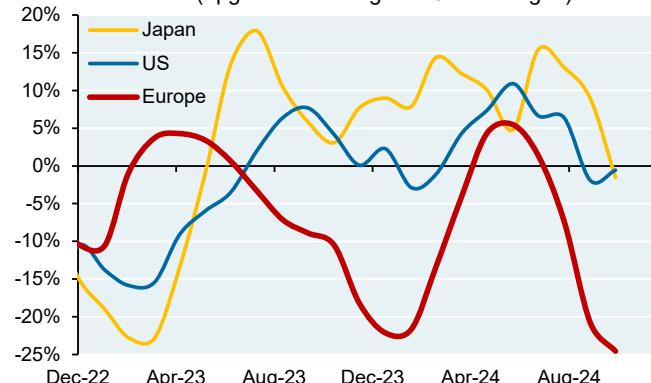
Other than healthcare, US ROE and ROA higher than Europe across sectors

	Return on Assets		Return on Equity	
	US	Europe	US	Europe
Consumer Staples	7.2	4.4	24.7	13.3
Consumer Discretionary	7.8	4.4	30.0	11.8
Technology	12.6	5.8	28.9	11.4
Healthcare	4.4	6.3	12.7	15.1
Communication Services	7.2	2.0	17.8	6.9
Financials	1.4	0.7	12.9	12.5
Industrials	6.6	4.9	23.2	16.5
Real Estate	3.0	-1.8	7.2	-4.7

Source: Bloomberg, JPMAM, December 27, 2024

3 month earnings revisions trend

Net EPS revisions (upgrades - downgrades/no. changes)



Source: Datastream, JPMAM, October 2024

Not on my way to Salamanca, which isn't far from Casablanca...**Decomposition of US equity outperformance vs Europe since 2009**

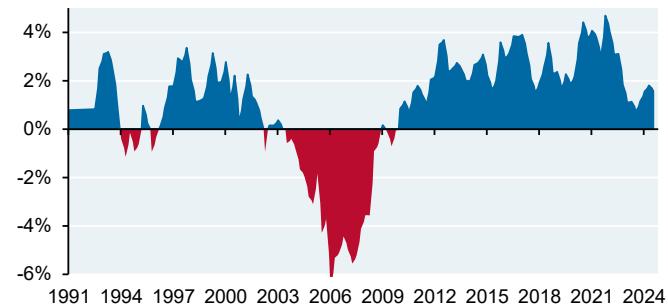
Total return index (100 = Dec 2009)



Source: Bloomberg, JPMAM, December 27, 2024

Not even at Trafalgar Square...I do not like them anywhere**Overweight US, underweight Europe**

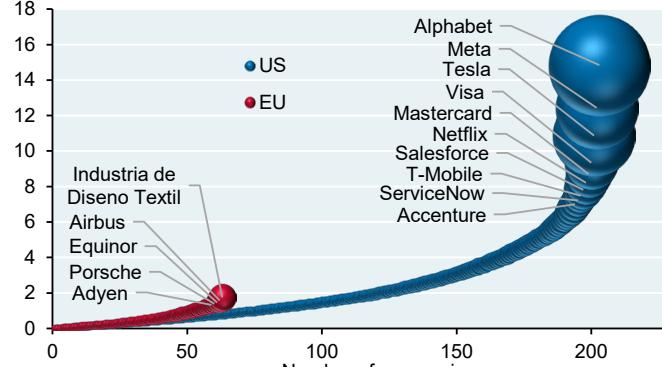
3-year rolling out (under) performance vs MSCI All World Index



Source: Bloomberg, JPMAM. September 2024. All equity portfolio, rebalanced quarterly. O/W US by 10%; U/W EUR by -10%; Assumes no currency hedging. Past performance is not indicative of future results

Creation of new public companies in the 21st century

Cumulative market cap in trillions of US\$



Source: Bloomberg, JPMAM, December 17, 2024

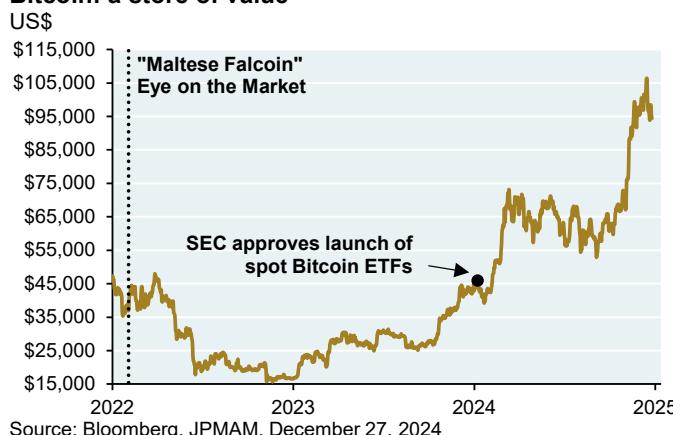
The crypto Presidency: on the crypto rally and the sky-high return on political donations

In February 2022, I wrote a skeptical piece on crypto called “The Maltese Falcoin”. To be clear, I am not qualified to opine on crypto legal issues (is it a security or commodity, who should regulate it), or its societal benefits and drawbacks (facilitation of criminal activity). I only focused on crypto’s merits as an investment. In the piece, I expressed doubt on the Bitcoin store of value thesis and expressed skepticism regarding decentralized finance and transactions-focused coins like Ripple, Stellar, Monero and Litecoin. Given the rally in many crypto assets, it’s a good time to see what I got right and what I got wrong. Short answer: wrong on Bitcoin; mostly right about Decentralized Finance and Transactions-focused coins, at least until the November 2024 election after which all crypto assets began to soar.

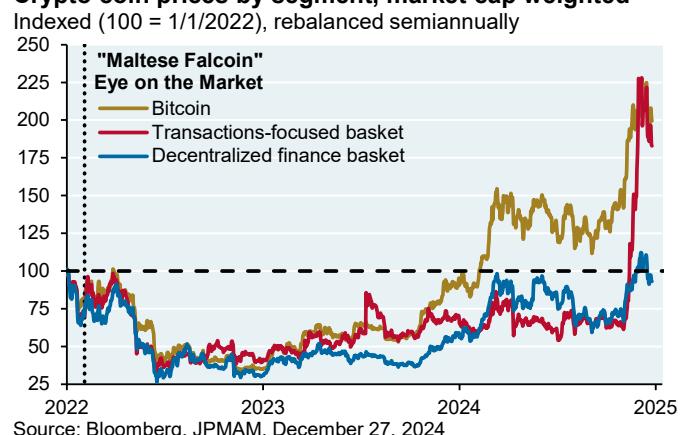
Crypto adoption. When I wrote the piece, there were ~320 million crypto account holders; that number has risen to ~560 million. Retail owners (less than 1 BTC) have risen from 6.8% of ownership in 2020 to 9.5%.

Bitcoin: digital assets as a store of value. Bitcoin fell by 65% after I wrote the piece but has rebounded to 2.6x its February 2022 value. At the end of The Maltese Falcoin, I wrote that I would take another look if Bitcoin plummeted. After a 65% decline by early 2023 I should have done exactly that, but I didn’t. After the SEC approved spot Bitcoin ETFs in January 2024, nine were launched and already had \$16 billion of inflows by the end of February and \$4 billion in average daily trading volume by March. The day after the November 2024 election, US Bitcoin ETFs received over \$600 mm of inflows, one of the highest days on record.

Bitcoin: a store of value

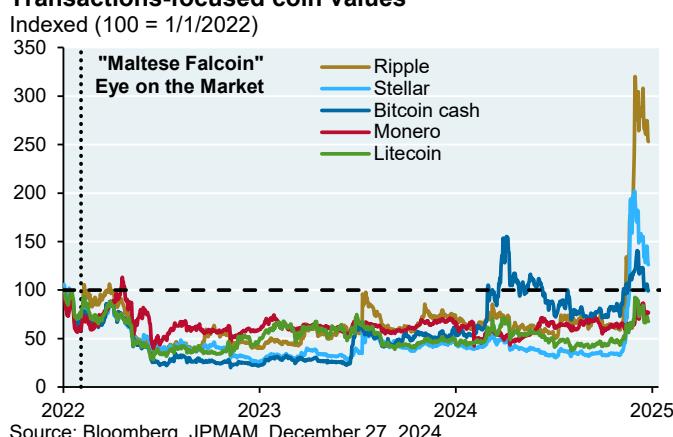


Crypto coin prices by segment, market cap weighted

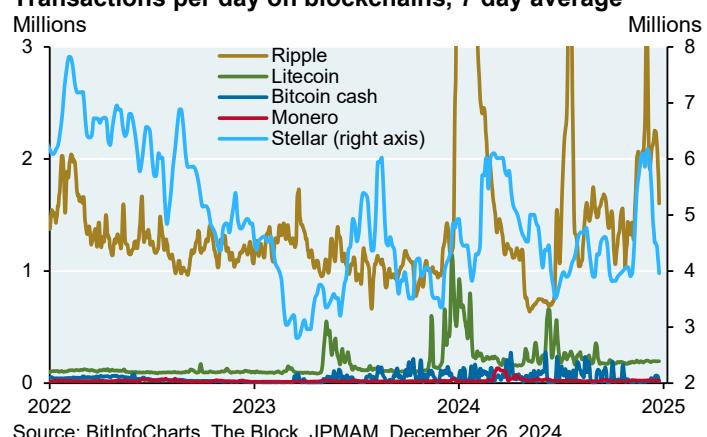


Transactions-focused coins. After the Maltese Falcoin piece, most transactions-focused coins fell sharply and stayed there for almost three years. After Trump was elected, transactions-focused coin values rose sharply, particularly Ripple. **If their value proposition is increased utilization, I don’t see it:** as shown, most volumes haven’t changed much since 2022. As a result, recent gains appear highly speculative, at least so far.

Transactions-focused coin values



Transactions per day on blockchains, 7 day average



Is Ripple rallying since it has one of the fastest execution times at just 4 seconds? I doubt it; the best explanation might be the departure of its critics at the SEC. Transactions-focused coin volumes may continue to flatline due to competition from stablecoins, which due to their mostly collateralized nature are not directional crypto investments per se. There are interesting questions about stablecoin economics as regulation is harmonized across borders, and as rate declines reduce yield arbitrage from stablecoin collateral. I still get the sense that stablecoins are used more for crypto trading than for cross-border remittances. While the cost of sending money on blockchains is generally lower than bank or Western Union payment rails, remittance recipients in developing countries that convert back into local currency often incur similar all-in costs.

Decentralized finance. This category refers to activities that disintermediate financial services by migrating them to permission-less blockchains. One way to measure the uptake of DeFi is to look at “total value locked”, which is the amount of crypto collateral deposited in DeFi applications. It’s imperfect due to double counting and leverage, but it’s a decent proxy for DeFi activity.

I wrote in 2022 that most DeFi lending seems associated with overcollateralized loans to other holders of crypto, so that those holders can either buy more crypto or obtain liquidity against appreciated crypto holdings without incurring capital gains taxes. As a result, should crypto prices decline, DeFi activity would presumably collapse as well given the circularity. Well, that’s exactly what happened during the 2022-2023 collapse and the subsequent recovery: crypto prices and total value locked in move in tandem, as shown below.

Nothing has changed about this dynamic as far as I can tell: DeFi activity is still linked to the level of crypto prices. In other words, I don’t see evidence of a thriving DeFi market that is immune from crypto prices in which people execute leases, mortgages, derivatives and other contracts. Since 2022, prices for DeFi coins collapsed and then recovered to early 2022 values, while Tron soared as it now rivals Ethereum as the largest stablecoin trading platform. Note how the number of Ethereum daily contracts is back to roughly the same level as early 2022.

Decentralized Finance coin values

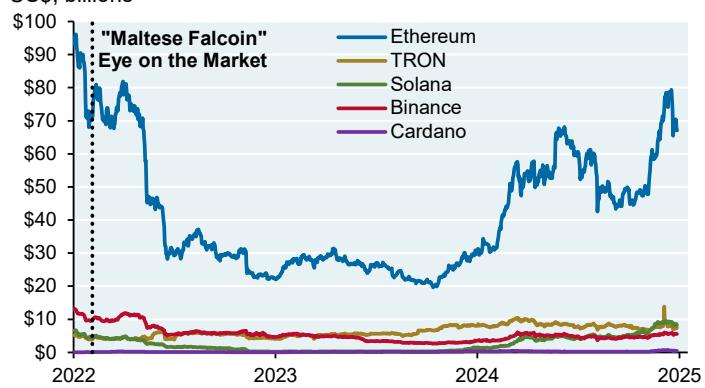
Indexed (100 = 1/1/2022)



Source: Bloomberg, JPMAM, December 27, 2024

Total value locked in DeFi platforms

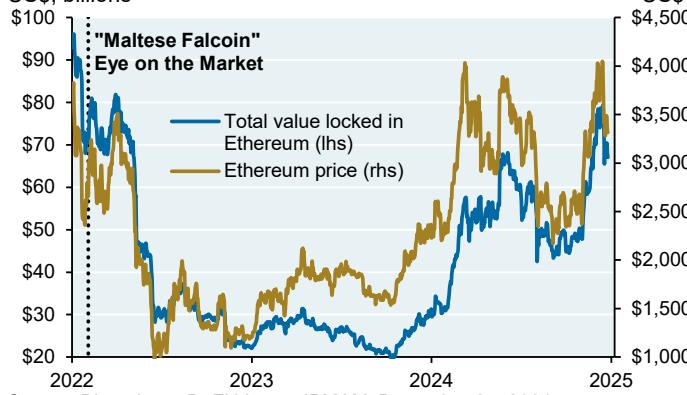
US\$, billions



Source: DeFi Llama, JPMAM, December 27, 2024

Ethereum price vs total value locked in

US\$, billions



Source: Bloomberg, DeFi Llama, JPMAM, December 27, 2024

Ethereum daily verified contracts

Total verified contracts per day, 7 day avg



Source: Etherscan, JPMAM, December 27, 2024