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US EQUITY VIEWS

AI capex, required revenues, and what's priced in the AI trade

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Outlook for AI capex: The largest US AI hyperscalers are on track to spend $800 billion in capex in 2026 and consensus expects $1.1 trillion in spending in 2027. Our baseline forecast is that capex spending will increase in 2027 and surpass consensus estimates but the rate of both capex growth and upside surprises will diminish relative to recent quarters.

What capex signals about required AI revenues: Based on average annual capex in 2026 and 2027, our equity analysts estimate that the hyperscalers need to generate annual AI revenues of roughly $300 billion in the next few years to break even on their investments. Hyperscaler cloud revenues have accelerated sharply this year, annualizing roughly $70 billion above the pre-AI trend in Q2 2026, and announced revenue backlogs exceed $1.5 trillion.

What required AI revenues signal about enterprise and consumer AI spending: We estimate that AI users would need to spend roughly $1 trillion annually on AI applications in order for the hyperscalers to generate solid returns on investment and the application layer to generate strong profit margins on their compute expenses. This compares with roughly $1.5 trillion in global software spending in 2026 and $1.8 trillion in potential annual US labor productivity gains that our economists estimate will eventually accrue to capital. However, not all of these productivity gains will necessarily accrue to the infrastructure and application layers. AI-related revenues and capex needs would be substantially larger accounting for physical AI or the potential emergence of AGI.

What the AI infrastructure trade is pricing: Many market participants are skeptical about the durability of AI infrastructure stock earnings, and that view is at least partially reflected in market pricing. At current share prices, earnings among some semiconductor stocks would have to decline substantially for the groups to trade in line with their historical average P/E multiples. The hyperscalers also trade at low earnings multiples, and the combination of increasing signs of ROI and the likelihood of decelerating capex growth should be supportive for these stocks.

The AI trade outside of the infrastructure layer: We expect the application layer will remain a source of return dispersion, as reflected by the recent outperformance of data infrastructure and cybersecurity stocks and underperformance of "consumer inertia" stocks. Enterprise adoption is still in early stages but the recent acceleration in enterprise AI spending suggests the impact of AI on corporate earnings should become increasingly visible in coming quarters. Nonetheless, current market-implied long-term growth expectations are only slightly above historical averages.

Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to www.gs.com/research/hedge.html.

An update on AI and US equities

Both stocks and investor views relating to the AI trade have been exceptionally volatile during the last few months. Most of the volatility has been concentrated in the AI infrastructure complex, but the latest earnings season also drove sharp moves in the hyperscalers and among software stocks.

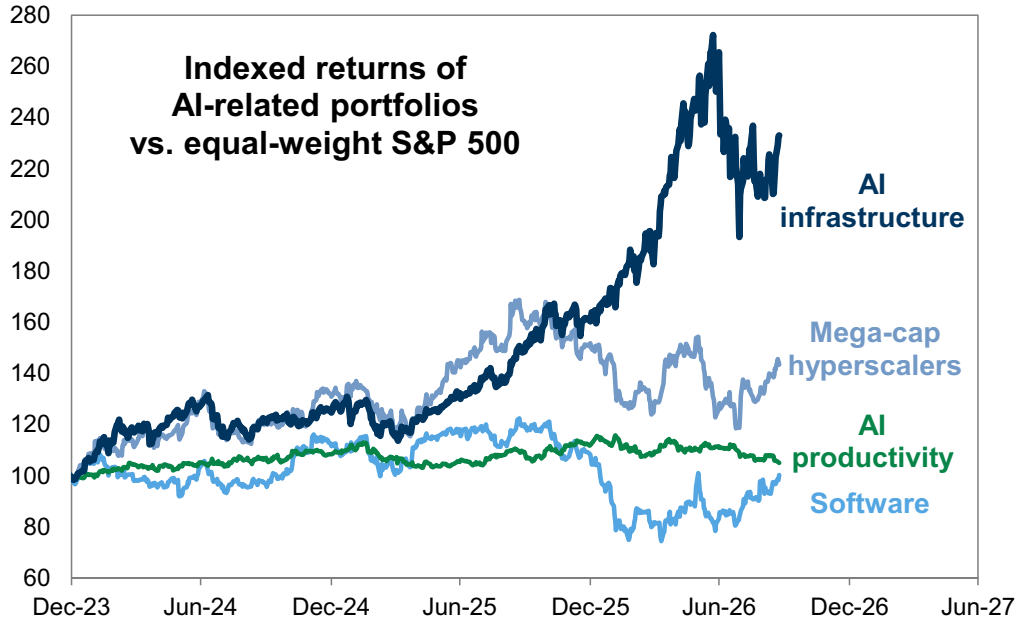
Below we address three of the most common AI-related questions we have received from clients in recent weeks:

1. What is the outlook for AI capex?

2. What revenues are required to generate a sufficient return on recent AI investments?

3. What outlook for AI is the equity market pricing?

Exhibit 1: Performance of the phases of the AI trade



"AI infrastructure" = GSCBAIP2, "Mega-cap hyperscalers" = AMZN, GOOGL, META, MSFT, ORCL, "Software" = IGV, "AI productivity" = GSXUPROD. Baskets developed by GBM.

Source: Goldman Sachs Global Investment Research

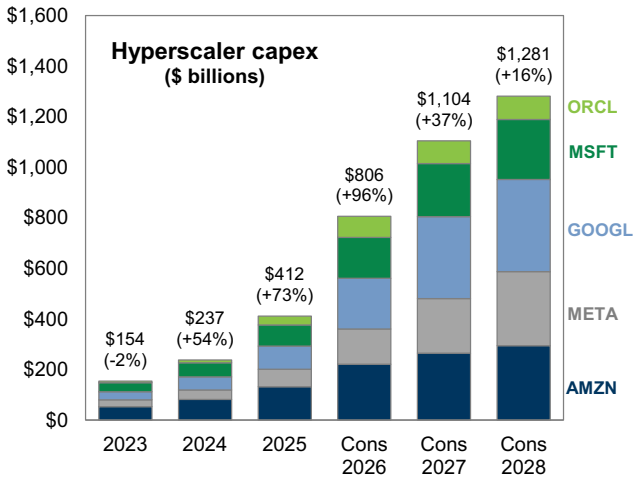
1. What is the outlook for AI capex?

The largest US hyperscalers are on track to spend $800 billion in capex in 2026 and consensus estimates imply they will spend $1.1 trillion in 2027. Consensus 2027 capex estimates have been revised higher by $175 billion since the start of the Q2 earnings season. Commentary from the hyperscalers during earnings season described a supply-constrained environment and large revenue backlogs, and these factors are driving the companies to tap both debt and equity markets to support additional investment spending. Based on consensus estimates, capex in 2027 is on track to reach a

larger share of GDP than any technological investment cycle since the railroad build-out in the late 1800's.

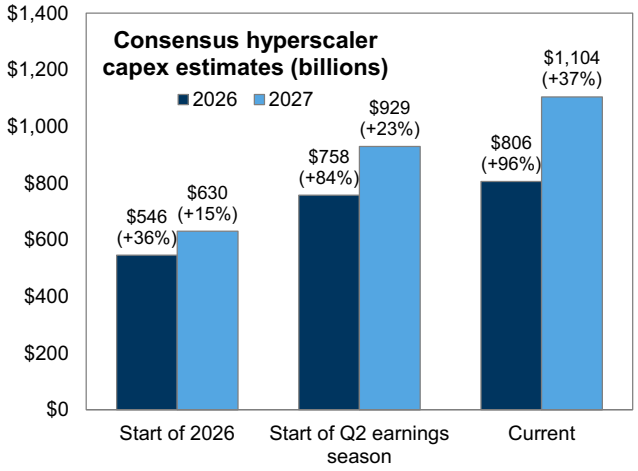
Our baseline forecast is that hyperscaler capex spending will increase substantially in 2027 but that the rate of both capex growth and upside surprises to consensus estimates will diminish relative to recent quarters. GS equity analysts estimate that hyperscaler capex will register $1.2 trillion in 2027 and $1.4 trillion in 2028. Their estimates are $130 billion and $100 billion above the consensus estimates, respectively, but nonetheless imply a deceleration in capex growth from nearly 100% in 2026 to 54% in 2027 and 12% in 2028.

Exhibit 2: Consensus hyperscaler capex estimates



Source: FactSet, Goldman Sachs Global Investment Research

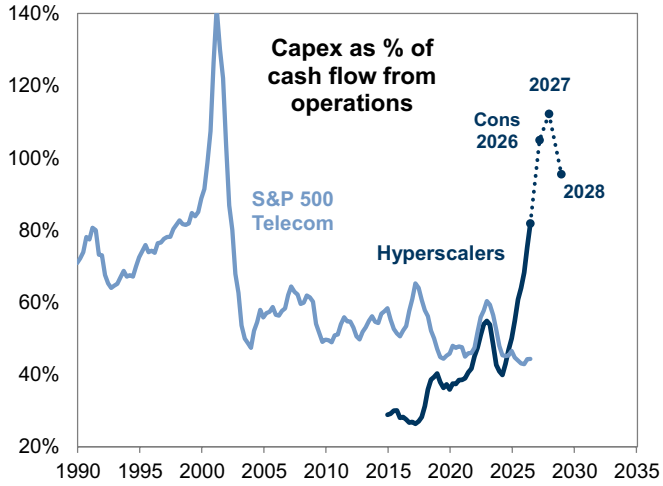
Exhibit 3: Capex estimates have been revised higher



Source: FactSet, Goldman Sachs Global Investment Research

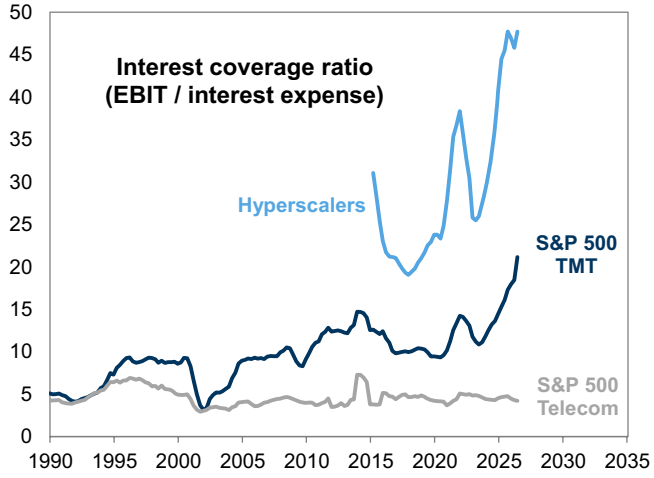
The need for external financing and potential supply bottlenecks will likely constrain the rate of capex growth next year. Hyperscaler capex spending now exceeds cash flow from operations, which means large further growth will increasingly need funding via debt and equity issuance. While hyperscalers have added leverage, their balance sheets do not appear to be a binding constraint and their interest coverage ratios remain extremely healthy. Our credit strategists instead point to concentration in the investment grade market as the more relevant bottleneck, which will require additional funding from private credit and equity issuance. Potential government restrictions on data center construction or an intentional slowdown in frontier model roll-out could also act as potential constraints on spending, as could shortages of labor, power, memory, or other inputs. Constraints on capex represent a risk to the near-term earnings of AI infrastructure beneficiaries, but could help ease investor concerns about overbuilding.

Exhibit 4: Hyperscaler capex expected to surpass cash flows from operations this year



Source: FactSet, Goldman Sachs Global Investment Research

Exhibit 5: Interest coverage ratios remain extremely healthy versus history

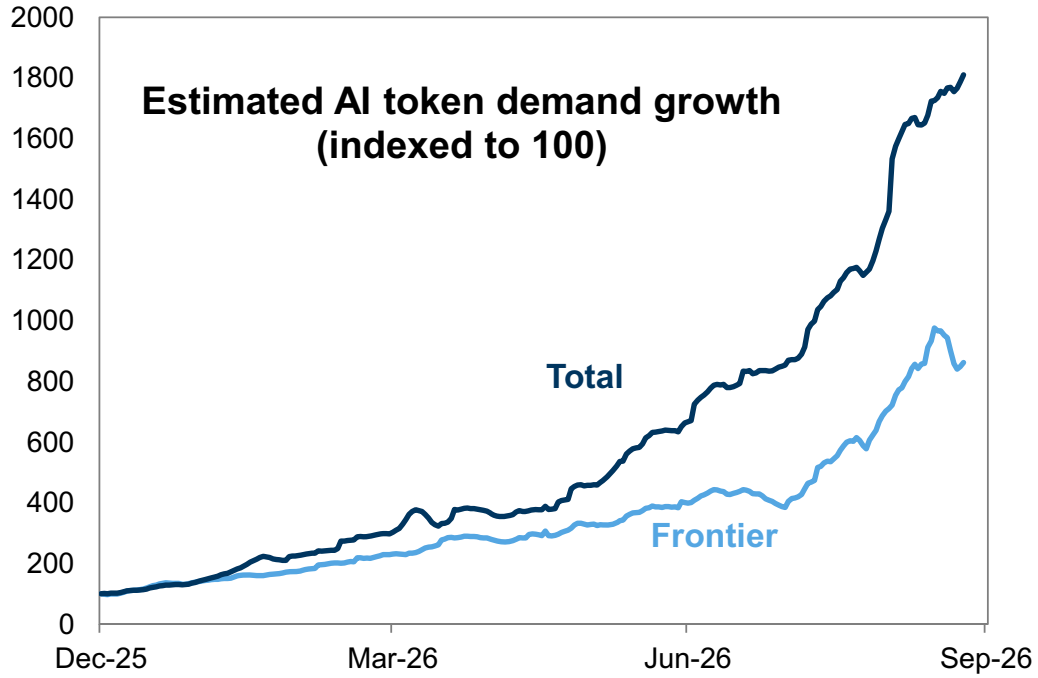


Source: Compustat, Goldman Sachs Global Investment Research

Going forward, token demand growth will need to outpace declining token prices to support continued growth in investment spending. Frontier models are currently a key source of demand for hyperscaler compute. However, the rise of competitive open-source models has contributed to a decline in average token prices. Measures of frontier token demand slowed in July, simultaneous with sell-offs of many AI infrastructure stocks, but accelerated again in August.

For most AI infrastructure companies, decelerating AI investment spending suggests decelerating EPS growth. AI infrastructure companies, and semis in particular, have been the clearest beneficiaries of the capex surge. Continued upward revisions to consensus 2027 capex estimates should support continued positive revisions to consensus 2027 EPS estimates for many AI infrastructure stocks, but the magnitude of revisions will likely diminish relative to what occurred in H1 2026.

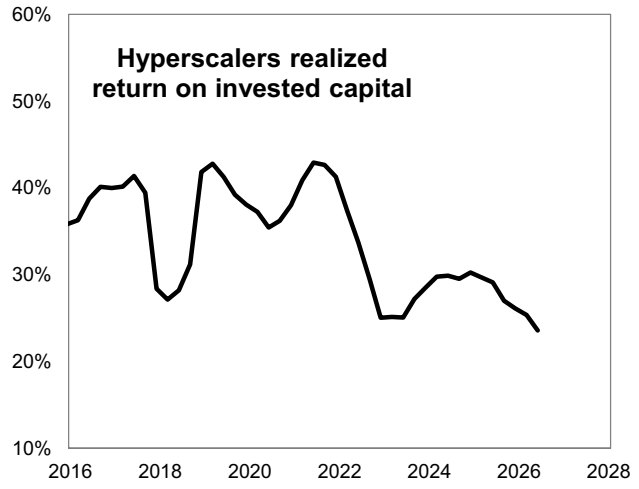
Exhibit 6: Estimated token demand growth
lines represent equal-weighted averages of growth implied by Anera and OpenRouter data



Source: Anera, OpenRouter, Goldman Sachs Global Investment Research

2. What revenues are required to generate a return on AI investments?
Our equity analysts estimate that the hyperscalers would need to generate annual AI revenues of roughly $300 billion in the next few years to break even on their average annual capex investments in 2026 and 2027. These estimates reflect their expectations for average annual AI capex in 2026 and 2027 for the US hyperscalers, including AMZN, GOOGL, META, MSFT, ORCL, and SPCX. The breakeven revenues required for this capex represent the sum of annual depreciation and operating expenses. Exhibit 8 provides an estimated sensitivity of required AI revenues the hyperscalers must generate in different return on invested capital ("ROIC") scenarios. These required revenue estimates are anchored on average annual capex in 2026 and 2027 and would argue for even larger estimates based on cumulative capex.

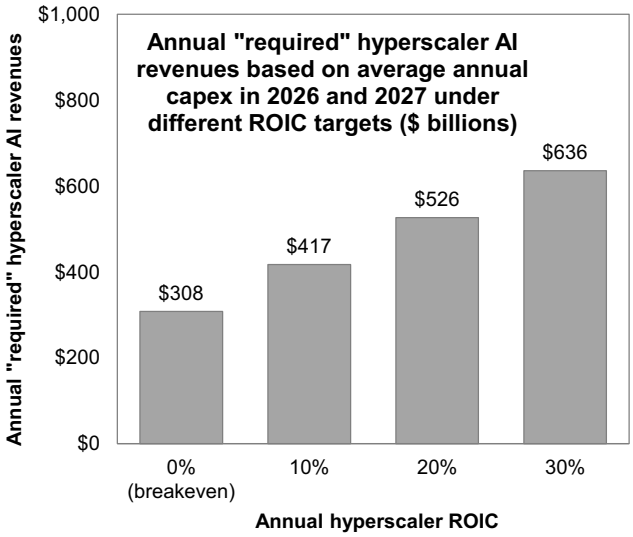
Exhibit 7: Realized hyperscaler return on invested capital has declined from 40% to 25%



Hyperscalers include AMZN, GOOGL, META, MSFT, ORCL. ROIC = (EBIT less taxes) / (equity plus debt less cash).

Source: Compustat, Goldman Sachs Global Investment Research

Exhibit 8: Sensitivity of annual "required" hyperscaler AI revenues to ROIC assumption

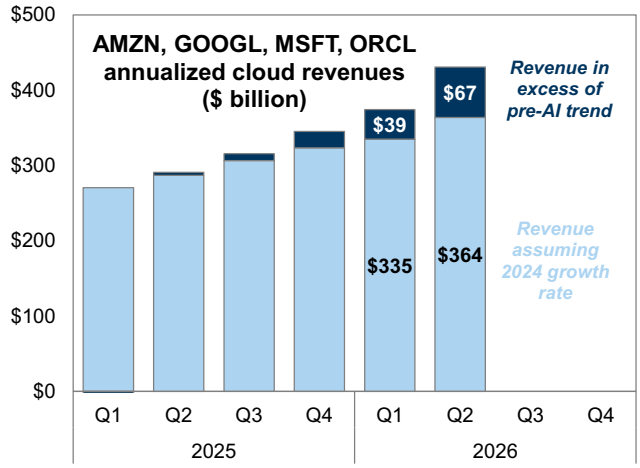


Hyperscalers include AMZN, GOOGL, META, MSFT, ORCL, and SPCX. "Required" AI revenues equal the sum of the estimated annual depreciation, annual operating expenses, and return on invested capital using gross capex, based on GS estimate of average annual AI capex in 2026 and 2027. See Sizing the AI Economy Needed to Justify ROIC on Hyperscaler AI Capex for more details.

Source: Goldman Sachs Global Investment Research

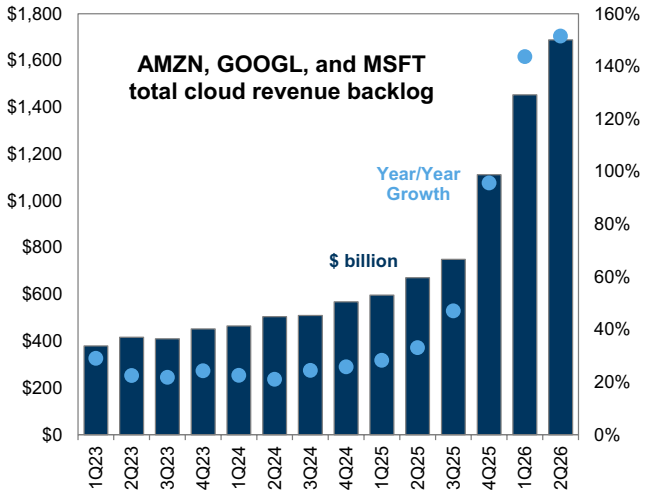
The hyperscalers' current estimated AI revenues remain below the amount that would allow them to break even on their capex, but those revenues are growing quickly and revenue backlogs are sizable. The hyperscalers have started to monetize their AI investments. Year/year cloud revenue growth for AMZN, GOOGL, MSFT, and ORCL has accelerated from 25% in 2024 to 48% in Q2 2026. In dollar terms, annualized cloud revenues in excess of their 2024 growth rate registered nearly $70 billion in Q2 and have been roughly doubling during the past few quarters. The three major US public cloud companies (AMZN, GOOGL, MSFT) have also announced a combined revenue backlog of $1.7 trillion, which provides line of sight into these companies' ability to meet required revenue targets.

Exhibit 9: Sizing cloud revenues in excess of 2024 realized growth rate



Source: Goldman Sachs Global Investment Research

Exhibit 10: The large public US cloud providers have announced sizable backlogs



Source: Goldman Sachs Global Investment Research

The magnitude of capex in 2026 and 2027 points to even larger "required" annual revenues in the next few years for the "application layer" of companies buying much of that compute from the hyperscalers. These revenues reflect the additional costs and profit margins of application companies on top of the "required" hyperscaler revenues selling compute. EBIT margins for large-cap software companies have averaged 40% during the past five years. We utilize EBIT margins rather than gross margins to include the costs of both training and inference, and assume additional expenses alongside compute. The range of potential required revenues is wide depending on which companies constitute the application layer and how their costs are structured.

Exhibit 11 provides a range of potential "required" revenues based on hyperscaler ROIC and application layer EBIT margins. For example, the application layer would have to generate over $1 trillion in annual revenues if those companies had a 30% EBIT margin and the hyperscalers generated a 10%-20% return on invested capital.

The "required" application layer revenues that would justify current capex are large but potentially achievable. For example, estimates of global advertising and software spending each equal roughly $1.5 trillion in 2026. Our economists estimate that total annual AI US labor productivity gains that will potentially accrue to capital total roughly $1.8 trillion. However, not all of these gains will necessarily accrue to the infrastructure and application layer companies. In addition, another year of strong capex growth in 2028 would raise the hurdle further. AI-related revenues and capex needs would be substantially larger accounting for physical AI or the potential emergence of AGI.

Exhibit 11: Sizing "required" revenues for the application layer

Annual "required" application layer revenues based on cumulative AI capex in 2026 and 2027 ($ billions)

Hyperscaler ROIC	Application layer EBIT margin			
	10%	20%	30%	40%
0%	$425	$475	$525	$625
10%	725	825	925	1,050
20%	1,050	1,150	1,300	1,500
30%	1,350	1,500	1,675	1,925

Based on GS equity analysts' estimates for cumulative AI capex for the hyperscalers in 2026 and 2027. "Required" application revenue assumes compute represents 75% of application layer operating expenses. EBIT margin not applied to META required revenues.

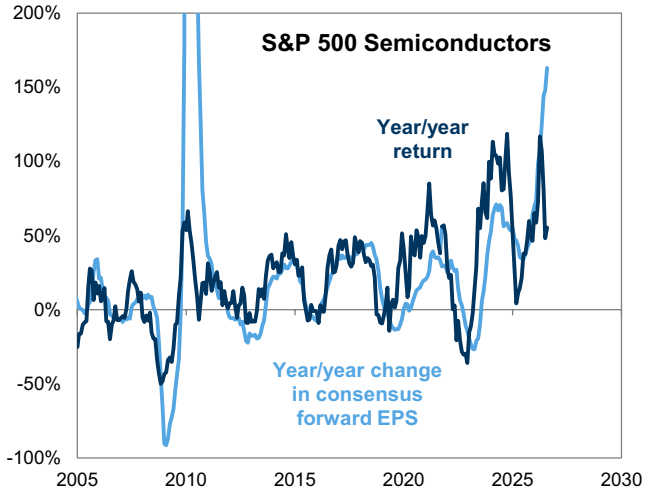
Source: Goldman Sachs Global Investment Research

3. What outlook for AI is the equity market pricing?

While market participants express skepticism about the durability of AI infrastructure stocks' earnings growth, that view is at least partially priced. The median AI infrastructure stock has de-rated from 32x consensus forward earnings in April 2026 to 22x today. In addition to tracking standard P/E multiples, comparing recent changes in market cap to recent changes in earnings can signal how long the market expects current earnings strength to persist. Among various AI infrastructure baskets, that ratio remains most elevated among optical networking, electrical grid, and liquid cooling stocks while expectations appear most conservative among semiconductors and utilities.

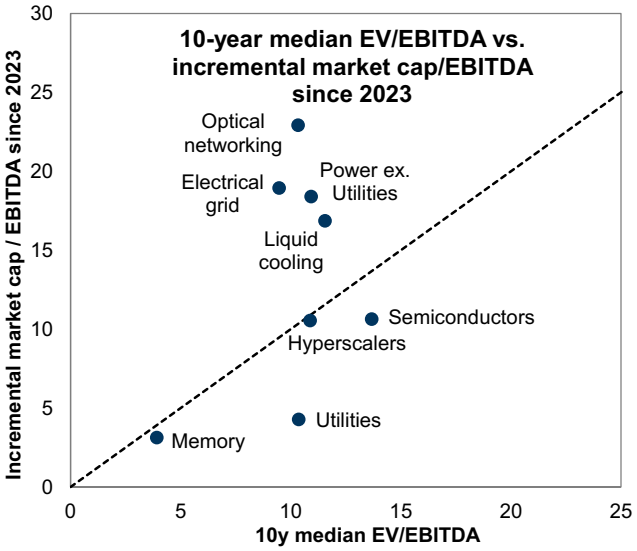
Semiconductor valuations appear to embed particularly skeptical views regarding the sustainability of current earnings strength. Valuations have declined sharply among Semis stocks, which is typical among cyclical companies with strong near-term growth but uncertain medium-term growth. We believe the investment opportunity is more compelling in fabless chip stocks than in memory stocks. Our equity analysts are Buy-rated on NVDA and AVGO but Neutral-rated on MU.

Exhibit 12: Semiconductor returns have decoupled from earnings



Source: FactSet, Goldman Sachs Global Investment Research

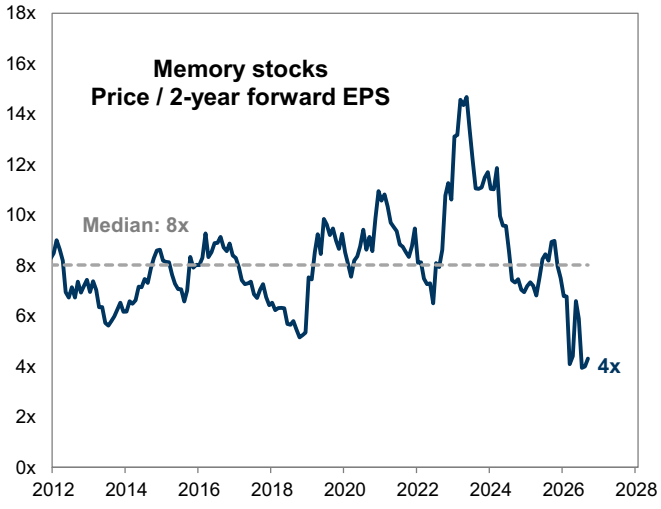
Exhibit 13: Expectations for earnings durability appear more conservative among Semis and Utilities



Source: FactSet, Goldman Sachs Global Investment Research

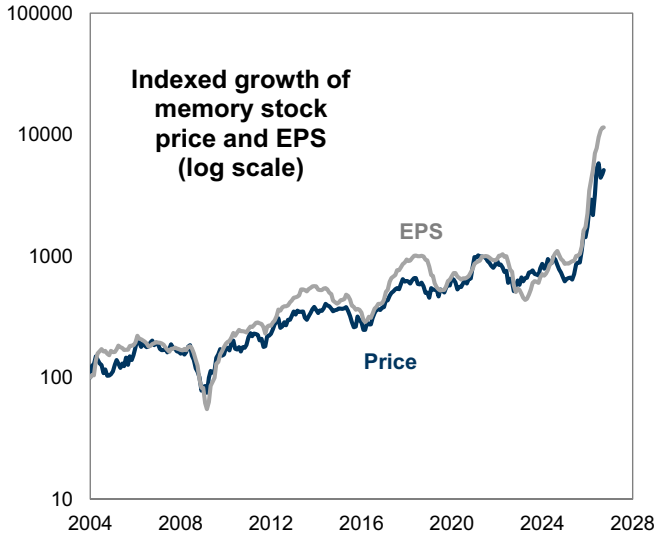
Memory stock prices imply earnings will decline in coming years, but the degree of pessimism does not appear particularly extreme relative to past cycles. Memory stocks currently trade at a 2-year forward P/E of 4x, half their 15-year average, but Memory firms currently enjoy gross margins of roughly 80%, more than double their historical average. To bring the current P/E of memory stocks to its 15-year average, earnings in coming years would need to decline by roughly 50%. While this decline is large in absolute terms, memory is a cyclical industry and has experienced larger EPS declines, including outright negative earnings, during previous cycles. This pricing will prove too pessimistic if 2028 forecasts are realized, but many investors have expressed skepticism about rotating back into higher beta pockets of the infrastructure trade as capex growth begins to normalize.

Exhibit 14: P/E of memory stocks
Memory represents US dollar-weighted combination of MU, SK Hynix, and Samsung



Source: FactSet, Goldman Sachs Global Investment Research

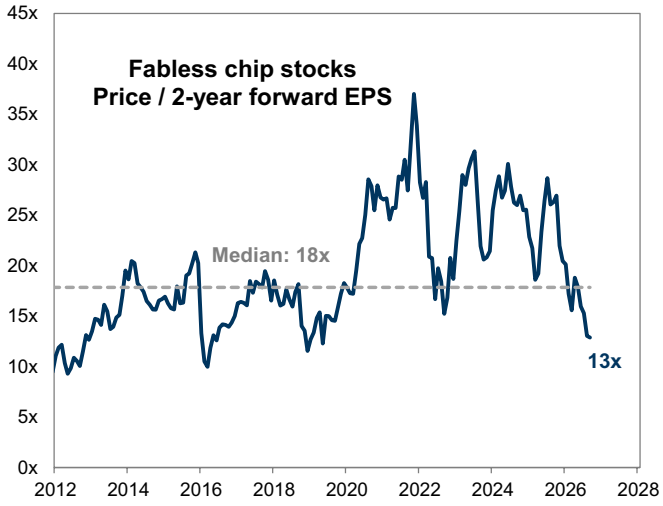
Exhibit 15: Price vs. EPS of memory stocks
Memory represents US dollar-weighted combination of Micron, SK Hynix, and Samsung; gray reflects consensus estimates



Source: FactSet, Goldman Sachs Global Investment Research

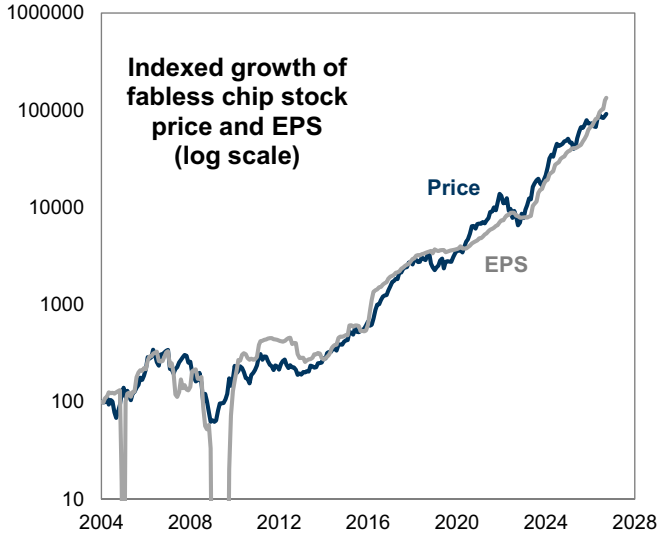
In contrast, the fabless chip stocks also trade at discounted valuations but have had less extreme margin expansion. Margins for the largest fabless chip stocks are only modestly above their historical average. Earnings in the next few years would need to decline by about 10% to bring the P/E back to its historical average. This is similar to the magnitude of historical realized cyclical earnings declines for the group.

Exhibit 16: P/E of largest fabless chip stocks
Fabless chip stocks represents dollar-weighted combination of NVDA, AVGO, AMD



Source: FactSet, Goldman Sachs Global Investment Research

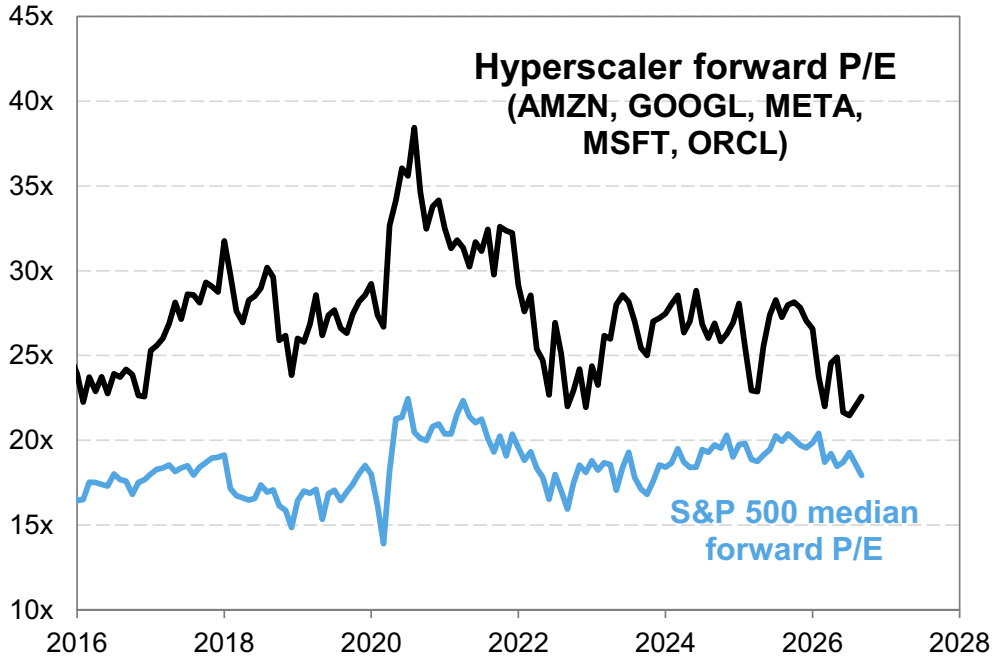
Exhibit 17: Price vs. EPS of fabless chip stocks
Fabless chip stocks represents dollar-weighted combination of NVDA, AVGO, AMD



Source: FactSet, Goldman Sachs Global Investment Research

The likelihood of decelerating capex growth should be a positive catalyst for the hyperscalers. We previously laid out three conditions for the hyperscalers to regain leadership. These include decelerating macroeconomic growth, demonstrated monetization of AI investment, and decelerating capex growth. Our economists believe US economic growth is no longer accelerating. The hyperscalers have already started to demonstrate signs of monetization, and we expect capex growth will slow in 2027. Uncertainty about the length, magnitude, and return on investment for this capex cycle will likely persist. However, the hyperscalers have de-rated to their lowest P/E multiples in over a decade, and the group now trades just four turns above the median S&P 500 company, its smallest premium on record. While investors have recently been focused more on the hyperscalers' negative free cash flows than on their earnings, visibility into improving FCF as revenues accelerate and capex decelerates should be supportive for the stocks.

Exhibit 18: Hyperscaler valuations have de-rated to lowest level in 10 years

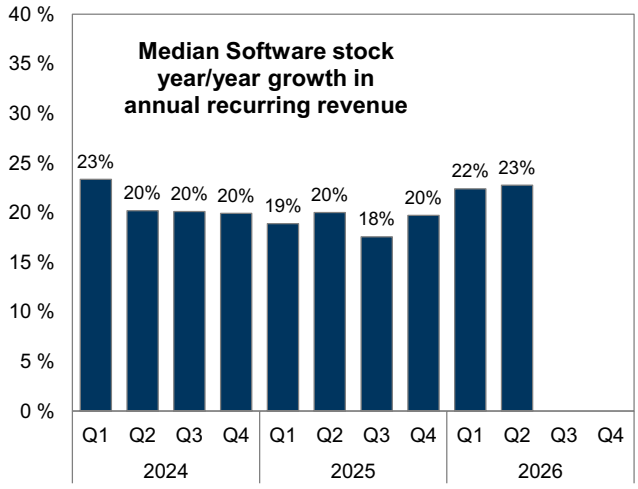


Source: Goldman Sachs Global Investment Research

We expect the progression of the AI trade towards application roll-out will remain a source of return dispersion. We believe the "winners" and "losers" from the application layer will take several quarters to play out, as AI applications get built and adoption broadens.

The threat of disruption had weighed on the share prices of many Software stocks earlier this year, but the group has rebounded sharply in recent weeks. Reported Software fundamentals have shown little sign of AI disruption, with annual recurring revenue growth for the median stock in GS analyst coverage accelerating slightly in recent quarters. A group of Software stocks has rallied by 45% and is now within 8% of its high reached in late 2025. Software stocks focused on IT infrastructure and cybersecurity have posted the strongest returns, while enterprise management software remain below their previous highs.

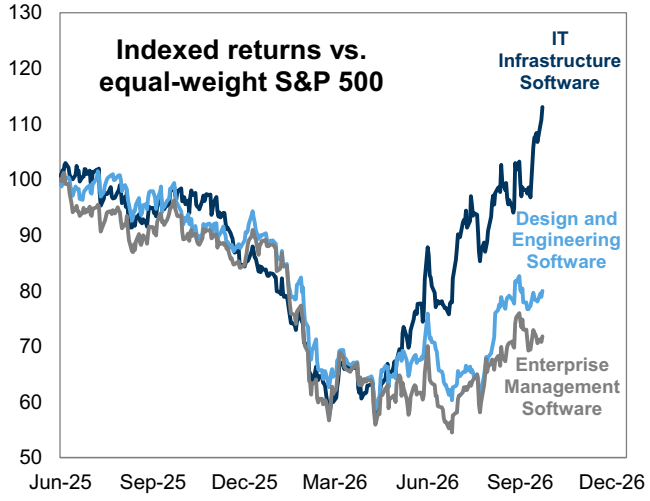
Exhibit 19: Software ARR has accelerated in recent quarters



Source: Goldman Sachs Global Investment Research

Exhibit 20: Within Software, IT infrastructure stocks have fared best

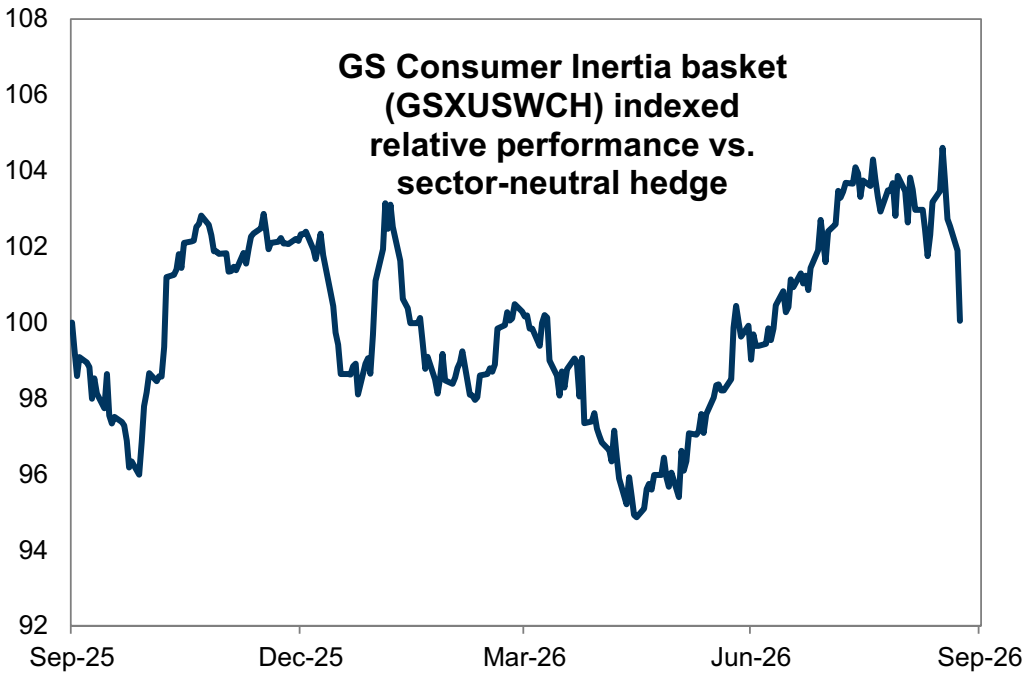
based on RBICS classifications



Source: FactSet, Goldman Sachs Global Investment Research

Consumer-facing businesses with high switching costs have also recently emerged as a potential area of disruption. The increasing use of agents, including by new consumer-facing tools such as Muse, may disrupt the business models of some consumer firms. Our colleagues in Global Banking & Markets developed a basket of "consumer inertia" stocks (GSXUSWCH) where user stickiness is driven more by effort required to take action rather than product differentiation. The basket includes insurance, telecom, travel, subscriptions, marketplaces, and fintech. The basket has lagged a sector-neutral hedge by 5 pp since mid-September.

Exhibit 21: Stocks with "consumer inertia" have underperformed recently

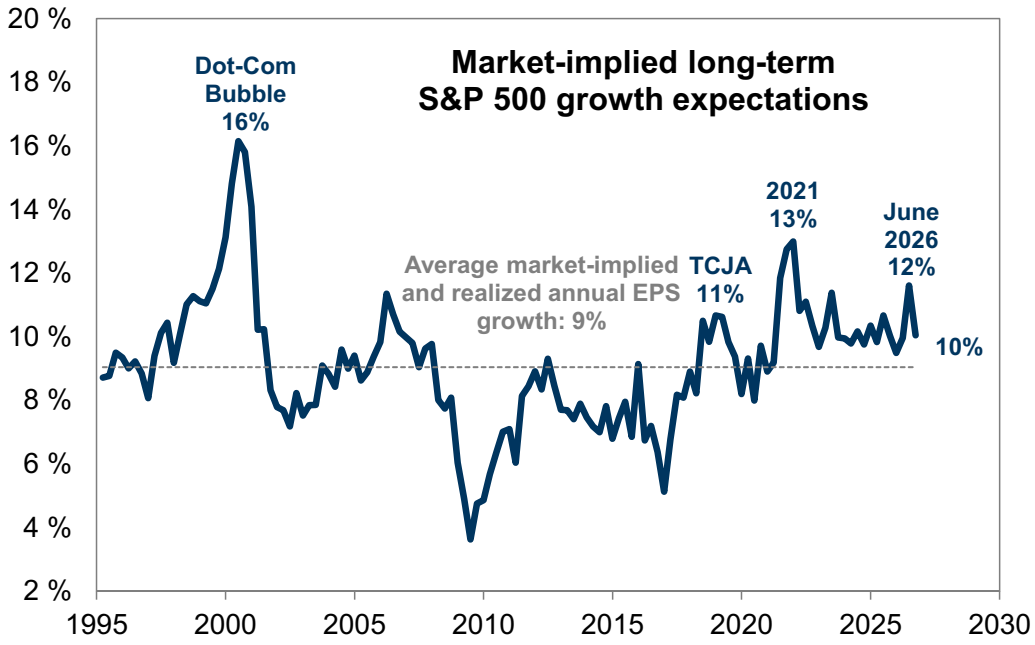


Source: Goldman Sachs Global Investment Research

Enterprise AI adoption remains in early stages but spending has recently accelerated, suggesting the impact of AI on corporate earnings should grow increasingly visible in coming quarters. The Census Bureau survey suggests that 40% of large US firms are using AI in the production of goods and services. Our analysis of Q2 earnings commentary suggests roughly 50% of S&P 500 companies are using AI in the context of productivity, but very few companies have quantified the productivity uplift today. However, the revenue run rates of model providers and alternative measures of company spending on AI have accelerated during the last several months alongside the increasing use of agentic harnesses.

In contrast with past periods of market exuberance, the equity market today does not appear to be pricing expectations of widespread productivity gains. Baskets of AI productivity beneficiaries have traded roughly sideways on a relative basis YTD, matching the trajectory of near-term forward EPS estimates. Similarly, the measure of market-implied long-term growth expectations in Exhibit 22 is only slightly above the historical average (for details, see US Equity Views: The next phases of the AI trade).

Exhibit 22: Market-implied long-term growth expectations are relatively contained



Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Ryan Hammond, Ben Snider, Daniel Chavez, Kartik Jayachandran and Christophe Sung, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

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