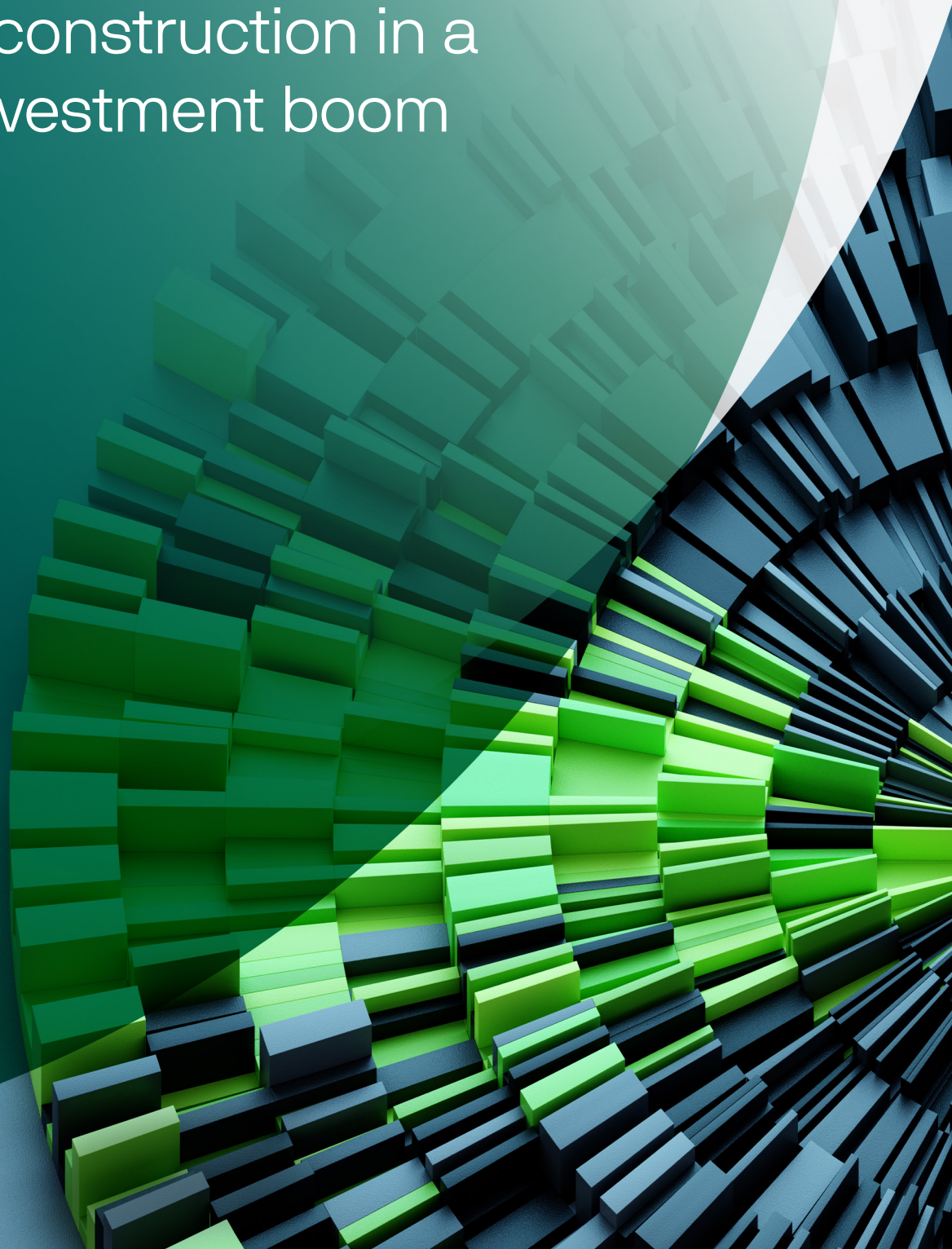


Strategic Investment Advisory Group

AI-conscious asset allocation: Portfolio construction in a capital investment boom



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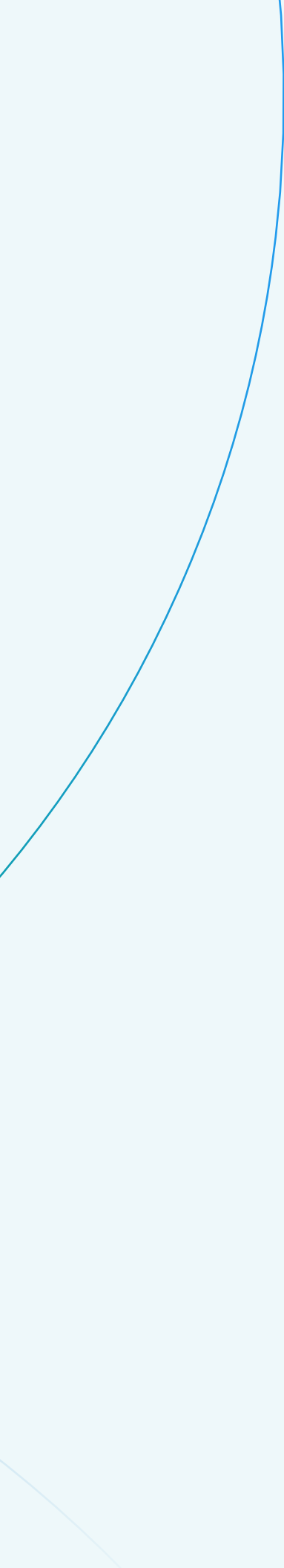


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George Gatch
CEO
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Foreword

The artificial intelligence (AI) boom is moving more rapidly than any previous technology-focused capital investment surge. Asset allocators face an old challenge with a new twist: **Harnessing AI's extraordinary investment potential while maintaining appropriate levels of portfolio risk diversification.**

In "AI-conscious asset allocation," our Strategic Investment Advisory Group (SIAG) gathers perspectives from many of J.P. Morgan Asset Management's top investors and strategists to provide a coherent framework for investing in the AI boom.

Investors will need to estimate both the degree of AI risk within specific asset classes and investment strategies, and the total exposure across the full allocation. Understanding the shifting AI ecosystem will require both tactical flexibility and strategic discipline.

Broadly, we suggest three constructive avenues to an AI-conscious asset allocation strategy.

- 1 Lean into core AI technology with a targeted, active approach to public and private equity investing.
- 2 Use the full allocation to spread out AI returns and risks across asset classes.
- 3 Reconsider past assumptions about portfolio risk diversification.

We underscore the power of an active approach and, in particular, a fundamental valuation framework. AI investments have thus far been characterized by positive correlation and momentum. Going forward, we believe active managers will be able to identify entry points (and exit points) where the market price of a firm's shares does not fully reflect its fundamentals. Given a sufficiently long time horizon, this can create opportunities for outperformance.

I'd like to thank the deep team of SIAG contributors. The unique insights reflect the team's ability to bring together deep expertise and perspectives, across every investment sector and market themes, enabling us to help our clients achieve their long-term investment goals and build stronger portfolios.

As always, we hope you find these insights valuable.

A stylized, handwritten signature in white ink, appearing to read "Gatch".

Portfolio construction in a capital investment boom

In brief

- 1 The AI capital investment boom is progressing at an unprecedented pace and scale, with profound implications for asset allocators. Capturing the gains from AI while maintaining a flexible investment strategy and a prudent level of risk diversification will be a challenge.
- 2 History offers useful insights into the phases and outcomes associated with the widespread adoption of capital-intensive technological innovations. In nearly every case, disruption among early leaders proved common. The eventual outcome, however, diverged sharply: some industries endured a prolonged period of competition, failure and consolidation, while others quickly coalesced around a single dominant firm.
- 3 A unique feature of the AI boom is the presence of large, profitable firms with strong balance sheets willing to subsidize the costs of the build-out—through internal cash flow as well as debt and equity issuance. This strength is a double-edged sword: it insulates the boom from the failures and defaults that ended past cycles, but it may also sustain overinvestment long past the point of adequate returns. Whether these subsidies hold to the projected capex peak and beyond is a central question for investors in AI today.
- 4 The AI capital investment boom is highly concentrated in the U.S., and in particular with respect to “core” AI models and hyperscalers. China represents a parallel AI ecosystem that appears capable of challenging U.S. dominance in key areas. Elsewhere, developed and emerging economies will benefit both as suppliers to the AI build-out and ultimately as long-term beneficiaries of AI’s boundary-less productivity enhancement.
- 5 Traditional asset classes exhibit a spectrum of relative AI intensity, ranging from those with more concentrated and volatile exposures (e.g., U.S. public equity, venture capital and growth equity), to private funds with more selective and potentially lower volatility AI risks (e.g., private equity, private credit and infrastructure), and finally to more AI-defensive market sectors (e.g., core bonds and core real estate).
- 6 Broadly, we suggest three promising avenues to an AI-conscious asset allocation strategy. First, lean into core AI technology with a targeted, active approach to public and private equity investing. Second, use the full allocation to spread out AI returns and risks across asset classes. And third, increase allocations to asset classes that present a defensive stance towards key AI risks.

Introduction

Artificial intelligence (AI) has advanced to the point where its transformative impact on the global economy and broader society is no longer in doubt. And yet these are still early days. No one can be certain how this powerful new technology will evolve. Markets aren't waiting to see how the future plays out, however, and investors may feel as if they are simply being taken along for the ride. Asset allocation choices that were intended to establish portfolio diversification now exhibit an increasing alignment with AI.

By almost any measure, the current AI boom is larger in scale and advancing more rapidly than any previous technology-focused capital investment surge. For the past few years public and private capital have flowed toward a handful of leading AI developers and the broader ecosystem of chips, data centers and power suppliers that AI developers rely upon. Technology valuations and market concentration have risen to historic levels, implying a high degree of confidence in the success of today's AI market leaders. In contrast, companies and sectors deemed vulnerable to AI have lost significant value based on investors' similarly confident expectation of future disruption.

What might shake that confidence? Investors should pause to consider that the AI story—and the extraordinary investment opportunity it represents—may not follow a predictable narrative. In the following pages we examine the patterns of past capital investment booms, compare AI to these historical precedents, and assess different forms of AI exposures across asset classes.

History tells us that technology-driven capital investment booms often evolve in unexpected ways. Early leaders sometimes fade as their capital investments prove unsustainable, society often adapts to new technology in counterintuitive ways, and regulation and government intervention can play important roles in shaping the technology's future.

Looking back five or 10 years from now, how will investors judge their response to the AI boom? From today's vantage point, we see a need for both tactical flexibility and strategic discipline: Investment skill can identify opportunities and navigate volatility, while discipline in portfolio construction can avoid excessive risk concentrations.

More specifically, we offer investors three promising paths forward:

1

Lean into AI technology with a targeted, active approach to equity investing.

In the long-run, extreme market enthusiasm is a poor substitute for fundamental research, critical judgment and careful portfolio construction. AI will create significant winners and losers among both public and private firms, and identifying them is perhaps the critical challenge for investors. Current market conditions raise the risks for passive strategies; skilled active managers can take advantage by thoughtfully deploying capital to firms across the full AI ecosystem.

2

Use the full asset allocation to take advantage of AI's potential opportunities.

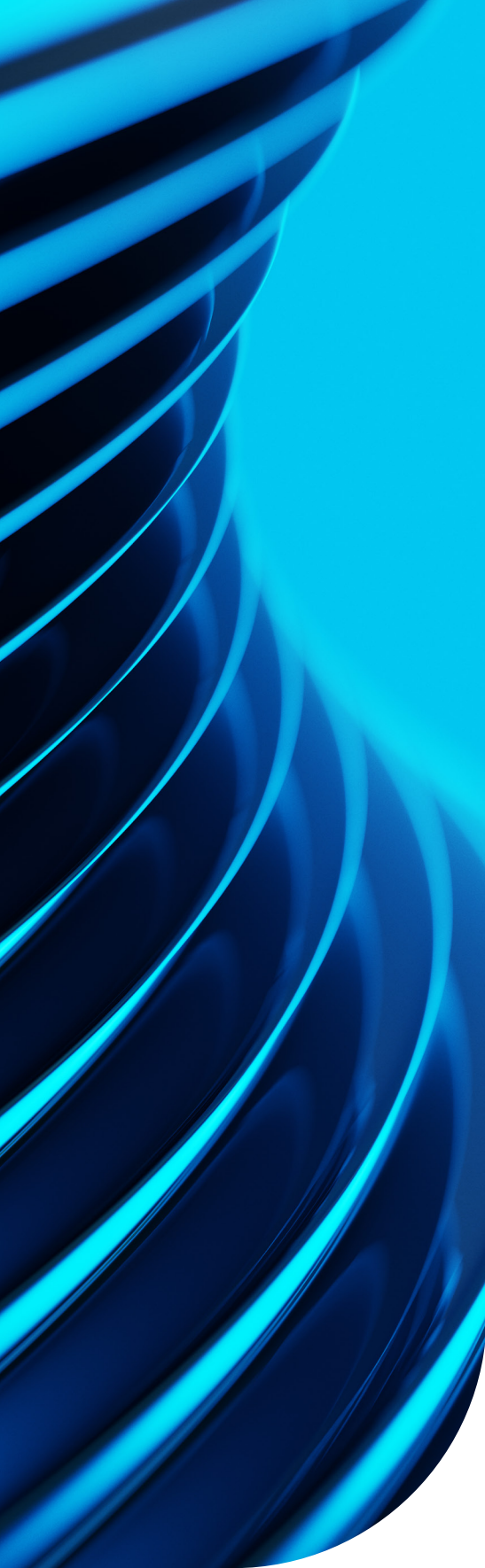
The scale and breadth of the AI boom allows allocators to spread out exposure without diminishing long-term potential gains. Across the asset allocation, capital can be deployed in alignment with the growth of AI over time: Active equity funds will own the public companies building and servicing AI, venture and growth equity funds will identify the next generation of AI leaders, public and private credit funds will lend to AI firms, and specialized real asset funds will finance data center construction and power delivery.

3

Revisit assumptions about portfolio diversification.

The sheer amount of capital being raised and deployed throughout the AI ecosystem may overwhelm traditional approaches to portfolio diversification. Direct exposure to AI-related businesses may be highest in U.S. equity allocations, but other asset classes have meaningful AI risk exposure and may tend to correlate more highly with one another. It will be increasingly important to identify suitably defensive low AI investments that counterbalance these risk concentrations. Stress-testing portfolios against specific AI scenarios (such as model commoditization, a pause in capital flows or barriers to data center capacity) can reveal the extent of the exposure.

Over the next few years, AI will become even more deeply ingrained in the markets, the broader economy and society at large. Exceptional investment opportunities will emerge, but also elevated valuations, extreme volatility and extensive disruption. Simply put, today's winners may not be tomorrow's winners across multiple realms—core AI firms, sectors and geographies.



1

The lessons of past capital investment booms

How can investors avoid flying blind in today's AI boom? Examining the origins, progressions and outcomes of past capital investment booms offers a useful perspective. Here, we dig into five historical case studies in which a transformative and highly capital-intensive technology was financed and deployed at scale.

They are (in roughly chronological order):

1. U.S. railroads in the middle of the 19th century
2. Telephone networks in the late 19th and early 20th centuries
3. The petroleum industry in the late 19th and early 20th centuries
4. Interstate highways from the 1950s to the 1990s
5. Fiber optics in the late 1990s and early 2000s

While the history of each boom is fascinating in its own right, investors should focus on a few common key attributes when looking for guidance in today's environment. The **Appendix** dives deeper into each of these historical booms.

These attributes include:

- **The breadth of the opportunity:** Here we consider the amount of legacy economic activity displaced by new technology, and the technology's capacity to improve growth and productivity. Displacement produces winners and losers, while improvements in growth and productivity emerge more slowly, but are often shared broadly across many sectors and firms.
- **The scale, source and duration of capital deployment:** All of the five historical examples we studied were highly capital intensive, but the source of capital—equity, debt or government subsidy—bears directly on the pace of deployment and the risks to which investors are exposed. Another critical element is how much ongoing capital expenditure is required to maintain and operate the assets over time.
- **The degree of competition among early providers to establish dominance:** Fierce competition tends to accelerate the deployment of new technology, while limiting the profitability of the firms that are raising and spending massive amounts of capital. Failures among early leaders are common, followed by a period of consolidation and greater stability. Third-party suppliers to technology firms ("picks and shovels") are often the key beneficiaries during the period of peak capital investment.
- **The potential for monopoly or regulated competition to emerge:** In situations where a single dominant firm establishes an effective monopoly, stable profits can sustain the high level of capital investment (both initially and on an ongoing basis). Regulators typically respond to a monopoly in one of two ways: Cementing the monopoly while limiting economic gains, or breaking up the monopoly to re-impose a degree of competition. A monopoly or highly regulated outcome usually has the negative side effect of reducing innovation.
- **The role of the private sector vs. the public sector:** With the exception of the interstate highway system, each of the booms we studied began among private enterprises, with risks borne by investors and stakeholders in the firms involved. Early enthusiasm and commercial momentum incentivized the rapid capital formation that allowed a boom to get started, though the momentum did not always last long enough to sustain it. In some instances, the government provided subsidies to encourage development (railroads are the prime example), which often encouraged overinvestment and unsustainable business models. In other cases, the government stepped in and imposed regulations to control the market power of monopolies (e.g., both telephones and petroleum).
- **A successful pivot to widespread adoption and productivity gains:** Sectors and regions that can access new technology will eventually benefit from higher productivity and growth. Often, the most valuable uses for new technology emerge well after its initial deployment, allowing second generation firms to move into dominant positions.

Common attributes of past capex booms are relevant today

EXHIBIT 1: KEY ELEMENTS OF HISTORICAL CAPITAL INVESTMENT BOOMS

	Railroad network	Telephone network	Petroleum refining and distribution	Interstate highway system	Fiber optic cable network
Timing	1830s to 1880s	1870s to 1930s	1860s to 1920s	1950s to 1990s	1990s to 2000s
Key industries displaced	• Horses • Carriages • Ships • Canals	• Mail • Telegraph	• Whaling • Transport (later)	• Railroads • Regional transit	• Copper wire • Telephone and cable networks
Level of intra-industry competition	Intense	Limited	Limited	None	Intense
Major failures among early leaders	Yes	No	No	No	Yes
Emergence of a monopoly and regulation	No	• AT&T monopoly • Break-up in the 1980s	• Standard Oil monopoly • Break-up in 1911	Federal/state ownership	No
Consolidation among key firms	Yes	Yes	Yes	No	Yes
High ongoing capital expenditures	Yes	Yes	Yes	Yes	Yes
Long-term productivity gains	Yes	Yes	Yes	Yes	Yes

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

How do the historical examples we studied illustrate these key attributes? **Exhibit 1** makes the connections.

A clear lesson from history is that capital investment booms tend to follow a recurring pattern of distinct phases. **Exhibit 2** lays out six such phases, from the origin of the new technology through its widespread deployment and subsequent adoption at scale. Although we list these as distinct phases, in reality they often overlap to some extent over time.

Where we observe variations across specific historical examples, the most common differentiator appears to be the extent of competition that emerges in phase 2, and its subsequent consequences in phases 3 through 5.

Capital investment booms often follow a consistent pattern

EXHIBIT 2: PHASES OF CAPITAL INVESTMENT BOOMS

PHASE 1: ORIGIN STORY	A new solution to an old problem	A viable solution to a longstanding and significant economic barrier or inefficiency is identified, attracting the interest of entrepreneurs and investors.
PHASE 2: BUILD-OUT	Aggressive capital investment	Firms compete aggressively to establish dominance, raising large amounts of capital from investors to build out the necessary infrastructure—often in parallel with one another.
PHASE 3: REALITY CHECK	Reality check on high expectations	Optimism over future growth potential collides with the reality of fierce competition, more costly or scarce capital, and/or broader economic weakness.
PHASE 4: SHAKE-OUT	Elimination of weaker competitors	Weaker enterprises are unable to meet lofty expectations and run into difficulty raising fresh capital. Often, they go bankrupt or are acquired by other firms at a discount.
PHASE 5: VIABILITY	Reorganization, rationalization and integration	Following a period of consolidation, operators are able to maintain more stable and profitable business models with sustainable capital structures.
PHASE 6: BROAD ADOPTION	Residual benefits to society	As access expands, costs fall, and new use cases emerge, the new technology fosters improvements in productivity and sustainably higher growth rates.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

Two of the four instances of private sector capital investment booms, railroads and fiber optic cables, featured an initial period of intense competition in which firms built out costly infrastructure in parallel. Investors initially responded to optimism over the new technology, but later became less willing to underwrite lofty expectations of its economic benefits and growth potential. Unable to generate enough revenue to support their capital investments, firms experienced widespread failures and eventual consolidation under new ownership.

In the other two examples, the U.S. telephone network and petroleum refining and distribution, a single firm quickly dominated the industry and effectively monopolized access to the new technology. These firms (AT&T and Standard Oil, respectively) not only raised the capital necessary to build out the costly infrastructure, but they generated the profits needed to sustain it over time. In both cases, regulation eventually constrained their profits and restored a measure of market competition.

Thus, the development of the railroads and fiber optic cable networks passed through all six phases in sequence, with a great deal of sector and firm-level disruption along the way. Conversely, the telephone and petroleum industries evolved within a monopolistic framework that avoided such widespread disruption and effectively jumped from phase 2 (launch) to phase 5 (stability).

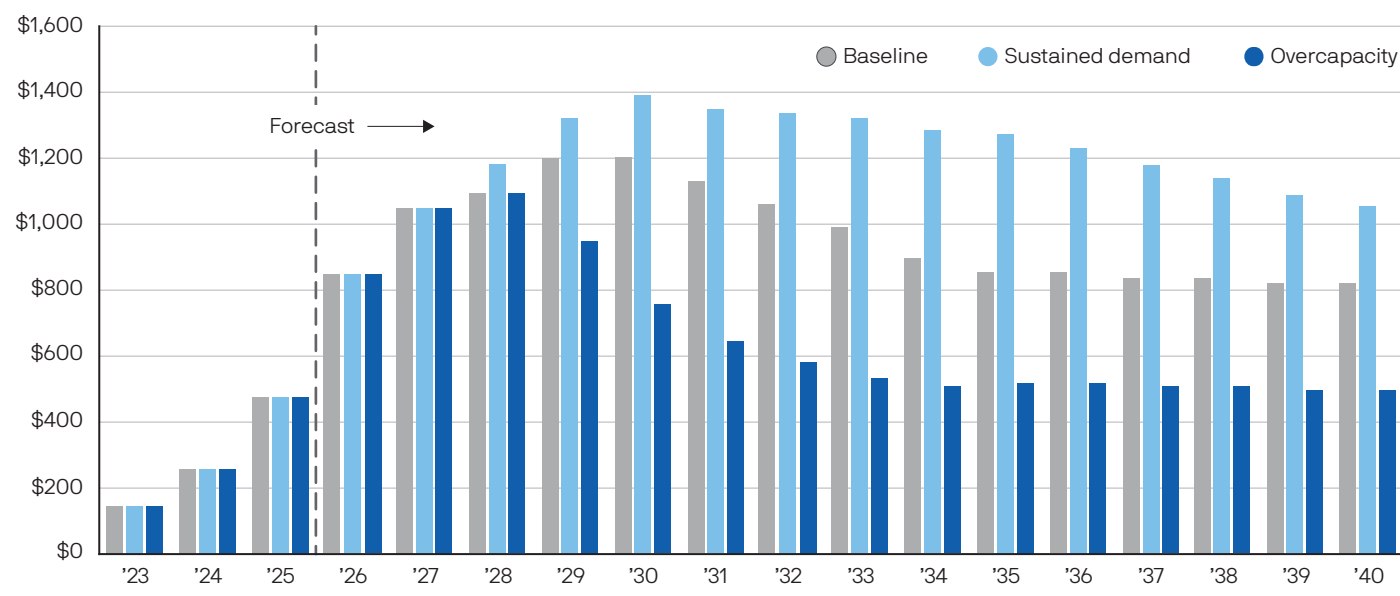
In some respects, the end point was largely the same: Society enjoyed higher levels of growth and productivity as a result of the widespread adoption of a powerful new technology. In the specific instances of monopoly, however, we cannot observe the counterfactual scenario in which competition allowed the technology to evolve organically. Whether the resulting benefits would have been greater or lesser can never be known.

Estimating the scale and pace of the AI boom

As we have noted, and as investors are well aware, AI is developing on a massive scale and at an accelerated pace. **Exhibit 3** provides a rough roadmap for the AI capital investment boom. It draws on three capital spending scenarios laid out in J.P. Morgan Asset Management's upcoming *2027 Long-Term Capital Market Assumptions* (LTCMAs).

In the AI build-out, we see a range of potential outcomes for AI capital spending

EXHIBIT 3: TOTAL U.S. AI CAPITAL EXPENDITURE (USD BILLIONS)



Source: Company reports, J.P. Morgan Asset Management; data based on availability as of July 31, 2026. Anchors to projections of spend from the top five hyperscalers and an assumption of capex for neocloud, enterprise and government AI infrastructure. Baseline: spending normalizes around \$800B as the initial buildout matures. Sustained demand: capex remains above \$1T as agentic AI and robotics extend the cycle. Overcapacity: returns disappoint or efficiency accelerates post-2029, limiting the pace of reinvestment, and spending corrects by roughly 45% of peak.

1. In the baseline scenario, spending peaks near USD 1.2 trillion before the end of the decade and then declines somewhat before stabilizing at roughly USD 800 billion a year. This represents a level of structural capital investment that covers ongoing reinvestment, continued growth in AI end-user demand, and an expectation of financial viability for most major AI firms.
2. In a “sustained demand” scenario, the peak rises to roughly USD 1.4 trillion and spending holds above USD 1 trillion for years. This scenario assumes a positive growth story for foundation models (large-scale AI models trained on broad data sets); agentic AI (AI that can act independently, with limited human guidance); robotics; and potentially other new modalities that push peak capex higher and require an elevated level of investment going forward. In addition to rising demand for AI, this scenario implies higher levels of productivity for end users and profitability for AI suppliers.
3. In a more pessimistic “overcapacity” scenario, spending still reaches a peak that is similar to the baseline but then falls far more sharply, to around USD 500 billion a year. Returns to AI providers falter through some combination of price competition, insufficient demand, difficulty monetizing AI services, the technological obsolescence of capital investments or a rising cost of capital.

Ultimately, the pace and scale of the AI boom will depend on investors’ willingness to underwrite capital allocation decisions across public and private markets. In the short term, all scenarios point to a massive increase in AI investments; divergence will occur later. Careful observation of AI’s ongoing evolution will be needed to determine which path will be followed.

For the capital markets, it’s “all hands on deck”

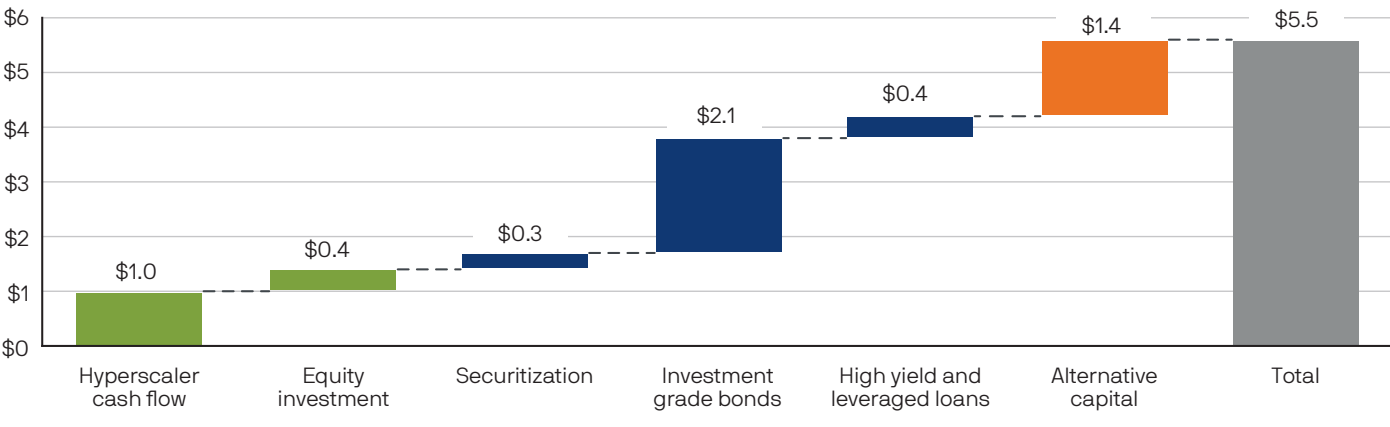
The acceleration of AI capex spending—from less than USD 200 billion in 2023 to a projected peak above USD 1.2 trillion less than a decade later—places an extraordinary demand on the capital markets to deliver. Public debt and equity markets are providing an increasing portion of the required capital as private AI firms pursue historically large IPOs and public hyperscalers issue large amounts of debt and equity. In total, we project potentially USD 5.5 trillion of AI capex spending through 2030 (**Exhibit 4**).¹

So far, investors have been willing to fund the capital spending based on confidence in AI’s potential, and that confidence is manifest in the high valuations assigned to key players. However, as capex continues to grow, even higher levels of debt and equity issuance will be required to fund the spending. To support that issuance, AI firms will need to deliver healthy revenues and profits.

Some firms will meet that bar while others will come up short. In this context, we note that fundamental valuation metrics will likely take on greater importance, separating the stronger and weaker players over time. Accounting scrutiny of off-balance sheet financing and contingent credit exposures will also become more critical. Essentially, AI is creating an environment in which research-driven investment skills will prove highly valuable across all segments of the asset allocation.

¹ J.P. Morgan Research, AI Capex 2.0.

The full scope of the capital markets are funding the AI build-out
EXHIBIT 4: EXPECTED TOTAL AI CAPEX INVESTMENT THROUGH 2030 (USD TRILLIONS)



Source: J.P. Morgan Global Research, J.P. Morgan Asset Management; data based on availability as of July 31, 2026. All funding forecasts come from the 2026 “AI Capex 2.0: If You Build It, They Will Finance It - Updated Growth & Capital Markets Forecasts” research report published by J.P. Morgan Global Research. Alternative capital includes private credit, real estate funds, infrastructure funds, REITs and government funding. Figures may not sum to total due to rounding.

Which phase of the capital investment boom are we in today?

We see clear signs that the AI boom is following the roadmap established in previous historical examples. At the moment, it is passing through both invention (Phase 1) and capital investment (Phase 2). As foundation models and chip technology advance steadily, user growth accelerates, and massive capital investments continue to flow into data centers and power infrastructure. For now, this process appears to be self-sustaining.

ChatGPT, OpenAI's chatbot, reports some 1 billion weekly users; Google's offering, Gemini, has upwards of 950 million monthly users. Competition among AI model providers is intense. New use cases for AI are emerging regularly, particularly as companies adopt agentic AI, and waves of startup companies are launching in response. U.S.-based firms attracted roughly USD 200 billion in venture capital in 2025, roughly three-quarters of all venture capital (VC) investments in AI (**Exhibits 5A and 5B**).²

² Stanford University's AI Index.

In our view, today's high expectations are grounded in real demand for AI that should grow fast enough to outrun supply for several more years. Usage of the tokens that drive foundation models has exploded with the shift toward agentic AI. Google now processes more than 3 quadrillion tokens a month, up roughly sevenfold in a year. Despite the vast investments made to date, hyperscalers expect capacity constraints on compute capacity will likely remain in place for some time—limiting the risk of a supply glut.

While optimism remains widespread, investors should closely track any emerging signs of an approaching Phase 3 reality check. Strong end-user demand may not last forever, and some emerging challenges at the operational level could disrupt the ability of AI firms to meet high expectations.

Indeed, areas of vulnerability are becoming more visible. These include: the high cost of model training, key large language models (LLMs) falling behind the cutting-edge leaders, end-user awareness of rising AI costs, growing challenges in locating and building data centers, difficulty in accessing sufficient power and water supplies, and competition from sophisticated low-cost models being developed in China.

AI usage and innovation continue to grow

EXHIBIT 5A: OPENROUTER WEEKLY TOKENS PROCESSED (TRILLIONS)

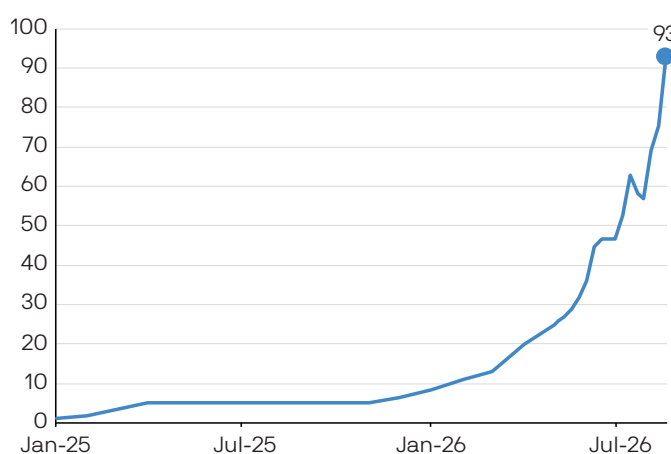
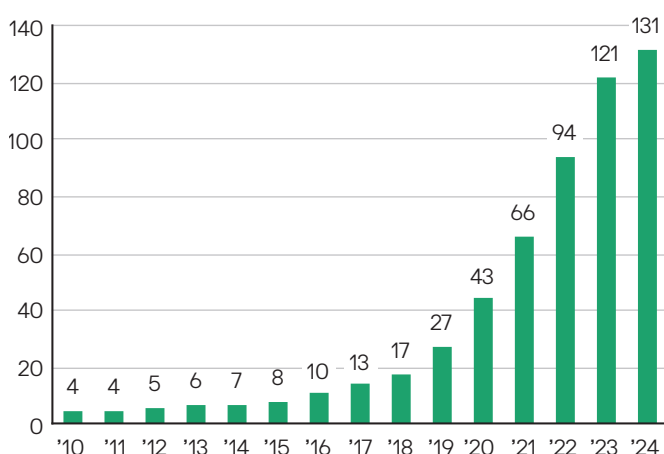


EXHIBIT 5B: AI PATENTS GRANTED WORLDWIDE (THOUSANDS)



Source: J.P. Morgan Asset Management. (Left) Source: OpenRouter, Google (I/O keynotes and quarterly earnings calls); data as of August 17, 2026. OpenRouter is an independent model-routing API platform that lets developers toggle between models. A token is a unit of text, generally about three-quarters of a word, that AI models read and generate. (Right) *Stanford University Human-Centered Artificial Intelligence – The 2026 AI Report*; data as of April 2026.

Hyperscalers have drawn on their revenue streams and balance sheet strength to fund AI capex

EXHIBIT 6A: HYPERSCALERS' CASH FLOW AND CAPEX AS A PERCENT OF SALES

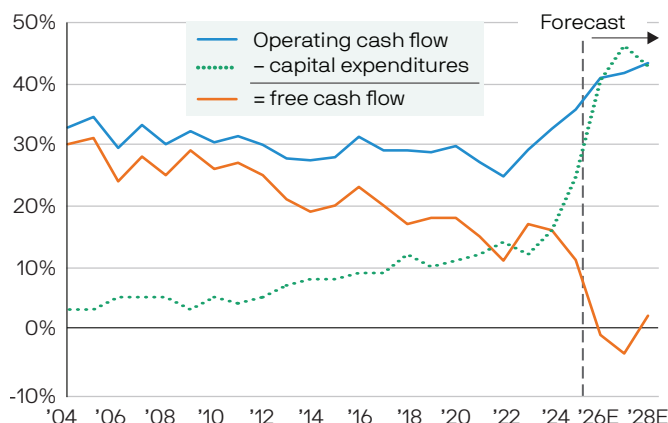
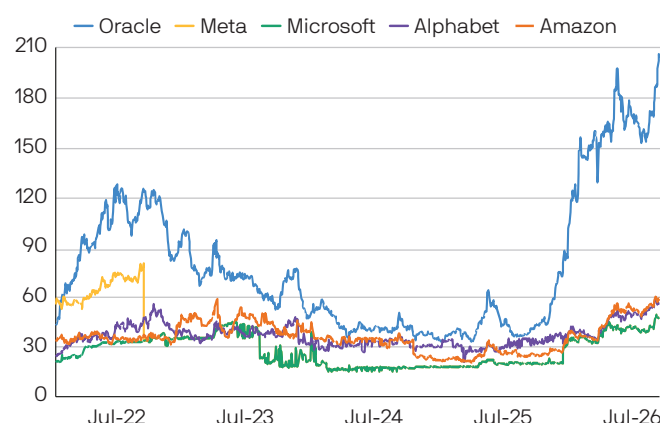


EXHIBIT 6B: FIVE-YEAR CREDIT SWAP SPREADS (BPS)



Source: Bloomberg, J.P. Morgan Asset Management. (Left) Data as of July 31, 2026. Data for 2026, 2027 and 2028 reflect consensus estimates. Capex shown is company total. Hyperscalers are the large cloud computing companies that own and operate data centers with horizontally linked servers that, along with cooling and data storage capabilities, enable them to house and operate AI workloads. (Right) Data as of July 22, 2026.

Looking ahead to future phases—and possible consolidation

During previous episodes in which a highly capital-intensive new technology emerged within a competitive marketplace, a period of consolidation eventually followed in which weaker firms were acquired, failed or restructured under new ownership. AI appears to be operating within this type of competitive model but has not yet experienced significant consolidation.

When might a shake-out begin? The short answer appears to be “not yet.” We think an ample supply of available investor capital will support the sector’s growth trajectory over the next three to five years.

An important feature of the AI boom is the presence of extremely large and highly profitable firms (hyperscalers and technology manufacturers) with revenue streams and balance sheets deployed to support the cost of the initial AI infrastructure build-out. Something similar happened in the railroad boom: Government subsidies in the form of land grants and per-mile payments allowed railroads to raise the capital needed to build a national network, and, for a time, insulated them from the full weight of the financial burden.

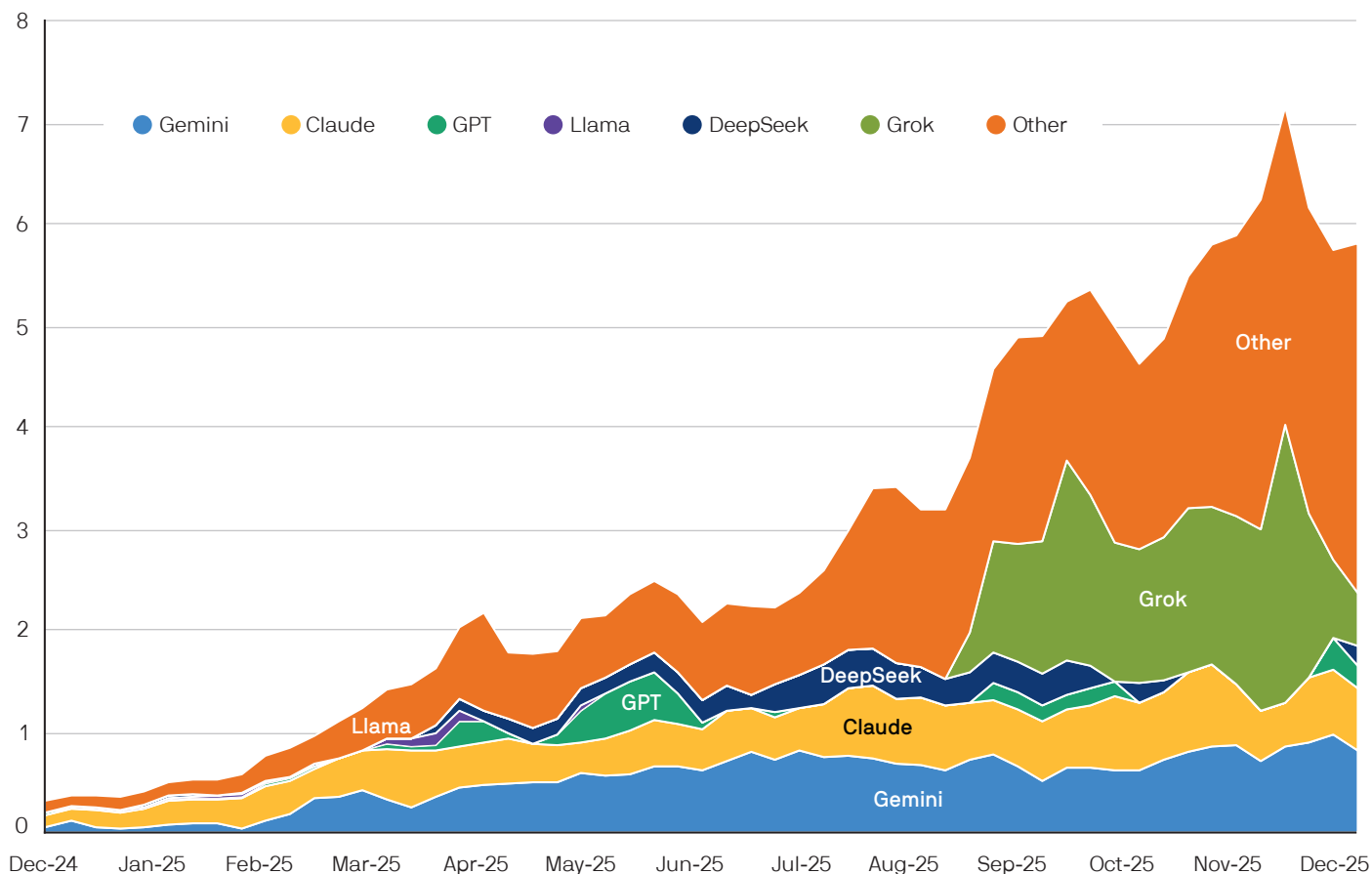
Hyperscalers’ willingness to subsidize the costs of data centers and power infrastructure is critical to enabling AI implementation on a global scale. Over time, the source of capital has shifted from diverting organic cash flow to debt issuance (on- and off-balance sheet), and more recently to secondary equity offerings. This shift has consequences for the firms involved: What was originally an internal business decision is now being underwritten and priced by the markets, and financial scrutiny will increase as a result (**Exhibits 6A and 6B**).

For now, we see little evidence of vulnerability among major players (Phase 4), nor any subsequent rationalization or reorganization (Phase 5). Public hyperscalers remain profitable despite this large capital spend and significant debt issuance, although they have less financial flexibility than they once did. Perhaps ironically, the ability of these firms to “stay in the game” longer could create the conditions for overinvestment in costly physical infrastructure that may have a hard time generating adequate returns.

In prior capital investment cycles, expensive infrastructure that could not generate adequate returns ultimately passed through bankruptcy to new owners who were able to operate them successfully. Hyperscalers shift this dynamic. Their shareholders might end up regretting the vast capital expenditures undertaken in the pursuit of AI dominance, but their balance sheet strength dramatically reduces the risk of default and reorganization.

AI model usage remains broadly distributed

EXHIBIT 7: TOKEN CONSUMPTION THROUGH OPENROUTER API CALLS (TRILLIONS OF TOKENS)



Source: OpenRouter LLM Ranking Leaderboard, J.P. Morgan Asset Management; data as of December 31, 2025.

No sign yet of a path to monopoly

History shows that the common alternative to fierce competition and an eventual shake-out is the establishment of a monopoly that can maintain profits at levels sufficient to complete the build-out and cover ongoing capex needs. Financial stability is generally positive, but over time monopolies tend to stifle competition, limit innovation and reduce the broader social benefits provided by the new technology.

As yet we see no sign that AI is trending toward a monopoly outcome, but it's early and the outlook could shift. Numerous providers of foundation and agentic AI models are competing for technological dominance and market share (Exhibit 7). Key technology

providers across chips and memory do exhibit more concentrated market share and have been able to command premium prices for their products at present. But in some sectors competitors are already either present or beginning to emerge, calling into question the sustainability of today's elevated margins.

Ultimately, end users will benefit as competition drives increasing product innovation while reducing the cost of AI access. Conversely, early leaders in the AI build-out may be most at risk: Continuous innovation in models, chip technology and energy efficiency could shift demand in unanticipated ways, making the high costs incurred during the early phases of AI expansion difficult to justify in retrospect.

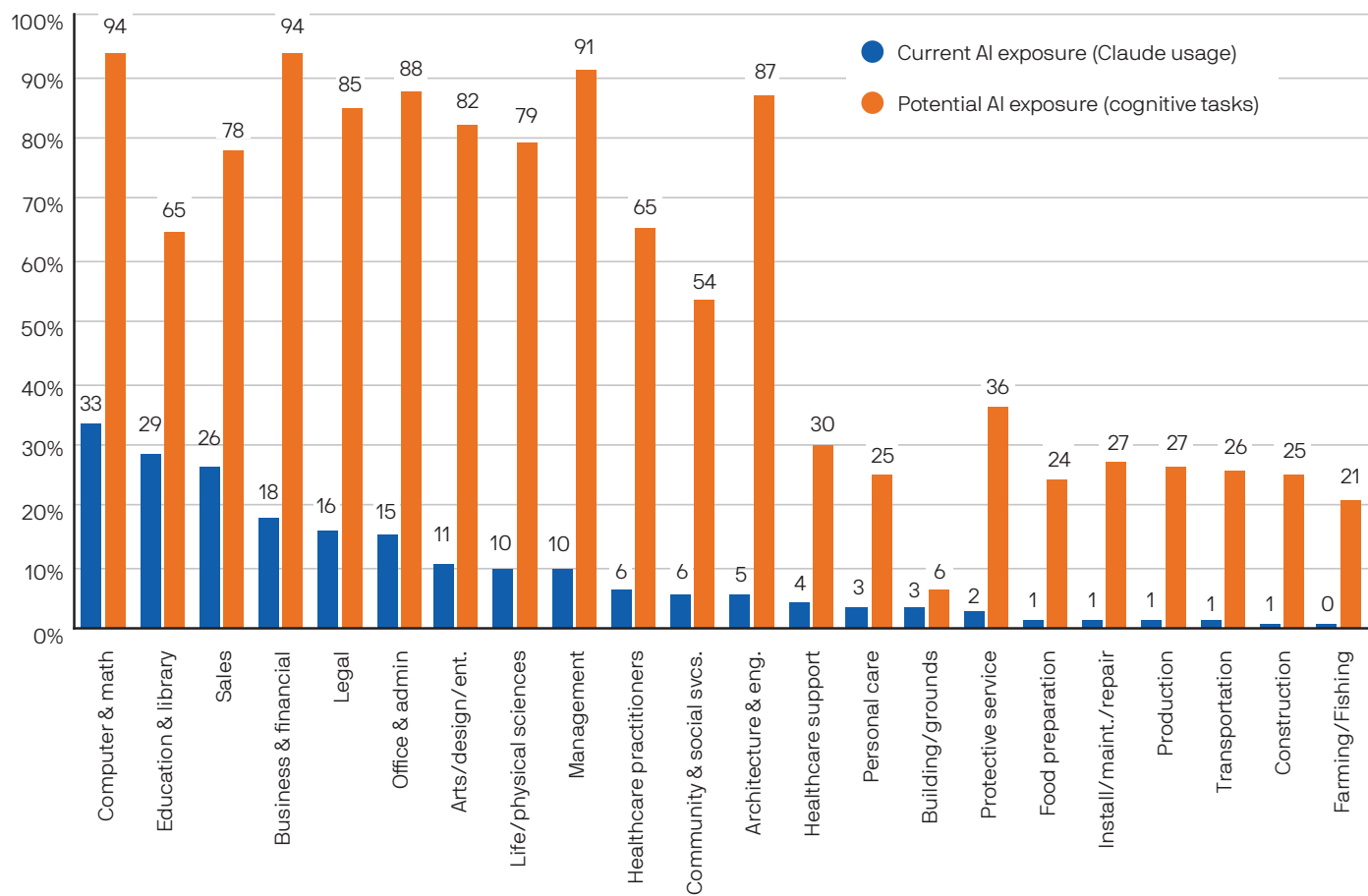
As productivity improves, a backlash begins

In the past, the magnitude and timing of productivity improvements from new technology have been difficult to predict. Often, they’ve emerged with a long lag or through unexpected channels. AI may diffuse faster, as it is broadly and instantly accessible over the internet, sidestepping the physical and geographic constraints that slowed the spread of earlier technologies. It also carries a relatively low skill barrier, and consumers are already adopting it at a rapid pace. Even so, much of the reorganization of work and firms needed to fully capture AI’s productivity potential still lies ahead.

The potential opportunity set for AI is staggering. Mapped against the task content of U.S. occupations, our analysis finds that today’s AI models, paired with complementary software built around them, can theoretically perform tasks that make up roughly two-thirds of the work in the economy. That share will rise toward three-quarters once we include robotics that will likely reach commercial use in the next decade. Theoretical exposure does not equate to real-world adoption, however, and current AI usage is well below these estimates of its potential (**Exhibit 8**).

AI usage is growing, but it is still well below its potential

EXHIBIT 8: SHARE OF AN OCCUPATION’S CURRENT AND POTENTIAL TASKS EXPOSED TO AI



Source: Anthropic Economic Index, Eloundou et al. (2024), O*NET, Bureau of Labor Statistics, J.P. Morgan Asset Management; data as of July 31, 2026. Potential exposure is the share of an occupation’s tasks that large language models, paired with complementary software, could perform with meaningful time savings, from Eloundou, Manning, Mishkin and Rock (2024). Current exposure is the share of tasks with observed, work-related Claude usage, as published by Anthropic.

How much of that potential we ultimately reach, and how quickly, depends on whether firms find AI reliable and cost-effective enough to deploy at scale and reorganize around it. The task content of the economy will also change, as AI creates new forms of work and society emphasizes the human nature of certain tasks and occupations.

Unsurprisingly, the rapid emergence and deployment of AI is leading to social and regulatory pushback, even as AI technology has not fully developed and the infrastructure is not fully built. We see a real possibility that such resistance could complicate AI's future growth in the U.S.

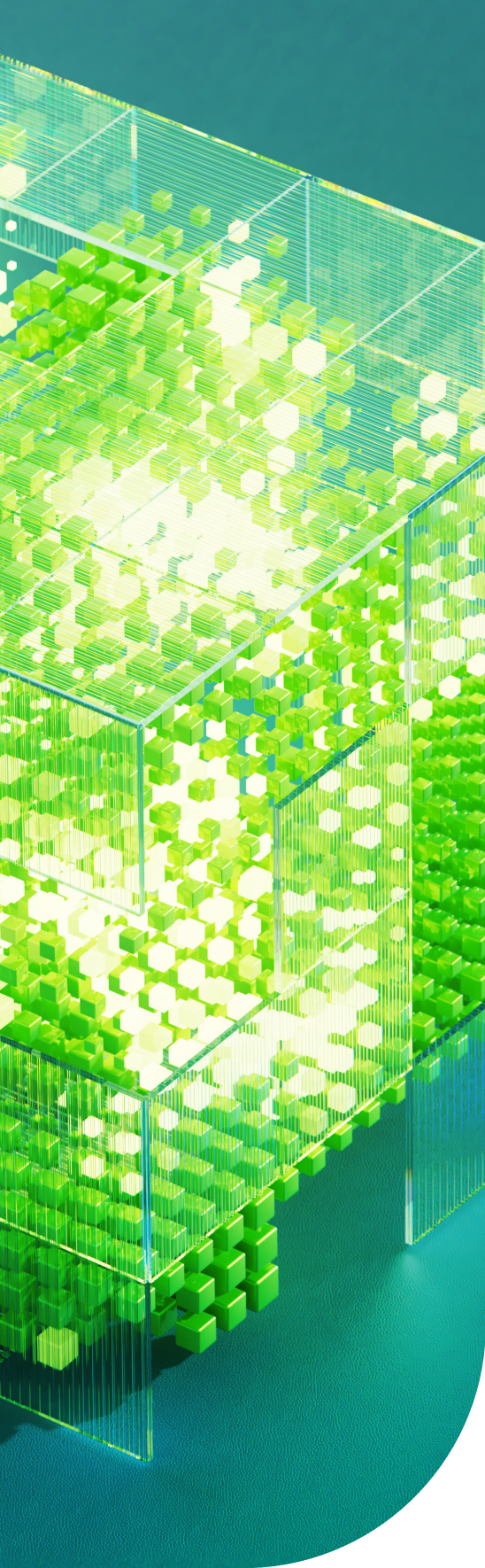
Already the physical infrastructure of AI is a leading cause of concern. A recent national poll found that roughly seven in 10 Americans would oppose a data center near them, including nearly half who are strongly opposed.³ The physical scarcity of key power and water resources in critical locations is becoming a major barrier to data center construction, with estimates that local opposition stalled or blocked more than USD 150 billion of projects in 2025 alone.⁴ This trend appears to be accelerating in 2026.

³ Gallup, "Americans Oppose AI Data Centers in Their Area," June 2026.

⁴ Data Center Watch, March 2026.

More broadly, as workers grow more anxious that their livelihoods may fall prey to AI, we hear increasing calls for regulation and/or economic transfers to those displaced. Regulation has played a direct role in past technology booms, and it would be surprising if it did not do so in the AI era. We anticipate an ongoing debate about the connections between technology, labor and capital.

How that debate plays out may determine who ultimately bears the social and economic costs of AI. Regulation and government intervention could change the economic assumptions that underpin the boom today.



2

AI's asset allocation challenge

Few, if any, asset allocations were developed with artificial intelligence explicitly in mind. Rather, the emergence of AI has created a new risk factor that is present to varying degrees within many individual asset classes. Successfully navigating the AI capital investment boom will therefore require estimating both the degree of AI risk within specific asset classes and investment strategies, and the total exposure across the full allocation.

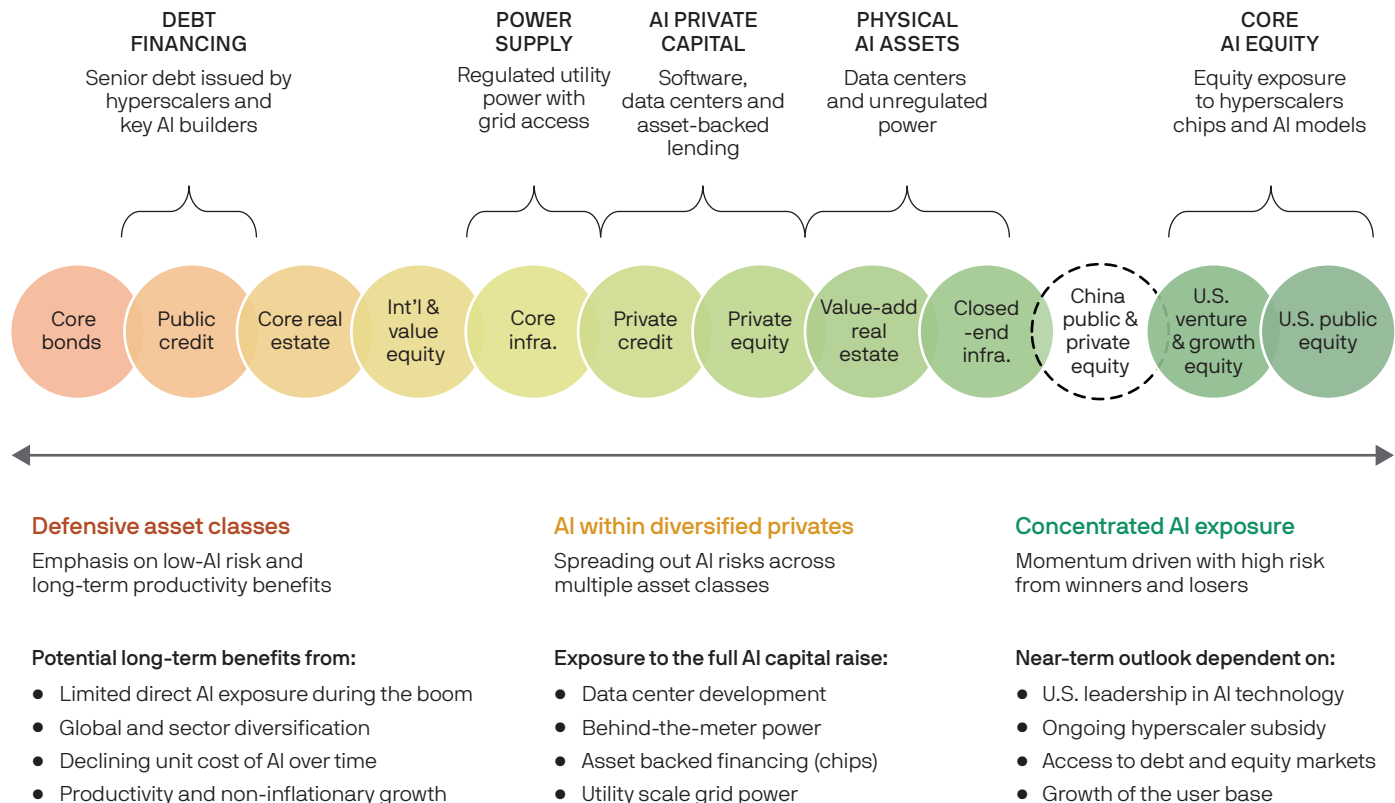
Mapping AI risk across asset classes

It is difficult to precisely quantify exposure to AI risk given the limited history, the relatively small number of highly capitalized firms involved, and its presence in both public and private markets that offer different degrees of transparency. However, understanding the relative level of AI exposure across asset classes,

and to certain subcategories within them, is a more manageable task. **Exhibit 9** describes a spectrum of relative AI intensity, from more AI-defensive to more AI-exposed, across a range of asset classes.

Exposure to AI is distributed broadly across asset classes

EXHIBIT 9: A TAXONOMY OF AI INTENSITY



Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

Investors can balance concentrated, diversified and defensive exposure to AI across their portfolio:

- At one extreme are the sectors that offer concentrated AI exposure (in public and private markets) through equity ownership of firms that are intrinsically related to the development and deployment of artificial intelligence. Key examples include public hyperscalers, the AI chip ecosystem, and pre-IPO stakes in AI technology firms.
- Also at the more concentrated end of the risk spectrum are real assets such as data centers and AI-focused “behind-the-meter” power generation. While some real assets are directly owned by hyperscalers, they are also accessible through closed-end value-add funds in the infrastructure or real estate sectors.
- In the middle of the AI risk spectrum are many private equity and private credit funds. They maintain some direct exposure to AI-focused firms, but within a more diversified portfolio that also holds investments unrelated to AI. The degree of AI exposure will be idiosyncratic, making it essential that investors understand the specific strategy and underlying investments in detail.
- Core infrastructure offers a somewhat distinctive value proposition, which is low-risk exposure to AI via the regulated power sector, where the highest quality data center owners seek to obtain grid access via long-term power supply contracts. Many utilities are taking advantage of elevated AI demand to expand and upgrade their generation capacity, providing a basis for long-term returns under any future scenario.
- Defensive assets are those with little or no direct AI exposure and the potential for uncorrelated performance in the event of a broad-based sell-off in other AI-sensitive asset classes. Core real estate is an inherently defensive asset class given minimal data center exposure and historically low correlation to broad equity risk. Core fixed income (Treasuries, mortgages and investment grade credit)

is dominated by duration risk, which is a natural hedge to a growth shock.

- Beyond the U.S., China is a special case: Despite a sophisticated AI ecosystem and superior power supply, China plays little or no role in many portfolios. An allocation to China could add diversification relative to otherwise U.S.-focused AI development. European and Japanese markets, in contrast, have limited direct AI exposure but could benefit from the long-term productivity potential of cost-effective AI.

Each asset class offers potential benefits and risks to investors looking to manage their AI risk—and not merely accept what the market gives them.

Long-term allocation models may be sensitive to AI trends

Investors will also want to understand the impact of AI on the key variables that drive asset allocation models (**Exhibit 10**). The most common data points are forward-looking estimates of the returns, volatilities and correlations across major asset classes. Also of interest are judgments about asset class liquidity and manager dispersion.

J.P. Morgan Asset Management’s annual Long-Term Capital Market Assumptions can provide a useful framework for evaluating the investment opportunity set. The upcoming 2027 edition will pay close attention to AI’s shifting dynamics.

At a high level, we expect some of AI’s portfolio-level impacts to include:

1. AI capital spending will support higher economic growth and higher corporate earnings, with benefits concentrated in the equity markets of AI-exposed countries.
2. Inflation uncertainty will increase in the short- and medium-term, keeping short-term interest rates anchored higher, and yield curves steeper, than they would otherwise be.

3. Productivity gains from AI will be most visible in developed economies with high degrees of technology adoption, potentially offsetting macroeconomic headwinds from declining labor supply.
4. The breadth of exposure to the AI risk factor exposure may reduce portfolio diversification, primarily across equity allocations but extending more broadly across credit markets and alternative asset classes.
5. High quality fixed income (and duration risk specifically) should remain a key source of protection against shocks to the prevailing AI narrative, whether as a low-risk defensive asset or through slowing growth.

Key access points to the AI opportunity set

EXHIBIT 10: POTENTIAL RISKS AND BENEFITS ACROSS ASSET CLASSES

	Benefits	Risks
U.S. large cap public equity	Liquid, low cost access to scaled players across the AI ecosystem	High valuations and risk concentration in AI markets
Growth equity	Later stage access to private firms with scalable business	Higher valuations and reduced portfolio diversification
Venture capital (VC)	Early access to AI innovators and disruptive business models	Surge in new business formation may be a challenge
China public equity & VC	Parallel AI ecosystem to the U.S., with differentiated characteristics	Government intervention and geopolitical risks
Closed-end infrastructure	Primary access point for direct exposure to data centers	Untested data center business model and illiquid fund structure
Value-add real estate	Building data center “shells” and converting legacy properties for AI	Real estate represents only a small portion of data center value
Private credit	Financing multiple elements of the AI build-out at attractive yields	Concentrated exposure to sectors and firms facing disruption
Core infrastructure	Regulated grid power delivery to AI firms under long-term contracts	Pushback from regulators and ratepayers over costs
International & value equity	Low AI intensity with long-term benefits from AI efficiencies	Limited participation in the key elements of AI upside
Core real estate	Very low AI exposure outside of localized office/residential gains	Long-term impact of AI on real estate usage is unknown
Corporate debt	Quality borrowers issuing paper at attractive all-in yields	Asymmetric risk and the scale of debt issuance are concerns
Core fixed income	Very low AI exposure outside of investment grade credit	Impact of AI on inflation and rates could be a concern

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.



3

AI considerations by asset class

The top-down strategic asset allocation process described in the previous section makes broad assumptions about how asset classes tend to behave, on an individual basis and relative to one another. Here we take a deeper look into individual asset classes and their specific relationships to the AI capital investment boom.

Public equity: Sorting AI's winners and losers with active management

Investors looking to capture the gains of the AI revolution are going to need exposure to public markets. Top AI firms have invested heavily in achieving a competitive advantage in models, chip technology and physical infrastructure, and markets have rightly rewarded them with rising share prices in anticipation of strong future revenues and profits. However, if the expectation of future success is already priced in for many top AI firms even as key risks remain, investment decisions are more difficult.

The single most important variable that will impact AI outcomes may be the sustainability of hyperscaler capital expenditures (**Exhibit 11A**). While all firms appear committed to raising ever larger amounts of capital, the markets may start to impose some limits. As aggregate capex estimates for 2027 have approached USD 1 trillion, investors have grown more concerned about debt issuance and free cash flow metrics. Additionally, major hyperscalers appear to be reducing share buybacks as free cash flow declines (**Exhibit 11B**). It is also worth noting that leading hyperscalers in China are significantly less capital-intensive than their U.S. counterparts.

Thus far, AI investments have been characterized by positive correlation and momentum. Going forward, however, firm-specific fundamentals should differentiate key players to a greater degree. As volatility and dispersion increase, a disciplined long-term valuation process can serve as an anchor for security selection. Our experience suggests that over longer horizons, there are a number of factors that help identify winners, and we think that these will apply equally to the AI ecosystem:

- The durability of a firm's competitive advantage and the defensive "moat" protecting its business.
- The long-term trend growth rate that can be achieved based on industry dynamics and firm-specific market share characteristics.
- The degree to which current profitability deviates (above or below) from a more normalized, or through-the-cycle level.

Active managers using a fundamental valuation framework will be able to identify entry points (and exit points) where the market price of a firm's shares does not fully reflect its fundamentals. Given a sufficiently long-time horizon and a broad set of firms being researched, this process offers the prospect of outperformance.

Hyperscaler capex keeps rising, but recent stock moves reflect investor concerns about their cash flow

EXHIBIT 11A: CLOUD AND HYPERSCALER CAPEX (USD BILLIONS)

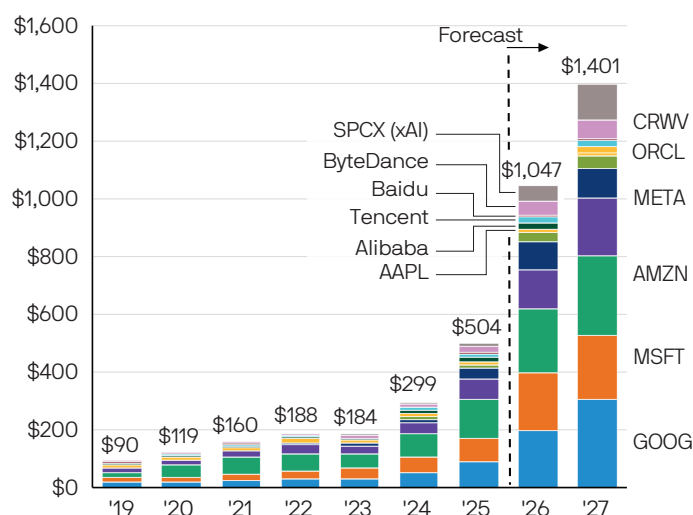
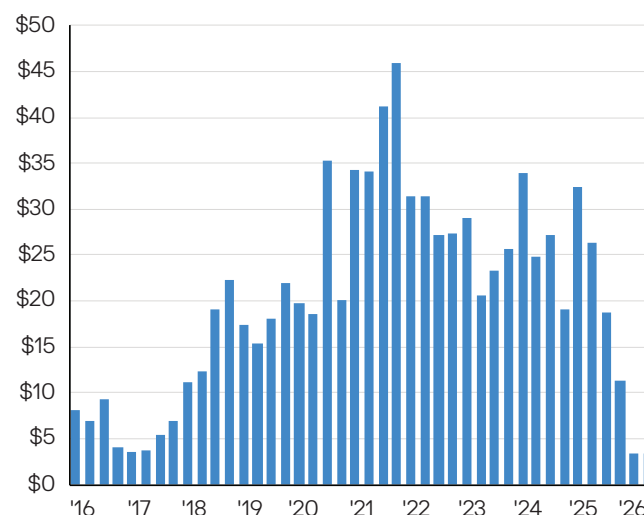


EXHIBIT 11B: HYPERSCALER QUARTERLY SHARE BUYBACKS (USD BILLIONS)



Source: Bloomberg, J.P. Morgan Asset Management. (Left) Data as of August 20, 2026. All of the forward-looking numbers here are based on Bloomberg Consensus estimates, aside from ByteDance which is private and based on Goldman Sachs' estimates as of June 9, 2026. (Right) Data as of June 30, 2026. Hyperscalers include Amazon, Google, Microsoft, Meta and Oracle.

What does fundamental analysis tell us about key stocks in the AI ecosystem?

We believe the most durable competitive advantages can be found in the highly specialized and capital-intensive semiconductor manufacturing sector, and specifically cutting-edge fabricator Taiwan Semiconductor Manufacturing Company (TSMC) and semiconductor manufacturing equipment provider ASML. These firms command near-monopoly control over the critical chokepoints in chip manufacturing, with few viable competitors in sight.

TSMC holds an estimated 95% market share in advanced foundry services. The company’s N3 and N2 nodes (its latest generation of chip-making technology) serve as the semiconductor industry benchmark, with capacity effectively sold out through 2028. ASML, as the sole global provider of extreme ultraviolet (EUV) lithography equipment used in semiconductor manufacturing, holds an analogous monopoly on the most critical piece of manufacturing

infrastructure needed to produce the most advanced and powerful chips.

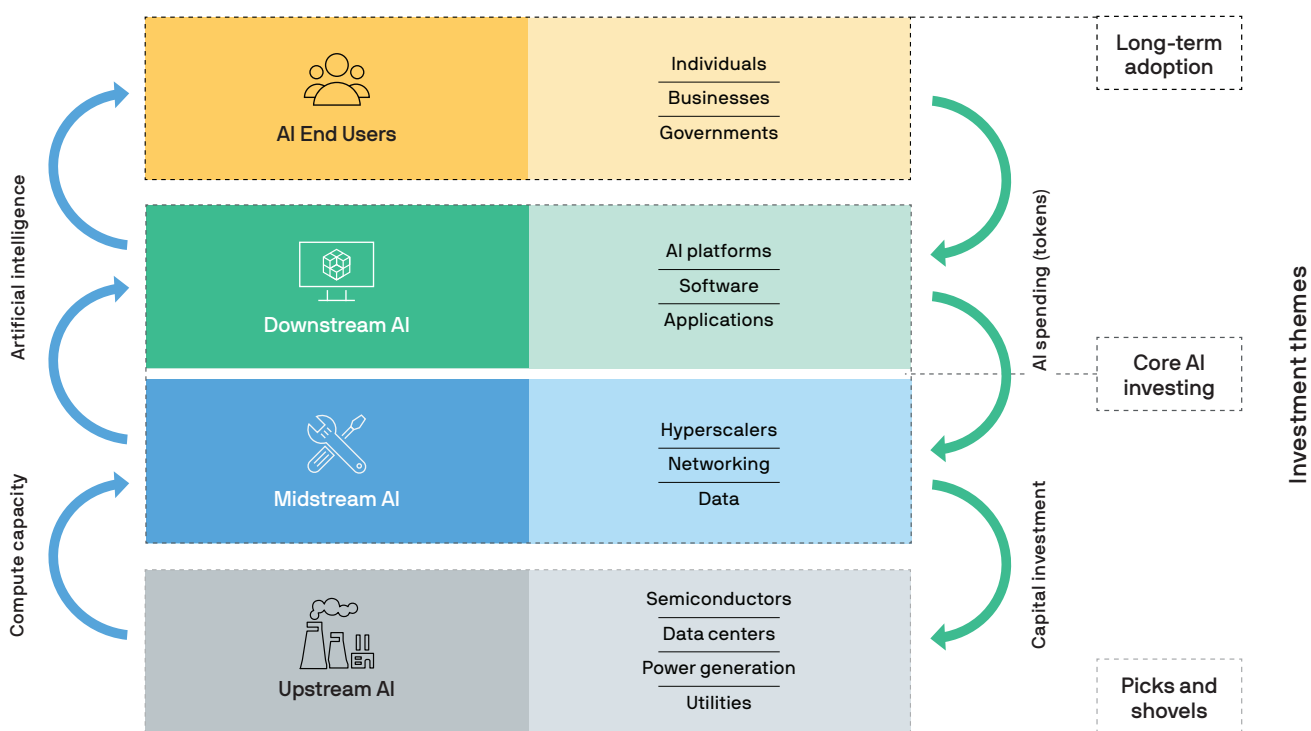
Critically, a positive feedback loop reinforces their competitive advantage. Returns fund investment, investment propels leading edge technology, technology spurs utilization, utilization drives cost advantage and cost advantage enables disciplined pricing. In short, the feedback loop creates a structural advantage that is nearly impossible to replicate.

Both TSMC and ASML can harness the benefits of competitive spending across the AI ecosystem. The firms are agnostic as to which model developer (such as OpenAI, Anthropic and Google) or which chip designer (such as Nvidia, AMD or Broadcom) ultimately wins market share. That’s because every AI accelerator, logic chip or memory device requires their infrastructure. As long as demand for AI remains strong, they can benefit regardless of competitive shifts among their customers.

Exhibit 12 presents key segments of the AI value chain.

Allocators can align investment themes with the AI value chain

EXHIBIT 12: KEY SEGMENTS OF THE AI VALUE CHAIN



Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

The sector mix of AI winners has shifted in recent years

EXHIBIT 13A: AI-RELATED INDUSTRY PERFORMANCE (2023-NOW)

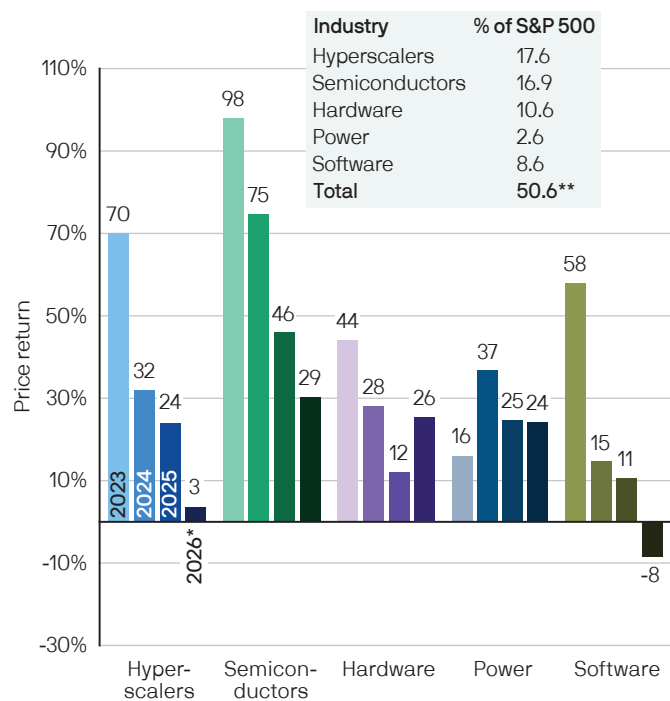
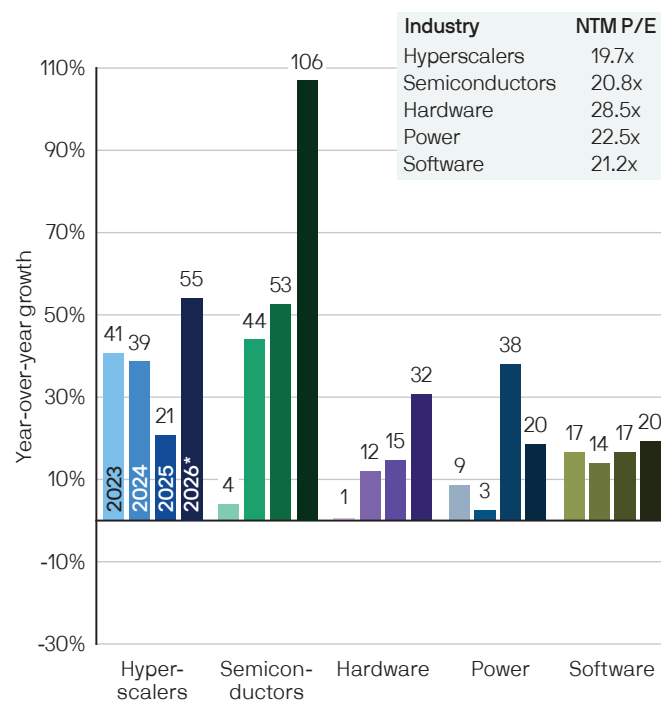


EXHIBIT 13B: AI-RELATED INDUSTRY EARNINGS GROWTH AND MULTIPLES



Source: FactSet, MSCI, Standard & Poor's, J.P. Morgan Asset Management; data as of July 31, 2026. *2026 price return is year-to-date, and earnings growth reflects 2026 consensus estimates as provided by FactSet. Hyperscalers is a market-weighted composite of AMZN (Sector = Con. Disc, Industry = Broadline Retail), GOOGL/GOOG (Comm. Svcs., Interactive Media & Svcs.), META (Comm. Svcs., Interactive Media & Svcs.), MSFT (Info. Tech., Software) and ORCL (Info. Tech., Software). The remaining categories are based on GICS Industries. **Total percentage in the S&P 500 does not double count hyperscalers that fall in additional categories.

Contrast this with other AI technology providers such as memory chip manufacturers Micron Technology and SK Hynix—both of which have seen surging demand and rising share prices. Memory has historically been a cyclical business characterized by boom-bust pricing cycles, capital-intensive capacity expansion and limited ability to sustain pricing power outside of supply-constrained windows. Although the memory market is currently booming, with excess demand and limited supply, over the medium term we expect new supply to emerge and drive returns lower.

Memory providers will continue to play a key role in AI development and may claim a long-term presence in an actively managed portfolio. However, fundamental analysis reveals that they operate with a less stable competitive advantage and generate more volatile revenue streams (that happen to be at all-time highs today). Active management can mitigate such risks while simultaneously allocating to secular winners positioned to compound returns as AI-driven demand for advanced semiconductors accelerates through the end of the decade.

AI suppliers occupy a profitable middle ground

AI capex is delivering substantial profits for a wide set of companies and sectors that are part of the AI ecosystem even as they have significant non-AI business. While these firms have less exposure to the AI boom, their AI-related gains may be long lasting.

Exhibits 13A and 13B illustrate the degree to which the market returns across different AI-related sectors have broadened over the past few years. Sectors such as hardware and power recently have seen greater appreciation than early leaders in the hyperscaler and semiconductor sectors. Some of these firms fall outside the technology or growth sectors, allowing managers with a core or value focus to align portfolios with AI opportunities.

Power needs of data centers are driving demand for new generation and grid access

EXHIBIT 14A: GLOBAL GAS TURBINE ORDERS (GIGAWATTS)

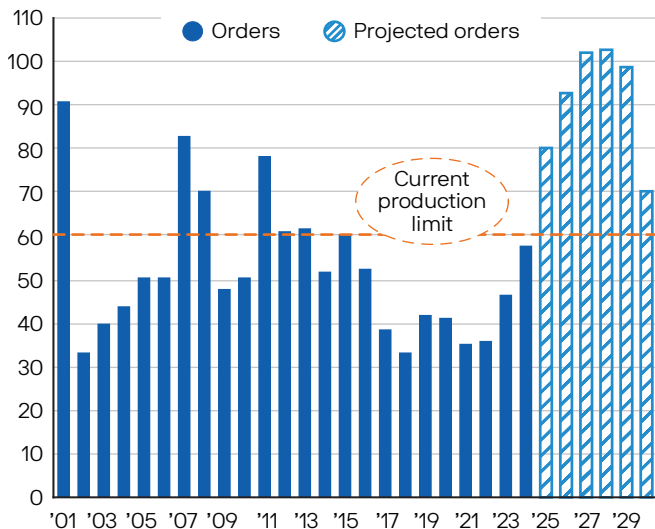
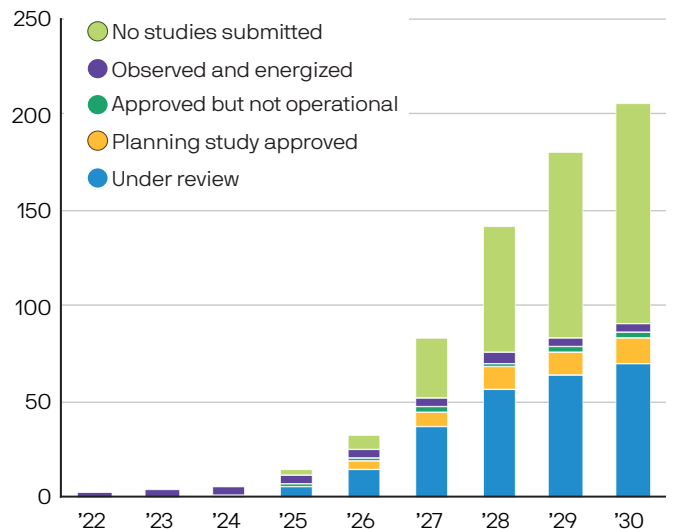


EXHIBIT 14B: ERCOT LARGE LOAD INTERCONNECTION REQUESTS (GIGAWATTS)



Source: J.P. Morgan Asset Management. (Left) Bloomberg News; data as of October 2025. (Right) ERCOT; data as of October 2025.

The utilities sector is a prime example of this trend. After decades of stagnant demand, the industry may now be at the start of an AI-driven electricity supercycle. Forecasters project that electricity consumption will accelerate through 2030, largely due to the massive surge in power demand from AI data centers. U.S. data center power demand alone is projected to more than double by 2030, translating directly into rate base expansion, new connection revenues and long-term contracted load growth not seen in a generation. Utilities with excess power supply, as well as the resources to strategically add generating capacity on an accelerated timetable, will benefit the most from the new demand.

Among major utilities, NextEra Energy looks well positioned for the new supercycle. The company is targeting multiple data center locations, seeking grid access as NextEra makes plans to deploy capacity through 2035. Additionally, NextEra's recent agreement to acquire Dominion Energy could accelerate new solar, gas and battery storage builds.

Data center operators may prefer grid access to utility power, but they are not waiting to conclude the time-consuming process of grid connection before they open for business. As a substitute for grid connection, natural gas-powered turbines are expected to supply over half of incremental data center power capacity. Already GE Vernova, a leading turbine manufacturer, reports increased order volume related to heavy-duty gas turbines committed to data center applications.

The power investment cycle is reinforced by structural supply bottlenecks—turbine blades, forgings and transformer availability—that extend the period of constrained supply well into the late 2020s. This should support pricing power across the value chain.

We think power supply will provide attractive investment potential for many years to come (**Exhibits 14A and 14B**). In the near term, utilities with spare capacity and firms that supply power equipment needed for data centers are well positioned. Over the longer term, utilities that can expand generation capacity and navigate regulatory hurdles to lock in long-term supply contracts will achieve lasting success.

The potential for disruption rises over time

Unlike most power suppliers, many companies across the AI ecosystem will find themselves vulnerable to AI disruption, up to and including the viability of their business model (**Exhibit 15**). For investors, identifying such firms is the mirror image of picking AI winners—potentially very rewarding but fraught with uncertainty. Concerns over potential disruption could well become self-fulfilling if such firms experience more restrictive financial conditions as investors grow uneasy about their business prospects.

When assessing which companies are most vulnerable to potential disruption, our framework focuses on the key pillars listed below. From this vantage point, company characteristics can be more easily assessed and categorized, helping us understand those companies that may be in better or worse positions within their respective industries. Businesses unfairly labeled as “AI losers” that possess strong fundamentals and consistently fall into lower risk categories represent potential opportunities that can be capitalized on via active management.

A framework for assessing AI disruption

EXHIBIT 15: KEY PILLARS

Factor	Description
Substitutability	Measures how easily AI tools can substitute the company’s primary value proposition • Higher risk: simple, commoditized information products • Lower risk: complex, or highly specialized offerings with human oversight
Switching costs	Assesses integration depth, workflow embeddedness and switching barriers • Higher risk: low integration, minimal lock-in • Lower risk: mission-critical systems, regulatory requirements, deep workflow integration
Data moat	Evaluates the uniqueness and defensibility of data assets • Higher risk: publicly available or easily replicable data • Lower risk: proprietary, structured, validated or exclusive datasets
Regulatory and trust barriers	Protection from compliance requirements and trust factors • Higher risk: unregulated, low trust requirement products • Lower risk: highly regulated industries requiring accountability and verified accuracy
AI integration capability	Measures willingness to transform, adopt AI and integrate into product stack • Higher risk: those with legacy technology and/or slow innovation cycles • Lower risk: organizations with strong tech capability, active AI development, proven track record

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

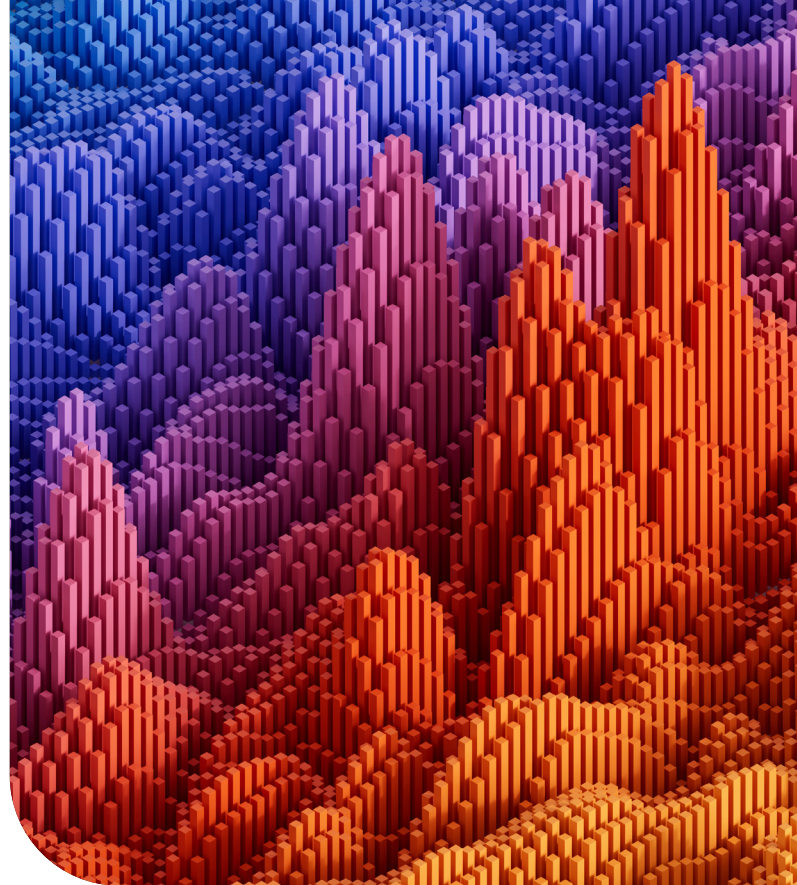
By using fundamental research as an anchor to the valuation process, combined with a coherent framework for judging potential AI disruption, active managers are well-positioned to identify mispricing. As examples, here we consider the insurance brokerage and music industries—both of which have been subject to widespread fears of AI disruption and share price volatility.

Insurance brokers: Unfair AI penalty?

Investors may have unfairly penalized the insurance brokerage industry as a likely victim of potential AI disruption. When OpenAI approved its first insurance apps on ChatGPT in early 2026, shares of insurance brokers fell sharply. The case against these companies rests upon the idea that they exhibit many of the high risk characteristics listed in the table above. For instance, critics have assumed that insurance brokers cannot incorporate data efficiencies as effectively as new AI entrants. Insurance clients, they believe, value cost savings on broker commissions more highly than the value the brokers provide.

At first glance, those arguments seem reasonable. But a nuanced understanding of the insurance marketplace and the role of brokers within it tells a different story. Successful insurance brokers use proprietary data extensively, deliver customized solutions to clients, operate within a regulated and “mission critical” environment, and provide clear accountability. Far from falling prey to new “AI-native” competition, these companies should be able to incorporate AI to potentially enhance their structural advantages and value proposition.

Two relevant examples are Aon and Arthur J. Gallagher & Co., which possess valuable proprietary technology and data on carrier pricing, claims propensity and market dynamics that cannot be easily replicated by AI startups or third-party data providers.



Aon’s most structurally differentiated tool, Broker Co-Pilot, connects Aon’s analytical and claims platform directly into its insurance placement platform. This end-to-end integration means a broker can move from risk quantification to placement recommendations within a single workflow—a capability that is currently unique to Aon. AI is expected to enhance the power of this platform and more deeply connect Aon to its clients.

Arthur Gallagher serves middle-market clients—typically business owners or CEOs without dedicated risk departments—who need external expert guidance tailored to their specific risk profiles across industry, geography and regulatory regimes. Generic AI models cannot accurately capture these distinctions without access to high quality proprietary data (that they are unlikely to obtain). Additionally, since the firm competes primarily against regional brokers with limited analytical capabilities in the middle market, we think AI adoption should help accelerate Arthur Gallagher’s relative value proposition.

Music platforms: Pricing dissonance?

The music industry has lost substantial value because the market believes that AI-generated music platforms will cannibalize streaming revenue and disintermediate rights holders. These fears may or may not hold merit over the long term. But already a select group of firms is proactively adopting and monetizing AI rather than resisting it.

Spotify has lowered its prices significantly, yet underlying business fundamentals and recent product enhancements suggest growth opportunities. A deeply entrenched platform like Spotify can add AI music creation capabilities similar to new AI entrants, while taking advantage of Spotify's robust digital service provider (DSP) product, deep catalog integrations and 600-plus million user base. The company's AI DJ product is already driving measurable engagement uplift, with higher compute costs today serving as a leading indicator of stronger retention, subscriber growth and pricing power.

Additionally, while the overwhelming percentage of uploads to Spotify are AI-generated, they represent a low single-digit percent of total music consumed on the platform. Listeners continue to prefer human-created content from their preferred artists, a behavior pattern that should help protect intellectual property (IP) economics at music labels.

We see evidence of the value of original IP in the performance of Warner Music Group, which has secured licensing agreements with AI-generated music platforms. These agreements are more attractive than Warner Music's existing major digital service provider agreements. Ownership of these valuable IP rights for the next several decades provides a durable advantage the company can continually monetize.

Long-term winners from AI's productivity benefits

Historically, most capital investment booms benefit society through their impact on increasing productivity and growth; ultimately they boost market value in the aggregate. Today, a quiet majority of firms are not specifically tied to the AI boom but are potential users of the technology once it has proven its worth and become available at a competitive price.

Importantly for equity investors, location shouldn't matter much. AI will be accessible globally across a wide range of platforms and price points. Instead, differentiation in AI-based productivity gains will be firm specific (bottom-up) and the result of the management decisions and the competitive environment in which different companies operate.

Walmart stands out as a firm that has already begun leveraging artificial intelligence to streamline operations and boost profitability across its business. AI-driven forecasting tools help optimize inventory management, reducing stock shortages and excess inventory while improving supply chain efficiency. In stores, Walmart deploys computer vision and automation to monitor shelf availability and automate restocking, minimizing labor costs and enhancing customer experience. Its AI-powered analytics personalize marketing and pricing strategies, driving higher sales conversion and boosting profit margins.

On the consumer-facing side, Walmart's Sparky AI shopping assistant drives higher average order values compared with non-users, while improving conversion rates through personalized, conversational commerce. Through these innovations, Walmart is creating a tech-led retail model designed to capture market share and further improve underlying business fundamentals.

Allocating to the next round of AI leaders: Venture capital and growth equity

We believe that investors will need a healthy allocation to venture capital and growth equity to fully participate in the AI opportunity. To date, these allocations have often represented only a small part of an overall portfolio. Going forward, we expect a significant portion of the value created within the broad AI ecosystem will accrue to pre-IPO investors. Legacy notions about the sizing of VC and growth equity allocations may need to change.

Specific features of AI's development are shifting the calculus for pre-IPO investing, including: the number of startups being formed, the amount of capital being deployed towards early stage AI, the speed with which firms are reaching high levels of annual recurring revenue (ARR) and the scale of valuations achieved in pre-IPO financing rounds.

Exhibits 16A and 16B illustrate AI's impact on the venture capital opportunity set. Private AI startups currently outnumber publicly traded companies by a significant margin. In response, VC firms are rapidly increasing their AI-related investments, which now constitute a dominant share of the overall VC market. The outsized footprint of the U.S. in AI and information technology has led to broad-based U.S. dominance of venture capital activity (**Exhibit 17**). This geographic concentration can be justified given the presence of the dynamic startup ecosystem in Silicon Valley (and to a lesser extent in other U.S. regions). However, some promising centers of AI innovation offshore—in China specifically—may attract new investor interest.

The venture industry is on pace for record deployment in 2026

EXHIBIT 16A: U.S. VC CAPITAL DEPLOYED (USD BILLIONS)

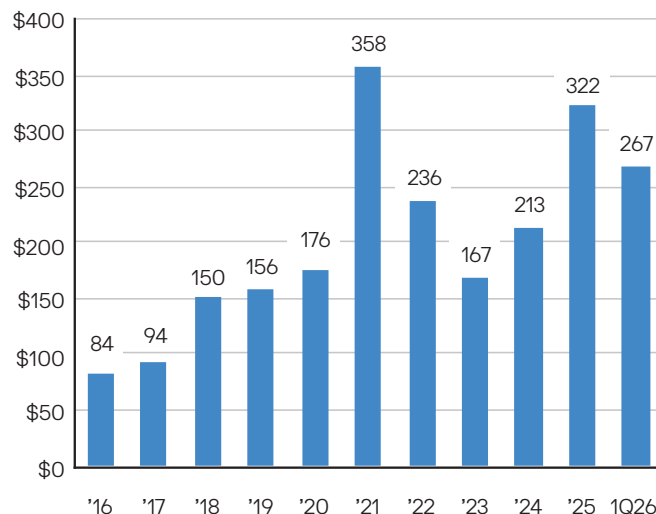
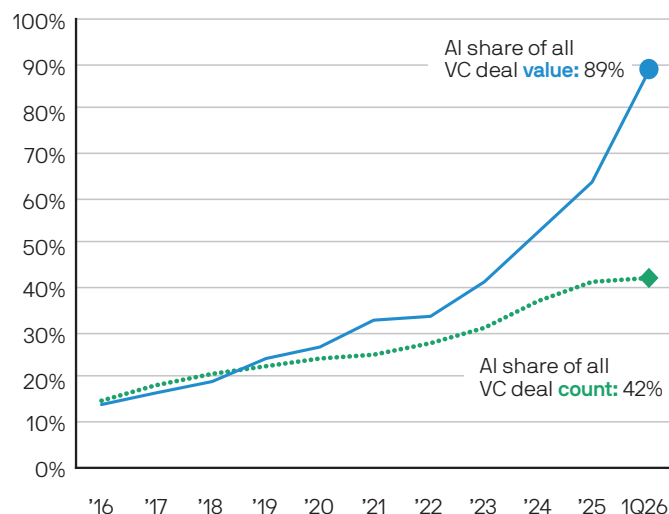


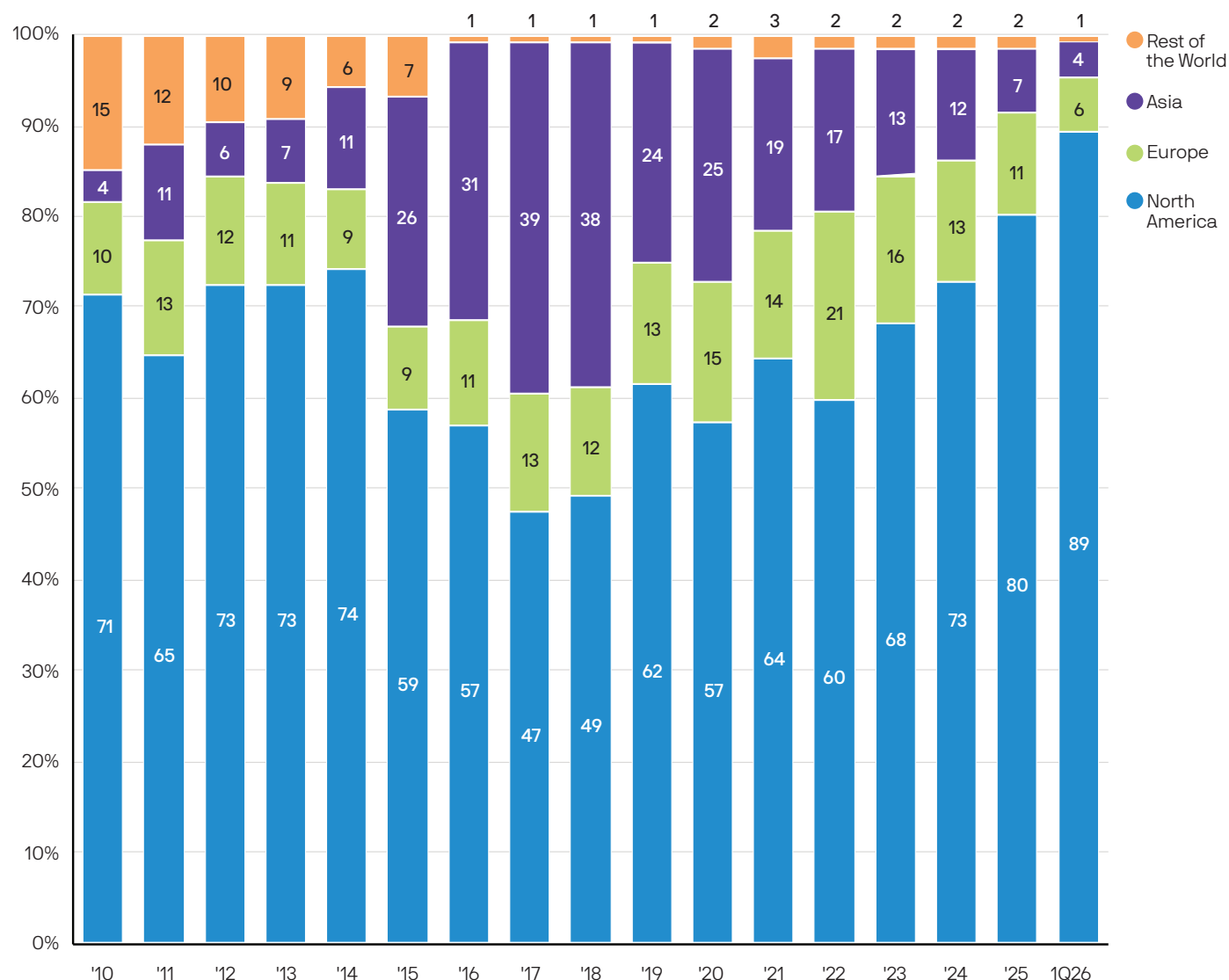
EXHIBIT 16B: AI SHARE OF ALL U.S. VC DEAL ACTIVITY



Source: Pitchbook, J.P. Morgan Asset Management; data based on availability as of March 31, 2026.

The U.S. claims the lion's share of global VC deals in AI and machine learning

EXHIBIT 17: GLOBAL AI AND MACHINE LEARNING VENTURE CAPITAL INVESTMENT BY REGION



Source: Pitchbook, J.P. Morgan Asset Management; data based on availability as of March 31, 2026.

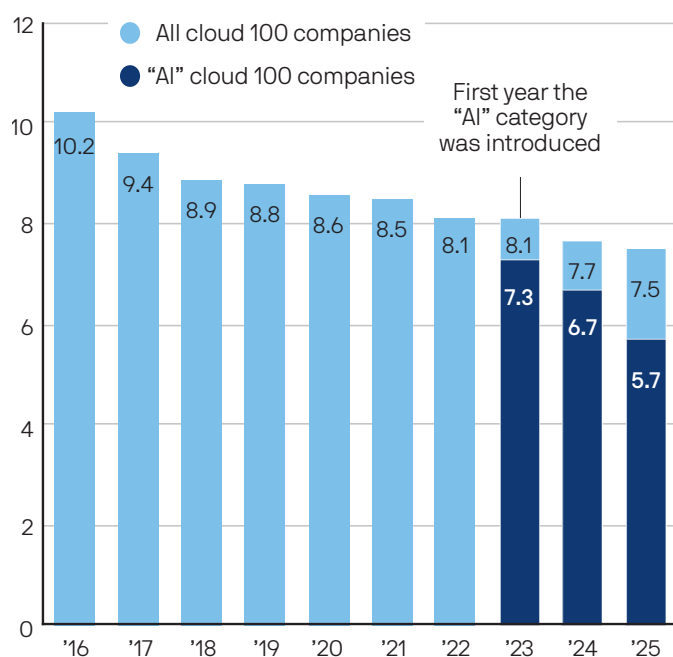
In the traditional view of venture investing, a few significant winners will more than offset a large number of unsuccessful investments (the so-called “power law”). AI may be creating the conditions for a more efficient venture ecosystem, in which firms burn less capital and take less time to achieve scale. **Exhibit 18** shows the average time to achieve “centaur status”—achieving USD 100 million of ARR—for Cloud 100 companies. While the time to reach this status has been declining for some time, there is a distinct acceleration taking place among AI-focused firms.

Startups are also staying private longer and reaching much higher valuations before they seek a public listing or a sale. The Forbes Cloud 100—an annual global ranking of the top private cloud computing companies—illustrates this point: in less than 10 years, aggregate valuations have grown 18x, and the top five firms now represent more than USD 1 trillion in market value.

At the time of writing, the market capitalization of the top two private companies—OpenAI and Anthropic—is roughly USD 2 trillion. That is roughly similar to the recent IPO valuation of SpaceX (not a pure AI play, but certainly related). OpenAI's most recent capital raise (USD 122 billion) was larger than that of the entire venture capital industry 10 years ago. The growth of private firms prior to IPO is changing the dynamics of venture capital and growth equity investing.

Revenue growth at AI startups has accelerated

EXHIBIT 18: AVERAGE YEARS TO USD 100 MILLION ANNUAL RECURRING REVENUE (CENTAUR STATUS)



Source: Bessemer Venture Partners' *The 2025 Cloud 100 Benchmarks Report*, J.P. Morgan Asset Management; data as of December 31, 2025.

Whereas investors have historically accessed the venture and growth equity sectors through third-party funds that diversify risk across many emerging firms, going forward the scale and viability of late-stage financing rounds may create demand for direct access. Meaningful financial gains will accrue not only to early-stage venture investors, but also to those later in the process.

The role of public and private debt in financing AI

No single capital market will be able to finance the build-out of artificial intelligence. U.S. hyperscalers are a case in point: Initial reliance on their organic cash flow has reached a limit, and they are now taking on large amounts of public and private debt, including via off-balance-sheet vehicles. Evidence suggests that hyperscalers should be able to service these obligations, but the increase in debt raises the level of risk. Large fixed obligations can shift the market's focus away from a positive long-term growth outlook and toward cash flow for debt service.

From an investor's standpoint, active management in credit markets is essential. In investment grade markets where credit spread compensation is relatively thin, the risk/reward proposition in AI-related firms must be evaluated relative to other sectors and firms. In more speculative credit markets with wider credit spreads, it will be critical to value this compensation against potential default risk. With respect to opaque off-balance-sheet financing transactions, expertise and experience will be invaluable. Managers with deep teams and skill in each market segment will be best positioned to understand and adapt to these dynamics in real time.

Investment grade credit: The rise of hyperscaler debt

As we’ve discussed, hyperscalers have signed up to finance the AI revolution, initially through operating cash flows and more recently via large scale bond issuance. **Exhibit 19** shows the magnitude of the increase from just USD 16.8 billion total combined in 2024 to nearly USD 223 billion year-to-date. We expect hyperscaler issuance will remain robust, nearly USD 280 billion in 2026 and potentially reaching USD 300 billion in our 2027 forecasts. (Given the rapid acceleration in on-balance sheet debt, it is not surprising that some large players are now pivoting to raise equity as well.)

The AI build-out is increasingly debt-driven
EXHIBIT 19: HYPERSCALER BOND ISSUANCE (USD BILLIONS)

2021	2022	2023	2024	2025	2026 (estimate)	2027 (estimate)
\$30	\$34	\$14	\$17	\$109	\$280	\$300

Source: J.P. Morgan Asset Management; data as of August 27, 2026.

The U.S. investment grade corporate bond market is undergoing an unprecedented composition shift: If Meta and Amazon (classified as Communications and Retail by Bloomberg Barclays Index) were added to the Technology sector, the combined debt would represent about 13% of the market. If the forecasts hold, by 2027 this cohort will surpass U.S. banks as the largest subsector in the market. Prior to the AI boom, many large technology firms were notable for their pristine balance sheets and strong free cash flow; today, that picture is changing.

In the first half of 2026, global investors maintained a positive view of hyperscaler debt. For the USD 107 billion of U.S. dollar hyperscaler bond issuance brought to market in the first half of the year, order books have been oversubscribed by roughly a factor of 4x. Demand for non-dollar debt has been substantial: Amazon issued the largest-ever euro- and Canadian dollar-denominated corporate bonds, and Alphabet issued the largest-ever deals in Japanese yen, Swiss franc and British pound. As part of its U.K. issuance, Alphabet included a tranche of 100-year bonds driven by reverse inquiry from pension funds seeking duration. Hyperscaler debt supply and benchmark concentration concerns are having an impact on investor demand, with subscription levels for new deals varying between 1.4x and 4.0x. Pricing concessions are increasing and credit spreads are approximately 25bps wider this year. Demand remains healthy, but selectivity is increasing.



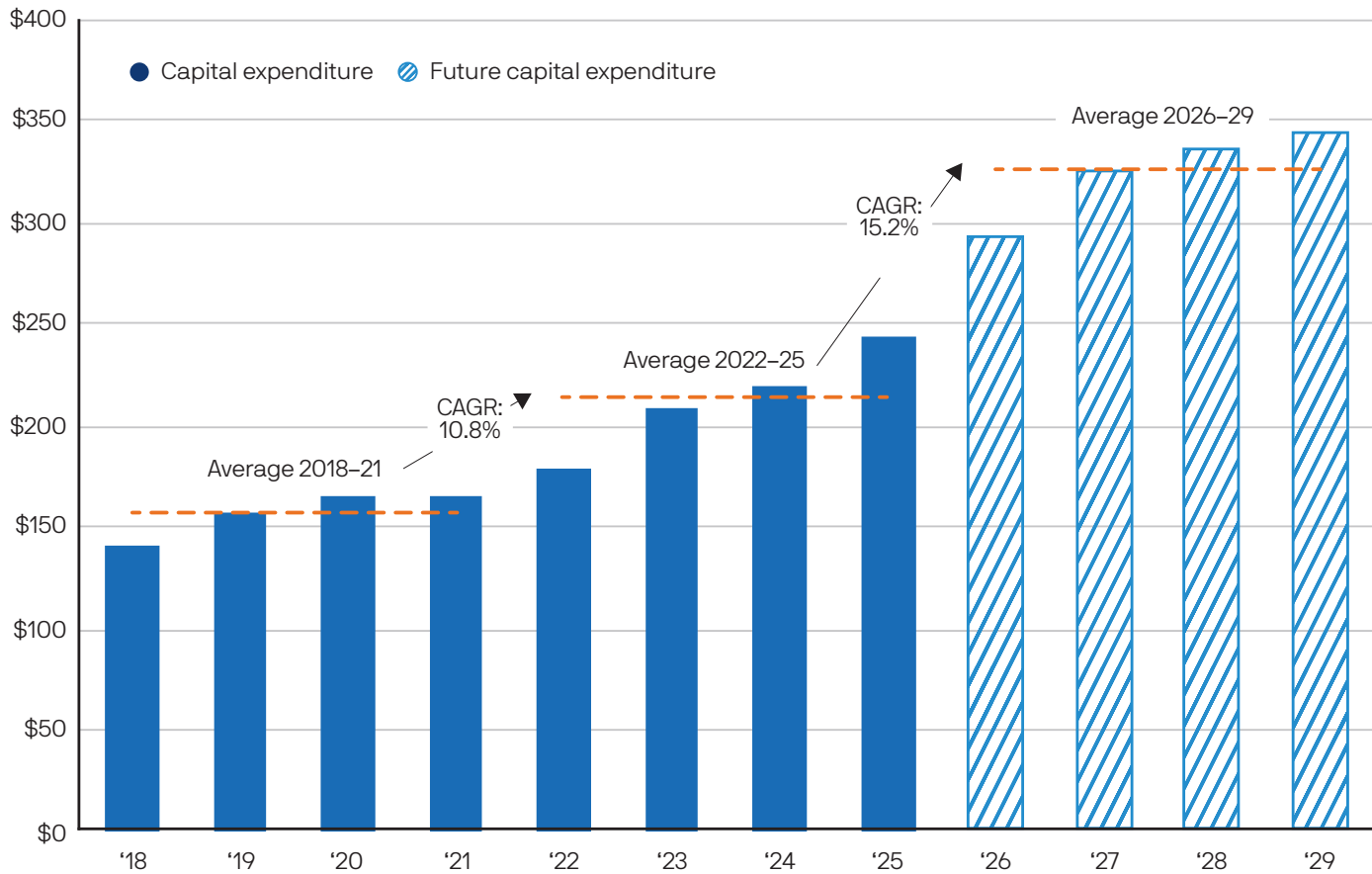
Utilities are ramping up capital investment to bring AI onto the grid

For investors looking at the full scope of AI-related opportunities, integrated electric utilities may offer a relatively lower-risk approach that can be accessed via public equity and debt markets as well as core infrastructure funds. Utilities generally operate under regulated frameworks that support cost recovery, maintain investment grade credit ratings and generate predictable cash flows. For active bond managers, targeted investment grade utility debt can provide exposure to the data center build-out with substantially less volatility than equity investments tied directly to AI.

For many years, efficiency gains largely offset economic growth and utilities had limited need to expand their generating capacity. Now, utilities across many regions are experiencing a surge in large-load requests from data center operators and they are responding with substantial investment in generation, transmission, substations and distribution infrastructure. In many utility service territories, the need to serve data centers is already accelerating capital spending plans and supporting larger rate bases (Exhibit 20). We view debt issuance as an opportunity to gain AI exposure through secured, unsecured and hybrid bonds in integrated utilities.

Power demand from data centers is transforming the utilities sector

EXHIBIT 20: NORTH AMERICA INVESTOR-OWNED REGULATED UTILITIES CAPITAL SPENDING (USD BILLIONS)



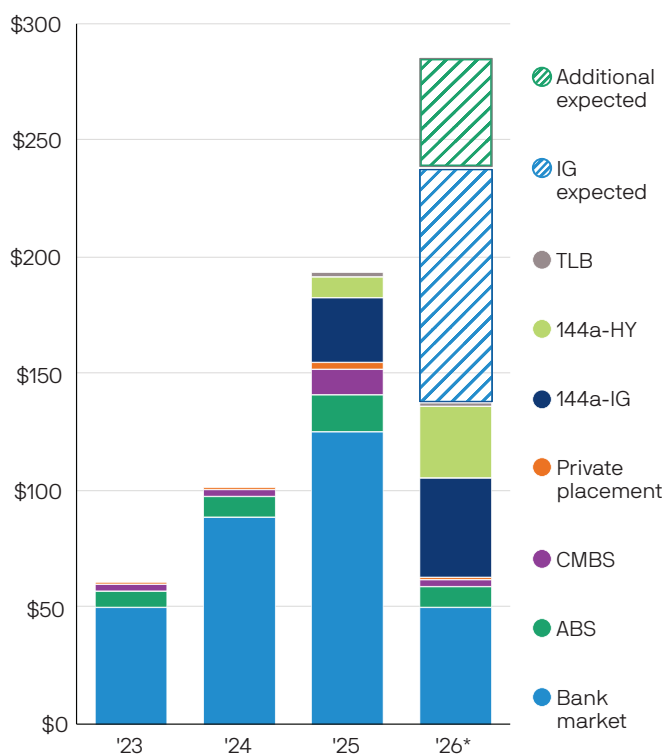
Source: Standard & Poor's, J.P. Morgan Asset Management; data as of May 1, 2026.

Data center financing requires additional layers of debt

AI cannot operate without data centers, and much of the capital raised for the AI infrastructure build-out targets this particular use. Before AI, data centers were initially financed with bank construction loans; when the centers were completed, the loans were refinanced into the commercial mortgage-backed securities (CMBS) or asset-backed securities (ABS) securitization markets. Today, the physical scale and enormous cost of state-of-the-art AI data centers require a different model (**Exhibit 21**).

Once financed with bank construction loans, data centers now draw in capital across the debt spectrum

EXHIBIT 21: DATA CENTER FINANCING (USD BILLIONS)



Source: J.P. Morgan Asset Management; data as of August 27, 2026.

Data center financing now draws in capital from multiple debt markets, including investment grade 144a (private placement), high yield 144a, private credit and term loans even before stabilization. This debt is not eligible for the U.S. investment grade corporate index, yet it represents a substantial incremental debt obligation attached to AI. We project investment grade 144a financing volumes to grow from USD 27 billion in 2025 to USD 80 billion to USD 100 billion this year, with potential to reach USD 150 billion to USD 200 billion of issuance next year as stabilized data center construction loan and high yield bonds come up for refinancing.

Private placement 144a bonds are not generally senior unsecured obligations of the hyperscalers; instead they are issued by bankruptcy-remote special purpose vehicles where the data center assets reside. There is no standardization yet for these structures, and investors must closely examine each transaction to properly price and consider unique risk factors. These include:

- the stability and credit quality of the developer building the project, the tenant leasing the data center, and the customer base that will be paying for the AI
- the risk of local and state level regulatory action (particularly zoning or permitting) that could block or delay completion or impose constraints on the data center's operations
- the extent to which insurance coverage protects the data center from catastrophic events like tornados, hurricanes or floods
- the potential ability of the tenant to terminate the lease in the event of construction delivery delays or inability to access power supply
- the risk that the data center becomes technologically obsolete and the projected lease rate cannot be maintained

The initial physical “shell” represents roughly 30% of the total cost for a completed AI data center, while the internal technology (graphics processing units (GPUs), memory, storage, networking, etc.) accounts for roughly 70%. Until recently, hyperscalers have paid much of this cost directly out of operating cash or financed via parent-level debt issuance. But this too is changing.

Creative financing structures have emerged in which AI chips are used as collateral for debt issued by a special-purpose vehicle. Over time, the portion of data center costs funded in this way will increase, and we estimate that 2026 year-to-date commitments for chip financing are already over 9x the 2025 level. This reduces the amount of equity capital needed to develop AI’s physical infrastructure, but the resulting debt adds an additional layer of leverage and risk.

Expanding use of off-balance sheet and contingent obligations

The use of special purpose vehicles for funding data center construction and GPU acquisition attaches fixed debt obligations to specific assets, often within vehicles that feature greater complexity and less transparency. Nonetheless, sophisticated fixed income investors can assess and price the risks embedded in such transactions.

Of potential concern, however, is the growth in “contingent obligations” of large debt issuers that are not included in balance sheet liabilities or rating agency leverage calculations—until there is a problem. These obligations generally take the form of a backstop to a lease or debt, from a stronger credit (often a hyperscaler or chip company) to a weaker credit (often an AI model firm or cloud provider).

The obligation is not recognized unless the weaker firm defaults on its obligations.

Examples include:

- A hyperscaler providing a residual value guarantee (RVG) for a data center construction project in exchange for shorter data center leases. The combination of the RVG plus shorter accounting lease terms means that debt financing the data center construction sits off-balance sheet for the hyperscaler until it becomes probable that the shorter-term leases will not be renewed, or the appraised market value of the data center is below the RVG.
- A semiconductor company providing a residual value guarantee on a majority of the debt collateralized by AI chips leased to a non-public AI model maker. While lending to such a counterparty—even on a collateralized basis—might be risky, the semiconductor firm is incentivized to grow the market share for its chips. Unless the model maker defaults on its obligations, the debt remains off-balance sheet.
- A hyperscaler providing lease guarantee for an emerging “neocloud” provider that is deploying the data center on behalf of its customer base. (Neocloud refers to a new generation of cloud service providers that deliver AI-native infrastructure.) Should the neocloud provider default, the hyperscaler will either assume the remainder of the lease or pay the net present value of the remaining lease payments.

Ultimately, the sustainability of the capital structure used by hyperscalers will depend on the ability of AI firms to generate revenue and profits from end users, and if not, from the continued willingness of hyperscalers to subsidize it. Neither is a certainty.

Real assets and AI: real estate and infrastructure

Data centers and power generation companies offer investors the primary real asset exposures to AI that can be accessed through a variety of public and private funds. Classifying these assets in either category can be subjective, which requires that investors take an intentional approach.

The direct and indirect impact of AI on real estate

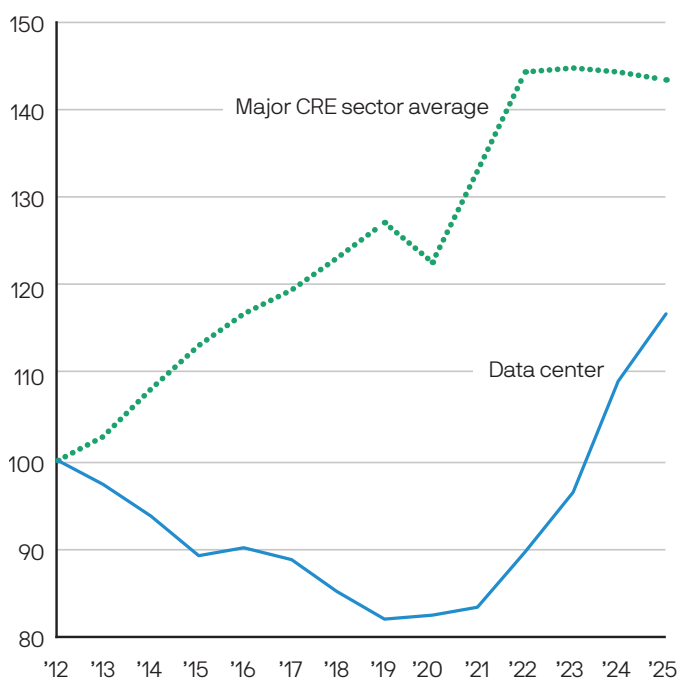
Data centers are not “real estate” in the classic sense. Unlike traditional industrial real estate, much of a data center’s value is in its internal technology and systems, not its real estate “shell.” MSCI’s global real estate data provider, Real Capital Analytics, reports that in the four quarters ending March 2025 the sales price for average industrial assets was USD 149 per square foot (PSF); that compares with an average data center asset price of USD 494 PSF. Traditional industrial assets therefore trade at roughly one-third the PSF value, implying that approximately two-thirds of the value is attributable to specialized infrastructure rather than the building shell and land. Lease terms also differ, with industrial properties using a per-square-foot basis whereas data centers are generally leased based on power/energy capacity (more akin to a utility).

As a point of comparison, earlier generations of data centers experienced protracted periods of underperformance. From roughly 2013 to 2022, data center rent and revenue growth significantly underperformed the broader real estate asset class in every year but one. Demand drivers—cloud computing, cloud storage and streaming—continued to grow.

But the sector struggled with changing design needs as the industry evolved and tenant concentration increased. Legacy assets with outdated designs and systems experienced significant declines in demand and rent revenue.

Historical performance of data centers has been mixed

EXHIBIT 22: MARKET REVENUE PER AVAILABLE FOOT, INDEXED TO 100 IN 2012



Source: Green Street Advisors, J.P. Morgan Asset Management; data as of December 31, 2025.

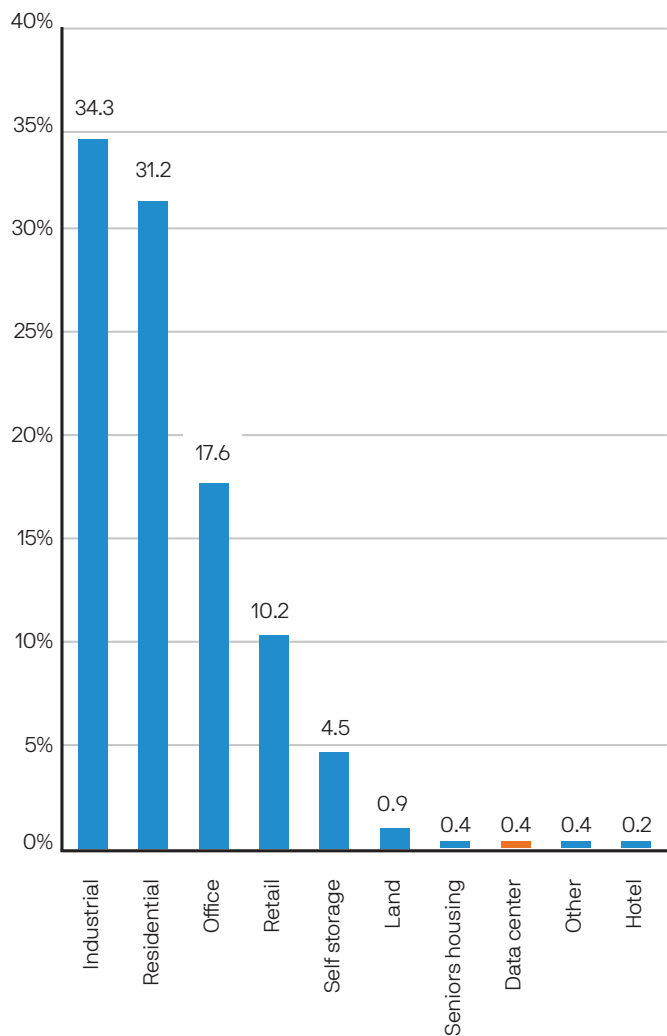
The latest generation of purpose-built AI data centers is seeing strong demand, but this dynamic may not persist (**Exhibit 22**). Changing technology could cause today’s state-of-the-art facilities to become less functional, or industry consolidation could erode demand. For this reason, data center exposure in dedicated real estate strategies will likely remain in closed-end value-add funds or in dedicated REITs that specialize in developing and selling these properties.

Core real estate remains a source of diversification

Investors looking to real estate to provide portfolio diversification can still find it in traditional open-core funds, where data center exposure in core real estate remains very limited (Exhibits 23A and 23B).

Open-end core real estate funds have limited data center exposure

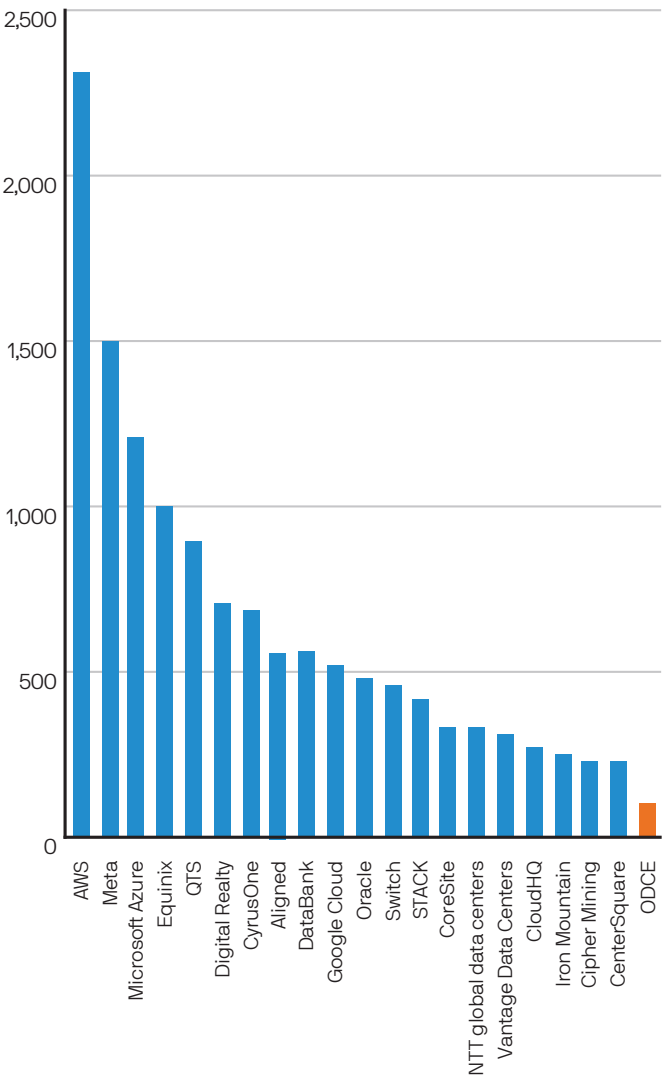
EXHIBIT 23A: NFI-ODCE SECTOR WEIGHTS



Source: NCREIF ODCE, J.P. Morgan Asset Management; data based on availability as of May 29, 2026.

For funds benchmarked to the NFI-ODCE (Open Diversified Core Equity) index and focused on the core sectors of industrial, residential, retail and office, exposure remains very low (sub-0.5% of the index). This helps to keep core real estate a powerful diversifier, even as AI exposure rises elsewhere in portfolios.

EXHIBIT 23B: IT CAPACITY FOR TOP 25 DATA CENTER COMPANIES (MEGAWATTS)



Source: NCREIF ODCE, ABI Research, Green Street Advisors, J.P. Morgan Asset Management; data based on availability as of May 29, 2026.

Indirectly, AI will have a profound impact on the broader economy and therefore the broader real estate asset class. While it's too soon to judge how strongly the impact will be felt, we see some signals emerging:

Industrial

Outside of data centers, industrial assets are reporting positive demand from advanced manufacturing. Policy stimulus and tariffs have been supportive of the reshoring of critical industries, including many in AI-related fields such as chip fabrication and power generation equipment. Given high domestic labor costs, however, firms are focused on efficiency and look to emphasize AI-enabled automation to remain competitive.

These advanced manufacturing facilities need more power than traditional industrial assets. As a result, access to power has become a key competitive differentiator across specific properties. Facilities with elevated power capacity already in place are outperforming, and we expect that advantage will persist.

Office

Performance in the office sector is already bifurcated, with new and trophy assets outperforming older properties. AI is likely to reinforce this trend as companies pay a premium for the best space to attract and retain their most productive employees, particularly those developing and deploying AI within corporate workflows. The key uncertainty is whether AI complements or displaces labor.

Six months ago, many market participants expected that coders would be displaced, and tech-heavy office markets would be most at risk. So far, however, the opposite seems to be true, with the San Francisco Bay Area among the biggest beneficiaries and tech market office conditions improving meaningfully. Instead, buildings and markets that house lower value add uses, such as back office and call center employees, may face greater downside risks if displacement accelerates.

Retail

AI is likely to have a modest direct impact on retail demand, though trends in income distribution that favor wealthier cohorts will influence the sector. A “K-shaped” recovery that benefits upper income households more than their lower income counterparts would tend to favor the best retail assets. Centers catering to higher-income shoppers should maintain a competitive advantage. “Fortress” malls—those with the highest foot traffic and strongest tenant rosters—are a clear example. While the vacancy rate for all malls is 8.8%, the vacancy rate for fortress malls is just 1.3%. Even within necessity-based retail (e.g., grocery-anchored centers), assets in higher-income trade areas tend to perform better.

Infrastructure can deliver AI exposure—directly or indirectly

Along with real estate, infrastructure is among the most common real asset investment strategies. However, as an asset class it has less well-defined subcategories, which leaves investors a little unsure about how to approach AI exposure. Specifically, the labeling convention of “core” and “value-add,” which is well understood in real estate, lacks precision when it comes to infrastructure assets.

Looking across the AI opportunity set, specific types of infrastructure assets may be best suited to specific types of funds. Riskier assets may indeed deliver higher returns, but investors should know what they are getting and understand that labels may be misleading.

- Data centers, for the reasons we discussed in the real estate section, are best characterized as value-add or “non-core” strategies. The current premium attached to cutting edge chips and on-site power may be temporary, creating some risk to future valuations and lease income. Though less common, data centers with guaranteed grid power supply and long-term leases to high quality counterparties could rightly be considered a “core” risk exposure.

- “Merchant” power, or generation assets that are not linked directly to a regulated distribution network or have a long-term offtake contract, offers a similarly elevated level of risk. Data center demand may be sufficient to generate high returns in the near term, but over the long term, most data centers would prefer the stability of regulated grid power. In particular, high cost on-site behind-the-meter power may be necessary today but could be effectively stranded if and when grid access is established.
- Regulated power, in the form of a traditional utility, is ideal for core infrastructure investors and may be among the most compelling risk-adjusted investments across the AI ecosystem. Current demand will finance additional generation capacity and system upgrades, while long-term contracts or regulated return frameworks reduce risk. Utilities with excess capacity will be able to negotiate advantageous contracts with the strongest AI providers.

The safest and most diversifying allocation to infrastructure will emphasize regulated and long-term contracted power generation and distribution over data centers and unregulated power. However, many of the largest infrastructure funds maintain substantial holdings in riskier asset types, despite being labeled as “core” or “core plus.” Ultimately, labeling is unimportant as long as investors recognize the underlying risks and how they relate to the overall AI ecosystem.



China charts its own AI path

Compared with the U.S., China offers a parallel version of AI development, which investors must account for even if they choose not to invest directly in Chinese public and private markets. Simply put, China appears fully capable of presenting an AI ecosystem that offers a viable alternative to its U.S. counterpart. While the nature of AI makes the technology somewhat borderless, a key question going forward will be the extent to which China's AI technology is adopted elsewhere.

The performance of Chinese AI models lags the star U.S. performers, but the difference is modest and ultimately may not prove a barrier to commercial implementation (**Exhibits 24A and 24B**). Much has been made of China's willingness to establish open source models as the standard; however, some of the country's most advanced models are proprietary. For example, Alibaba Group's Qwen 1 and Qwen 2 were open source,

but the most sophisticated Qwen 3 is proprietary. Equity investors may see this as an advantage, for Alibaba at least.

Beyond raw analytic capabilities, AI model usage is increasingly driven by price considerations that put Chinese models in an advantageous position. Users are becoming increasingly adept at assigning tasks to models that can deliver acceptable output at the lowest cost – creating an opening for Chinese models. Since the beginning of 2026, OpenRouter usage data of top AI models shows that Chinese models have accelerated past U.S. models in total tokens.

While the U.S. allocates a significant share of capital to developing cutting-edge chips and frontier models, China is emphasizing AI deployment across many sectors of the economy, including manufacturing, electric vehicles, smartphones, agriculture and robotics. China's bet is that integrating AI into the existing factory floor and supply chain may well produce more durable productivity gains than the pursuit of model leadership. Moreover, the Chinese market may be better suited to dealing directly with

Chinese AI models are close behind top U.S. performers, and are seeing growing adoption

EXHIBIT 24A: ARTIFICIAL ANALYSIS INTELLIGENCE INDEX SCORES

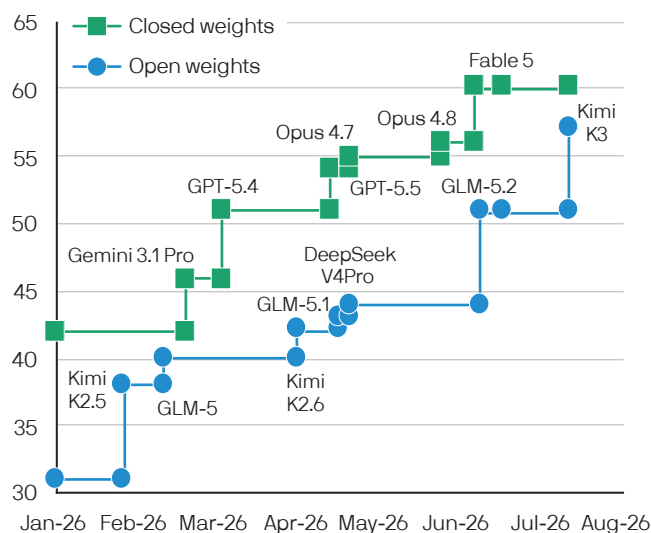
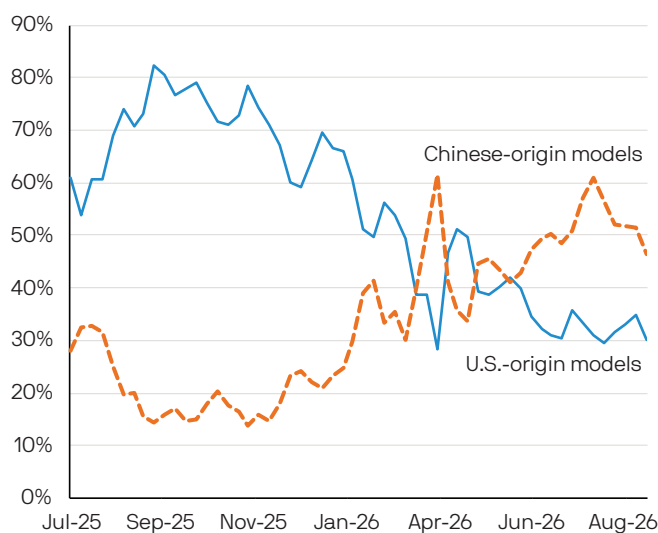


EXHIBIT 24B: WEEKLY SHARE OF TOKENS PROCESSED ON OPENROUTER

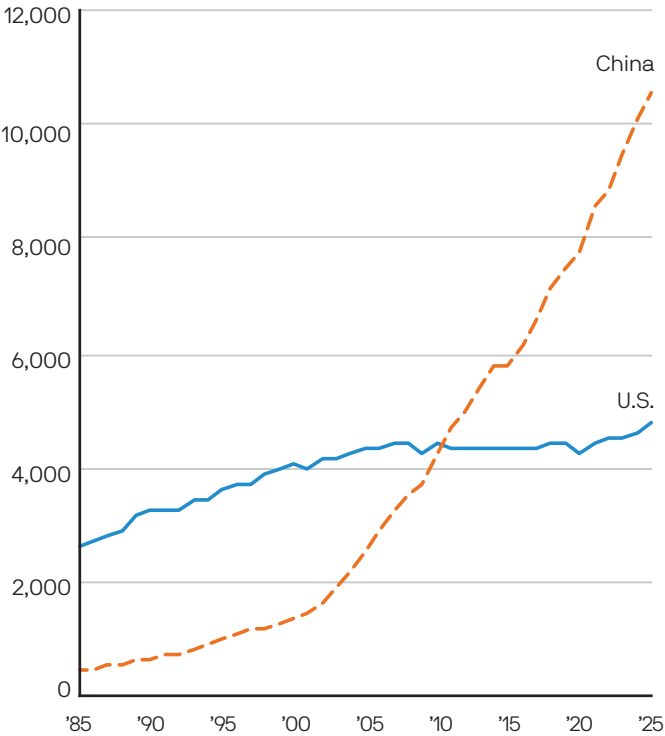


Source: J.P. Morgan Asset Management. (Left) Liquid AI, Maxime Labonne, Artificial Analysis; data as of July 17, 2026. (Right) OpenRouter; data as of August 17, 2026. OpenRouter is a developer-facing service that routes API (application programming interface) requests across hundreds of models, so its usage skews toward developer and agentic workloads. It under-represents enterprise workloads, which mostly run on the major cloud platforms or directly with a model developer, such as OpenAI or Anthropic. Weekly data, July 13, 2025 to August 17, 2026.

other business users or within well-established online platforms, than the individual subscription-based models that are common in the U.S.

Chinese hyperscalers are also exhibiting a greater degree of financial discipline than their U.S. counterparts, with total capex of roughly 10% of the U.S. hyperscalers' spend. As a share of revenue, Chinese AI capex runs approximately 10% vs. 27% in the U.S.; as a share of operating cash flow, 50% vs. 71%. Funding comes from internal cash flow rather than third-party financing, and the government's National Development and Reform Commission (NDRC) actively manages power-quota releases to prevent overbuilding.

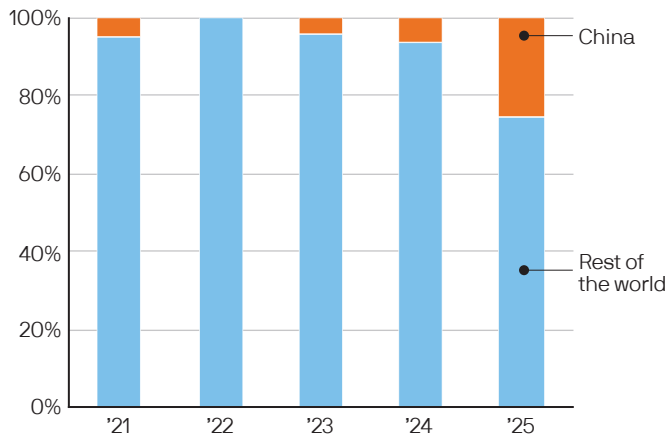
China generates more electricity than the U.S.
EXHIBIT 25: ELECTRICITY GENERATION (TERAWATT-HOURS)



Source: Energy Institute, J.P. Morgan Asset Management; data as of June 30, 2026. One terawatt-hour equals one trillion (10^{12}) watt-hours.

The role of Chinese chips in LLM training is modest, but growing

EXHIBIT 26: ORIGIN OF CHIPS USED TO TRAIN CHINESE LLMS AS A SHARE OF TOTAL MODELS TRAINED



Source: EpochAI, J.P. Morgan Asset Management; data as of July 2025.

The most consequential difference between the two ecosystems: China has an abundance of energy and a lack of compute, while the U.S. faces the opposite constraint (**Exhibit 25**). Chinese electrical generation has grown roughly fivefold over the last 20 years, surpassing U.S. generation around 2010, and adding 10 times more capacity in 2025 relative to the U.S. However, U.S. export controls have restricted access to the highest performance chips and manufacturing equipment (EUV lithography, advanced high bandwidth memory (HBM) needed to make equivalents domestically). Through 2024, over 90% of LLMs developed in China were trained on hardware made outside of China (**Exhibit 26**).

China presents a conundrum to investors looking to build diversified AI portfolios. The scale and pace of AI development in China is second only to that of the U.S., and the local market runs the gamut from venture and growth opportunities to well-capitalized hyperscale providers. However, it remains to be seen if Chinese firms can develop AI products that will achieve commercial success elsewhere. Regardless, the presence of sophisticated, low-cost Chinese models should limit the ability of any other model to achieve commercial dominance in any market where they are available.

Europe and Japan play the waiting game

From a distance, Europe and Japan may appear to be also-rans in the race for AI development, and market data suggest that this is indeed the case. **Exhibit 27** shows the weight of AI-related industries in the U.S., Japan, Europe and emerging markets (e.g., China, Korea and Taiwan). For reasons described earlier, this lack of AI exposure may offer some defensive benefits for portfolios broadly, along with more reasonable valuations.

However, even within these limited sector allocations, some firms offer strong opportunities to participate in the AI boom. Power equipment and semiconductor technology are both well represented.

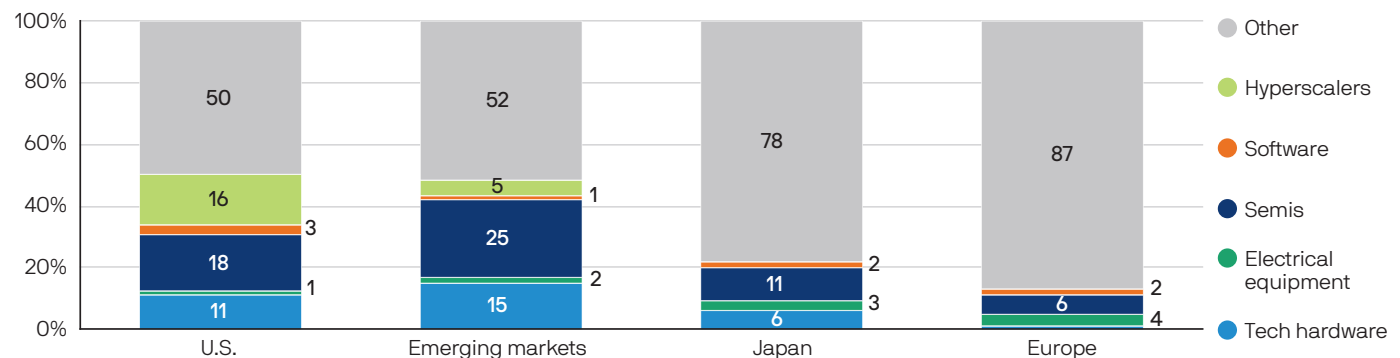
- Japan has benefited from technology and engineering expertise in the chip manufacturing and energy sectors, which are both critical to AI. During the capital-intensive phase of AI's build-out, key players in memory, optical fiber, ceramic capacitors and packaging have been performing very well. Heavy industry companies are also finding success in delivering advanced power generation and cooling systems to data centers globally.

- Longer term, Japanese leadership in robotics—and specifically sophisticated industrial applications as opposed to humanoid robots—will provide a platform for AI implementation on the factory floor. This will be an advantage regardless of which AI model ends up in a dominant position.
- Europe has not been playing a leading role in AI technology, but it is not absent from the stage altogether. ASML occupies a unique place in the semiconductor manufacturing ecosystem, and the engineering and power generation sectors are global leaders.
- There are reliable power sources in Europe, particularly in France (nuclear) and Spain (solar), which offer a favorable environment for data center construction.
- The European Union (EU) is taking a more forceful stance on data sovereignty that may provide a moat for European AI firms. The EU approach could also serve as a model if other jurisdictions eventually pivot toward increased regulation.

Ultimately, both Europe and Japan will likely benefit from AI's potential to improve productivity in technologically sophisticated societies with aging populations. The lack of homegrown national champions will allow a more flexible approach to choosing among the best AI providers, whether in terms of capabilities or price. As a result, firms in those regions should be fully capable of realizing productivity gains from AI.

The size and composition of AI-related sectors varies across global equity markets

EXHIBIT 27: EQUITY INDEX EXPOSURE TO AI-RELATED INDUSTRIES AS A PERCENT OF TOTAL MARKET CAP



Source: LSEG Datastream, MSCI, S&P Global, J.P. Morgan Asset Management; data as of July 31, 2026. MSCI indices are used for emerging markets, Europe and Japan, US: S&P 500. U.S. hyperscalers include Alphabet, Amazon, Meta, Microsoft and Oracle. Emerging markets hyperscalers include Alibaba and Tencent. The U.S. software weight is adjusted to exclude Microsoft and Oracle given they are counted as hyperscalers.

Conclusion

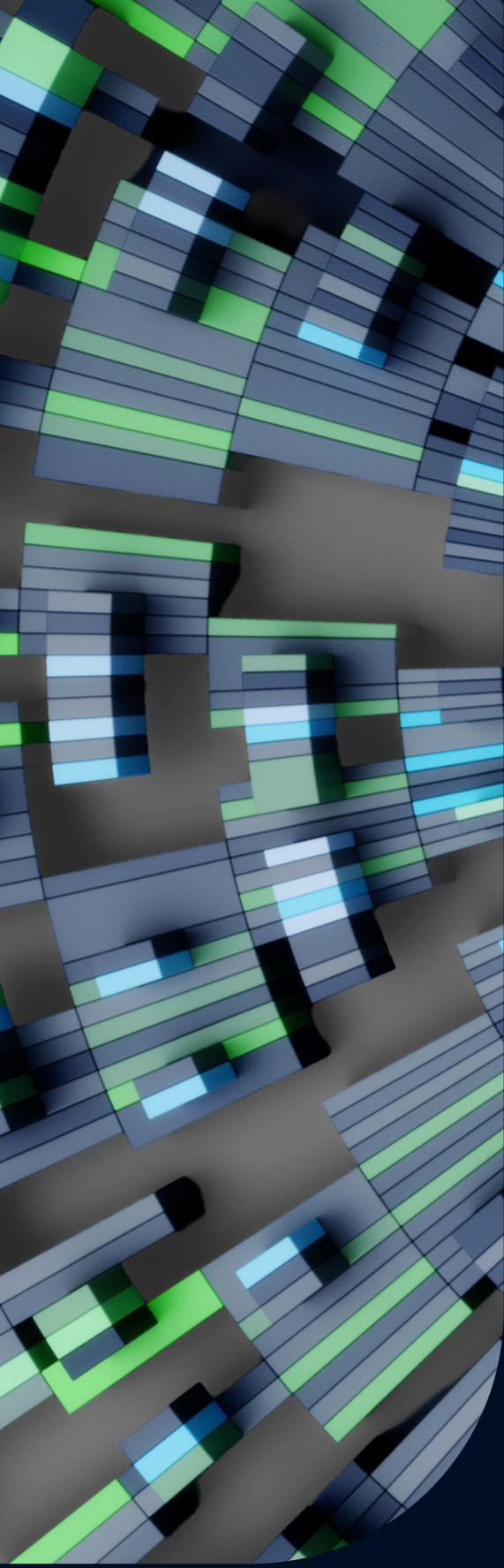
The feeling that AI has become omnipresent has grown steadily and is having a palpable influence on the process of asset allocation. In choosing a title for a paper on the AI boom, we might have referenced the title of a recent Oscar-winning film: “Everything Everywhere All at Once.” Across many asset classes, allocators increasingly view their investment decisions through the lens of AI and the expectations of its evolution.

On the one hand, this makes perfect sense. The transformational power of AI technology on human society, the global economy and financial markets cannot be ignored. Taking a view on AI, even if that view is simply borrowed from passive benchmarks, provides some guidance on capital allocation.

On the other hand, examination of past technology booms reveals how unpredictable they can be, and how risky it is to assume that current market valuations are good predictors of the future. Understanding the phases of other, similar booms can provide a useful perspective on the AI story as it unfolds (and not simply in hindsight).

Applying fundamental analysis to sector and security selection offers a counterbalance to excessive market enthusiasm. Recognizing the massive weight of capital flows into AI-related investments suggests that allocators must consider both diversification within AI and diversification from AI as they navigate the path ahead.





Appendix

Historical case studies of capital investment booms

CASE STUDY 1

The railroad boom

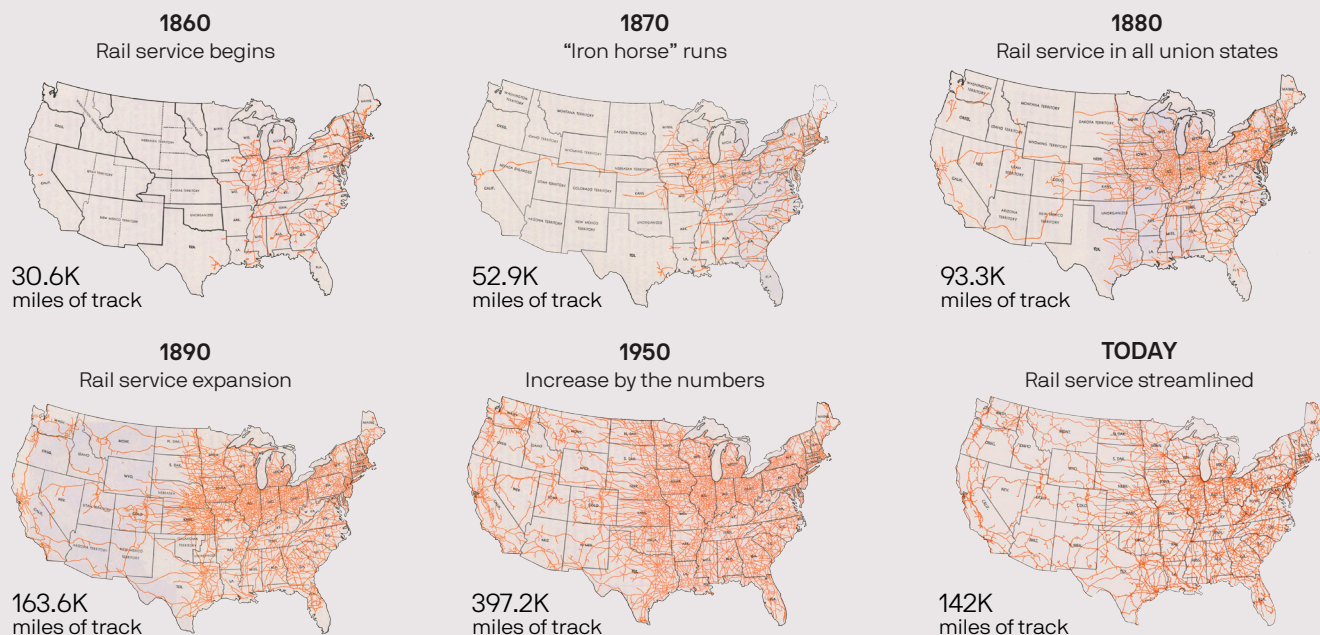
In the early days of the U.S., the challenge of transporting goods and people overland was a nearly insurmountable barrier to growth. Population centers clustered along the coasts or navigable rivers, augmented—where geography allowed—by networks of canals. In 1800 it cost as much to move a ton of freight 30 miles on land as it did to carry it across the Atlantic Ocean. Even as late as the gold rush of 1849, it was faster to get to California by sailing around South America than to cross the continent by land.

The development of the steam engine and railroad track, along with the engineering expertise needed to cross a varied landscape, offered a viable solution. In 1830, the Baltimore & Ohio Railroad began operations, laying track west from the port of Baltimore and eventually reaching the Ohio River in 1854. (Another line ran south to Washington, D.C., which coincidentally provided the right-of-way for the first U.S. telegraph line in 1844.)

By 1860 the U.S. had more than 30,000 miles of railroad track, virtually all of which was east of the Mississippi River. In 1869, workers on the first transcontinental railroad, a joint enterprise of the Western Pacific, Central Pacific and Union Pacific railroads, successfully completed a track from Oakland, California to Council Bluffs, Iowa, where it joined the Eastern rail networks. By the turn of the 20th century, more than 190,000 miles of track had been laid, connecting major urban centers and greatly accelerating population shifts to the West. Railroads had become the dominant means of long-distance transportation for passengers and freight in the U.S.

The financing of the railroad boom was a combined effort of private and public capital. Entrepreneurs and investors provided the equity and borrowed heavily in the bond market to finance the construction of the railroads. As the railroads moved West, the U.S. government offered subsidies in the form of per-mile

Growth of the U.S. rail network



Source: *American Railroads: Their Growth and Development*, Association for American Railroads, January 1950.

cash payments and generous land grants along the routes. This served as collateral for large-scale bond issuance and encouraged the development of settlements near the railroad tracks.

Despite the subsidies, the highly leveraged capital structures of railroads were a constant risk. Failures among the major railroads, whose securities were widely held by financial institutions, contributed to

financial panics in 1857, 1873 and 1893. In 1873, for instance, the failure of the Northern Pacific Railroad led to the downfall of Jay Cooke & Co., a prominent Wall Street bank, followed by a string of bank and insurance company collapses, further railroad failures, and a deep economic depression. In the panic of 1893, the financier J.P. Morgan famously led a reorganization that ultimately consolidated the vast majority of the U.S. rail network into seven entities.

Key characteristics of the railroad boom

Descriptor	Key question
Origin	After emerging in the United Kingdom, railroad technology rapidly spread to the U.S. where geographic scale made the technology incredibly valuable.
Scale of investment	Peak investment reached 6% of GDP in the 1870s, and an estimated 180 million acres of land grants were issued by the U.S. federal and state governments.
Duration	The railroad build-out took 60–70 years, peaking in the 1870s.
Key players	Initially, many smaller operators competed to establish commercially viable routes where geography was favorable. Consolidation gradually reduced the number as economies of scale became a key factor.
Sources of capital	Railroads raised large amounts of public capital in debt and equity markets, with support from government subsidies.
Nature of competition	Initially open competition, with increasing regulation as the scale of railroad operations grew and competitors consolidated.
Competitive end state	Passenger and freight rail were subject to local monopolies while competition increased near major urban centers and port facilities.
Market reaction	At their peak in 1881, railroads represented 66% of U.S. stock market capitalization.
Extent of business failures	Widespread bankruptcy was a defining characteristic of the railroad boom, as the need for huge capital investment created debts that could not be serviced in economic downturns.
Residual infrastructure	The rail system and its right-of-way are still in existence and would be impossible to build today.
Residual productivity/growth	By some estimates, the development of the railroads increased U.S. GDP by 25%. They facilitated decentralized manufacturing and industrialization. Farming in the Midwest and ranching in the West became profitable.
Disruptions	Except in localized cases, river and canal shipping became rapidly obsolete.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

CASE STUDY 2

The rise of the telephone

In 1860, the fastest means of communication between the East and West Coasts of the U.S. was the Pony Express, a 1,900-mile relay of fast horses and riders that could carry a letter from Missouri to California in 10 days. With 190 stations along the route, it required thousands of horses and hundreds of riders to operate. Within a few years of its creation, however, it was shut down, having been rendered instantly obsolete by a superior technology.

The arrival of the telegraph allowed long-distance messages to be sent by wire in the form of Morse code. Initially designed to aid railroads in managing traffic, the technology was quickly adapted to more general communication. Point-to-point messaging over dedicated wires allowed for rapid communication, with subsequent transfer to paper for individual distribution

in the form of the well-known “telegram.” The first transcontinental telegraph in the U.S. was completed in 1861; the Pony Express ceased operations two days later.

The transition to the telephone began with Alexander Graham Bell’s patent in 1876. The superiority of voice communication quickly displaced the legacy telegraph business, and the volume of telephone calls grew exponentially. Bell and his backers initially adopted a dual structure in which the Bell Company licensed its technology to local affiliates while a separate company, American Telephone and Telegraph (AT&T), established long-distance lines between them.

Following the expiration of the Bell patents in the 1890s, AT&T began buying up the local units to form a single national monopoly that included the sole capacity

The long distance and regional telephone system



Source: M. D. Fagen, ed., *A History of Engineering and Science in the Bell System: The Early Years (1875–1925)*, vol. 1 (New York: Bell Telephone Laboratories, Inc., 1975).

to manufacture telephones and equipment. AT&T's operations demanded a massive capital investment program that included expanding the vast network of local lines, transcontinental long distance lines within the U.S. and Canada, and undersea cables to link North America with the rest of the world. Along the way, AT&T became the U.S.'s most valuable company, and "Ma Bell," as the company became known, was the country's largest individual employer.

The scale of capital investment needed to keep the system running was staggering. In 13 years, from 1960 to 1973, NASA spent roughly USD 26 billion on the Apollo Program. Over the same period, AT&T spent nearly three times that amount on telephone infrastructure. Its manufacturing subsidiary, Western Electric, would have been the 12th largest U.S. company on a standalone basis.

Key characteristics of the telephone system build-out

Descriptor	Key question
Origin	Telephone service piggybacked on the success of the telegraph, quickly replacing code-based transmission with voice transmission.
Scale of investment	Hundreds of billions of dollars were spent to build and maintain the telephone network, often reaching 3%–4% of GDP on an annual basis.
Duration	60–70 years
Key players	One: AT&T
Sources of capital	Public debt and equity
Nature of competition	Very limited. With few exceptions, the entire U.S. was using the AT&T local and long distance network.
Competitive end state	Monopoly. Eventually, AT&T split up into a series of geographic regional monopolies; there was little competition at the consumer level.
Market reaction	AT&T eventually became the most valuable company in the world by market capitalization, and a massive issuer of investment grade bonds.
Extent of business failures	Limited due to AT&T's monopoly
Residual infrastructure	Significant, capital-intensive infrastructure including long distance and local networks, undersea cables, and switching technology.
Residual productivity/growth	The productivity advantages provided by instantaneous low-cost communication are exceptionally large. AT&T's research arm, Bell Labs, developed many groundbreaking technologies including the transistor, laser and solar cell.
Disruptions	Legacy communication systems disappeared almost immediately, and the barrier to entry limited competition and innovation. Longer-term consequences include higher prices for connectivity, long-distance calling, and a lack of choice in equipment.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

CASE STUDY 3

The petroleum boom

When the first commercial oil well in the U.S. was drilled in 1859 in Titusville, Pennsylvania, the potential use case for refined petroleum was not as a transportation fuel, but for indoor lighting and heating. Until the Civil War era, the most common sources of ambient light were candles and whale-oil lamps, while wood and coal provided the most common sources of heat. Distillation of petroleum into kerosene proved superior for both purposes, and it quickly came to dominate these markets.

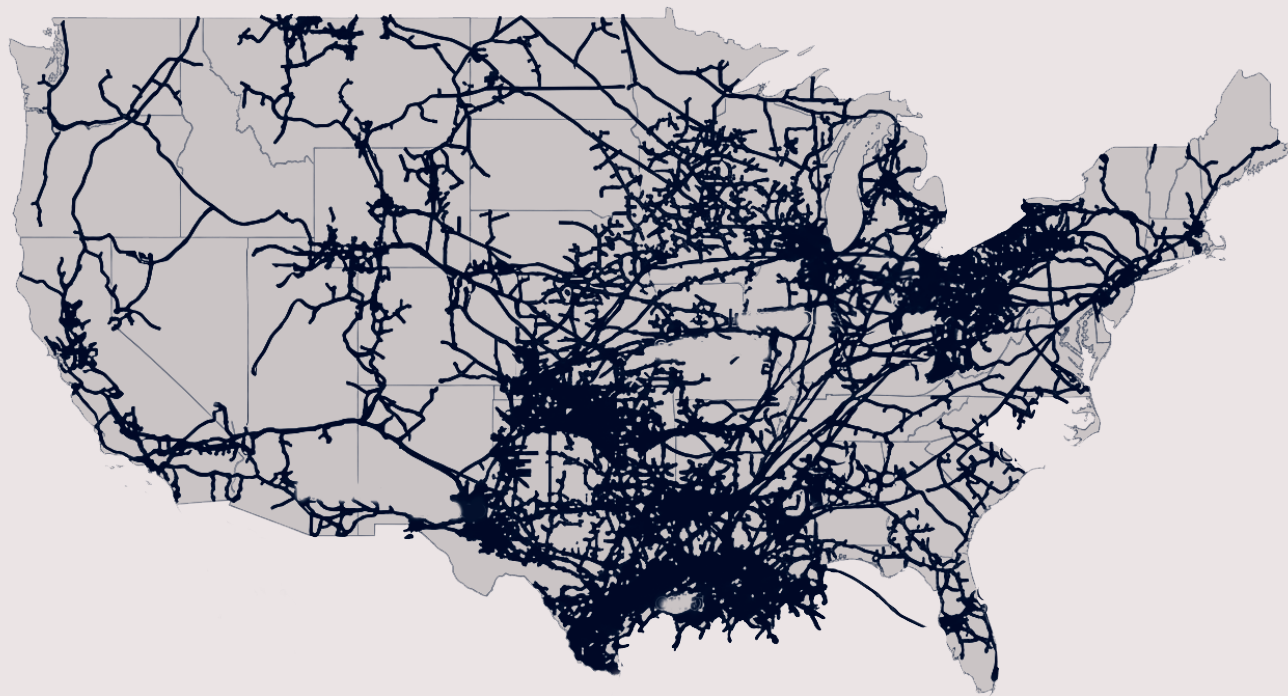
The subsequent development of the industry proceeded on two parallel tracks: a speculative “upstream” drilling sector characterized by smaller producers and subject to violent booms and busts; and an increasingly consolidated “downstream” sector focused on refining and distribution. Beginning in 1901, the drilling business shifted from Western

Pennsylvania to Texas and Oklahoma, each of which experienced a surge in production followed by widespread bankruptcy.

Under the leadership of John D. Rockefeller, Standard Oil quickly monopolized the downstream business. At its peak Standard Oil controlled 91% of refining and 85% of final sales of petroleum products in the U.S. Its formal holding company, Standard Oil of New Jersey, was the largest corporation in the U.S. until it was broken up into a series of regional successor companies in 1913. In many respects this dual upstream/downstream model remains in effect today (Viz. Landman).

Despite the early success, the vast use case for petroleum distillates was not fully appreciated until the development of the internal combustion engine

Oil and gas pipelines in the U.S.



Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. *National Pipeline Mapping System (NPMS)*. Accessed July 31, 2026. <https://www.npms.phmsa.dot.gov>

in the late 19th century. The high energy density and portability of kerosene (and later gasoline) made for an ideal transportation fuel, allowing the development of the automobile, airplane, diesel locomotive and bulk-fuel ships. Petroleum became the dominant source

of transportation fuel, a position it retains to this day. Additional subsidiary products include precursor chemicals used in plastics and fertilizer.

Key characteristics of the petroleum boom

Descriptor	Key question
Origin	Petroleum emerged as a replacement for costly lighting and heating energy sources in the second half of the 19th century.
Scale of investment	Investment in oil and gas has grown steadily over time, though the economy's oil intensity has diminished as efficiency gains and electrification have taken hold.
Duration	The industry emerged into something resembling its modern form between 1880 and 1930.
Key players	Upstream production has remained a fragmented industry. Downstream production was consolidated under Standard Oil and subsequently shifted to a small number of oil majors with limited direct competition.
Sources of capital	Standard Oil was formed as a private partnership and never listed its shares on any stock exchange. Other oil companies raised capital in the public equity and debt markets.
Nature of competition	Limited. A monopoly under Standard Oil, and subsequently a highly regulated business with limited direct competition.
Competitive end state	Limited competition across large, well-capitalized refining and distribution companies. Speculative upstream drilling and extraction.
Market reaction	Standard Oil was the largest company in the world at the time of its breakup—valued at over USD 1 billion (estimated value of USD 1 trillion today).
Extent of business failures	Upstream drilling is subject to booms and busts based on access to producing fields and prevailing market prices. Downstream refining and distribution are generally highly profitable and there have been few, if any, business failures.
Residual infrastructure	The infrastructure of the oil and gas industry requires an enormous amount of ongoing capital investment. Major facilities/assets (pipelines, tankers, refineries, storage) have long working lives.
Residual productivity/growth	The widespread availability of a steady supply of concentrated, portable energy allowed for the development of the automobile, airplane, diesel trucks and locomotives.
Disruptions	Whaling and candle-making for lighting were displaced rapidly by kerosene, which in turn was displaced by electricity. Personal transportation and airlines eventually displaced passenger railroads for long-distance travel, though not for freight traffic.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

CASE STUDY 4

The interstate highway system

In the summer of 1919, a convoy of 81 vehicles belonging to the U.S. Army's Motor Transport Corps left Washington, D.C. on a journey to San Francisco. Over the next 56 days the convoy traveled 3,250 miles at an average speed of about 10 miles per hour, enduring frequent breakdowns and delays caused by poor road conditions and inadequate bridges. With no known route, motorcyclists would scout the route ahead, leaving signs for the larger group to follow. Among the officers participating in the expedition was a young lieutenant by the name of Dwight Eisenhower.

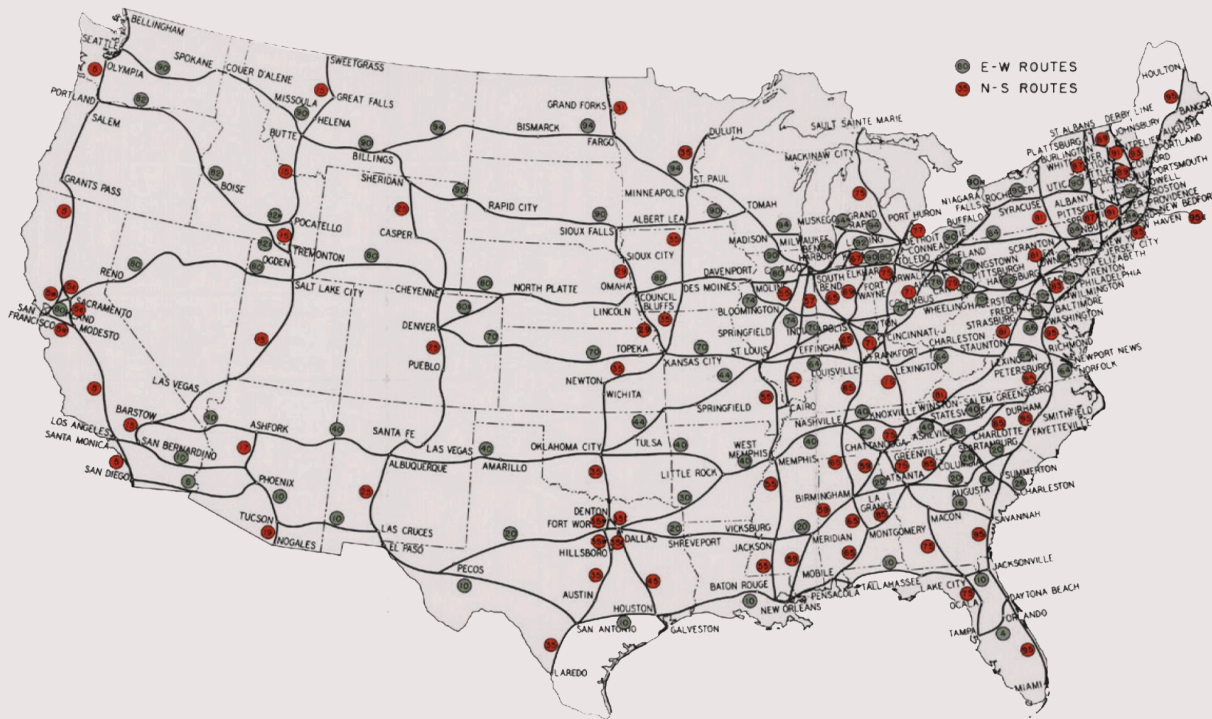
Years later, Eisenhower—as President of the U.S.—signed the Federal Highway Act of 1956 into law, authorizing the construction of 41,000 miles of limited access highways across the country. Informed by his experience in 1919, and also by observing Germany's autobahn network during World War II, Eisenhower supported the construction of

the interstate highway system as an investment in the U.S. economy and as an aid to national defense.

Over the next four decades, land was purchased, rights-of-way were acquired and obstacles were demolished (often existing neighborhoods). Road crews laid down more than 48,000 miles of multi-lane divided highways from coast to coast. A key feature of the new system: limited access points and no crossings “at grade” (meaning overpasses or underpasses are constructed for any local roads that cross the route). This ensured that traffic could flow at high speed without interruption. The final leg was a section of I-70 in Glenwood Canyon, Colorado, an engineering marvel whose 12 miles include numerous bridges and tunnels.

The total expense exceeded USD 600 billion in current dollars, far more than the original estimate of USD 25 billion.

The U.S. interstate highway system



Source: Elisheva Blas, “The Dwight D. Eisenhower National System of Interstate and Defense Highways: The Road to Success?,” *The History Teacher* vol. 44, no. 1 (November 2010): fig. 1 (appendix), 134.

The federal government paid 90% of the cost, funded by gas taxes and direct contributions, while the individual states covered the remaining 10%. Although intended to be operated entirely as freeways, some significant portions of the network are toll roads. Ongoing capital investment and maintenance needs are significant, and often unmet: Estimates of the backlog of deferred maintenance exceed USD 1 trillion.

Quantifying the value of the interstate highway system is difficult, but the benefits in terms of overall economic productivity are substantial. More directly, the scale of the project created enormous opportunities for firms in the civil engineering sector,

as well as for producers of cement, asphalt and steel. Automobile and truck manufacturers were enthusiastic supporters of the project, which had clear benefits as the U.S. shifted from rail to roads. Trucking and logistics businesses grew, allowing companies of all sizes to get products to customers with greater speed and efficiency.

There were losers as well. Passenger railway usage declined, ultimately leading to the nationalization of passenger rail service under Amtrak. Suburban sprawl, increased traffic and longer commutes became normalized, and urban public transport networks have atrophied in all but the most densely populated cities.

Key characteristics of the interstate highway system build-out

Descriptor	Key question
Origin	The federal government initiated a massive capital investment project to create a nationwide interstate highway system.
Scale of investment	In current dollars, more than USD 600 billion was spent on the system and there are extensive ongoing maintenance costs.
Duration	30–40 years
Key players	The project was initiated and designed by the Federal Highway Administration, with state agencies leading the contracting and supervision.
Sources of capital	Gas taxes and public debt
Nature of competition	None. The interstate highway system is effectively a government monopoly. The construction bidding process was competitive.
Competitive end state	Monopoly. Technically the individual states “own” their portions of the interstate network, with costs shared between federal and state authorities. In rare cases, privately financed toll roads compete with existing interstates.
Market reaction	No public securities were issued specifically to fund the highway system.
Extent of business failures	None.
Residual infrastructure	The system represents more than 44,000 miles of highways
Residual productivity/growth	Estimates of the multiplier effect of highway spending range from 1.8x–6.0x, and some estimates suggest that the system is responsible for roughly one quarter of overall productivity growth during the period of its construction.
Disruptions	Decline in passenger rail, higher levels of pollution and greenhouse gas emissions associated with automobile traffic, destruction of some urban neighborhoods and increased suburban sprawl.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

CASE STUDY 5

The fiber-optic boom

Up to the late 1980s, the term “telecommunications” meant local and long-distance telephone service, and to a lesser extent, cable television, distributed via electrical current across vast networks of copper wire. The high cost of the existing network infrastructure meant that the barrier to entry for rival systems was high.

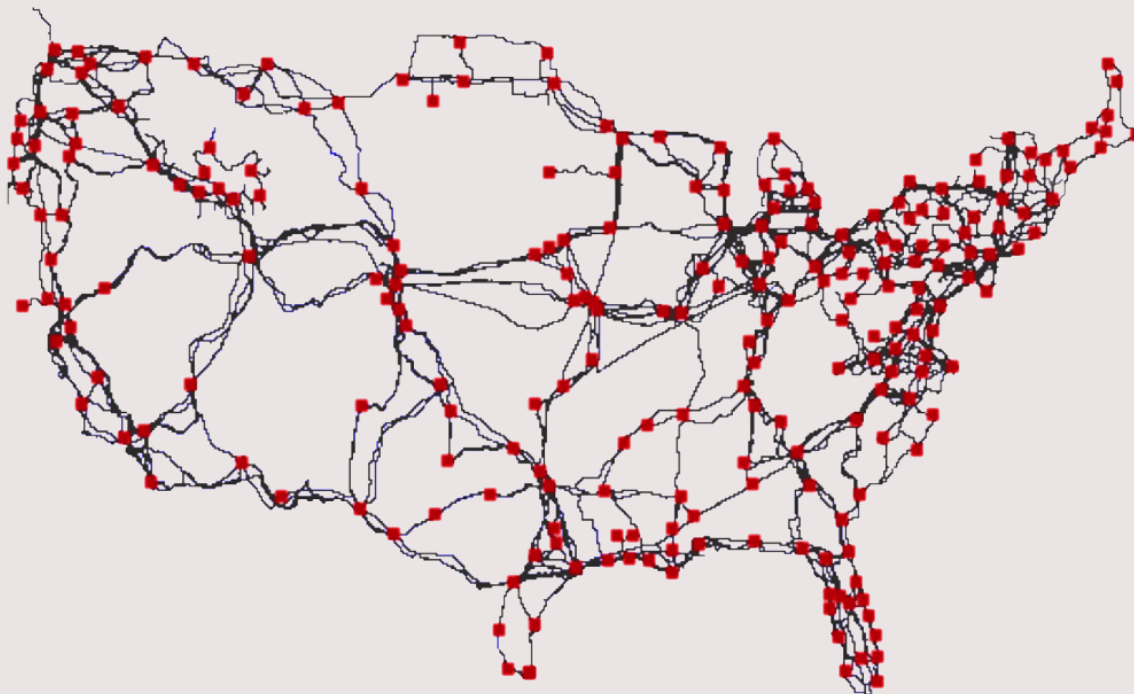
Behind the scenes, however, rapid development in the field of optical fiber technology had opened up the possibility of using light, rather than electrical impulses, to transmit a far greater amount of data over longer distances. These developments arrived at the precise moment when data traffic was increasing exponentially because of the arrival of the internet.

While the breakup of AT&T had opened up competition for long-distance calls, there was only limited competition within cable TV markets and virtually

none in local telephone service. Cellular telephones had limited service coverage and high costs. Sensing an opportunity to improve the system, Congress passed the Telecommunications Act of 1996 to open up competition across the full spectrum of telecommunications.

It set the stage for a capital investment boom of historic proportions. Backed by optimistic growth projections of internet data traffic, companies like WorldCom, Global Crossing and Qwest Communications International borrowed billions of dollars to build out fiber-optic networks on a global scale. Capital investment in fiber optic networks peaked at over USD 100 billion annually.

Fiber-optic cable network



Source: Ramakrishnan Durairajan et al., “InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure,” in *Proceedings of the 2015 ACM Conference on Special Interest Group on Data Communication (SIGCOMM’15)* (London, United Kingdom, August 17–21, 2015), fig. 1, <https://doi.org/10.1145/2785956.2787499>.

Overcapacity quickly became a problem, and the high costs of building out the network proved unsustainable. At the peak, nearly 40 million miles of fiber-optic cable had been laid in the United States, but only a tiny percentage was “lit” (in use). More than 90% remained “dark” for years. Several of the major players failed (in the case of WorldCom, on the back of massive accounting fraud), and key suppliers carried the financial burden of unused capacity.

With time, however, the data traffic arrived and the cables were lit, and they have stayed lit ever since. Key pieces of the modern internet economy—social media, streaming, cloud computing and now artificial intelligence—exist only because of the foundation of fiber-optic cable laid down years earlier. The total value created in the process dwarfs even the staggering losses of the fiber-optic boom.

Key characteristics of the fiber-optic boom

Descriptor	Key question
Origin	Deregulation of the telecommunications industry coincided with advances in fiber-optic cable technology.
Scale of investment	Hundreds of billions of dollars were spent to build out a fiber-optic network in parallel to the older copper wire network.
Duration	10 years
Key players	Several large telecom firms, including WorldCom, Global Crossing, Nortel Networks, Qwest and Lucent Technologies; suppliers including Cisco, Corning and JDS Uniphase.
Sources of capital	Public equity and debt
Nature of competition	Highly competitive. Telecom deregulation allowed wide-open competition across telephone, internet and cable providers.
Competitive end state	Low cost competition
Market reaction	Fiber-optic investment and valuations reached a peak within a few years and collapsed quickly. Shareholder and bondholder losses were extreme.
Extent of business failures	Numerous companies failed and others lost much of their peak equity values.
Residual infrastructure	The extent and durability of fiber networks established in the late 1990s remain operational today.
Residual productivity/growth	The modern internet could not exist without the massive capacity of the fiber-optic network created between 1996 and 2001. The scale of the network could only have arisen from a capital boom in which multiple companies competed for total dominance.
Disruptions	Legacy cable and dial-up internet were disrupted.

Source: J.P. Morgan Asset Management; data as of July 31, 2026. For illustrative purposes only.

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