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INVESTMENT MANAGEMENT

Counterpoint Global Insights

Bayes and Base Rates

How History Can Guide Our Assessment of the Future

CONSILIENT OBSERVER | February 10, 2026

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Introduction

The field of artificial intelligence (AI) has been around for a long time, but use of the technology really accelerated after OpenAI launched ChatGPT in late 2022.[1] ChatGPT was the first generative AI (GenAI) tool that was easily accessible. GenAI creates data rather than simply analyzing it.

The introduction of GenAI has spawned a series of opportunities and challenges for investors. One is how to analyze the competitive dynamics of the companies vying to offer products and services customers desire. It is unclear how the market will be divided among the competitors and whether these businesses will earn an attractive return on their investments.

Another is how GenAI will affect businesses in general.[2] Introducing AI into corporate workflows presents the prospect of improved productivity, but firms will integrate AI at different rates. Adept companies may separate themselves from the pack.

Finally, GenAI will change how investors analyze opportunities. While judgment is still necessary for investing based on analyzing fundamentals, GenAI allows for more efficient gathering of information, increasing the output of investors who use it well.

Companies now are investing more in AI than companies did in prior general purpose technologies such as railroads and the internet.[3] As a result, the firms making these new investments have to grow profits substantially to achieve a satisfactory return on investment.

Sales growth is the most important value driver for most companies.[4] Private and public companies are estimating rapid sales growth in the coming years, consistent with the excitement of a new technology and the massive spending.

This report offers no investment advice. But it tries to assess the plausibility of some forecasts in the context of history. We rely on public disclosures and past results. The goal is to develop reasonable beliefs about future states of the world.

We speculate on the potential strategic motivation for the flurry of deals and announcements. Much of it boils down to deterring competitors and potential entrants by signaling grand plans.

A Bayesian Approach to the World

The classic way to understand a changing world is with Bayes' Theorem, a mathematical method to combine an initial belief with recent objective data in order to produce a new and improved belief (see exhibit 1).

Exhibit 1: Bayes' Theorem

New and improved belief = Recent objective data + Initial belief

$$\underbrace{P(A \mid B)}_{\text{New and improved belief}} = \frac{\overbrace{P(B \mid A)}^{\text{Recent objective data}}\ \overbrace{P(A)}^{\text{Initial belief}}}{\underbrace{P(B)}_{\substack{\text{Sum of probability under all hypotheses}}}}$$

Source: Counterpoint Global.

The math can be daunting but the mindset is straightforward. The goal is to have beliefs that are held lightly and open to revision.

The Good Judgment Project (GJP) was a team that participated in a forecasting tournament sponsored by the Intelligence Advanced Research Projects Activity, the research and development arm of the national intelligence community in the U.S. Through careful measurement, the GJP team found that about two percent of its participants made forecasts that were consistently exceptional. They called them "superforecasters."[5]

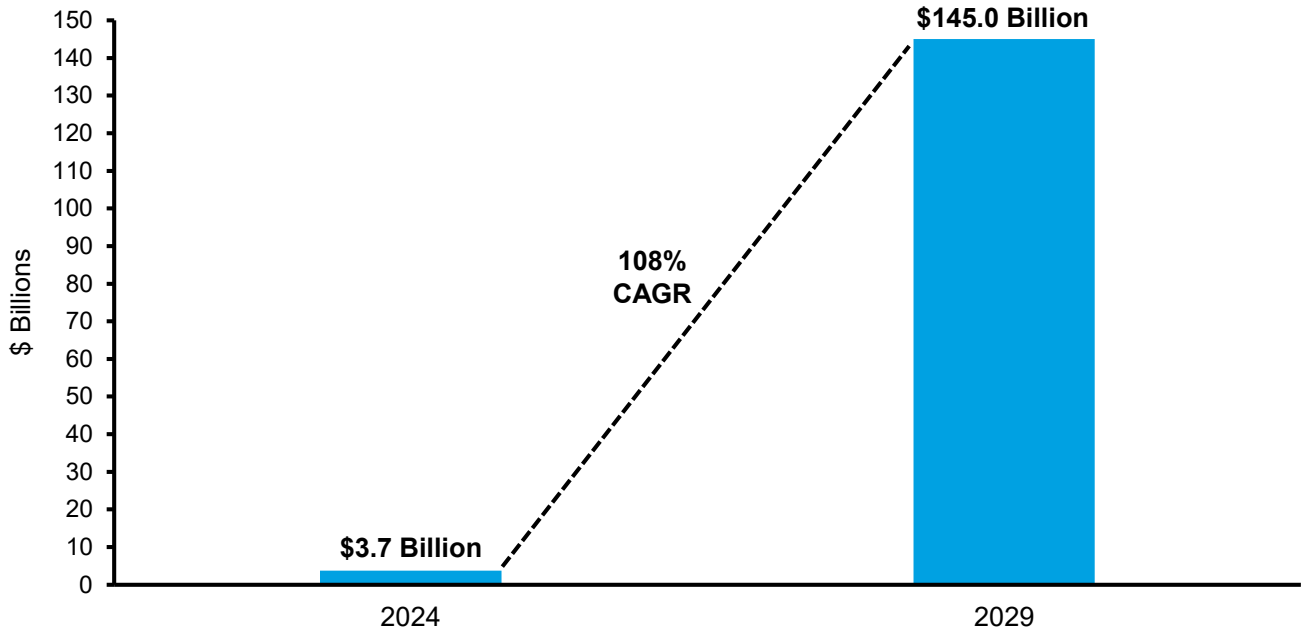
Phil Tetlock, a professor of psychology at the University of Pennsylvania and one of the leaders of the GJP, noted that superforecasters are comfortable with numbers but did not use Bayes' Theorem formally. He wrote, "What matters far more to the superforecasters than Bayes' theorem is Bayes' core insight of gradually getting closer to the truth by constantly updating in proportion to the weight of the evidence."[6]

If you accept this approach, the first question to ask is how to establish your initial belief. One way to do this is to use a base rate, which reflects the results for a specific reference class.

For instance, if a company with $5 billion in sales forecasts 10 percent compound annual growth for the next five years, you can calculate what percentage of companies of that initial size have achieved that rate of growth. Then, you can update your assessment of the probability of the company achieving its goal as the company reports its results.

OpenAI. All of this is best understood through example. In the fall of 2025, OpenAI projected revenue of $145 billion in 2029 (see exhibit 2). The company's sales in 2024 were $3.7 billion.[7] That reflects a 5-year compound annual growth rate of 108 percent.

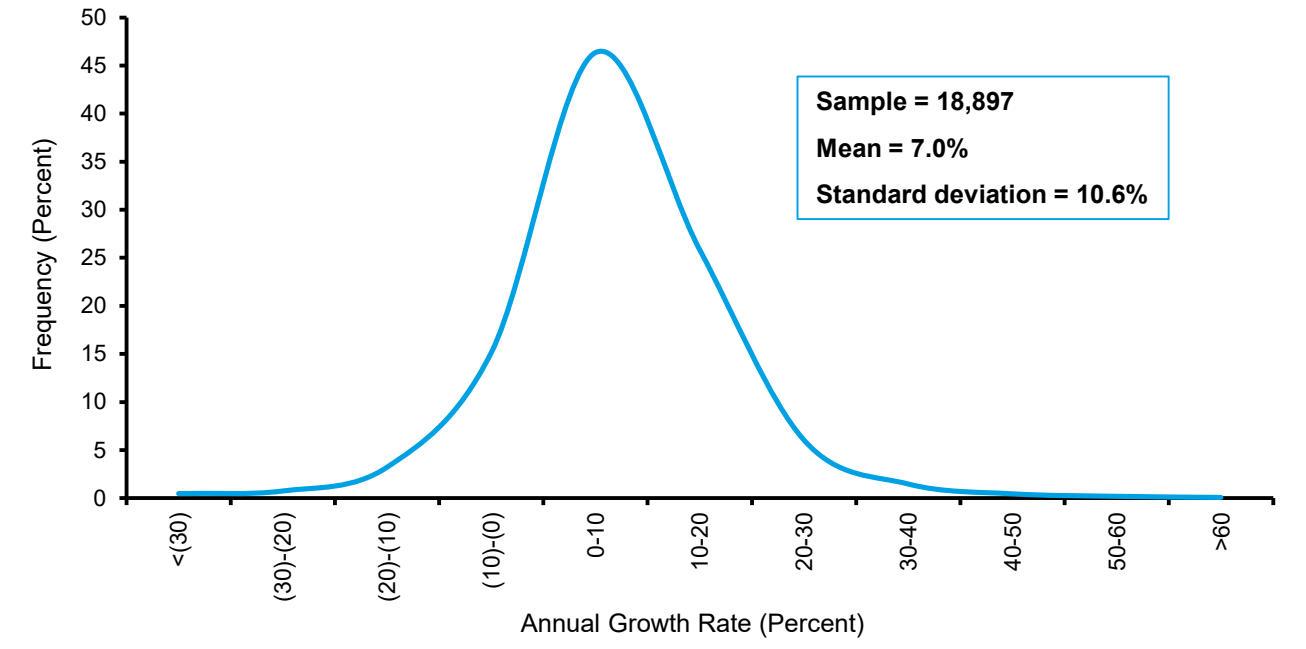
Exhibit 2: OpenAI's Sales Forecast, 2024 to 2029



Source: Counterpoint Global and Sri Muppidi, "OpenAI Says Its Business Will Burn $115 Billion Through 2029," The Information*, September 5, 2025.*

To assess the plausibility of this forecast, we can start with an initial belief based on what companies with $2-5 billion of starting sales have actually done. Exhibit 3 shows the results, based on a sample of nearly 18,900 firm-period observations for U.S. public companies from 1950 to 2024. Note that companies can appear in the sample more than once.[8]

Exhibit 3: Base Rates of 5-Year Sales Growth for Firms With $2-5 Billion in Sales, 1950-2024



Source: Counterpoint Global; Compustat; FactSet.
Note: CAGR=compound annual growth rate; growth rates are nominal; U.S. companies with beginning year sales of $2.0-5.0 billion in 2024 U.S dollars, 1950-2024.

The data reveal that no public company has grown this fast for five years in the last three-quarters of a century. The results include all industries. The average compound annual growth rate is 7.0 percent, and the standard deviation is 10.6 percent. The forecast implies a roughly 9.5 standard deviation outcome for OpenAI under a normal approximation, which is extraordinarily unlikely.[9]

The math of Bayes' Theorem does not work if the initial belief is based on an outcome with a probability of zero. As a result, it is conventional to use a heuristic to come up with a non-zero initial belief. Common methods yield probabilities that are less than one-tenth of one percent.[10]

It is important to bear in mind that base rates aren't immutable and can change as the world changes. There are at least two results that might raise OpenAI's likelihood of success from the vanishingly low base rate.

The first is the rapid rate of adoption of ChatGPT. For example, it took ChatGPT just 2 months to reach 100 million users. This compares to 9 months for TikTok, 28 months for Instagram, and 4.5 years for Facebook, all social media platforms. The internet got to 100 million users in 7 years, mobile phones in 16 years, and the telephone in 75 years. The adoption of ChatGPT is rapid by historical standards even if we scale these results for population growth. That said, users need not translate directly to sales because many do not pay for the service.

Second, OpenAI expects to report sales of about $13 billion in 2025, or growth of about 250 percent.[11] This is well ahead of the compound annual rate over the full five years. But as companies get bigger, the standard deviation of growth rates tends to shrink. In other words, it is a lot easier for a company with sales of $1 billion to double in size in one year that it is for a company with $100 billion in sales.

Since the company also provided a sales forecast of $200 billion for 2030, we can roll forward to a new five-year forecast. The projected compound annual growth rate from 2025 to 2030 comes to 72.7 percent.

A reference class of companies with initial sales of $10-15 billion provides a sample of almost 3,700 firm-periods. Here again, no company with starting sales in this range has ever achieved 72.7 percent compound annual growth for five years.

In fact, even an expanded reference class, to initial sales of at least $6.5 billion, includes no company that has realized that rate of growth. This sample includes more than 16,400 firm-periods from 1950 to 2024.

Another point worth emphasizing is that growth in and of itself does not create value. We define total addressable market as the revenue a company could realize if it had 100 percent share of a market it could serve while creating shareholder value. A company creates value only when the return on its investment exceeds the cost of capital.

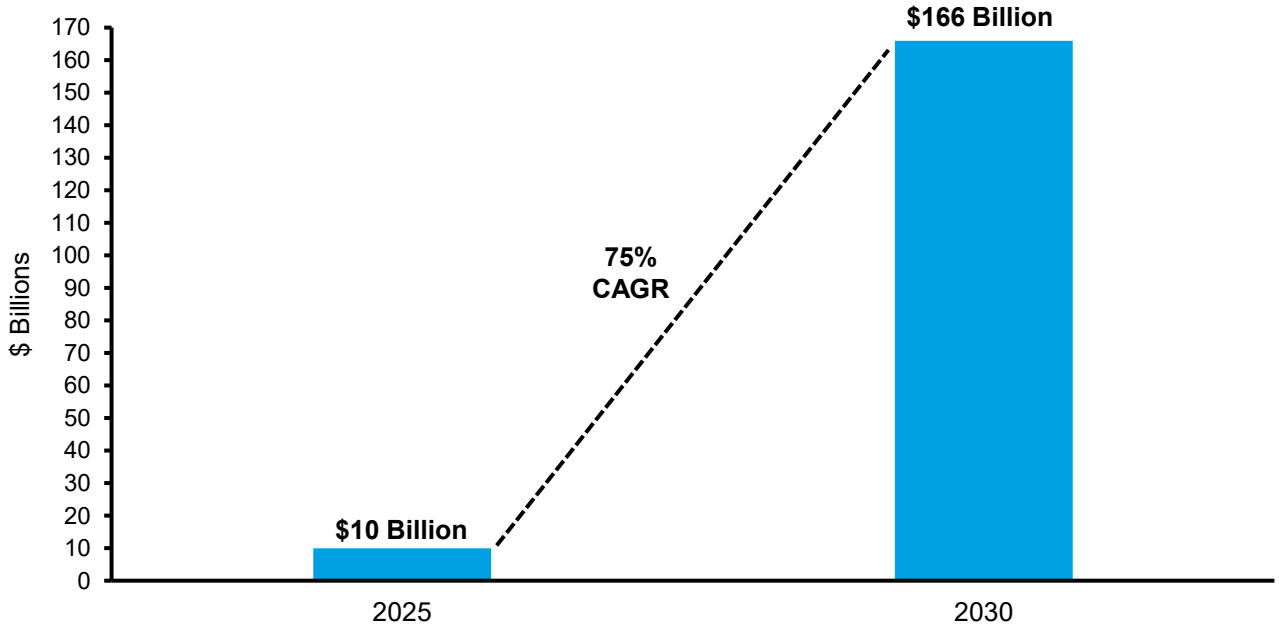
OpenAI's free cash flow was reported to be negative $9 billion in 2025 and is expected to be negative $17 billion in 2026.[12] This is because the business is unprofitable and it is investing heavily. The company's ability to grow at the blistering rate will almost certainly require it to raise a substantial amount of capital from outside investors.

In addition, a large percentage of employee pay is in the form of stock-based compensation (SBC). Estimates suggest that total SBC in 2025 was more than 45 percent of sales. This comes out to a $1.5 million annual rate per employee, a sum that is 7 times higher than the next highest issuer of SBC among large technology companies prior to going public.[13]

Oracle. In the fall of 2025, Oracle announced multiple multi-billion dollar deals for its cloud infrastructure business, substantially increasing its "Remaining Performance Obligations."[14] These are signed customer agreements that reflect anticipated revenues.

As a result, management forecasted that revenues from its cloud business would go from $10 billion for the fiscal year ending in May 2025 to $166 billion in fiscal 2030 (see exhibit 4). This implies a 75 percent compound annual growth rate over the five years.[15] The Oracle Cloud business was 17 percent of Oracle's total sales of $57.4 billion in the fiscal year ended May 2025.

Exhibit 4: Oracle Cloud Sales Forecast, 2025 to 2030



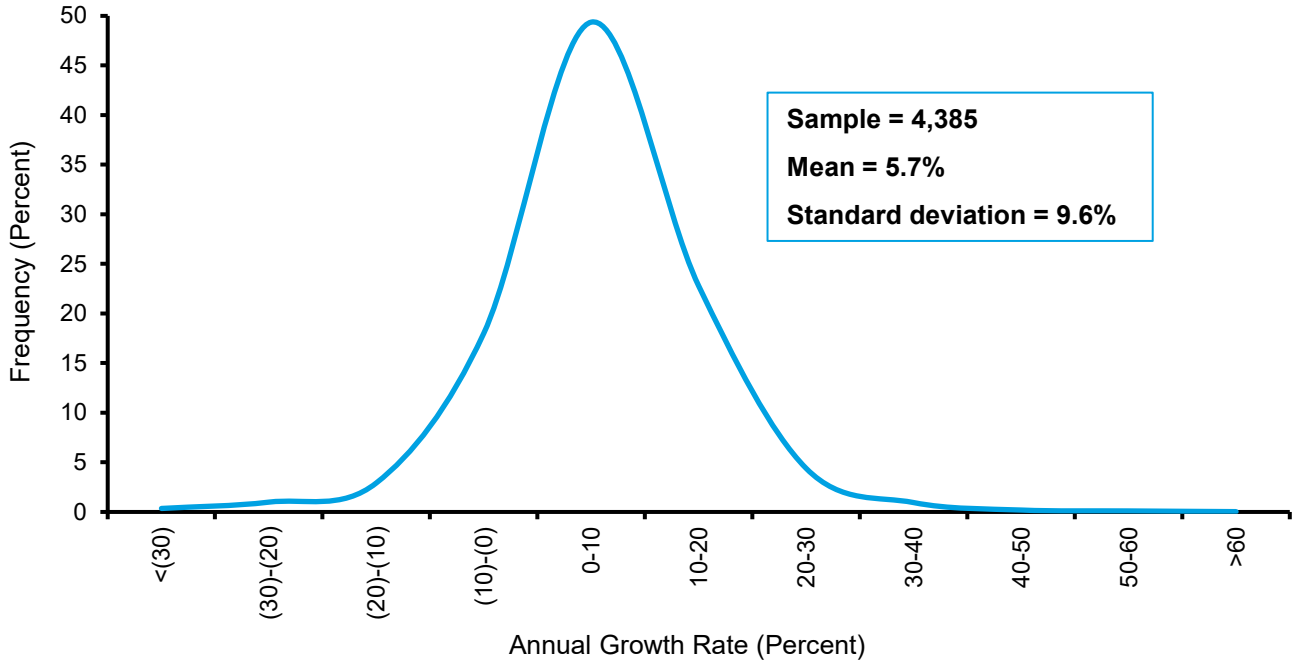
Source: Counterpoint Global and Oracle Financial Analysts Meeting October 16, 2025.

Here again, the question is how likely this outcome is given the base rate. The data show that no company with $10 billion or more in sales has grown this fast for five years in the past 75 years. In fact, no company with $5.6 billion or more in sales has achieved that growth rate.

Exhibit 5 shows the base rates for the reference class with beginning sales of $8-12 billion. The sample is almost 4,400 firm-period observations for U.S. public companies from 1950 to 2024. Note we are comparing a division within a firm to firms. The average compound annual growth rate is 5.7 percent, and the standard deviation is 9.6 percent.

Modifying a probability from the base rate makes sense given the magnitude of the company's Remaining Performance Obligations. But growth expectations have to be balanced against the financing needs to support that growth, counterparty risk, and potential delays in completing the necessary infrastructure.

Exhibit 5: Base Rates of 5-Year Sales Growth for Firms With $8-12 Billion in Sales, 1950-2024



Source: Counterpoint Global; Compustat; FactSet.
Note: CAGR=compound annual growth rate; growth rates are nominal; U.S. companies with beginning year sales of $8-12 billion in 2024 U.S dollars, 1950-2024.

How Big Things Get Done (or Not)

The main investments for leading AI companies are AI hardware and data centers. For example, both OpenAI and Oracle are partners in a venture called Stargate Project, which is expected to spend up to a half trillion dollars on AI infrastructure through 2029.

AI data centers are different from traditional data centers. While data centers used to be dedicated to storing data and hosting applications, AI data centers combine specialized hardware, power and energy infrastructure, and cooling. Compared to traditional data centers, AI data centers have more expensive hardware, substantially higher power demands, and a greater need for cooling.

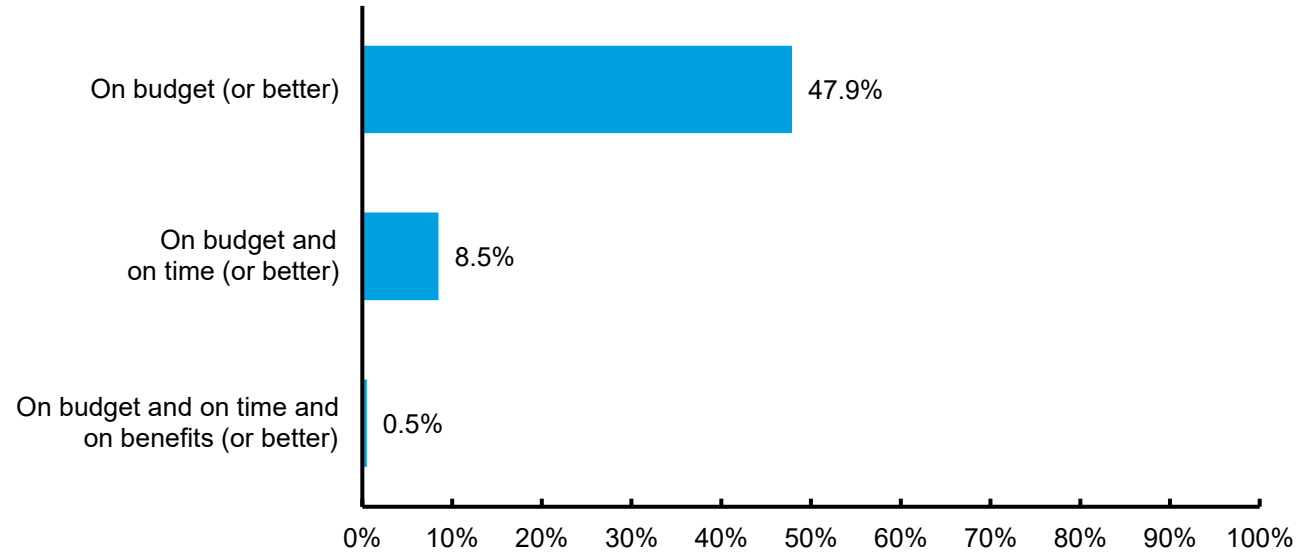
AI data centers are large projects, with common bottlenecks that include access to power and specialized hardware. AI companies are spending hundreds of billions of dollars on sophisticated projects.

This brings us back to base rates. Bent Flyvbjerg, an economic geographer, has amassed a database of 16,000 projects from 136 countries and more than 20 fields. Think of the Channel Tunnel that connects the United Kingdom to France, the Central Artery/Tunnel Project ("Big Dig") that rerouted highways in Boston, Massachusetts, or the Sydney Opera House in Australia.

Flyvbjerg collaborated with Dan Gardner to write a book called *How Big Things Get Done*, which summarizes his research on the failure rate of big projects and how to manage them properly.[16]

The results are sobering (see exhibit 6). Fewer than one-half of projects are completed on budget, fewer than 9 percent on budget and on time, and just one-half of one percent on budget, on time, and delivering the anticipated benefits.

Exhibit 6: Success Rates of 16,000 Large Projects Based on Various Measures



Source: Counterpoint Global based on Bent Flyvbjerg and Dan Gardner, How Big Things Get Done: The Surprising Factors That Determine the Fate of Every Project, From Home Renovations to Space Exploration and Everything In Between *(New York: Currency, 2023), 8.*

Flyvbjerg and Gardner suggest that project planners should explicitly incorporate base rates into their planning (the official term is "reference-class forecasting"). But few do, because they want to proceed with the project and don't want a reality check, believe that their project or skills are unique so base rates don't apply, or, most likely, simply don't have the data on base rates.

Here again, a Bayesian mindset is helpful. The base rate of projects going off without a hitch is low. The bottlenecks of access to power and access to specific hardware create the risk of longer timelines than anticipated to build AI data centers. The flip side is that companies are turning to modular designs, which tend to have higher success rates than unique designs.

The authors advocate for an approach they call "think slow, act fast." The idea is to spend a lot of time upfront thinking about how best to address potential issues (think slow) which then allows for rapid execution (act fast). The challenge is that demand for AI is growing rapidly and there is a competition for which companies will assume leadership in GenAI.

A Possible Strategic Rationale for the Flurry of Deals

By our count, OpenAI announced about 15 deals related to building infrastructure in 2025. They were not the only company spending. Hyperscalers including Alphabet, Amazon, and Microsoft all increased their capital expenditure forecasts during the year, and AI labs and infrastructure specialists such as Anthropic and CoreWeave also made large commitments to AI infrastructure.

It is interesting to ask whether there is a strategic rationale for all of this activity. After all, we know that prior investment booms, including the telecom buildout in the late 1990s and early 2000s, led to industry overcapacity and corporate bankruptcies.

We also know that the opportunity remains large. Global AI diffusion, the share of people who have used a GenAI product, was just 16 percent in the second half of 2025.[17]

Michael Porter, the renowned professor of strategy, outlined the elements that go into the decision to expand capacity. These are helpful for analysts assessing the situation. They include:[18]

- **Capacity additions.** Examine the company's options for magnitude and type.
- **Demand and costs.** Consider likely demand and input costs.
- **Technological change and obsolescence risk.** Gauge the rate of change.
- **Anticipate competitor moves.** Evaluate the likely capacity additions by competitors.
- **Estimate industry supply and demand.** Judge what the actions of the firm and its competitors mean for price and costs.
- **Evaluate cash flows.** Estimate scenarios for the cash flows that the capacity addition might generate.
- **Stress test the analysis.** Consider whether the conclusions are consistent with the premises.

Porter goes on to describe what he calls a "preemptive strategy," where a firm seeks to lock up a major part of the market to discourage competitors from trying to expand and to deter entry.[19]

The challenge is that competitors in AI include young companies such as Anthropic, OpenAI, and xAI, which must raise a substantial amount of capital to compete, and incumbents such as Amazon, Alphabet, and Meta, which have substantial financial resources.

Porter adds that a preemptive strategy is inherently risky "because it involves the early commitment of major resources to a market before the market outcome is known." He also adds "disastrous warfare" can follow if the strategy doesn't deter competition.

Conclusion

The launch of ChatGPT, a GenAI technology, catalyzed a wave of investment in AI infrastructure on scale with some of the largest investment booms in U.S. history. This growth in supply seeks to satisfy a huge increase in anticipated demand. As a result, some firms are offering growth forecasts that are historically very high.

The question is how investors should assess these projections. One sensible approach is to mimic the math of Bayes' Theorem by starting with an initial belief and updating that belief as new results appear.

Base rates, the results for a specific reference class, are a sensible start for initial beliefs. An examination of the base rates for U.S. public companies from 1950 to 2024 suggests that OpenAI and Oracle Cloud have a low probability of meeting their five-year revenue projections.

Offsetting this initial belief are data showing a rapid diffusion of the technology, which signals large demand, and substantial short-term revenue growth so far. These increase the odds of successfully meeting those forecasts.

A large database of projects from around the world shows that less than 10 percent are completed on time and on budget. Investors should keep an eye out for potential bottlenecks in the buildout of AI infrastructure, including securing sufficient power and the necessary chips and equipment.

Companies sometimes pursue a preemptive strategy in which they announce big capacity commitments to deter competitors and entrants from investing. In today's environment, large incumbents generate a lot of cash and can afford to spend large sums on their AI initiatives. Startups are in a more challenging position as they must raise capital to compete. Through 2025, investors, employees, and other firms have supplied that capital. But that is subject to change.

Please see Important Disclosures on pages 10-12

Endnotes

[1] This was enabled by increasingly powerful graphics processing units (GPUs), which process information in parallel—versus the serial processing of central processing units (CPUs)—and the introduction of transformer architecture for neural networks. "GPT" stands for Generative Pre-trained Transformer.
[2] Thomas Kamei, "AI Beneficiaries: Investing in Second-Order Effects," *Counterpoint Global Insight*, May 7, 2025.
[3] Kai Wu, "Surviving the AI Capex Boom," *Sparkline Capital Research*, October 22, 2025.
[4] Michael J. Mauboussin and Alfred Rappaport, *Expectations Investing: Reading Stock Prices for Better Returns—Revised and Updated* (New York: Columbia Business School Publishing, 2021), 52-56.
[5] Philip E. Tetlock and Dan Gardner, *Superforecasting: The Art and Science of Prediction* (New York: Crown Publishers, 2015).
[6] Ibid., 171. When tested in the lab under controlled conditions, superforecasters are better at updating than regular forecasters. See Barbara Mellers, Eric Stone, Terry Murray, Angela Minster, Nick Rohrbaugh, Michael Bishop, Eva Chen, Joshua Baker, Yuan Hou, Michael Horowitz, Lyle Ungar, and Philip Tetlock, "Identifying and Cultivating Superforecasters as a Method of Improving Probabilistic Predictions," *Perspectives on Psychological Science*, Vol. 10, No. 3, May 2015, 267-281.
[7] James Fahey, "OpenAI's Explosive Growth: A Revenue Breakdown and Industry Comparison," *Medium*, June 7, 2025.
[8] This base rate includes 2,229 unique companies.
[9] The distribution of past sales growth rates is not a normal distribution. It is more peaked (i.e., most values near the average), has a steeper slope on both sides (fewer medium size changes), and fatter tails. For example, one-tenth of one percent of companies grow at a compound annual rate of 55-60 percent in the realized data and effectively zero do if you assume a normal distribution.
[10] These include 3/N and Laplace smoothing [1 ÷ (N+2)]. Both approaches provide a likelihood of less than one-tenth of one percent.
[11] "OpenAI Faces a Make-or-Break Year in 2026," *The Economist*, December 29, 2025.
[12] Ibid.
[13] Berber Jin, Nate Rattner, and Bradley Olsen, "OpenAI Is Paying Employees More Than Any Major Tech Startup in History," *Wall Street Journal*, December 30, 2025.
[14] "Oracle Announces Fiscal Year 2026 First Quarter Financial Results," September 9, 2025.
[15] "Oracle Financial Analysts Meeting," October 16, 2025.
[16] Bent Flyvbjerg and Dan Gardner, *How Big Things Get Done: The Surprising Factors That Determine the Fate of Every Project, From Home Renovations to Space Exploration and Everything In Between* (New York: Currency, 2023).
[17] "Global AI Adoption in 2025: A Widening Digital Divide," *Microsoft AI Economy Institute,* January 2026.
[18] Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York: Free Press, 1980), 326-336.
[19] Ibid., 335-338. See also Thomas C. Schelling, "An Essay on Bargaining," *American Economic Review*, Vol. 46, No. 3, June 1956, 281-306; Michael A. Spence, "Entry, Capacity, Investment and Oligopolistic Pricing," *Bell Journal of Economics*, Vol. 8, No. 2, Autumn 1977, 534-544; and Avish Dixit, "The Role of Investment in Entry-Deterrence," *Economic Journal*, Vol. 90, No. 357, March 1980, 95-106.

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