

Bubble Talk

Analogies and the Dangers of Macro Pattern-Matching

Political scientist Yuen Foong Khong has warned that historical analogies often mislead more than they clarify.¹

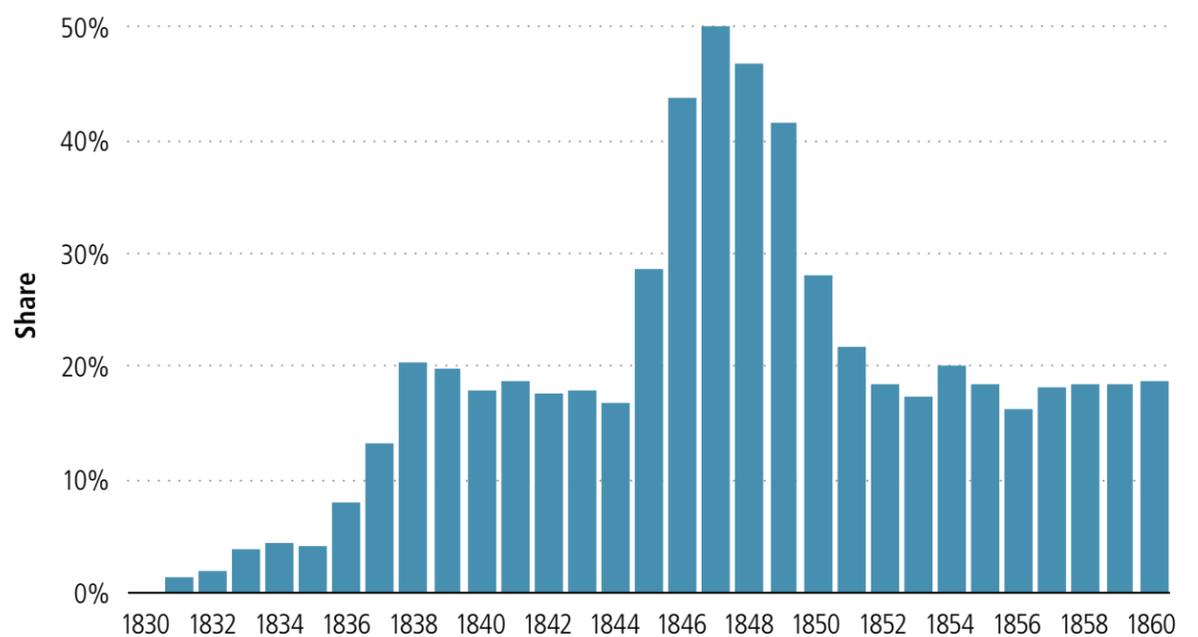
But analogies are alluring, he argues, because pattern-matching is “a major way human beings comprehend their world.”²

Investors are no exception (most of us are human, after all). Analogies compress uncertainty into a story that “makes sense,” at very low cognitive cost. If one analogy stops working, we can always substitute another. The analogies are not always wrong, but they create a false sense of understanding and certainty about complex, evolving systems.

The current AI buildout has become a magnet for such reasoning. Investors casually reach for familiar scripts: “it’s just like the railroad mania,” “we saw this in the dot-com bubble,” and “here we go with another shale boom and bust.” To evaluate whether those comparisons illuminate or mislead, it helps to revisit what actually went wrong—or right—during those episodes.

«THE ECONOMIST DESCRIBED BRITAIN’S NINETEENTH-CENTURY RAILWAY BOOM AS “ARGUABLY THE GREATEST BUBBLE IN HISTORY.”»

fig 1. INFRASTRUCTURE OVERBUILD? RAILWAY INVESTMENT AS A SHARE OF TOTAL BRITISH FIXED INVESTMENT



Sources: Odlyzko (2010), using data compiled by Mitchell (1988) and Gayer, Rostow, and Schwartz (1953)

The goal is not to decide whether AI is “a bubble,” but to understand the recurring mindtraps that analogies invite.

RAILROAD TIES

The railroad analogy is often invoked with a hazy image of Victorian exuberance: grand engineering feats, enormous capital requirements,

and a speculative frenzy. *The Economist* described Britain’s nineteenth-century railway boom as “arguably the greatest bubble in history.”³

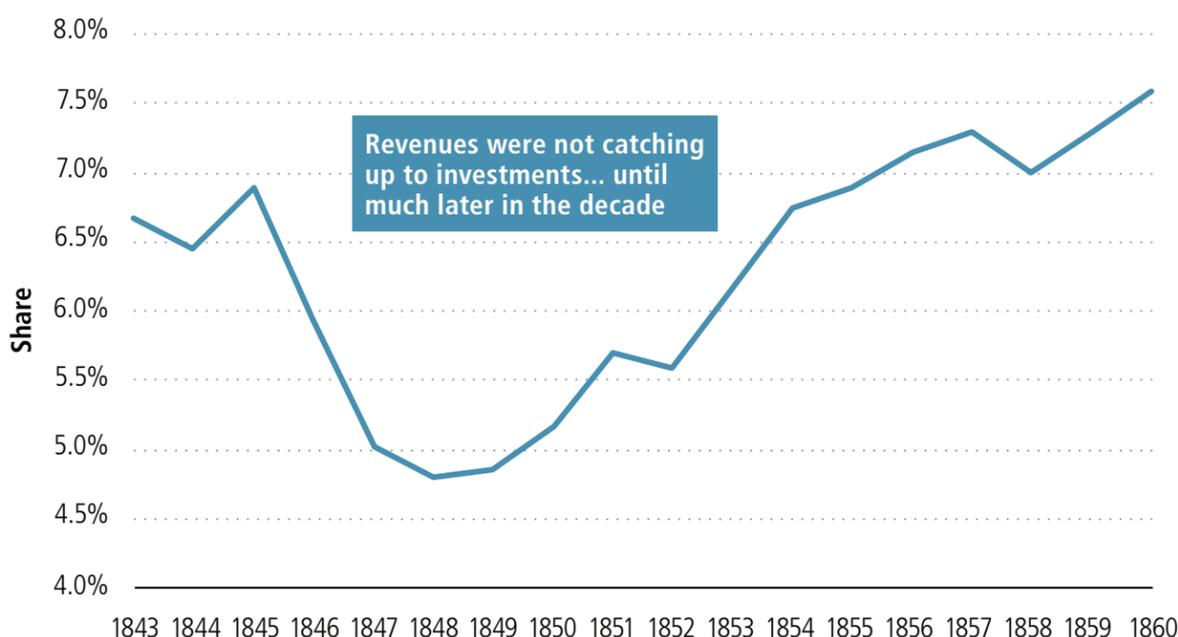
On the surface, the comparison with the AI buildout is enticing. Railways required massive upfront investment, private capital poured in rapidly, and competition encouraged overbuilding.

Following the world’s first public steam-powered train in 1825, predictions that “horse and foot transit shall be nearly extinct” triggered a surge of investment in the UK.⁴

By mid-century, British railway spending accounted for a striking share of fixed investment (see Figure 1). Railway companies proposed new lines with little relation to realistic traffic demand or construction timelines. Companies sometimes built overlapping branch lines—not because they were obviously profitable, but because allowing a rival to build first risked being driven out of business altogether. On aggregate, the total length of railways that were being considered was twenty times the length of England!⁵

«BUILDING RAILS IS CONCEPTUALLY DIFFERENT FROM BUILDING DATA CENTERS.»

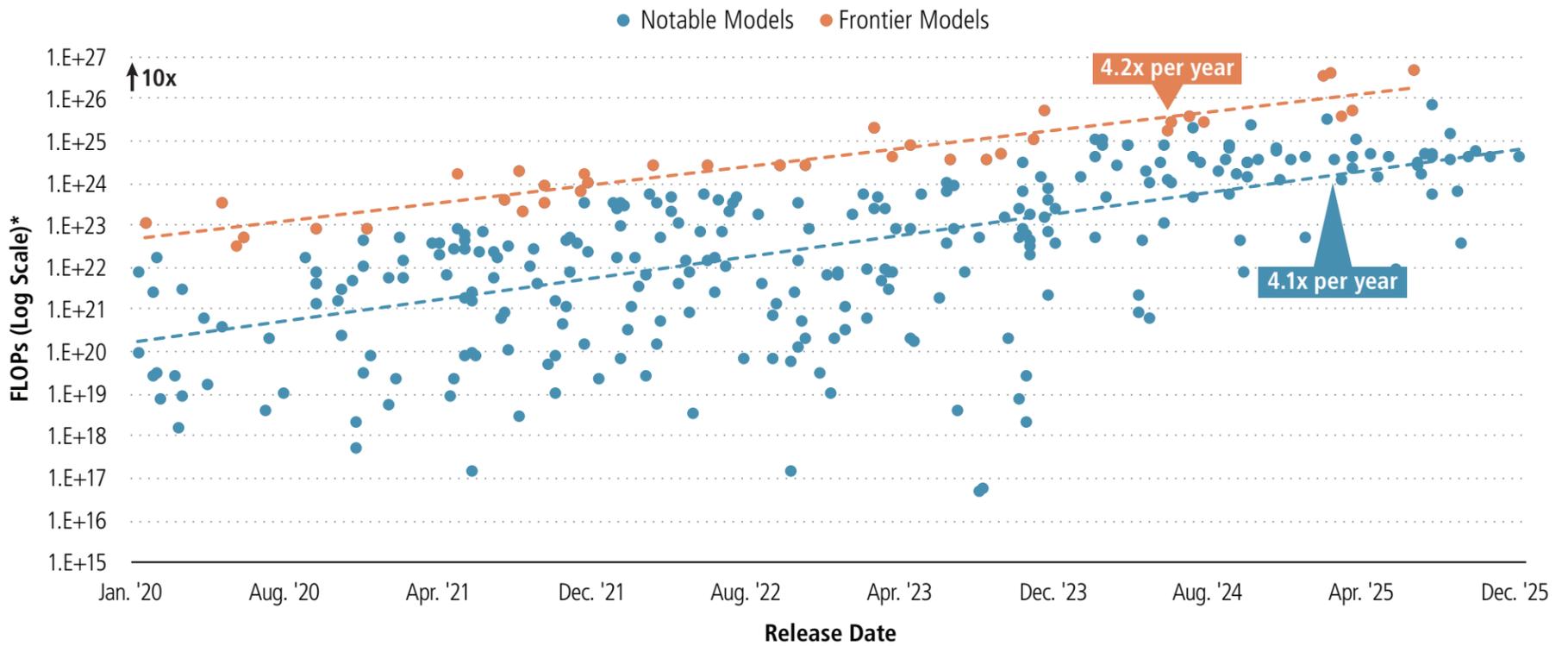
fig 2. DISAPPOINTING TIMES: BRITISH RAILWAY REVENUE AS A SHARE OF CUMULATIVE CAPITAL INVESTED



Revenues were not catching up to investments... until much later in the decade

Sources: Odlyzko (2010), Payden Calculations

fig 3. SCALING STARTS:
COMPUTING POWER REQUIRED TO TRAIN NOTABLE AND
FRONTIER LARGE LANGUAGE MODELS SINCE 2020



Source: EPOCH AI

*Floating Point Operations (FLOP) is a unit of computation. Total FLOPs measure the amount of computation required to train or run an AI model.

The AI buildout competition today appears to reflect the same strategic logic, critics contend. But this is also where the railroad analogy begins to mislead.

First, building rails is conceptually different from building data centers. There is probably only one useful, efficient rail route between two points (e.g. London and Manchester). However, computing capacity, which is provided by data centers, can be duplicated; the more computing capacity, the better, at least for the end user. Data centers function more like production plants—once built, they increase overall computing capacity, regardless of how the extra capacity is used.

Second, the railway bubble wasn't about debt: it was primarily funded by equity. The real problem was that companies were overbuilding based on the false assumption that ridership would increase dramatically. For example, investors purchased railway shares expecting dividend yields of approximately 10 percent. But to support those payouts, passengers would need to be "whirled from place to place with almost magical rapidity."⁶ As a result, capital formation outpaced revenue growth at the peak (see Figure 2 on page 1).

Similar to railway construction, the AI buildout today rests on the belief that demand for AI will grow rapidly enough that the revenues generated by AI subscriptions will support the massive capital spending. But unlike Victorian investors centuries ago, modern markets can observe demand for AI in the form of computing power required to train and run AI models. Forecasts projecting the annual computing power required to train new AI models to grow by four to five times are broadly consistent with the observed growth since 2020 (see Figure 3).

«MEANWHILE, RAILWAY STOCKS MADE UP 71% OF THE TOTAL UK STOCK MARKET VALUE IN 1848.»

Third, the AI cycle is nowhere near as extreme as the railroad infrastructure buildout. Technology investment, including but not limited to AI, rose to 28% of U.S. total private fixed investment in 2025, a much smaller share of overall investment than railways at the peak of the UK railway bubble (see Figure 1 on page 1 again). Meanwhile, railway stocks made up 71% of the total UK stock market value in 1848, whereas the magnificent seven make up only a third of the total market cap of the S&P 500 today.⁷

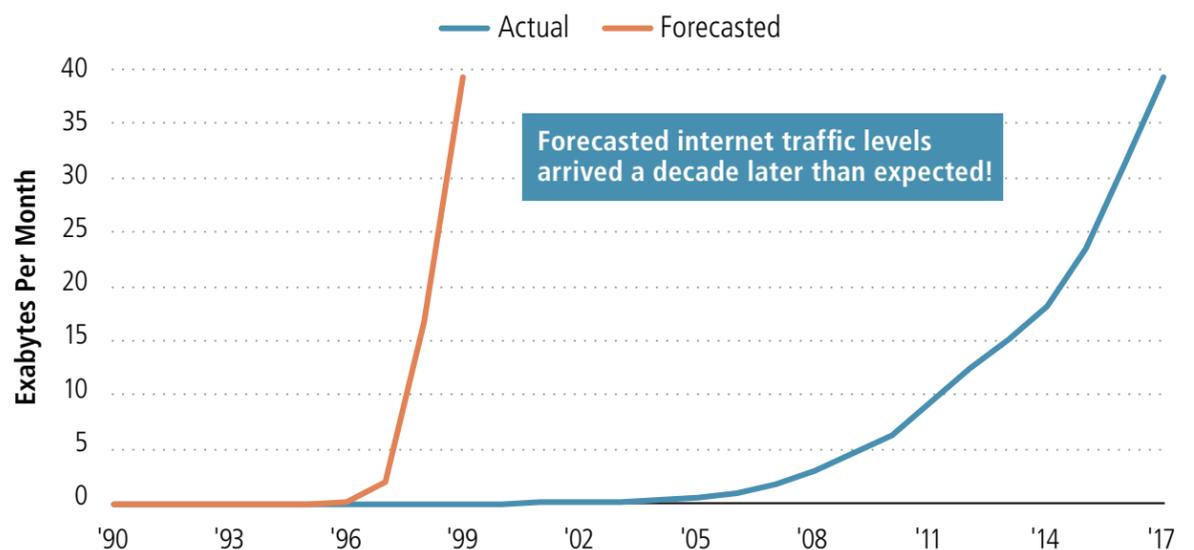
DOT-COM DREAMS

The dot-com bubble is by far the most used analogy for AI investment. Many investors recall the late 1990s through the wreckage of "dot bomb" companies—those that raised capital, reached lofty valuations, and collapsed shortly thereafter.

The deeper dot-com story, though, is not about failed startups but about infrastructure built on the back of a flawed idea.

«BETWEEN 1995 AND 2000, COMPANIES LAID TENS OF MILLIONS OF MILES OF FIBER-OPTIC CABLE... BUT LESS THAN 10% WAS UTILIZED.»

fig 4. PREMATURE PREDICTIONS:
U.S. INTERNET TRAFFIC SINCE 1990



Source: Cisco Visual Networking Index

Continued from page 6

Between 1995 and 2000, companies laid tens of millions of miles of fiber-optic cable, the physical infrastructure that carries internet data as pulses of light between buildings and cities. The total length was enough for at least 100 round-trips from the Earth to the Moon—but less than 10% was utilized.⁸

The overbuild was driven by a widely accepted belief that internet traffic doubled every three months. That belief was wrong. Internet usage did not accelerate according to that timetable, unlike smartphones and AI (see Figure 4 on page 2; also see *Did You Know? Cloud Compounding*). Adoption was slow as devices were scarce. However, the fibers laid out remained highly valuable in subsequent decades. Markets just mispriced the timing and pace of demand growth.

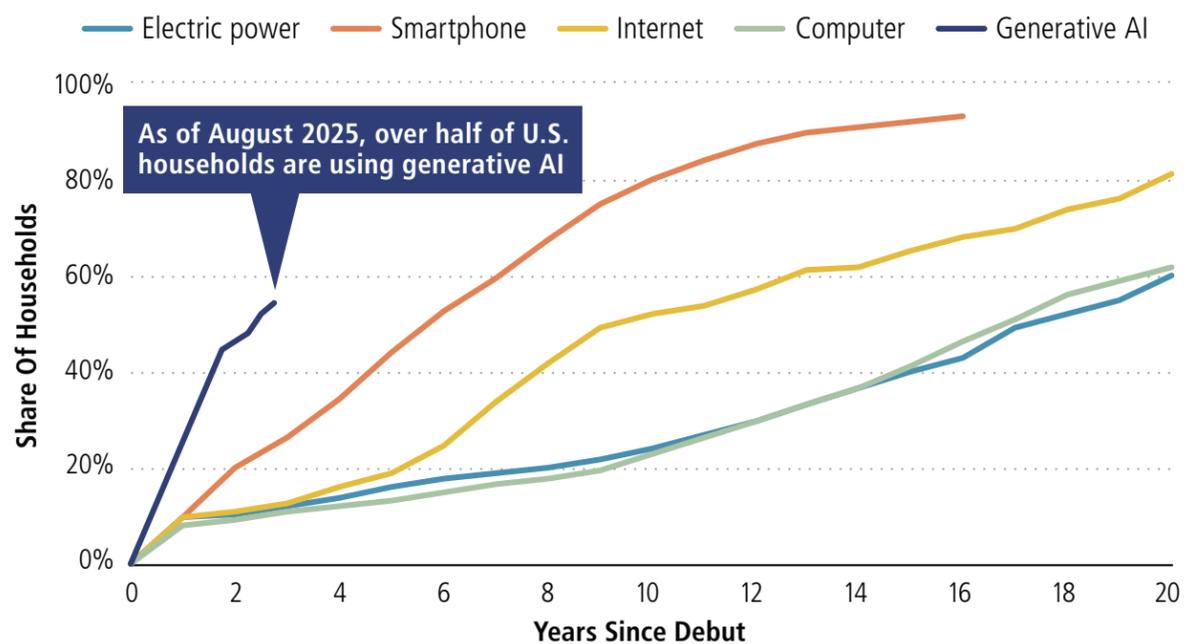
Similarly, to argue that AI is “the next dot-com,” one must specify how the AI buildout will fail. Is the concern that capital is flowing to fundamentally useless ventures? Or that infrastructure is being built faster than near-term demand can justify?

«WE ARE CURRENTLY MORE CONCERNED ABOUT HYPERSCALERS RUNNING OUT OF COMPUTING CAPACITY THAN ABOUT AN OVERSUPPLY.»

At present, we think most agree more with the latter. However, we are currently more concerned about hyperscalers running out of computing capacity than about an oversupply.

Every chatbot interaction consumes resources. Increasing the capability, adoption, or introduction of autonomous AI agents increases token usage and inference costs (see our article *Intelligence “on Tap”* in this PoV edition). Unlike in the late 1990s, the adoption of generative AI is straightforward: most households and firms already have the hardware and connectivity required to use chatbots. Within a few years of

fig 5. ASYMMETRIC ADOPTION: ADOPTION OF SELECT TECHNOLOGIES BY U.S. HOUSEHOLDS



Sources: Bank for International Settlements, Federal Reserve Bank of St. Louis, Real-Time Population Survey

mainstream launch, adoption of generative AI has progressed more rapidly than that of the early internet (see Figure 5).

Perhaps one day there will be too many data centers, leading to a slump. However, we haven't yet observed a substantial oversupply in data center infrastructure.

SHALE HELL

A more recent analogy is the shale boom and bust of the 2010s. Advances in hydraulic fracturing and horizontal drilling had unlocked new waves of oil production from shale rocks. Producers spent more than 100% of their operating cash on drilling, mostly funded by high-yield bonds. In 2014, energy-related high-yield bond issuance made up 20% of total high-yield issuance—up from 9% in 2004.⁹

When oil prices were elevated above \$100 per barrel, capital flowed into the industry to fund extraction, and U.S. shale oil production surged (see Figure 6 on page 4). Investors believed that capital investments would eventually lead to efficiencies through reduced drilling times and lowered costs.

The model unraveled when oil prices collapsed in 2014. Shale producers were price takers in a global commodity market. While extraction techniques could be engineered, the selling price could not. When supply surged and the dollar strengthened, revenues fell sharply, and the economics broke down.

Today's investment in semiconductor design and manufacturing, and the hope that chips will become more efficient, seems more analogous to the shale buildout—oil was a geopolitical asset, and so are chips today.

However, the key stages of producing advanced chips, namely design and manufacturing, can only be done in a few countries due to their technological complexity. So far, the U.S. accounts for 73% of the global value-added in logic chip design (graphics processing units, or GPUs), and Taiwan accounts for 90% of the market for the most advanced chip manufacturing.¹⁰ Global supply being constrained by lack of expertise reduces the likelihood of a sudden price collapse driven by oversupply, even if profit margins compress over time.

Nonetheless, the shale analogy is useful for perspective and as a reminder: capital-intensive expansions fail when investors treat controllable inputs as if they determine uncontrollable outcomes.

«OFTEN, THE ERROR IS NOT BUILDING TOO MUCH TOO QUICKLY BUT TREATING A DOMINANT IDEA AS A LAW OF NATURE.»

MIND-TRAPS

Taken together, these episodes point to a deeper lesson; often, the error is not building too much too quickly but treating a dominant idea as a law of nature.

DID YOU KNOW?

CLOUD COMPOUNDING

A more mundane example of AI for the 2010s may be the cloud buildout. Cloud computing was a baseline input rather than a speculative bet on explosive end-user demand. Nearly every firm required some computing power, storage, and reliability, even if usage per firm was modest. Capital investment looked excessive to skeptics for years, yet there was no single “cloud crash”—only gradual normalization as usage scaled and prices fell. How so? The technology adoption rate for smartphones was much faster, thereby increasing existing demand. Cloud infrastructures also enabled the formation of new firms across domains such as e-commerce, streaming, cloud storage, social media applications, food delivery, rideshare, and online banking. Returns were uneven, of course, and many smaller firms failed along the way, but solid demand flow kept a floor under the buildout.

During the Victorian railway boom, it was anticipated that passenger traffic would drive profits, but goods (cargo) soon surpassed passenger volume...only decades later.

In the dotcom era, the prevailing idea was that companies would need to create content and deliver it to end consumers via the Internet “rails,” which led to the desire to expand fiber-optic networks. Instead, what emerged was an open, decentralized web accessible to all (see *Did You Know? Bubble Benefits*).

In shale, technological confidence encouraged investors to believe that returns could be engineered—even though the selling price was set by a global market.

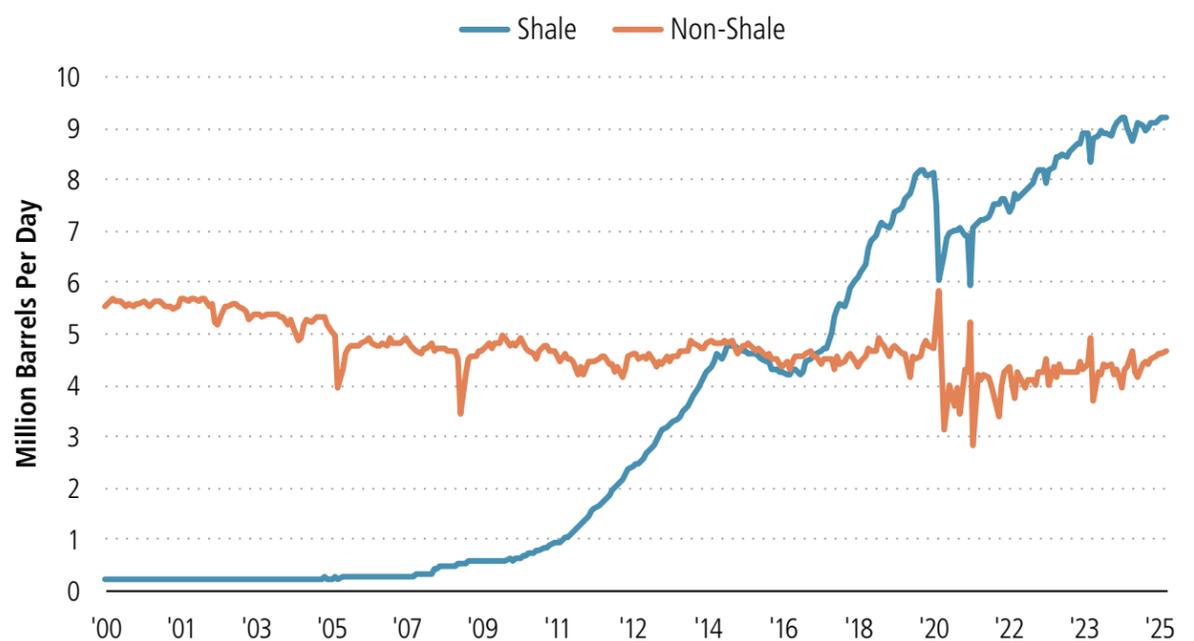
The critical question, then, is not whether AI looks like a past bubble, but which AI ideas might fail.

For example, the central idea driving today’s AI investment is the belief that “scale works.” However, perhaps scaling is not the best approach. OpenAI co-founder Ilya Sutskever has noted that scaling recipes are attractive precisely because they reduce perceived investment risk: if results improve predictably, the incentive is simply to build more.¹¹ After all, as OpenAI’s CFO said, the company’s “revenue directly tracks available compute.”¹² So, for the hyperscalers, the business model is simple: the more computing capacity grows, the more revenue grows.

For investors, focusing on the mind traps shifts the problem from calling a turning point to identifying which ideas could go wrong.

But without a view on which mechanisms are likely to break—and what evidence would change that view—declaring AI a bubble is not analysis. It is pattern-matching. 

fig 6. SHALE BOOM:
U.S. OIL PRODUCTION BY TYPE SINCE 2000



Sources: U.S. Energy Information Association, Federal Reserve Bank of Dallas

DID YOU KNOW?

BUBBLE BENEFITS

Each of the episodes discussed here left an infrastructure of lasting value. After the British railway bubble burst, real social value remained. In 1835, a trip from London to Edinburgh would take two days, and only seven were offered in a year. By 1850, you could book the same trip on any day—and it would require fewer than 12 hours.¹³ In fact, some of the rail lines built in the 1800s are still in use for cargo transportation today. Similarly, the 1990s fiber-optics buildout, although largely laid “waste” before the turn of the century, eventually made bandwidth cheap enough for YouTube and other firms to emerge in the mid-2000s. The shale boom and bust were also key drivers of U.S. crude oil production, ultimately transforming the nation from a net oil importer to an exporter in 2020. Energy independence made the U.S. economy far more resilient to geopolitical shocks in 2022 than European economies. So even if an AI boom were to overshoot and unwind, the legacy may be an abundance of data center capacity at far lower cost, enabling new businesses and economic activity in the years to come.

ENDNOTES

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