The Concentration Game:

Understanding Portfolio Effects of U.S. Equity Market Concentration

February 2026

D E Shaw & Co

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In recent years, breakthroughs in tech and artificial intelligence have helped drive notably strong performance in a handful of mega cap stocks. Today, the ten largest constituents of the S&P 500® account for more than 40% of the index's weight, the highest level in decades. This increase in equity market concentration has coincided with a decline in the risk-adjusted performance of many actively managed portfolios.

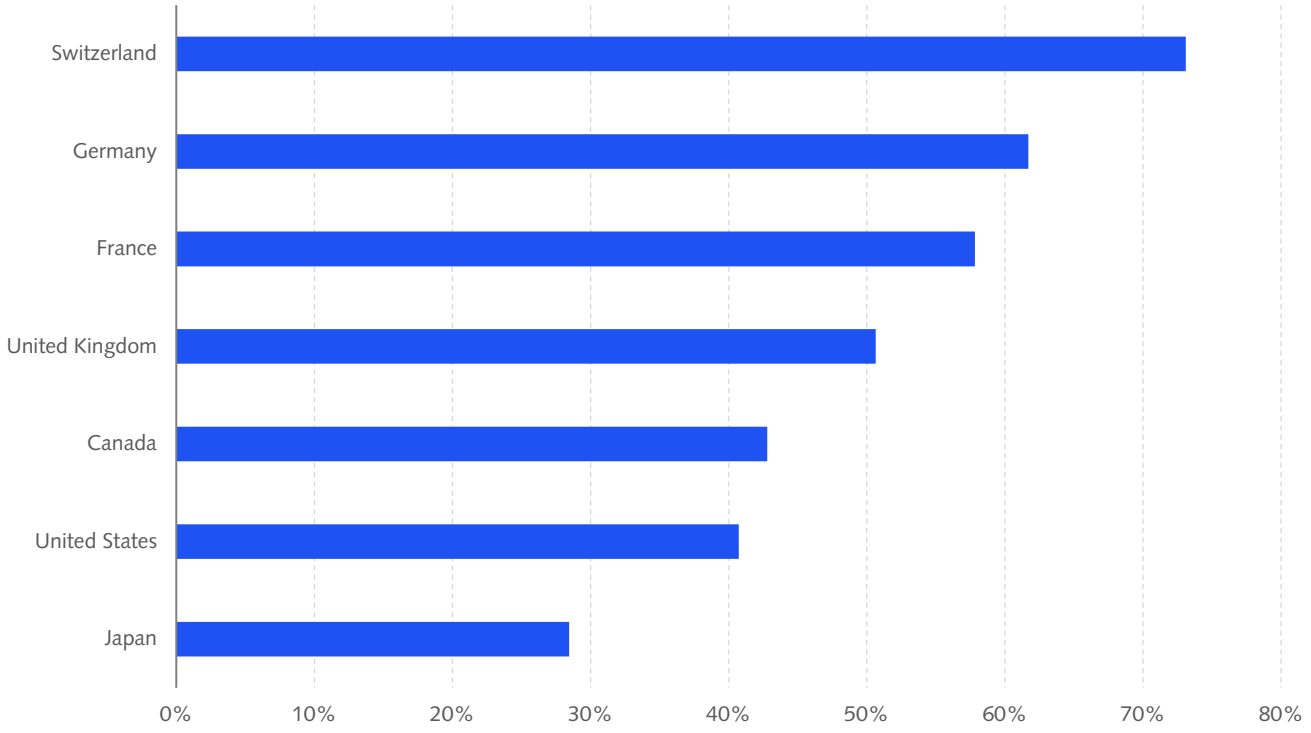
To understand this dynamic, we consider the impact of concentration on overall equity portfolio risk and the potential to generate positive active returns. While concentration can challenge common approaches to managing risk and producing alpha, understanding concentration's underlying drivers may allow investors to adjust their processes to better account for its effects.

Risky Concentration?

We begin by noting for context that index concentration varies across both time and region: there's no "natural" level. Smaller economies tend to have fewer public companies overall, which can result in a larger share of their market capitalization being concentrated in a handful of names. That said, economic size alone does not fully explain cross-country differences in concentration. For example, Japan and Germany have broadly comparable economic footprints, yet Japan's equity market is substantially less concentrated.

Figure 1 illustrates this dispersion across major developed markets. The ten largest companies in Germany, France, and the United Kingdom together represent more than half of those countries' equity market capitalization, while the corresponding figures for the United States and Japan are meaningfully lower, at 41% and 28%, respectively.

Figure 1: Weight of Ten Largest Companies by Country
(As of 12/31/2025)



Note: For all countries other than the United States, the weights reflected in Figure 1 *are derived from the MSCI World Index, which covers ~85% of the free float-adjusted market capitalization in each country. The U.S. market is proxied by the S&P 500®.*

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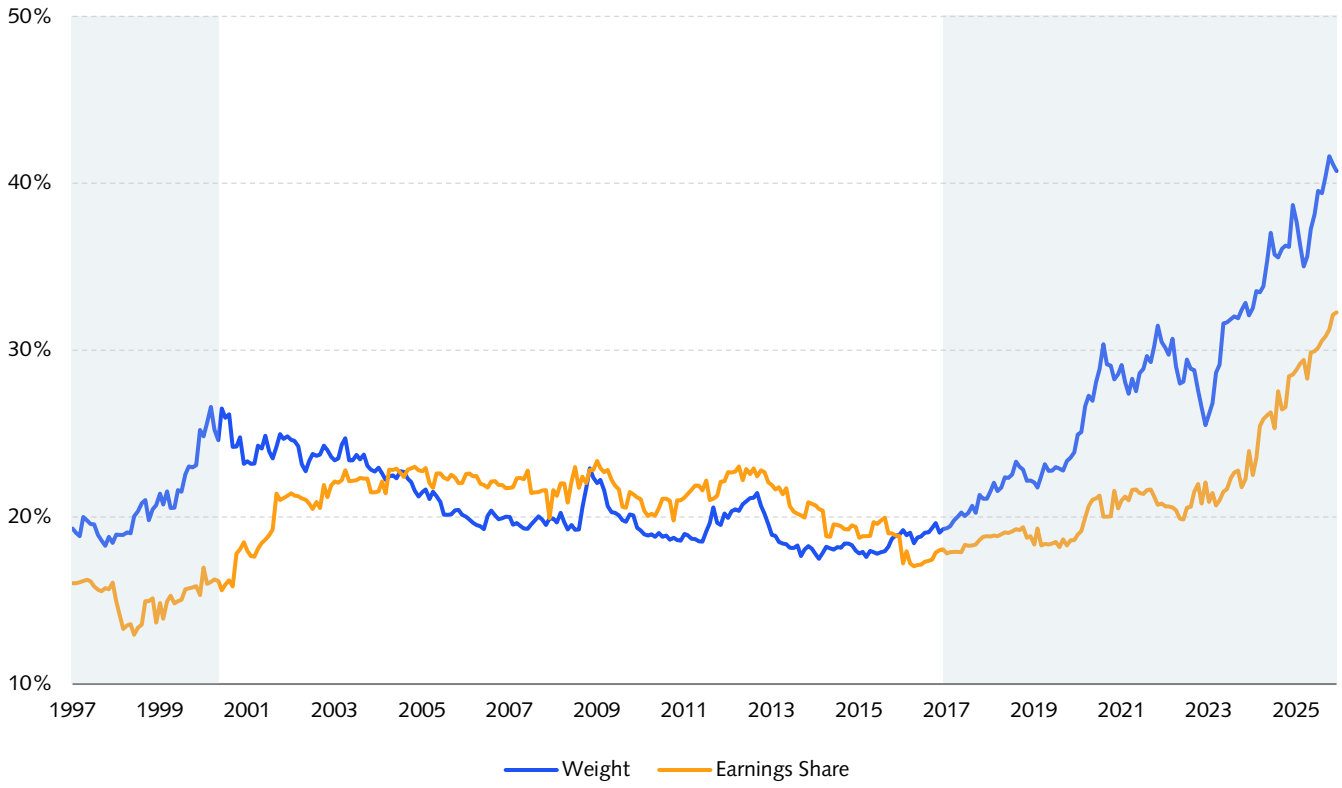
Even if concentration in the U.S. equity market isn't unusual on its face, the overall size of that market is. The S&P 500® represents more than $60 trillion of market capitalization, more than 2.5 times the value of the MSCI World ex USA Index. As a result, marginal concentration risk in U.S. markets has a disproportionate impact on investors globally.

Moreover, U.S. markets have become notably more concentrated in recent years. The aggregate index weight of the ten largest companies more than doubled between the mid-2010s and today, a remarkable period of outperformance. A key question arises: Are there fundamental differences that might explain the growth of the largest companies?

Figure 2 shows the weight and forward earnings share of the ten largest companies over time. Two periods are highlighted: the lead-up to the "dot-com bubble" and the period from 2017 through the end of 2025.

Figure 2: Weight and Earnings Share of 12-Month Forward Earnings of Ten Largest Companies
1/1/1997 – 12/31/2025



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In the earlier period, the ten largest companies' share of index weight increased by more than 5 percentage points, while their share of earnings remained roughly flat. In contrast, during the more recent period, the index weight and earnings share of the largest stocks both increased, especially from 2020 onwards. Put differently, in the late 1990s, the market share of the largest companies was driven primarily by expanding valuation multiples, whereas in the more recent period both prices and earnings have increased.

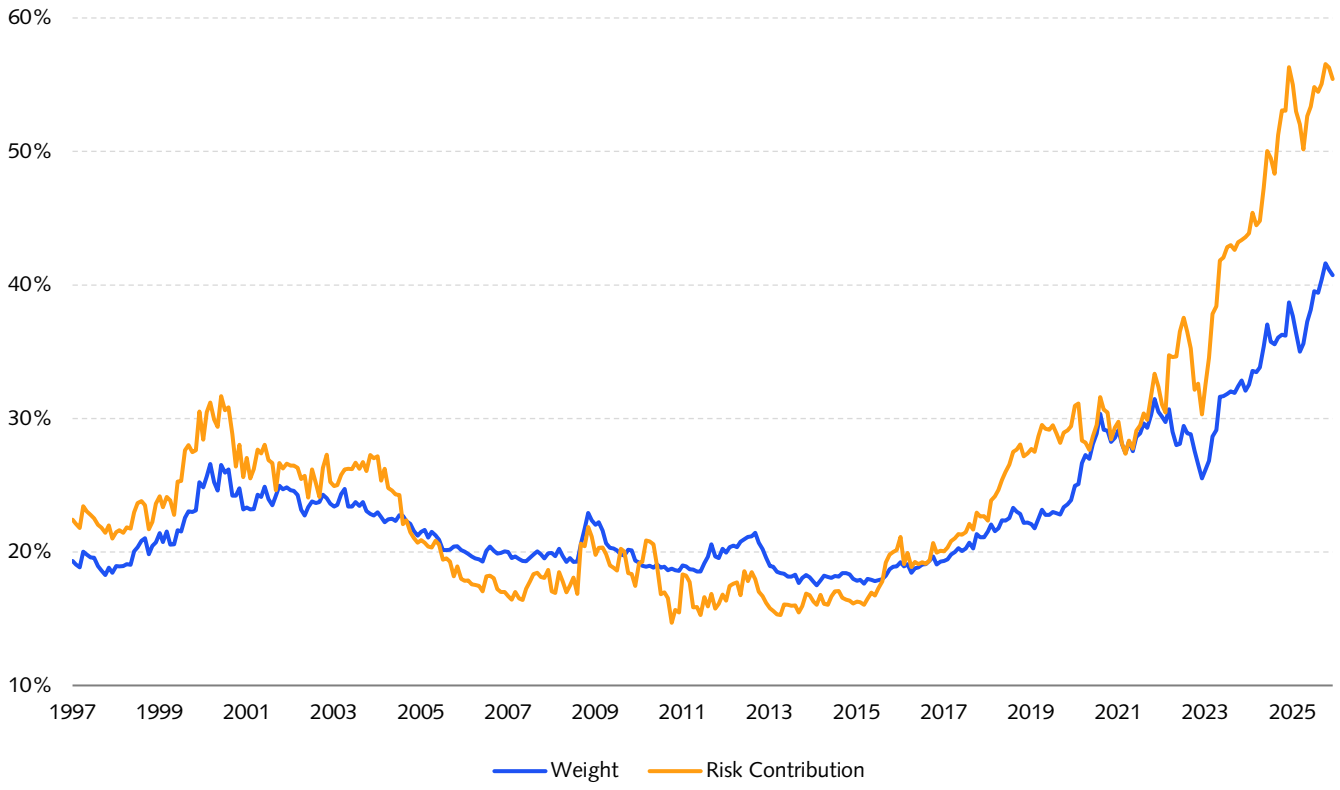
In both periods, investors appeared to be pricing growth. However, in the more recent period, a greater share of these growth expectations has been realized as the largest companies have come to account for an increasing amount of fundamental economic activity.

Understanding concentration's fundamental drivers enables investors to assess its likelihood of reverting and to better evaluate how they might address concentration's investment consequences.

Risk Concentration

In addition to increased index weight, the ten largest companies have, over the past decade, accounted for a growing share of the overall volatility of the S&P 500®, contributing more than 50% as of December 2025. This can be seen in *Figure 3*.

Figure 3: Weight and Risk Contribution of Ten Largest Companies in S&P 500®
1/1/1997 – 12/31/2025



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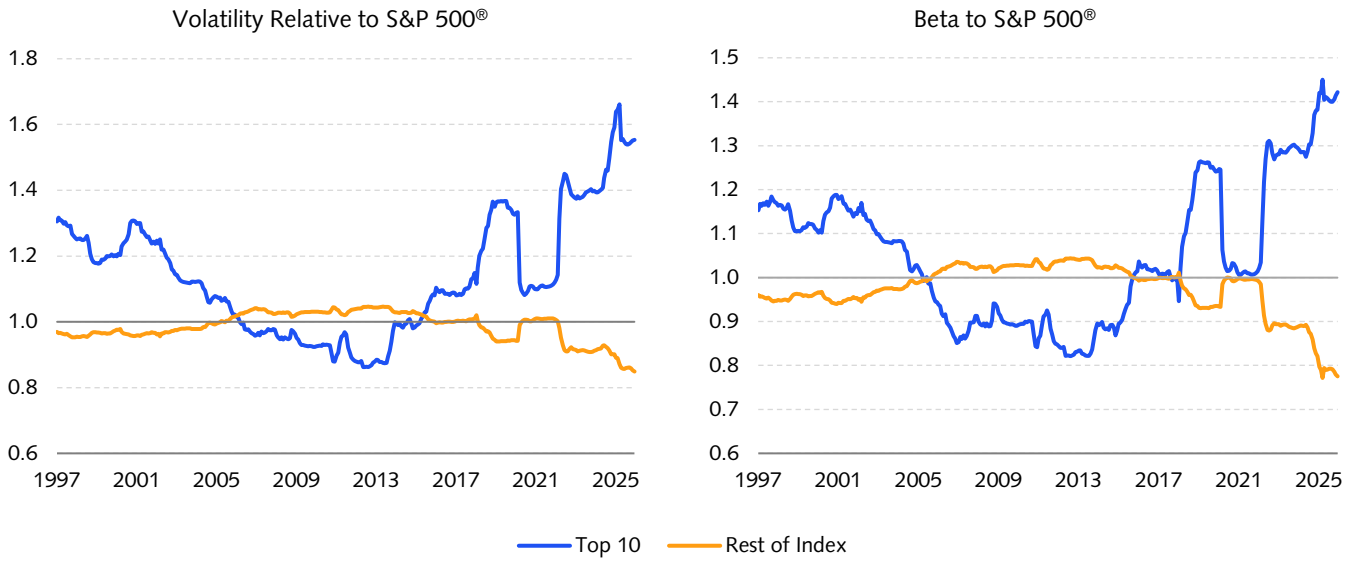
Part of this effect is mechanical, since risk contribution scales quadratically with weight, but in recent years the index's largest constituents have also become more volatile than their predecessors, both in aggregate and in some cases individually.

In the early 2010s, when a diverse group of blue-chip companies like Apple, ExxonMobil, and Johnson & Johnson were the largest names in the S&P 500®,[1] the risk contribution of these companies was lower than their index weight. Today, the ten largest companies are concentrated in technology-related industries, making them more correlated to one another. At the same time, they include stocks like Tesla and Nvidia that are generally more volatile than their more stable predecessors.

[1] Between 2011 and 2015, the ten largest S&P 500® companies were (in descending order based on average index weight): Apple, ExxonMobil, Microsoft, General Electric, Alphabet, Johnson & Johnson, Chevron, Procter & Gamble, IBM, and Wells Fargo. Between 2021 and 2025, they were: Apple, Microsoft, Alphabet, Nvidia, Amazon, Meta, Tesla, Berkshire Hathaway, J.P. Morgan, and Broadcom.

As a result, the ten largest companies now have an aggregate volatility that's 1.5 times the volatility of the S&P 500® as a whole, as can be seen in *Figure 4*. The market beta of the ten largest stocks is now well above 1.0—no easy feat for a group that itself accounts for more than a third of the market.

Figure 4: Risk Characteristics of Ten Largest Stocks vs. Rest of Index
1/1/1997 – 12/31/2025



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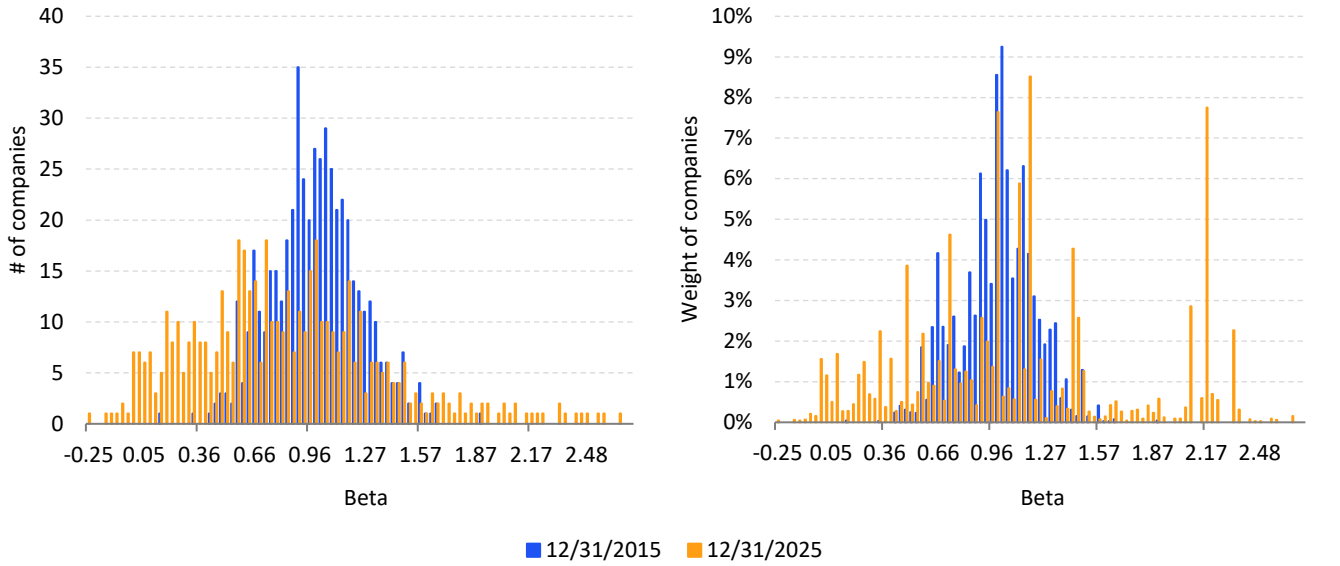
Because the S&P 500® always has a beta of 1.0, the distribution of betas within the index must widen as a result of the increased beta of the largest stocks. *Figure 5* shows, by count and by weight, the beta of each company in the S&P 500® at two different points in time: 2015 and 2025. In 2015, betas were distributed relatively tightly around 1.0. By contrast, in 2025, the distribution had widened and, by count, moved notably leftward, with a long right tail; by weight, almost 20% of the index had a beta of less than 0.5, and over 15% of the distribution had a beta greater than 2.0.

Figure 5: Distribution of Betas to S&P 500® (By Count and Weight)



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Investors' existing risk models may be unprepared to contend with this uneven distribution. To take an extreme example, it's now possible to construct a beta-1.0 portfolio with half its weight in stocks with a beta of ~2.0 and the other half in stocks with a beta of ~0.0. While beta estimates can generally be unstable during periods of market stress, the wider dispersion of betas in concentrated markets can make portfolios more sensitive to estimation error. During market crises, this can translate into materially more or less market exposure than anticipated, suggesting a need for more robust approaches to measuring and managing beta risk.

Implications for Alpha Generation

So far, we've focused primarily on concentration's implications for overall market risk. We now turn our focus to the impact on an active manager's ability to generate outperformance, or alpha, in a benchmark-relative portfolio. We begin with what's commonly known as the "fundamental law of active management"[2]:

$$\boldsymbol{IR} = \boldsymbol{IC} \times \boldsymbol{TC} \times \sqrt{\boldsymbol{N}}$$

Here, the information ratio (IR) represents the risk-adjusted active return of an equity portfolio. This ratio is a function of three variables:

- the manager's skill (the information coefficient, or IC),
- the ability of the manager to translate that skill into portfolio positions (the transfer coefficient, or TC), and
- the effective number of independent forecasts, or the number of times the manager can apply their skill (breadth, or N).

We consider concentration's impact on the latter two terms, TC and N, since it's unlikely to directly affect a manager's forecasting skill.

Implications for Alpha Generation: Transfer Coefficient

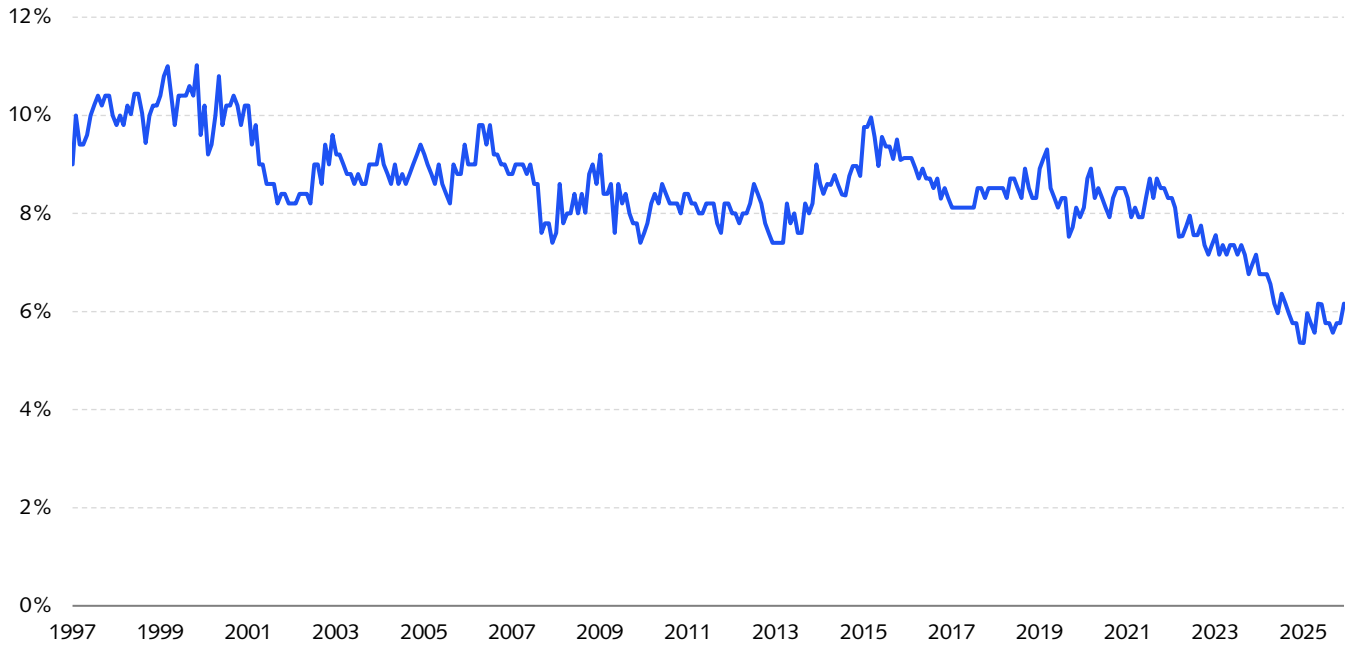
One of the most significant restrictions on a portfolio's ability to reflect investment insight is the long-only constraint, under which a manager can underweight a stock but can't take an outright short position. This creates a natural limit on how effectively negative views can be expressed. For example, if a manager has a negative outlook on a company that accounts for 0.50% of the index, the most they can do is omit the name from the portfolio, yielding an underweight of -0.50%. As large companies come to dominate an index, the remaining stocks naturally represent less weight. This constrains the manager's ability to turn negative views—especially on smaller companies—into meaningful active positions.

The long-only constraint also creates a more subtle limitation on expressing positive forecasts. Any overweight position must be offset by an equal amount of underweights elsewhere in the portfolio. In a concentrated market, the pool of stocks from which meaningful underweights can be drawn becomes much smaller. This can force a manager into an uncomfortable trade-off: either underweight companies for which they have only mildly negative, or even mildly positive, forecasts, or scale back the size of their highest-conviction overweights. In this way, even strong positive forecasts may not be efficiently expressed.

As a simple illustration of this dynamic, *Figure 6* shows that the share of stocks in the S&P 500® with a weight of at least 50 basis points declined from approximately 10% in 1997 to about 8% in 2022, and has since fallen further to 6%. In practice, this means that long-only managers seeking to offset meaningful overweights are increasingly forced to concentrate their underweights in a smaller subset of stocks, making it more difficult to diversify stock-specific risk. This can in turn reduce the efficiency with which active risk is converted to returns and potentially decrease the strategy's information ratio.

[2] The fundamental law was first proposed by Richard C. Grinold in his 1989 article "The fundamental law of active management" and further elaborated on by others over time.

Figure 6: Percentage of S&P 500® Companies With Weight ≥ 50 bps
1/1/1997 – 12/31/2025



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Relatedly, the long-only constraint can lead managers to have a long bias toward smaller index constituents, which is generally exacerbated by concentration. As we'll see, such a size tilt can become a headwind if the largest stocks outperform.

Relaxing the long-only constraint and allowing some degree of shorting in the portfolio can help address these challenges, as can targeting a lower level of tracking error, which generally requires a smaller magnitude of underweights.

Implications for Alpha Generation: Breadth

Breadth is best understood as the number of independent stock forecasts a manager can make. Accordingly, when assessing the effective breadth of a strategy, it's important to consider not only the number of stocks across which the manager's forecasts are expressed, but also the correlation of those stocks' benchmark-relative excess returns. An index with 500 constituents with largely uncorrelated excess returns will provide much more scope for a manager to exploit their forecasting skill than one where constituents' excess returns move together.

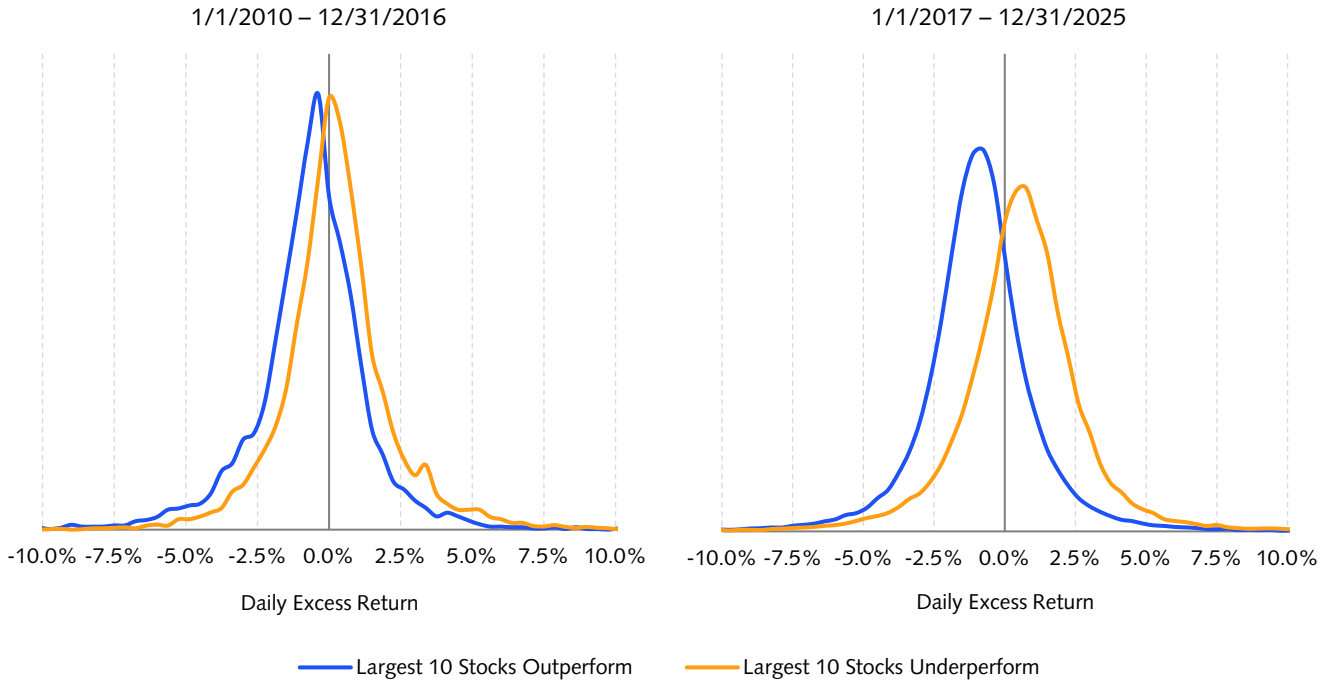
In a benchmark-relative context, each stock's return can be measured against those of the overall index. By definition, the weighted sum of all excess returns must equal zero. Consequently, the excess return of each stock in the index mechanically affects every other stock's excess return, which must in aggregate over- or underperform by an offsetting amount.

Often, this impact is negligible. In an equal-weighted index of 500 stocks, outperformance of 2% by a single stock means that the remaining 499 will, on average, underperform by -0.04%. In this scenario, the impact of any one stock's idiosyncratic performance on the distribution of excess returns should be quite small.

The magnitude of this effect changes as the benchmark becomes more concentrated. For example, if on a given day ten stocks representing 40% of index weight were to outperform by 2%, then the remaining 490 constituents would need to underperform by an average of 1.3%. The more concentrated the index, the more we'd expect the distribution of excess returns to depend on the company-specific performance of the largest stocks.

To help visualize this effect, *Figure 7* plots the distribution of daily excess returns for the S&P 500® on days when the ten largest stocks outperform by at least 1% and on those when they underperform by at least 1%. Two periods are provided. The first, from 2010 through 2016, was a period of relatively low concentration, when the ten largest stocks represented an average of 19% of the index's weight. The second, from 2017 through 2025, was much more concentrated, with the ten largest stocks representing 28% of the index on average.

Figure 7: Distribution of Daily Excess Returns of S&P 500® Stocks, Conditioned on Excess Return of 10 Largest Stocks



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During the lower-concentration period, daily excess returns tended to cluster around 0.0%. The distribution shifted modestly to the left on days when the largest stocks outperformed, but the modal centers stayed within 50 basis points of each other.

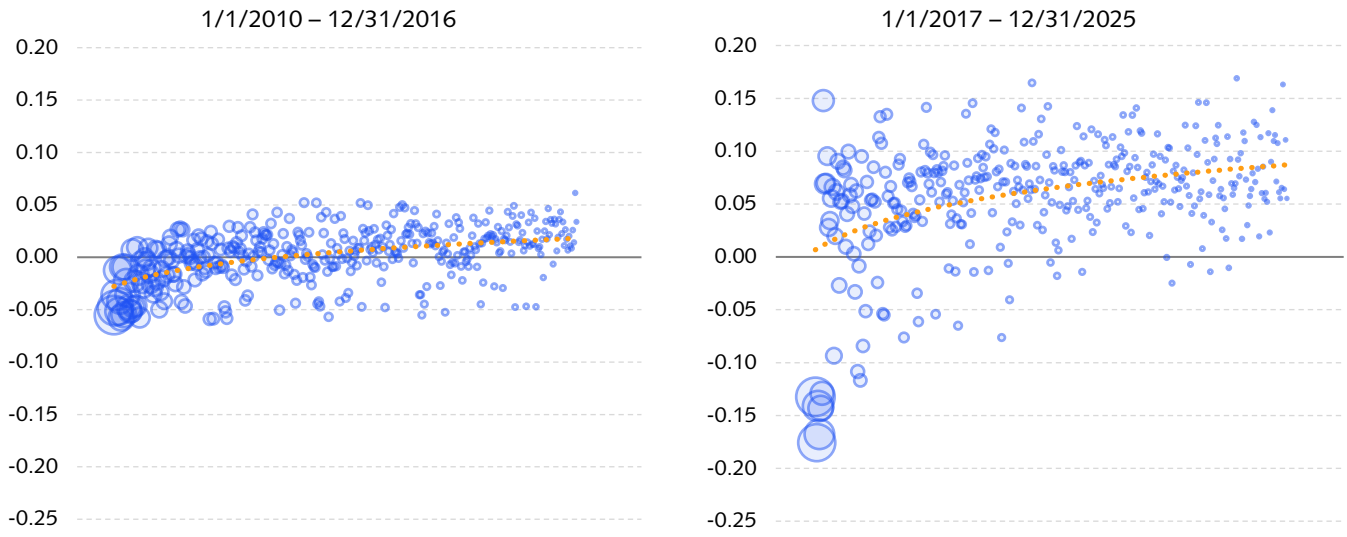
During the higher-concentration period, the two distributions notably separated, with a difference of approximately 1.5 percentage points between their modal centers. As expected, the majority of stocks had positive excess returns on days when the largest underperformed, and negative excess returns when the largest outperformed.

This effect suggests that, during periods of elevated concentration, most stocks should, in excess-return terms, be negatively correlated with the largest stocks (underperforming when the largest outperform and vice versa), and positively correlated with each other.[3]

Empirically, that's exactly what we observe. *Figure 8* shows the low- and high-concentration periods again. Each individual stock in the S&P 500® is presented along the x-axis, sorted from largest to smallest (left to right). For each, the y-axis plots the median pairwise excess return correlation with all the other stocks in the index, with bubble size proportional to market capitalization.

[3] This increased correlation is strictly a result of the math of benchmark-relative excess returns and does not apply to total returns. An airline company is not suddenly more fundamentally correlated with a software company during concentrated markets.

Figure 8: Median Pairwise Excess Return Correlation of S&P 500®



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In both periods, we see that the largest stocks are negatively correlated with the majority of stocks in the rest of the index, while smaller stocks tend to be more correlated with one another. However, this effect is considerably more pronounced in the high-concentration period, when the largest stocks have a median correlation of less than -0.10 with the rest of the index, and nearly all other stocks have a positive median correlation. Put another way, in periods of high concentration, most stocks are exposed to a prominent benchmark-relative factor: the performance of mega caps.

These correlation effects would, all else equal, reduce the breadth of a given strategy's forecast expression, and thus its expected information ratio. In theory, investors could consider novel modeling approaches to account for this effect during periods of heightened concentration. For instance, an investor might consider managing to two separate benchmarks, one comprising the largest stocks and one the rest of the desired index, in which case the benchmark-residual returns of the latter would no longer be more correlated than usual. In practice, however, this may entail operational complexities and introduce additional distortions, making it an interesting area of research.

Concentration: Where Do We Go From Here?

Given the extreme level of current U.S. equity market concentration relative to recent history, one might assume this trend will eventually revert. However, it's helpful to consider what it would take for the weight of the ten largest companies in the S&P 500® to return to the pre-2020 average of 20.8%. In one such scenario, if the largest stocks were to remain flat, the rest of the index would need to return more than 160%. Given the scale required for full reversion, it seems likely that markets could remain highly concentrated for some time.

Investors who believe concentration will persist may wish to consider its effect on their portfolio's risk characteristics and alpha potential, and how those effects might be most efficiently addressed. This may include interrogating managers' risk models, expanding the opportunity set by allowing short positions, or re-evaluating the tracking error level most aligned with manager skill and portfolio objectives.

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