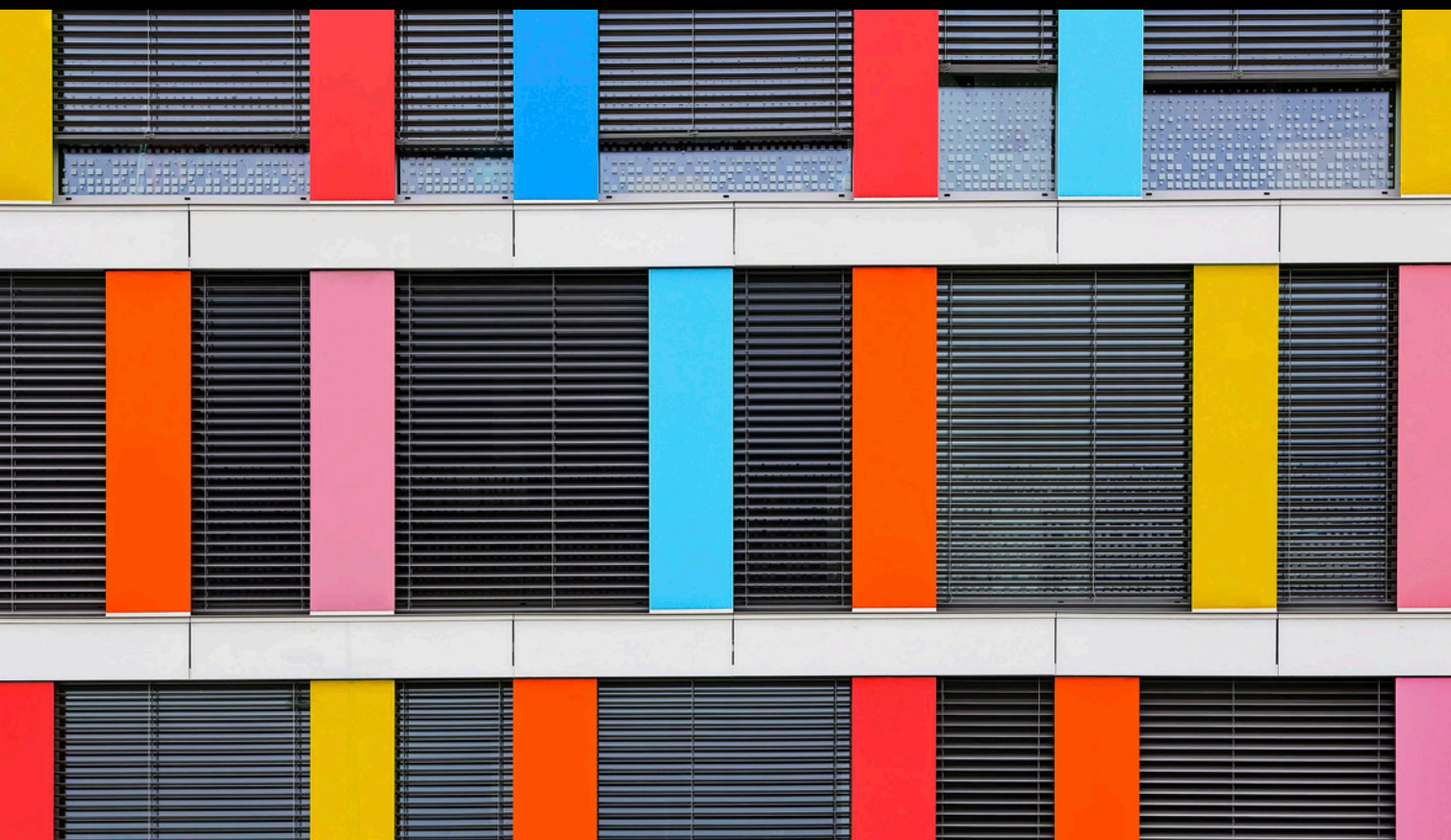


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# **Benchmark concentration and the effects on active portfolios**



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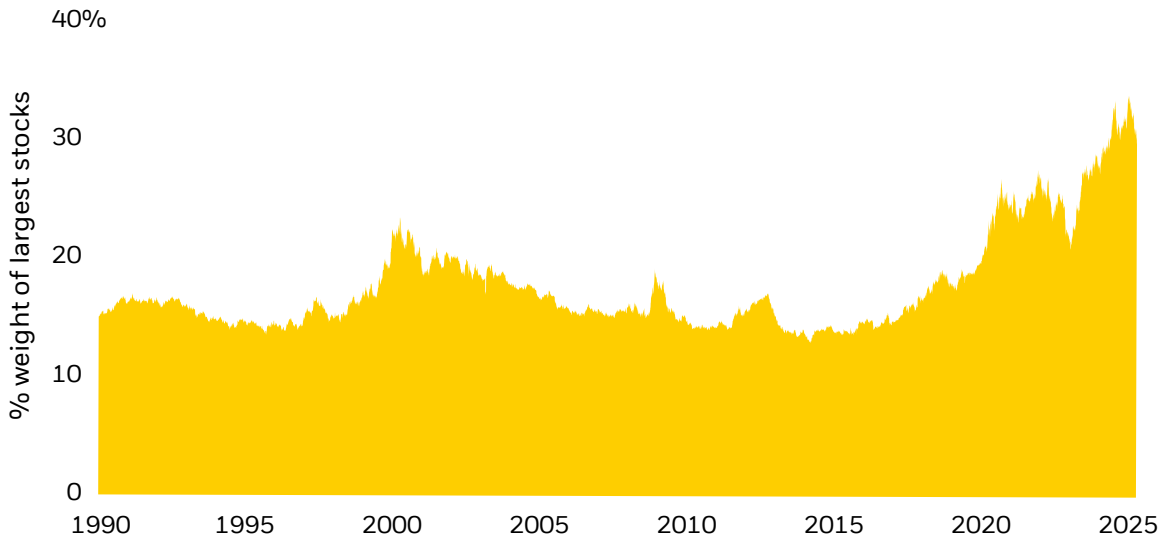
## Summary

- Over the last five years, equity market concentration has climbed significantly, meaning a smaller number of stocks have increasingly driven the bulk of the returns within equity markets. For passive investors, increased concentration reduces diversification and increases volatility, leaving major indices more susceptible to the idiosyncratic risks of its largest constituents.
- In this paper, we compare the effect of benchmark concentration across long-only, and partial long-short (i.e., 130/30 and 175/75) portfolios. We simulate hundreds of cross-sectional return forecasts across varying levels of benchmark concentration to measure the effect on forecasted information ratios (“IRs”) across various portfolio implementations.
- Overall, we find that partial long-short strategies exhibit a much lower sensitivity to the effects of increased benchmark concentration than long-only strategies.
- Moreover, we find that portable alpha strategies, defined as full long-short equity market neutral with futures overlays, are an attractive way to further insulate portfolios from increased market cap weighted concentration.
- For long-only investors, we find that lower active risk reduces sensitivity to increased market concentration. Furthermore, we find that forecasted IRs can be maintained when benchmark concentration increases.

## Introduction

In recent years, the outperformance of the largest firms in equity markets has led to increasingly concentrated market cap weighted benchmarks. In the U.S., for example, the largest seven stocks now make up nearly one-third of the S&P 500 (Figure 1).

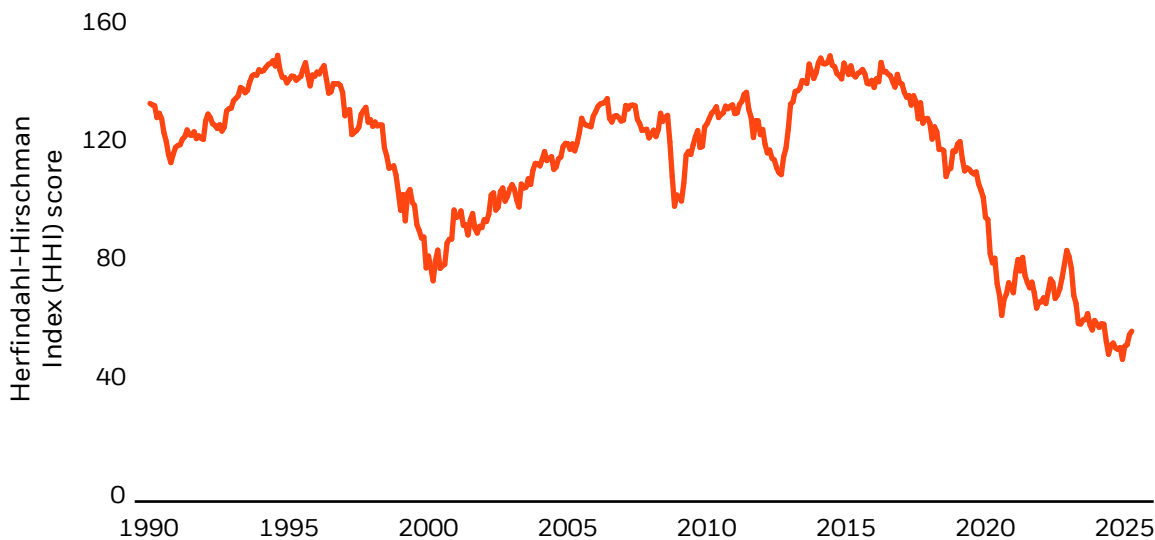
**Figure 1: Total weight in the S&P 500 from the seven largest stocks, monthly**



Source: BlackRock Systematic, data as of April 2025.

Similarly, the effective breadth of the S&P 500 – a measure which attempts to distill the “effective” number of constituents in an index based on the concentration of the weights – has declined to its lowest point in decades (Figure 2).

**Figure 2: Effective breadth of the S&P 500 index**



Source: BlackRock Systematic, data as of April 2025.

We define effective breadth as the reciprocal of the sum of the squared benchmark weights (a construct often called the inverse Herfindahl index):

**1** 
$$EB = \frac{1}{\sum_1^N h_n^2}$$

The term  $h_n$  is the benchmark weight and  $N$  measures the number of stocks in the benchmark. For an equal-weighted benchmark,  $h_n = \frac{1}{N}$ , and the effective breadth is  $N$ , the maximum possible value for the effective breadth. If the benchmark is extremely concentrated, e.g.,  $h_1 = 1$  and  $h_i = 0$  for  $i \neq 1$ , then the effective breadth is 1, the minimum possible value. There are many ways to quantify benchmark concentration. For this paper, we will primarily use effective breadth.

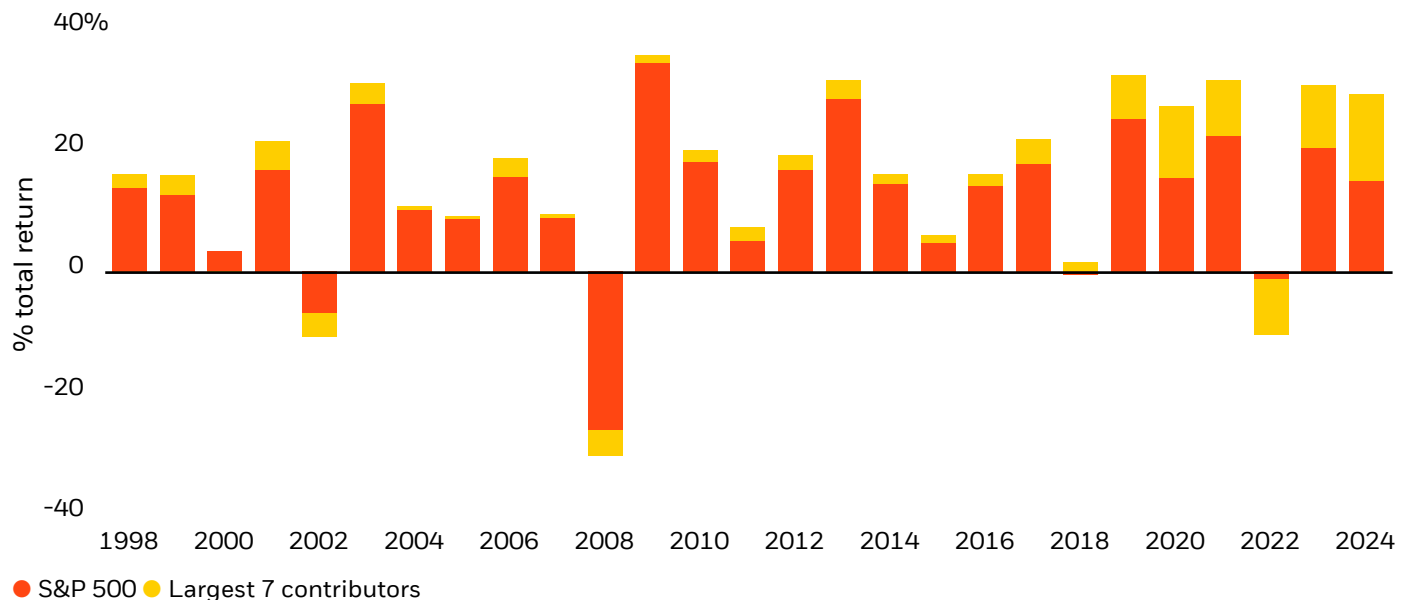
The effect of benchmark concentration on index returns has been similarly dramatic with fewer than 10 stocks frequently driving 25 to 50% of the total return outcome in recent years (Figure 3).

The increasing concentration of cap-weighted equity indices has implications for active managers. This paper examines these effects and evaluates whether certain portfolio construction approaches are more robust to higher concentrated benchmarks. Our goal is to offer insights on how investment managers can adapt their investment processes to maximize the likelihood of index relative outperformance.

We investigate the relationship between active risk and benchmark concentration across three strategies: Long-only, partial long-short, and full long-short implementations. Partial long-short strategies are defined by an aggregate net equity position of 100%, and maximum gross leverage of either 160% (130% long and 30% short) or 250% (175% long and 75% short). Full long-short strategies are characterized by an aggregate net equity exposure of 0% and gross leverage of 600% (300% long and 300% short).<sup>1</sup>

Before moving to our analysis, it's important to briefly review the general impact of long-only and partial long-short constraints on portfolios, without focusing specifically on highly concentrated benchmarks.

**Figure 3: Annual return contribution from the largest 7 stocks relative the annual total return, S&P 500**



The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results and should not be the sole factor of consideration when selecting a product or strategy. Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index. Source: BlackRock Systematic, data as of April 2025.

<sup>1</sup> Short positions in portfolios provide greater risk, including the potential for significant unlimited losses.

As described in Grinold and Kahn, we begin with a set of alpha forecasts that are independent of benchmark index weights.<sup>2</sup> Specifically, we assume that these alpha forecasts do not include views on size (i.e., whether large-cap stocks will outperform small-cap stocks, or vice versa). Additionally, we assume that optimal portfolios will be constructed using mean-variance optimization:

$$2 \quad \text{Utility} = \mathbf{p}_A^T \cdot \boldsymbol{\alpha} - \lambda \cdot \mathbf{p}_A^T \cdot \mathbf{V} \cdot \mathbf{p}_A$$

In Equation (2),  $\mathbf{p}_A$  are the active portfolio positions (overweights and underweights),  $\mathbf{V}$  is the covariance matrix, and  $\lambda$  is a risk-aversion parameter. In the absence of constraints, the portfolio that maximizes the utility (Equation (3)) is:

$$3 \quad \mathbf{p}_A = \left(\frac{1}{2\lambda}\right) \cdot \mathbf{V}^{-1} \cdot \boldsymbol{\alpha}$$

In Equation (4),  $w$  represents the active risk of the portfolio. Notice that without constraints, decreasing risk aversion  $\lambda$  leads to larger overweights and underweights (Equation (3)) resulting in higher active risk (Equation (4)).

$$4 \quad w^2 = \mathbf{p}_A^T \cdot \mathbf{V} \cdot \mathbf{p}_A = \frac{\boldsymbol{\alpha}^T \cdot \mathbf{V}^{-1} \cdot \boldsymbol{\alpha}}{4\lambda^2}$$

$$w = \frac{\sqrt{\boldsymbol{\alpha}^T \cdot \mathbf{V}^{-1} \cdot \boldsymbol{\alpha}}}{2\lambda}$$

When we introduce a long-only constraint to our optimization, we can no longer derive a general analytic solution as in Equation (3). However, intuitively we can see that our optimal underweights are constrained by the benchmark weights. Specifically:

1. It will be more challenging to implement underweights on small-cap stocks compared to large-cap stocks, although almost all stocks may be affected.
2. The difficulty will increase as we lower risk aversion to achieve higher active risk. Higher active risk involves larger overweights and underweights, making the long-only constraint increasingly impactful as active risk rises.

Additionally, the long-only constraint affects overweights because the overweights and underweights need to balance. Limiting our ability to underweight will, therefore, limit our ability to overweight. We can capture the net effect of this through the transfer coefficient (“TC”), which measures the correlation between the portfolio we can build with constraints<sup>3</sup> and the optimal portfolio (Equation (3)), we could build without constraints. Equivalently, it also measures the reduction in ex-ante information ratio, which is expected active return per unit of active risk, or IR, due to the constraints:

$$5 \quad \text{IR constrained} = \text{TC} \cdot \text{IR unconstrained}$$

In our view, long-short portfolios most accurately reflect manager views because they are not constrained by the long-only limitation. While these portfolios are not guaranteed to succeed, as manager views can be incorrect, investors may choose managers based on their expertise and desire portfolios that reflect their views.

The appeal of partial short strategies (e.g., 130/30 or 175/75 strategies) follows the same logic. These strategies relax – but do not eliminate – the constraint on shorting. For instance, 130/30 strategies allow some shorting, but it’s limited to 30% of portfolio value. At low levels of active risk, the constraint is not binding, but as active risk increases, the constraint eventually becomes binding.

However, partial short strategies are not directly comparable to long-short strategies, as partial short strategies typically will have market betas close to one and long-short strategies will have market betas close to zero. A closer comparison is between partial short strategies and portable alpha strategies (long-short plus market index). This distinction is important for fund allocators, though it does not impact the analysis in this paper.

Note that partial short strategies enable portfolios to better reflect manager views, even though they are not as flexible as pure long-short strategies. These strategies have been around for more than 15 years, but, in our opinion, their reputation has suffered to unfortunate timing. They gained popularity, particularly among U.S. quantitative investment strategies, just before the financial crisis, when standard quantitative strategies underperformed significantly. During that period, investors would have benefitted from choosing more constrained portfolios. Outside the U.S., these strategies became more popular after the financial crisis. Recently, interest in partial short strategies has been growing in the U.S.<sup>4</sup>

<sup>2</sup> Grinold, Richard C., and Ronald N. Kahn. *Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk*. 2nd ed. New York: McGraw-Hill, 2000. <sup>3</sup> The transfer coefficient captures the total impact of constraints and costs. We are ignoring costs in this analysis. <sup>4</sup> Duffin, S. “A More Appealing Environment for Equity Long/Short Strategies.” Cambridge Associates. February 2025.

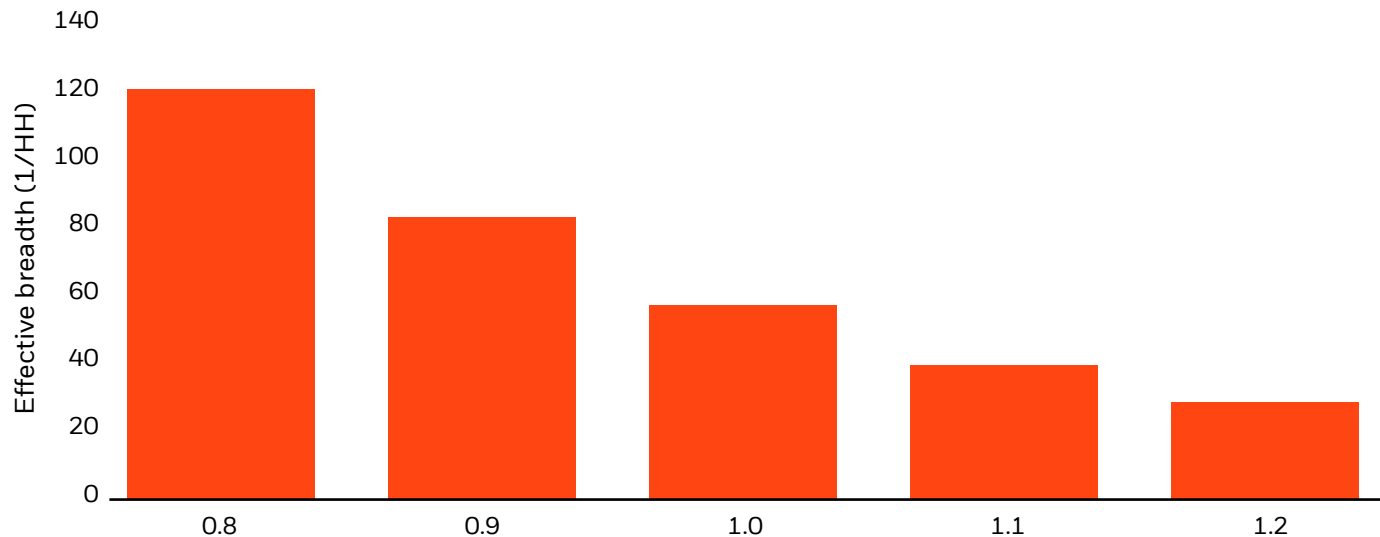
## Data and methodology

In this analysis, we focus on the expected risk-adjusted return, specifically the forecast information ratio, to compare and draw conclusions from simulated data. To evaluate the effects of benchmark concentration, we create permutations of the current S&P 500 Index weightings by adjusting concentration levels. Starting with the S&P 500 benchmark weights as of April 2024, we compute new asset weights using the following function:

$$6 \quad h_{n,adjusted} = \frac{h_n^m}{\sum_n h_n^m}$$

In Equation (6),  $m$  is the concentration factor which we vary from 0.8 to 1.2. Values of  $m$  greater than one increase benchmark concentration, while values less than one decrease concentration. This formulation preserves the rank order of the benchmark constituents across the permutations. Figure 4 shows the resulting effective breadth for the S&P 500 at varying values of  $n$ .

**Figure 4: Effective breadth of the S&P 500**



**The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results. Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index.** Source: BlackRock Systematic, data as of April 2024. All analysis as of April 2025.

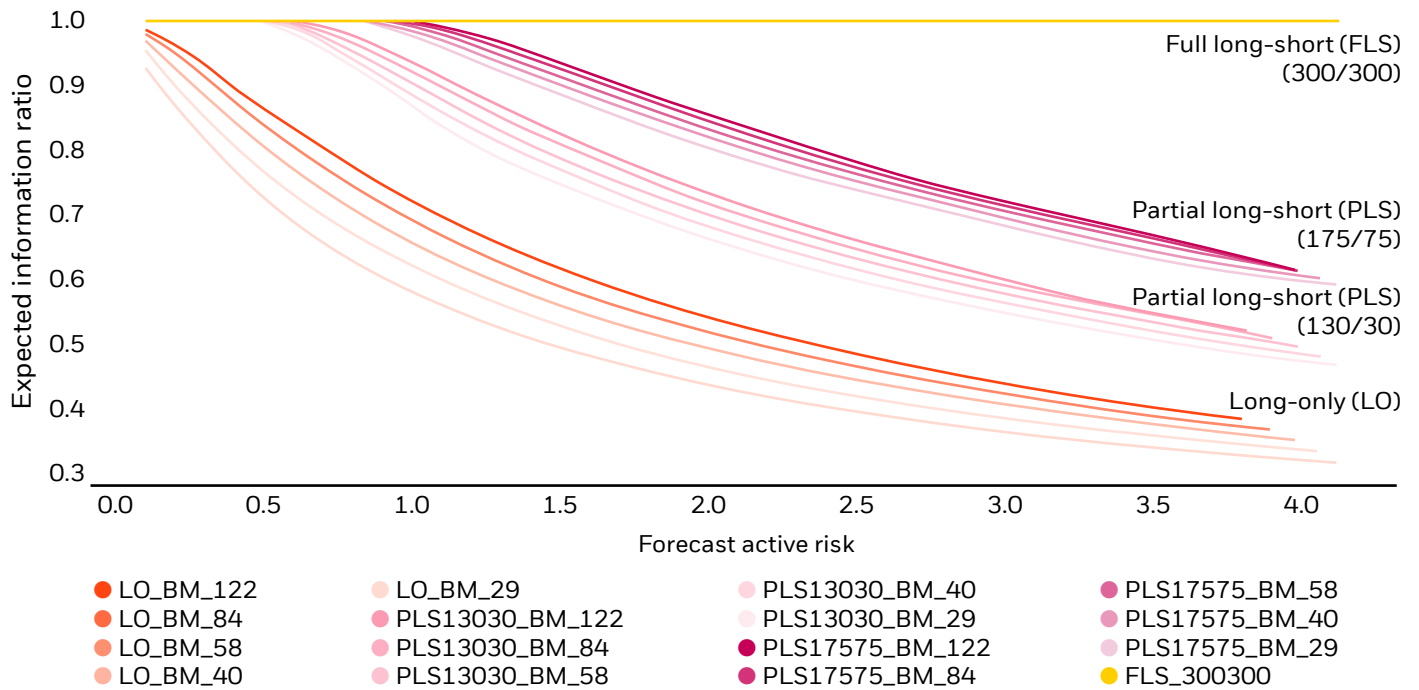
We conduct single period mean-variance optimizations using simulated return forecasts across various implementations: Long only, partial long/short (130/30 and 175/75), and full long-short market neutral (100% long and 100% short). We measure forecast IRs across different risk and benchmark concentration levels. For these portfolio optimizations, we use the USE4S Barra Risk model, assuming no transaction costs or borrow costs. All portfolios are constructed using data as of April 2024.

The return forecasts are generated using a random distribution of 900 sets of stock-level alphas where each set is normally distributed with a mean of zero and a standard deviation which corresponds to an expected IR of 1.0 in the unconstrained long-short portfolio. Thus, each observation in the proceeding results corresponds to an active risk level, benchmark concentration, and implementation type which are *averaged* over the 900 sampled return forecasts.<sup>5</sup>

<sup>5</sup> We generate multiple simulations because our random alphas are sometimes easier to implement than other times. For example, in our simulation we may generate negative alphas for the largest stocks. That is easier to implement than if we had positive alphas for the largest stocks. We want to average over all such possibilities.

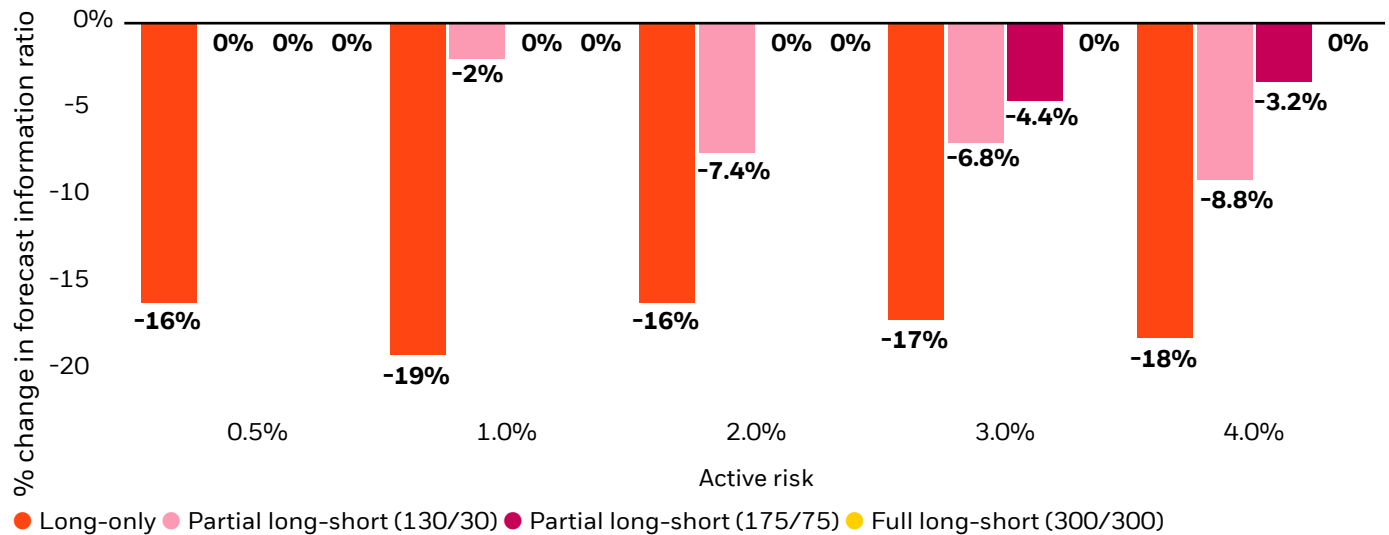
# Empirical results and discussion

**Figure 5a: Simulation results, model assumed IR = 1.0**



BM\_## represents benchmark effective breadth level.  
Source: BlackRock Systematic, data as of April 2024. All analysis as of April 2025.

**Figure 5b: Change in forecast IR when BM effective breadth declines from 122 to 29, assumed model IR = 1.0**



Forecasts are based on estimates and assumptions and should not be relied upon as actual results may vary significantly and may not be achieved. The hypothetical performance returns are provided for illustrative purposes only and demonstrated strategy performance and are not meant to be representative of an existing portfolio, product, or actual performance returns of, or to project or predict returns for, any particular investment and does not exist and therefore does not reflect the deduction of any fees or expenses, including advisory, management and performance fees, as well as brokerage fees, commissions and other expenses that might normally apply. There are frequently sharp differences between a hypothetical performance record and the actual record subsequently achieved. In addition, allocation decisions were not made under actual market conditions and cannot completely account for the impact of financial risk. The data was selected with the full benefit of hindsight, after their performance over the period shown was known. Hypothetical performance results are not indicative of future returns. Source: BlackRock Systematic, data as of April 2024. All analysis as of April 2025.

Figure 5a, presents simulation results for an assumed model IR of 1.0 across different implementations (long-only (LO), partial long-short (PLS) at leverage levels of 130/30 and 175/75, and full long-short (FLS) with leverage of 300/300), across various risk levels (from 0.5% to 4.0%), and for a set of benchmark effective breadth levels (ranging 29 to 122). The legend displays the implementation (LO, PLS13030, PLS17575, FLS) and the benchmark effective breadth (from 29 to 122). Thus, each line in the plot represents how the forecast IR evolves with respect to forecast risk for a given level of benchmark effective breadth.

A few things stand out visually from Figure 5a. First, the dispersion of the lines is much wider in the long-only cases and much tighter for the partial long-short cases. This suggests that the sensitivity of the long-only implementation is much higher to benchmark concentration when compared to the partial long-short implementations.

Second, the slope of the long-only lines becomes much steeper as risk falls especially when compared to the partial long-short cases where the slope is relatively constant with respect to risk. The increasing slope of the long-only cases when risk moves from high to low suggests additional returns are earned per unit of risk as forecast risk is decreased.

Figure 5b plots the percentage change in IR when benchmark effective breadth drops from 122 to 29 for each of the portfolio implementations. For context, the historical long-run average effective breadth in the SP500 from 1990 to 2020 (shown in Figure 2) is approximately 120, while

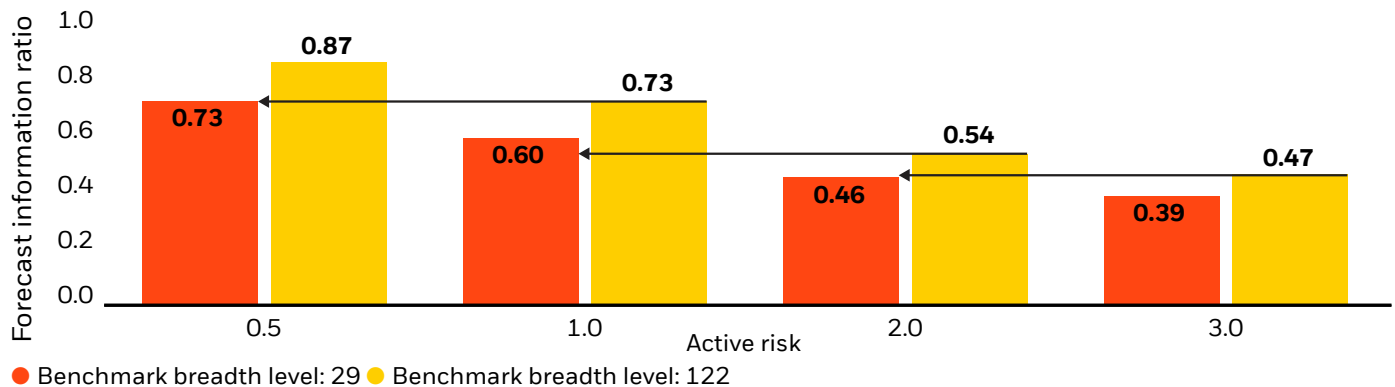
average effective breadth post-2020 has been roughly 60. Thus, an effective breadth from 122 to 29 a doubling and halving of post-2020 effective breadth levels.

From Figure 5b, at 1.0% active risk, the forecast IR drops by -19% in the long-only implementation when the benchmark breadth drops from 122 to 29. In contrast, the partial long-short 130/130, partial long-short 175/175 and full long-short simulations show declines of -2.0%, 0.0%, and 0.0%, respectively. Therefore, a long-only strategy aiming to generate **100 bps** of excess return above the benchmark at a benchmark breadth is 122 is expected to generate **81 bps** when the benchmark breadth drops to 29. Conversely, at the 1% risk level, the partial long-short and full long-short strategies are expected to generate 98 bps and 100 bps, respectively, demonstrating greater resilience to the decline in effective benchmark breadth.

For long-only investors, reducing active risk may help maintain the portfolio's expected IR when benchmarks become more concentrated. As shown in Figure 6, at a 3% active risk level with a benchmark effective breadth of 122, the expected IR is 0.47. This is roughly equivalent to the expected IR at a 2% risk level when benchmark breadth drops to 29. Conversely, if the risk level remains at 3%, the IR declines to 0.39 when the benchmark breadth drops to 29.

Similarly, if the S&P 500 becomes twice as concentrated compared to 2024 levels, the expected IR in long-only strategies may be maintained by halving active risk.

**Figure 6: Forecast IR by active risk and effective benchmark breadth long-only**



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## Conclusion

This study's findings underscore the significant impact of benchmark concentration on portfolio expectations and the robustness of various investment approaches. As benchmarks become more concentrated, maintaining consistent information ratios ("IRs") becomes more challenging, especially for long-only portfolios. To counteract the effects of rising benchmark concentration, reducing risk levels in long-only portfolios adopting partial long-short strategies can be effective.

Our simulations demonstrate that:

### **1 Partial long-short portfolios are more robust**

Partial long-short (130/30) implementations show greater resilience to increased benchmark concentration compared to long-only portfolios. The sensitivity of forecast IRs to changes in benchmark breadth is significantly lower for partial long-short strategies, making them a preferred choice for investment managers seeking consistent risk-adjusted returns.

### **2 Portable alpha strategies are attractive for flexible investors**

Full long-short market neutral strategies, when combined with index futures, can generate alpha independently of equity benchmark concentration effects.

### **3 Active risk adjustments for long-only investors**

For long-only investors who cannot implement partial long-short strategies, adjusting active risk levels is crucial. Reducing risk levels as benchmark concentration increases helps maintain consistent IR levels. This approach is particularly important as sensitivity to benchmark concentration effects is amplified at lower active risk levels.

These insights provide valuable guidance for investment managers in adapting their portfolio construction approaches in the face of increasingly concentrated benchmarks. By leveraging partial long-short implementations or carefully managing risk levels, managers can better position themselves seeking to achieve consistent outperformance relative to concentrated indices.

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