

RESEARCH BRIEF

How Diversification Impacts the Reliability of Outcomes

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RESEARCH

MAIN FINDINGS OF THE PAPER

- **Robust and reliable premiums can be used to potentially enhance expected returns and growth of investments.** Pursuing sensible, well-documented premiums in broadly diversified, efficiently managed portfolios can enhance expected returns with an increasing probability of outperformance the longer the investment horizon.
- **Broad diversification puts investors in the best position to reliably capture the premiums.** Because it is impossible to predict which stocks will drive the realized premiums, not being fully diversified exposes investors to greater uncertainty.
- **The benefits of diversification extend beyond just volatility reduction.** By reducing unnecessary constraints on diversification, portfolios that target the same premiums and have the same expected return can have meaningful improvements in how reliably the premiums are captured.

INTRODUCTION

Consistent with basic valuation theory, research shows that focusing on small cap, value, and profitability premiums can improve expected returns. While outperformance is never guaranteed, one can improve the odds through careful portfolio design and management. Broad diversification not only reduces unnecessary risks associated with company or industry specific concentrations and volatilities, it also is critical to reliably capturing the premiums, as shown in the white paper *“How Diversification Impacts the Reliability of Outcomes.”*

Why can diversification improve the reliability of outcomes?

Research shows that certain stocks are expected to outperform others. Value stocks have higher expected returns than growth stocks. Similarly, high profitability stocks and small cap companies have higher expected returns than low profitability stocks and larger market capitalization companies.

The realization of the expected premiums can happen by different companies providing outperformance at different points in time. A positive average premium across a broad group of securities does not mean that every security moves by the same excess return—some securities may have performed extremely well and contributed greatly, while others may have had average or poor returns. Which ones of these stocks will outperform others at any point in time is unpredictable. If you miss out on those stocks with higher realized outperformance at a point in time, you may not capture the premium even if the premium is positive during that period.

Pursuing premiums without enough coverage or diversification among the stocks expected to deliver the desired premiums reduces confidence in the ability to capture the benefits while also increasing costs and turnover. For that reason, we believe it is important to pursue the premiums in a broadly diversified way.

How do different levels of diversification impact the probability of outperformance?

Quantifying probabilities requires using models and parameters to make assumptions about how stocks behave. These models are imprecise but if they are reasonable enough can provide some guidance or insights instead of absolutely precise estimations.

If we assume growth of wealth invested in a portfolio and in a benchmark index is described by a lognormal distribution with certain parameters that can be estimated from historical data, we can derive the probability that a portfolio will outperform a benchmark.

As an example, **Exhibit 1** shows the estimated probability of outperforming the Russell 1000 Index for simulated US large cap portfolios with different levels of diversification. They all focus on securities with higher expected returns within the large cap universe: those that are mid cap, have lower relative price, and higher profitability. The fully diversified portfolio is represented by the Dimensional Adjusted Large Cap Equity Index, which includes the full large cap universe of 1,000 names.

While these portfolios, on average, maintain the same exposure to the premiums and have the same expected return, there was a substantial increase in the reliability of outperformance as the portfolios become more diversified. Over one year, the estimated probability increases from 56% for 50-stock portfolios to 67% for 500-stock portfolios, and the highest probability of 71% was achieved by the fully diversified portfolio. The estimated improvement was even more significant over longer investment horizons.

How does diversification impact the tracking error of those simulated portfolios?

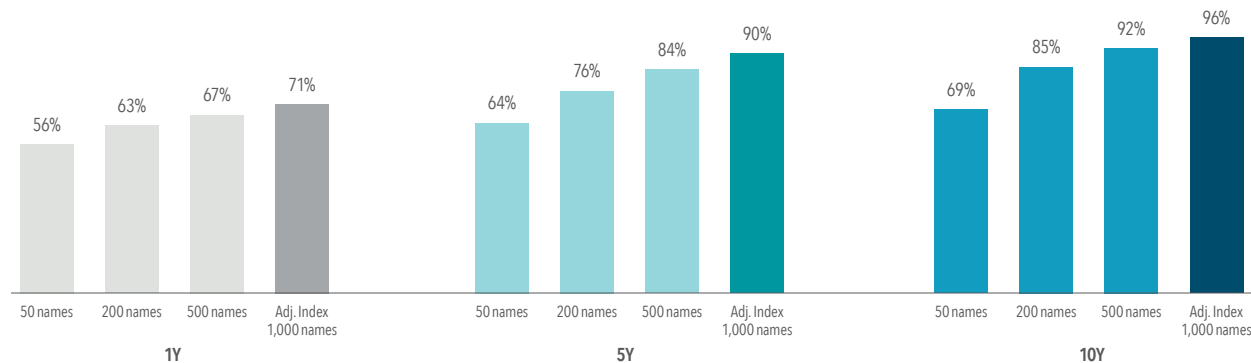
Tracking error, which is measured by the standard deviation of the difference in returns between the portfolios and the benchmark, declines steadily as portfolios include more names.

Fully diversified portfolios will only have the necessary deviations from the benchmark to achieve the exposure to the desired premiums without the company specific excess deviations due to the sampling. Since the sampling component of the deviation adds uncertainty without improving expected returns, minimizing it through broad diversification helps the portfolios to capture the premiums they target and therefore outperform the benchmark in a more reliable way.

What is the right level of diversification for a portfolio?

A portfolio should be as broadly diversified as possible while staying consistent with efficiently pursuing the goal of the portfolio. As shown in this paper, diversification can increase

Exhibit 1: Estimated Probability of Outperforming the Russell 1000 Index for Simulated US Large Cap Portfolios with Different Diversification Levels and Dimensional US Adjusted Large Cap Equity Index (Adj. Index) over Various Investment Horizons
Assuming Their Continuously Compounded Returns are Normally Distributed with Constant Parameters



The estimated probabilities are analytically derived by assuming that continuously compounded returns are normally distributed with constant parameters. The parameters are estimated from the historical returns of Dimensional US Adjusted Large Cap Equity Index and Russell 1000 Index, as well as simulated portfolios with different diversification levels, over the sample period from July 1979 to June 2016. The simulated portfolios with different diversification levels are formed by bootstrapping stocks from the large cap universe—the greater the number of draws, the more diversified the resulting portfolios are in terms of the average number of unique names. The diversification levels shown, 50, 200, and 500 names on average, correspond to 56, 294, and 1,161 draws, respectively. All simulated portfolios maintain the same tilts toward the size, value and profitability premiums as the Dimensional US Adjusted Large Cap Equity Index. The projections or other information generated by bootstrapped samples regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results will vary with each use and over time. Please see Appendix for more information regarding assumptions and methodology and a description of the Dimensional index shown. Frank Russell Company is the source and owner of the trademarks, service marks, and copyrights related to the Russell Indexes.

the odds of capturing the premiums when they appear. In our example, the highest probability of outperformance was achieved by a fully diversified portfolio that spreads its investments across the entire eligible universe. In addition, there are other benefits that come with diversification such as reducing unnecessary turnover and lowering transaction costs through flexible and patient trading. To fully enjoy these benefits, one should diversify as much as possible.

How diversified are actual mutual funds out there?

If we look at US large cap core equity mutual funds with holdings data as of December 2015¹, more than half of the funds hold less than 90 stocks. Even at the 90th percentile, the coverage of 459 names is still less than half of the full large cap universe of 1,000 names.

CONCLUSION

This white paper² shows that it is possible to increase expected returns by structuring portfolios around the small cap, value, and profitability premiums. However, not all ways of pursuing the premiums are created equal, and the differences can greatly affect the reliability of capturing the premiums when they show up. Among many other things, broad diversification, combined with long-term investing, is critical to improving the reliability of investment outcomes. While this study focuses on diversification across names, in practice a strategy should also take into account other types of diversification such as across industries and countries, if applicable. These considerations are carefully made in the design and management of Dimensional’s strategies.

1. Data source: CRSP Survivor-Bias-Free US Mutual Fund Database. The sample universe consists of 347 funds that are identified as Large Cap Core Equity Funds by Lipper Class (“LCCE”) and have holdings data as of December 2015.

2. The full white paper is available at https://my.dimensional.com/insight/papers_library/198357/

Diversification does not protect against loss in declining markets.

Investing involves risk and the possible loss of principal. There is no guarantee strategies will be successful.

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