# Planning Perspectives 4Q 2019

## Integrity in Investing

# A Reliable Way to Improve Your Planning Results

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PROFESSIONAL FINANCIAL
*Purposeful Wealth Management*

*"Something that everyone knows isn't worth knowing."*
– **Bernard Baruch**, Legendary Investor

This is part of a series exploring integrity in professional wealth planning

### Key takeaways:

- Broad diversification positions investors to reliably capture equity premiums. Concentrated positions holding only a small number of stock increases risk since relatively few stocks drive returns realized for an asset class, and which ones are unpredictable. Missing any can be costly.
- The benefits of diversification are more than volatility reduction. Portfolios with reduced diversification are less likely to reliably capture equity premiums than those with greater diversification.
- Robust premiums in broadly diversified, efficiently managed portfolios can potentially enhance expected returns with increased probability of successful long-term outperformance.

**Many investors have a mental model of the stock market where roughly half of the stocks outperform the market and half underperform the market.** Based on that simple model of market, an active manager's job should be relatively easy: simply concentrate on building a portfolio that assembles winning stocks from the top half, or better, from the top quarter of the market. That way even a poor manager should end up with at least an "average" return minus expenses. Unfortunately, that doesn't work.

Models are commonly used for financial planning and investment management for making better decisions. Every model simplifies reality, however, so knowing a model's limitations is important. There is the model, the user, and its application. Users should understand their model's inherent limitations before applying the output produced. A popular model we all use provides weather forecasts. But a poor weather forecast has limited negative practical consequences most of the time.

Models for investment strategies rely on numerous inputs, just like those for weather forecasts. Instead of inputs like barometric pressure or prevailing wind directions, investment models look at variables like implied market risk premia or historical price volatility. Whereas a weather forecast model looks only days ahead, retirement and wealth planning models are projecting outcomes perhaps decades ahead. Application by a user unaware of the many underlying assumptions, and how they were derived, can have enormous negative consequences for retirement decision-making, for instance.

### Limits for Financial Model Applications

An asset allocation model of investment vehicles such as mutual funds (or an asset allocation matching an investor's current holdings) calculates the interaction of returns and volatility of multiple asset classes supposedly based on inputs requiring assumptions. Mutual funds, exchange traded funds or individual stocks or bonds usually cannot be specifically modeled based on historical data (often due to lack of it), but instead the advisor must substitute asset class estimates as proxies to approximate asset class risk and return. The quality of the insights an asset allocation model provides for decision-making is closely related to

how reasonably proxies corresponding to actual client investments were selected, and then how well those proxies relate to actual or proposed investment solutions. For investment solutions comprising Dimensional funds or Vanguard index funds, it's not difficult. For many actively managed funds with additional layers of expenses, it is.

Professional Financial has a state-of-the-art retirement and wealth planning model. It thoughtfully considers client expectations and concerns, social security choices, mitigating income taxes, health care costs, longevity ranges, and risk preferences as well as their portfolio strategy. The probability of retirement success due to the interaction of stated goals, differing levels of savings or spending, the impact of electing Social Security later or beginning pensions at different ages are all factors, plus many more. Expected portfolio returns for investment strategies cannot be known in advance, so are based on reasonable assumptions from implied expected returns with dimensional premium adjustment, historical volatility and finally historical covariance.

Academic 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 large cap companies. Consistent with basic valuation theory of modern financial science, research shows that focusing portfolios 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 dimensional equity premiums as they interact.[1]

## How Well Can Actively Selected Stock Strategies Be Modeled?

Computerized mathematics provides the appearance of smart sophistication for unwary investors. As with any modelling, caveat emptor. The saying "garbage in, garbage out" certainly applies to financial planning models. A model's output depends on its input. Not only can poor assumptions lead to misleading results, but even with reasonable assumptions, placing excessive faith in asset class inputs that are inherently imprecise and may imprecisely be matched to a particular security can lead to nonsensical outputs, and therefore, lead to erroneous conclusions and poor decision-making.

A frequent modelling challenge financial advisors have in practice is when a prospective client's portfolio is comprised of only a few large stock or actively managed ETF positions. (We ignore modelling large real estate positions in this paper.) I believe we can fairly illustrate the potential benefits of a multi-dimensional portfolio strategy of which most readers are familiar. Attempting to fairly fit a concentrated stock portfolio or one with many actively managed funds within our asset allocation framework requires considerable professional judgement and experience. It is not a task to be taken lightly.

Very simply, we lack a fair proxy in our planning system's asset class models to proxy risk and return for a single stock or a number of stocks. What most prospective clients fail to realize is that the **only** reason they are meeting with us is good luck. That is, had other stocks been purchased in the past (maybe a parent that they inherited them from), they would not have enough wealth to justify our conversation. You see, these prospective clients have *only one sample of data*—their own personal experience and family history. They are usually unaware of the experience of neighbors or friends. They don't seem to realize how easily wealth may be lost due to holding only a limited number of stocks. Anyone remember what happened to stalwarts such as Kodak, Xerox or even GE, not to mention Enron or Global Crossing?

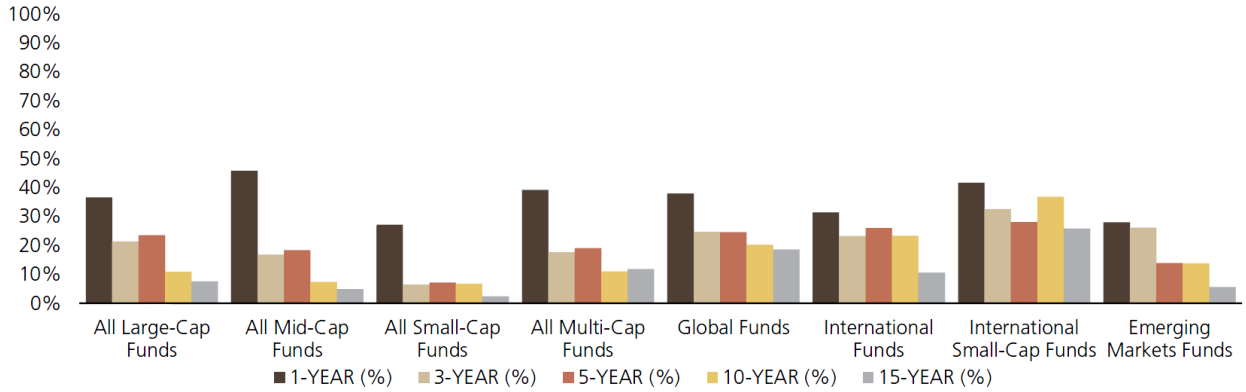
## The Challenge of Outperformance for Stock Selectors

An active manager's primary task requires selecting a small subset of stocks that hopefully outperform. Successful stock selection can result in very substantial wealth gains. For example, Warren Buffett's Berkshire Hathaway has been responsible for about 1% total of wealth creation in the U.S. market since 1926 despite being active for only fifty years.[2] On the other side of the coin, active managers who exclude even a few top-performers in assembling their portfolios are doomed to underperformance. Unfortunately, ongoing studies point to the conclusion that active managers are not consistently picking or keeping that small sub-set of outperformers. Data shows that active managers as a group underperform passive benchmarks over all time horizons, and top-managers show little evidence of performance persistence.

The most popular active versus indexing analysis is Standard and Poor's Index Versus Active (SPIVA) report series.[3]

**Exhibit 1:** Poor Performance of Active Managers Versus Indexes Over Multiple Time Periods

Percentage of outperforming active managers




***Source:*** *Standard & Poors,* Index Versus Active, U.S. Mid-Year 2018 *(October 2019). Past performance is no guarantee of future results.*

**Exhibit 1** shows SPIVA recent results for the period ending June 2018.

- Over the 15 year period shown, most U.S. and international equity funds underperformed their respective benchmarks by over 90%.
- Over shorter 3-, 5-, 7-, and 10-year periods most active managers also underperformed, but only by about 80%.

We see in **Exhibit 2** that performance persistence for active fund managers remains very low, and top-quartile managers in one year rarely remain top-quartile in the next year. Even top-quartile managers (i.e. those in the top 25% of performance) have struggled to perform in line with their benchmarks, on average, over shorter periods. While most surveys compare average active managers with benchmarks, even the top-performing managers in the first year lag benchmarks in most categories due to low performance persistence. We see that top-quartile funds in the longer five-year period ending March 2013, during the next five years were far more likely to fall into the very bottom quartile of performance than stay in the top quartile. Small cap top-quartile funds ended up in the bottom quartile of performers almost two-thirds of the time.[4]

## "Do Stocks Outperform Treasury Bills?"

Some investors think that mutual fund managers are dumber than other portfolio managers. Actually, it's because mutual funds cannot hide their results from public scrutiny like most other active managers. A recent published article by Hendrik Bessembinder of the title above contributes to our understanding of the highly risky nature of individual stocks in planning and why it is so difficult to model their risk and negative impact on a retirement or wealth plan using regular asset allocation modelling methods.[5]

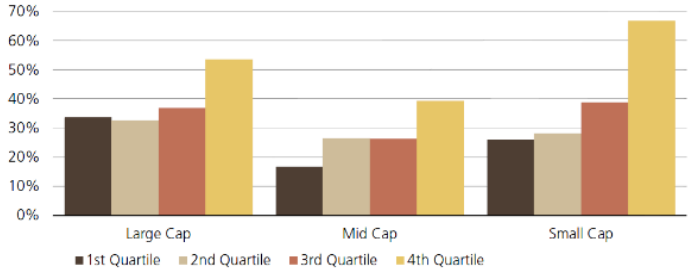
Bessembinder shows that while the aggregate stock market in the U.S. and other developed countries has had a positive risk premium (in excess of riskless one-month Treasury bills) as we expect, this is due to a relatively small sub-set of stocks that substantially out-perform all other stock combined. In fact, most individual stocks realized a negative risk premium and a negative return measured from inception.

- Of 25,782 publicly traded listed companies since 1926, about 30 and their successors are responsible for an entire third of the total wealth creation in the market over that period.
- Only 4% of stocks (983 companies) account for nearly 100% of the wealth creation over that 90-year period—all remaining stocks collectively provided the equivalent of a cash-like return.

Bessembinder's study covered the period 1926 through 2015 and included all common stocks listed on the NYSE, Amex and NASDAQ exchanges. Returns assume reinvesting the dividends those stocks paid. The study finds a strong positive skewness in returns with individual

**Exhibit 2:** Non-Persistence of Former Top-Quartile Active Managers

From March 2013, subsequent 5-year rankings of previous top-quartile managers




***Source:*** *SPIVA U.S. Mid-Year 2018; Data based on two non-overlapping 5 year periods and only includes managers that have not been merged or liquidated and maintained the same investment style.*

stocks, particularly at longer time horizons—that is, the aggregate **mean** (the value-weighted average) return is well above the **median** return of the total number. So the 10.0% historical mean return for the total stock market is disproportionately driven by a small set of all stocks, *not by positive excess returns from the average stock.*

Bessembinder's findings suggest a high degree of positive skewness (lottery-like distributions) inherent in risky individual stock returns. He claims that the 86 top-performing stocks, less than one-third of 1% of the total, collectively accounted for more than half of the wealth creation. And the 1,000 top-performing stocks, less than 4% of the total of that period, accounted for all the wealth creation. The other 96% of stocks simply matched the riskless returns of one-month Treasury bills! The study compared successful stock bets with buying lottery tickets with this observation: "Only 31.5% of monthly returns to stocks in the lowest share price decile exceed one-month Treasury bill rates, as compared to 59.1% of monthly returns to stocks in the highest share price decile." Here are other observations:

- Annually only 47.7% of stock returns are larger than the one-month Treasury rate. Only a minority of stocks outperformed Treasury bills even at a decade horizon.
- Looking at individual stocks in the sample period, from the first appearance in the data through delisting, just 42.1% have a holding period return greater than one-month Treasury bills.
- Only 49.2% of stocks had a positive lifetime holding period return greater than zero, and the **median** lifetime return of all stocks was -3.7% compared to a **mean** market return of 10%.
- Reflective of the positive return skewness, only 599 stocks, just 2.3% of the total, have lifetime holding period returns that exceed the cross-sectional mean lifetime return.
- In simulations, a single-stock strategy outperformed the one-month Treasury bill only 28% of the time. Only 3.8% of single-stock strategies produced a holding period return greater than the value weighted market over the full 90-year horizon. Buy and hold of a single stock does not work.
- The median time that a stock is listed on the Center for Research in Security Prices' (CRSP) database is slightly more than seven years. Of course, this excludes mergers and going private.

## "Do Global Stocks Outperform U.S. Treasury Bills?"

Bessembinder with others also studied stock returns relative to those outside the U.S.[6] Looking at nearly 62,000 publicly traded stocks around the world from 1990 to 2018, they concluded: "While the cross-sectional mean stock return is indeed positive in all 42 countries we examined, returns to the majority [all but seven] of global stocks fall short of returns to one-month U.S. Treasury bills over matched time horizons." The best performing 811 firms (just 1.33% of the total) accounted for all net global wealth creation by their methodology, which was less than 1% if only non-U.S. firms were considered.

Additionally, they found: "Only 40.5% of global common stocks, including 43.7% of U.S. stocks and 39.3% of non-U.S. stocks, have full-sample buy-and-hold return that [simply] exceeds the accumulated return to one-month U.S. Treasury Bills over matched time horizons." Also, while "the most frequently observed annual returns are clustered in the vicinity of zero… the most frequently observed returns for both U.S. and non-U.S. stocks at the decade horizon (rounded to 5%) are -95% and -100%." That is, most stocks eventually became worthless or at least nearly so in the capitalistic process of "creative destruction."

An extreme degree of skewness in individual stock returns, as opposed to aggregate market index returns, again is illustrated because individual stock ownership so risky. For stocks globally the skewness at annual horizons is in excess of 18, and at the decade horizon in excess of 68! The skewness of a normal distribution is zero. Commenting on the high degree of positive skewness, the authors noted, "Full-sample median returns were just 1.27% at the annual horizon, and -2.16% at the decade horizon."

While decades of empirical evidence show the existence of an equity risk premium of 4% to 8% for the stock market relative to bills, most stocks will eventually show negative returns. This implies how great the uncompensated risk may be for holding individual stocks in general and why implementing an informed asset allocation strategy through broad diversification strategy is critically important.

Bessembinder further used his findings to suggest why actively managed portfolios and funds underperform: they are insufficiently diversified due to the industry practice of searching and buy to hold onto "winners." He remarked that "the results potentially justify a focus

**Exhibit 3:** Number of Stock Holdings in Actively Managed U.S. Large Cap Core Equity Funds

December 2015 for 347 funds

| Percentiles | 10th | 25th | 50th | 75th | 90th |
|---|---|---|---|---|---|
| Number of Holdings | 34 | 52 | 86 | 194 | 459 |

***Data source:*** *CRSP Survivor-Bias-Free U.S. 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.*

on less-diversified portfolios by those who particularly value the possibility of 'lotterylike' outcomes, despite the knowledge that the poorly diversified portfolio will most likely underperform."

Such a lottery approach makes good business sense when agency theory is applied—at least for the fund managers. They are incentivized to gamble with customer money: if they do well, and gain 5-star ratings, investor money pours in paying them fat fees. If they do poorly, the fund closes but the money lost is not theirs, but that of fund investors. Mutual funds and managers operating separate accounts, just like hedge fund managers, are not responsible for the funds' investment risk. In fact, many managers have very little of their own money in funds they manage. The investment risk of actively managed funds is almost all held by fund investors. Managers have fiduciary responsibilities *only* for following fund investment policies and how brokerage transactions are implemented. The portfolio manager will find another job, and the failed fund is summarily closed and its existence and history expunged.

So we are not surprised in **Exhibit 3** that about half of all large cap core equity funds have only 86 holdings! (By contrast, Dimensional's U.S. Core Equity 1 Portfolio holds about 2,825 stocks.) For the twenty-year period ending 2018, 58% of U.S. mutual funds closed.[7] In all the decades of my career, I have never once seen a mutual fund company advertise in any publication the closure of a failing fund.

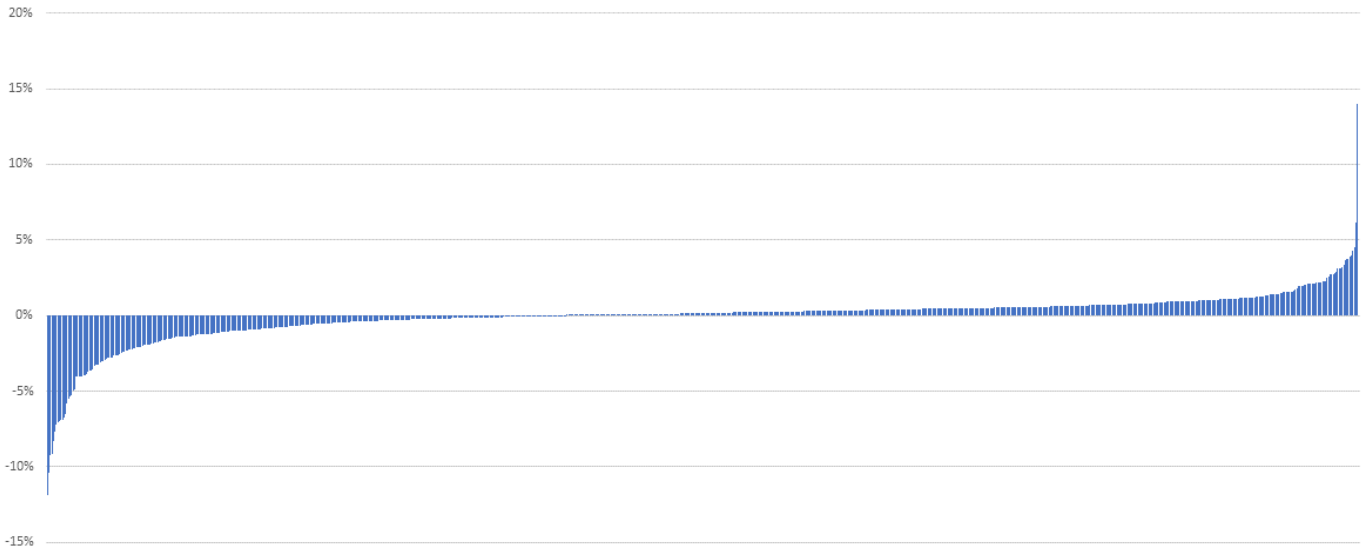
## Dimensional Research on Stock Outperformance

Other researchers have studied the same data as Bessembinder. While academic research previously documented that only a small subset of stocks drive returns of the entire market and the equity premium, and the range of single stock outcomes is very wide, Dimensional submits that Bessembinder's findings that market returns driven 1% to 4% of all companies is likely sensitive to his methodology.

**Exhibit 4** illustrates how wide the range of single stock outcomes can be. The average monthly return in excess of the S&P 500 index for each constituent of the S&P 500 index is shown over a 15-year period ending July 2019. The index return was 9.1% annualized for that period. The sample includes constituent stock held within the S&P 500 at any point during the period, including the excess returns for those months during when it was a

**Exhibit 4:** Average U. S. Market Constituent Monthly Excess Return Over S&P 500 Index

August 2004 – July 2019




***Source:*** *Dimensional Fund Advisors and S&P 500 index equivalent data from Center for Research in Securities Prices, University of Chicago. Past performance is no guarantee of future results.*

**Exhibit 5:** Benefits of Diversification by Excluding Top Performers

Compound average annual returns: 1994-2018


***Source:*** *Dimensional Fund Advisors. Idiosyncratic risk is unsystematic (diversifiable) risk associated with exposure to a single stock, sector, or country. "All stocks" includes all eligible stocks in all eligible Developed and Emerging Markets at their market cap weights. Eligible stocks are required to meet a minimum market capitalization requirement. REITs and investment companies are excluded. Compound average annual returns are computed as the compound returns of the value-weighted averages of the annual returns of the included securities. "Excluding the top 10%" and "Excluding the top 25%" are constructed similarly but exclude the respective percentages of stocks with the highest annual returns by security count each year. Individual security data are obtained from Bloomberg, London Share Price Database, and Centre for Research in Finance. The eligible countries are: Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Republic of Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Russia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, and the United States. Diversification does not eliminate the risk of market loss. Past performance is no guarantee of future results.*

constituent. Of the stocks that were a constituent for any time during the sample period, more than 60% (524 out of 868) outperformed the index on average. We also see that a very small subset of stocks had a hugely disproportionate impact on returns at either end of the spectrum.

**Exhibit 5** also highlights how a small subset of stocks from a global universe potentially impacts stock returns. However, we see that the subset size is much greater than 1% or 4%. The compound average annual return on a global stock portfolio decreases rapidly as the top performing stocks of each year are excluded. Excluding only the top 10% of performers each year reduces a 7.2% annualized return for all stocks to only 2.9%. The U.S. 6-month Treasury bill return for the period was 2.8%, leaving remaining stocks with a rate of return very close to the risk-free rate. This implies outperformers are about 10%.

We further note that missing out on the top 25% of "top performers" each year would have resulted in a negative average return of -5.1% annualized. This would be due to dead weight from non-performers and to stocks failing at the spectrum's extreme left side. This highlights the serious return risks due to active stock selection—missing just a few outperformers dramatically reduces returns, which may be worsened by making bets on stock that go wrong, getting the worst of both worlds. There is no evidence that active managers collectively consistently predict which stocks will out-perform, much less be top return contributors even for even one year, and not for the decades involved in planning successfully.

## Examining Index Impact of Recent Top Performers

An informal test of the robustness of Bessembinder's research and Dimensional's findings for practical planning purposes is simply to consider how much U.S. equity market returns would have differed by excluding a set if top-performing growth stocks during the last decade of strong equity returns and then look at a similar period of strong equity returns leading up to the Tech Bust that began in 2000.

**Exhibit 6** analyzes the relative performance of U. S. value stocks compared to U.S. growth stocks first including and then excluding so-called high-performing FAANG stocks (Facebook, Amazon, Apple, Netflix, and Google) over the 10-year period ending December 2018. Growth stocks outperformed value stocks by over 4.0% annualized with all stocks included but only 2.7% annualized without the FAANG stocks. Since expected return of popular growth stocks is historically less than value stocks, this result suggests that the FAANG stocks significantly contributed to growth's outperformance but still did not drive all outperformance for the period. We notice, however, that without the FAANG stocks the return between growth stocks and the total U. S. equity market would have been similar for the period.

## Top Performer Impact During Dot-Com Boom

**Exhibit 7** lists the "Top 10" return contributors to the overall U.S. stock market for the one- and three-year periods ending in March 2000, which we identify as the "peak month" of the dot-com boom years.

**Exhibit 6:** Relative Performance of U.S. Value and Growth Stocks, Including and Excluding FAANG

Compound average annual returns: 2009-2018

| Value Stocks | Growth Stocks | Growth ex FAANG | Total Market |
|---|---|---|---|
| 11.03 % | 15.10 % | 13.75 % | 13.27% |

***Source:*** *Dimensional Fund Advisors using data from Center for Research in Securities Prices, University of Chicago. Value stocks classified as stocks with Book-to-Market ratios above the 70th NYSE percentile, while growth stocks classified as stocks with Book-to-Market ratios below the 30th NYSE percentile. Book-to-Market breakpoints obtained from (https://http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Breakpoints). Stocks are weighted by market capitalization. Portfolios formed at the end of each June and include common stocks listed on NYSE, NYSE Mkt, and NASDAQ. Growth ex FAANG formed similarly but excluding Facebook, Apple, Amazon, Netflix, and Google. Diversification does not eliminate the risk of market loss. Past performance is no guarantee of future results.*

**Exhibit 7:** Top Return Contributors for U.S. Market Performance During Dot-Com Period
For 12- and 36-Month Periods Ended March 2000

| | 12 Months Ended March 2000 | 36 Months Ended March 2000 |
|---|---|---|
| 1 | Cisco Systems Inc | Microsoft Corp |
| 2 | Intel Corp | Cisco Systems Inc |
| 3 | Oracle Corp | General Electric Co |
| 4 | General Electric Co | Intel Corp |
| 5 | Sun Microsystems Inc | Wal-Mart Stores Inc |
| 6 | Microsoft Corp | International Business Machines Corp |
| 7 | Texas Instruments Inc | Oracle Corp |
| 8 | Qualcomm Inc | Lucent Technologies Inc |
| 9 | Hewlett-Packard Co | Dell Computer Corp |
| 10 | Citigroup Inc. | America Online Inc |

***Source:*** *Dimensional using data from Bloomberg. The 'Market' is defined as all equities and equity REIT companies domiciled in the U.S. with market capitalization greater than or equal to $10 million. For reference, the tech-heavy Nasdaq Composite Index peaked on March 10, 2000.*

**Exhibit 8** below shows U.S. total market returns, market returns excluding the top 5 contributors, and market returns excluding the top 10 contributors from Exhibit 7 over the one- and three-year periods ending in March 2000. This shows that although a small number of top performers contributed strongly to aggregate market performance, that 1% of the 1000 largest U.S. companies were certainly were not the drivers of all equity returns. A larger set of stocks much closer to 10% of the total number of companies would have been responsible for market returns in excess of risk-free returns during those years.

## Broader Diversification for Better Outcomes

Investors with only a handful of stock positions—5, 10 or even 20--don't recognize how poorly diversified they are, and how easily their portfolios may underperform due to the very high risk of excluding those few stocks in the market that will generate the largest positive returns. In everyday practice, a basic Morningstar back test usually shows good past performance for those clients; but past performance is no guarantee of future returns. When they adopt a new investment strategy with a lower equity allocation after they become client, later when they compare what "might have been" in the months following (to see they should regret making the change), they are usually surprised that their old set of stocks would have done less well than their new lower-equity allocation strategy.

Stocks do not move in lockstep. A positive average premium realized across a broad group of securities does not mean that every security moved by the same excess return during that period—some stocks will perform extremely well and contribute greatly, while most will have modest or poor returns. *Which stocks will outperform others and when is unpredictable.*

The exhibits above offer us important insight as to why decades of research shows that conventional actively managed portfolios systematically underperform their benchmarks. For years it was assumed underperformance was simply due to higher transaction costs, fees and/or behavioral biases related to trading. *Underperformance is expected as a byproduct of the "missing stock" effect—an inherent defect of all active stock selection.* It is not possible to consistently predict which securities will do well because news about why they will do well in the future has not yet arrived. A poorly diversified strategy is inherently likely to exclude from its holdings the very companies that would generate higher realized premiums.

Dimensional Fund Advisor equity portfolios are broadly diversified. Premium realization does not depend on identifying which stocks in the top one, four or ten percent. The more diversified an equity portfolio, subject to goals and constraints, the more likely investors are positioned to reliably capture market returns when they happen. There are other appealing benefits to diversification: portfolio volatility is reduced, relieving some investor stress; idiosyncratic exposure to sector and country failure is reduced; and due to a large set of stocks to choose from, flexibility at the time of execution, which can reduce turnover costs, thus resulting in more cost-effective trading further enhancing portfolio returns.

**Exhibit 8:** Market Performance During the Dot Com Boom Period and Excluding Top 10 Performers

Compound average annual returns, 12- and 36-month periods ended March 2000

| | 12 Months Ended March 2000 | 36 Months Ended March 2000 |
|---|---|---|
| Total Market | 25.09% | 27.98% |
| Market Exc. Top 5 | 18.73% | 24.55% |
| Market Exc. Top 10 | 16.64% | 22.77% |

***Source:*** *Dimensional using data from Bloomberg. The 'Market' is defined as all equities and equity REIT companies domiciled in the U.S. with market capitalization greater than or equal to $10 million. Past performance is no guarantee of future results.*

## Greater Diversification Increases Likely Outperformance

When a realized premium has been positive, not all securities in the group have contributed equally to its return.[8] Some securities performed extremely well and contributed greatly, while others had average or poor returns. We believe that the most reliable way to capture in a portfolio higher expected returns associated with equity factor premiums is to highly diversify the portfolio with a continuous focus on all stocks expected to deliver higher returns. Thus highly diversified Dimensional strategies are preferable to mutual fund portfolios or managed strategies consisting of only a small number of stocks.

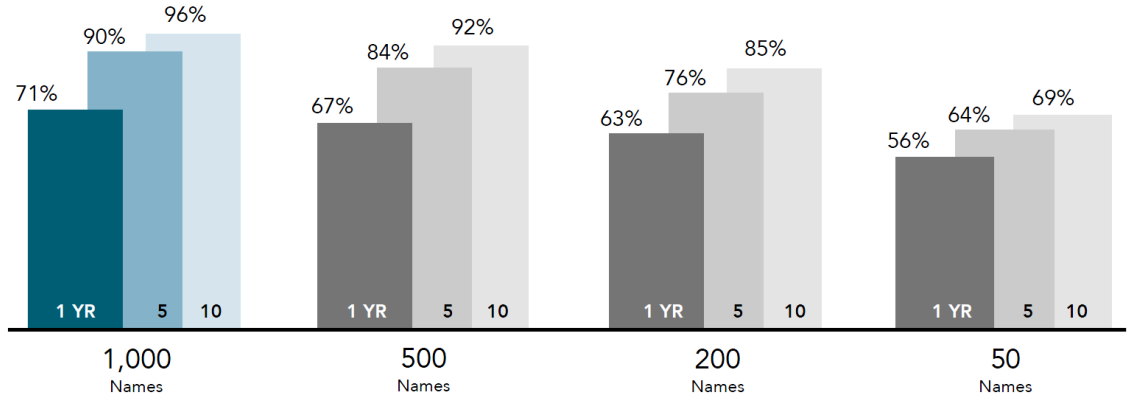
Let's introduce a mathematical model illustrating how stocks behave that provides theorical support to what we empirically observe to offer useful insights for planning.

For our fictional simulations, let's assume the growth of wealth and the benchmark index is described by a lognormal distribution with certain parameters that can be estimated from historical data. This derives the probability of a portfolio outperforming a benchmark.

**Exhibit 9** calculates the estimated probability for a simulated US large cap portfolios with different levels of stock diversification of outperforming the Russell 1000 Index. 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. Securities selected Dimensional are among a group with higher expected returns within the large cap universe: those that are mid cap, have lower relative price, and higher profitability. We are looking at relative, not absolute, likelihood of performance.

**Exhibit 9:** The Value of Diversification for Increasing Reliability of Outcomes

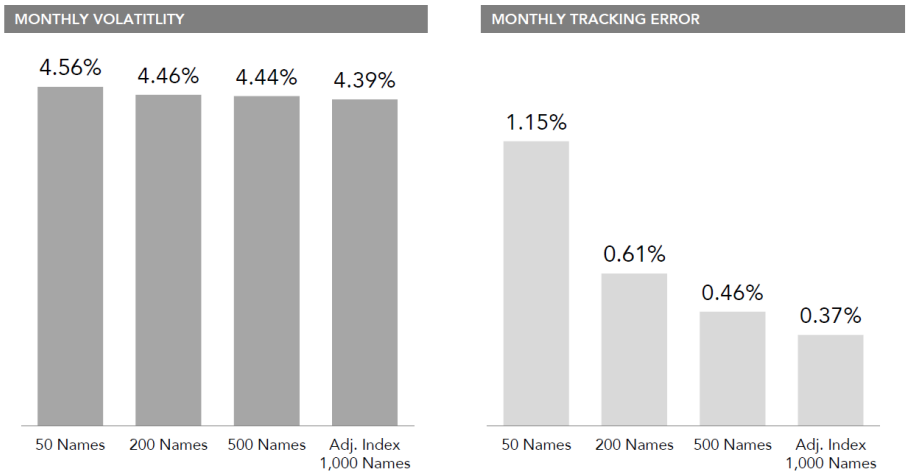
Estimated probability of outperformance based on number of U.S. large cap equity holdings




***Diversification does not eliminate the risk of market loss.***
*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 U.S. 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 lilts toward the size, value and profitability premiums as the Dimensional U.S. Adjusted Large Cap Equity Index. Sample period begins in 1979 with the start of Russell 1000 index data. Rebalanced annually in June. 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. See "Methodology and Index Description" in the appendix for more information regarding methodology and a description of the Dimensional index shown. 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.*

**Exhibit 10:** Minimizing Unnecessary Tracking Error Pursues Premiums More Reliably

Average monthly volatility and tracker error of U.S. large cap equity portfolio at different diversifications




*Monthly volatility and tracking error of Dimensional U.S. Adjusted Large Cap Equity Index and 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 U.S. Adjusted Large Cap Equity Index. Rebalanced annually in June. 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. See "Methodology and Index Description" in the appendix for more information regarding methodology and a description of the Dimensional index shown. 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.*

Exhibit 9 illustrates that while controlling for the same premium exposures and same expected return, as the portfolios become more diversified, the reliability of outperformance substantially increases. 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 with 1,000 names. The estimated improvement is most significant over longest investment horizon of ten years, increasing to 96% confidence.

**Exhibit 10** looks at how tracking error reduces relative to a benchmark. Again, as simulated portfolios hold more names, while return volatility decreases slightly, tracking error (due to the increased correlation between sampled portfolios and the benchmark) greater reduces. Here as in Exhibit 9, the expected returns are kept constant assuming that sampled portfolios maintain the right exposures to the premiums. The tracking error is directly related to sampling size—holding fewer names in the portfolio increases the tracking error. This disentangles the diversification effect on the reliability of outcomes for portfolios with similar stocks. Similar Dimensional portfolio strategies hold more than 2,800 holdings.

## Conclusion–Modeling and Reality

Many people have a model of the earth in their minds that describes it as a round sphere. While this is a fair approximation, it is not truly accurate. Technically, the earth is an imperfect oblate spheroid—fatter at the equator and more squashed at the poles than a perfect sphere. Additionally, the reality is that the surface of the earth is varied and ripples extensively—it is not perfectly smooth.

For a manufacturer of globes, or teaching children about the solar system, assuming the earth is a perfect sphere is a good application of that model. For a geologist studying sea levels or NASA engineers launching an object into space, it would be a poor model. The difference lies in who uses that model and a user's application of that model. Since all models are a fictious abstraction of reality, there is no "good" model or "bad" model. The purpose of financial models such as we use in this paper are intended to give us insight that will help you make more informed and wise decisions for retirement and wealth planning.

Many people when they first come to us have a mental model about investing for retirement. While the understanding of the more educated may be a fair approximation, their model is not truly accurate. Common notions of diversification popular in the media, do not work well in practice. You *should* learn about models that will better inform your planning decisions. A rightly applied model can be invaluable for pointing you in the right direction to avoid potentially costly mistakes.

But every model simplifies reality. When evaluating planning strategies or investing methodologies, you must be confident of your advisor's ability to test and implement applications garnered from their models. If you don't understand your

advisor's model, then you should carefully judge their professional qualifications and ability to make sophisticated judgments for retirement and wealth planning from the output of those models. For opaque quantitative strategies used by hedge funds or complex technical analysis used by stockbrokers, the required level of trust you must have in their commercially developed models is very high.

We at Professional Financial rely on models developed from decades of theorical and empirical support of modern financial science. The efficient market hypothesis (EMH) is a useful financial model, for example. It states that asset prices reflect all available *information.*[9] The EMH model informs us that we can rely on market prices. It tells us that trusting an active manager to outguess prices set collectively by millions of market participants is not worth their cost. Yet that model has limitations. For example, even if prices quickly reflect information, EMH does not address operational inefficiency from the ill effects of unlucky timing or high trading costs and trading with asymmetric information. So professionals must always understand the practical limits of the many models we must use in various aspects of planning.

Each family at some point in time must make informed choices regarding how best to plan for retirement income and leaving a legacy. Even though we write these papers, their purpose is not to teach you. You will never learn enough. I surely cannot. Their purpose is to help you focus on this important question: who can you really trust? Who has the education, competence, judgement and integrity to know what you don't know even to ask, and to do the right thing when doing it is hard to do? As CFP professionals specializing in wealth management with a network of experts we can call on as the need arises, it is our mission and privilege to guide every client in their journey for investing wealth, mitigating taxes, protecting assets from loss, passing assets to those you love, and to make an impact in your world.

## APPENDIX: INDEX DEFINITIONS

### Dimensional US Adjusted Large Cap Equity Index

January 1975–present: Compiled by Dimensional from CRSP and Compustat data. Targets the securities of the largest 1,000 US companies traded on the NYSE, NYSE MKT (formerly AMEX), and Nasdaq Global Market with an emphasis on companies with smaller capitalization, lower relative price, and higher profitability. Profitability is measured as operating income before depreciation and amortization minus interest expense scaled by book. Exclusions: non-US companies, REITs, UITs, and investment companies.

The index has been retroactively calculated by Dimensional and did not exist prior to December 2012. The calculation methodology for the Dimensional US Adjusted Market 1 Index was amended in January 2014 to include direct profitability as a factor in selecting securities for inclusion in the index. June 1927–December 1974: Targets the securities of the largest 1,000 US companies traded on the NYSE, NYSE MKT (formerly AMEX), and Nasdaq Global Market with an emphasis on companies with smaller capitalization and lower relative price.

Results shown during the periods prior to each Index's index inception date do not represent actual returns of the Index. Other periods selected may have different results, including losses. Backtested index performance is hypothetical and is provided for informational purposes only to indicate historical performance had the index been calculated over the relevant time periods. Backtested performance results assume the reinvestment of dividends and capital gains.

### Endnotes

1 See Wei Dai, "How Diversification Impacts the Reliability of Outcomes," Dimensional Fund Advisors research paper (November 2016). See also, Eugene Fama and Kenneth French (1992, 1993, 2006), Robert Novy-Marx (2013), and Gerald O'Reilly and Savina Rizova (2013).

2 Hendrik Bessembinder, "Do Stocks Outperform Treasury Bills?" *Journal of Financial Economics* (September 2018).

3 Standard & Poors, *Index Versus Active* (SPVIA) for period ending June 30, 2018 (October 2019).

4 From a different viewpoint, this corresponds with the findings of Dimensional Fund Advisors in their annual *Mutual Fund Landscape* series, most recently for 2019, based on Center for Research in Securities Prices data.

5 Hendrik Bessembinder, *Ibid.* All data following is from his article.

6 Hendrik Bessembinder, Te-Feng Chen, Goeun Choi and K.C. John Wei, "Do Global Stocks Outperform U.S. Treasury Bills?" *Journal of Financial Economics* (July 2019)

7 Dimensional Fund Advisors, *Mutual Fund Landscape* 2019 (April 2019). Only 23% out-perform benchmarks.

8 Eugene Fama and Kenneth French, *Migration* (2007) documented how different transition groups have contributed to size and value premiums as stocks migrated across different size and value portfolios.

9 This goes way back to Eugene F. Fama, "The Behavior of Stock Market Prices," *Journal of Business* (1966)