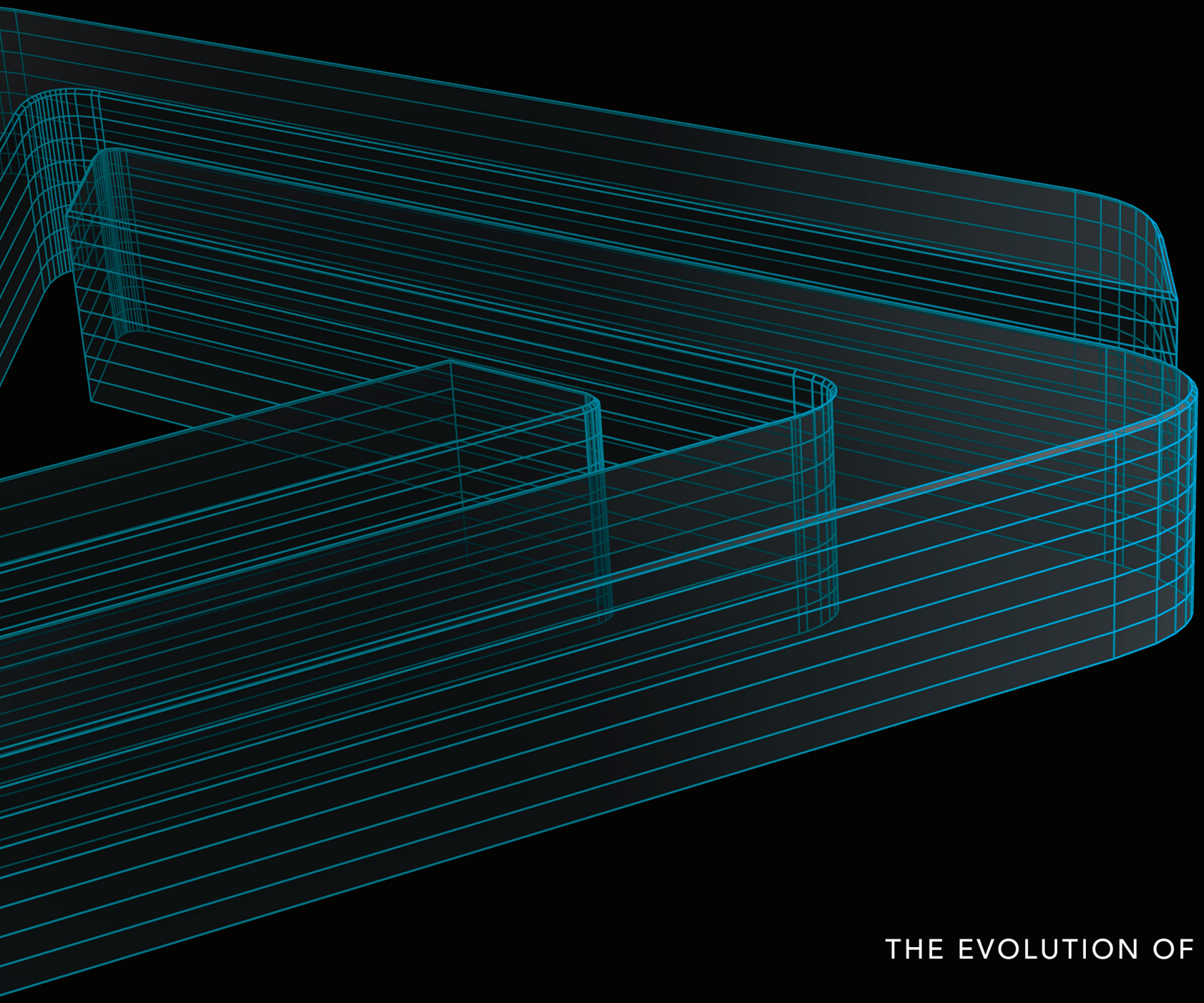
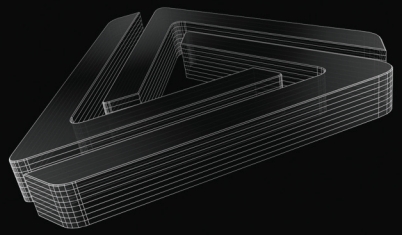
Dimensional



THE EVOLUTION OF DIMENSIONAL



Decades of financial research underlie our views on the capital markets and form the basis for how we invest. As research progresses, Dimensional continues to evolve—offering new dimensions to investors.

Dimensional evolves as the science of investing evolves, which explains why we keep such close connection to the academic community. Many, if not most, of the major advances in portfolio management over the last 60 years have come from academic research.

We believe that the best way to add value over benchmark returns is by structuring portfolios around the dimensions of expected returns. Portfolio structure, rather than the tactical shifts associated with conventional management, drives the performance of portfolios.

Clients vary in their preferences toward these investment dimensions. We work with clients to figure out what structure works best for them. Often, this involves trading off increased expected returns against costs and tracking error.

Identifying dimensions of expected returns

We consider a dimension to be a factor that explains differences in returns, is persistent and pervasive, and is consistent with an equilibrium view of investing. These characteristics give us confidence that we can expect the relations observed in the past to repeat in the future.

Our fixed income portfolios are structured around two generally accepted dimensions of fixed income expected returns: term (maturity) and credit spread (quality). Our equity portfolios are based on four dimensions of expected returns that have been identified by academic research: the overall market (beta), company size (small cap/large cap), relative price (high/low), and direct profitability (high/low).

WE CONSIDER A DIMENSION TO BE A FACTOR THAT EXPLAINS DIFFERENCES IN RETURNS, IS PERSISTENT AND PERVASIVE, AND IS CONSISTENT WITH AN EQUILIBRIUM VIEW OF INVESTING.

Beginning in the mid-1960s, asset pricing models have been developed to explain differences in average returns across portfolios and individual securities. Testing any model eventually produces anomalies, because no model can perfectly describe reality. But eventually, most anomalies disappear, get explained away, or sink the pricing model that revealed them.

Evaluating the research

Our evolution parallels the evolution of research. In 1981, when we started our firm offering small cap investment strategies, the "size effect" was an anomaly. Small cap stocks had higher average returns than could be explained by the single-factor market model used at the time. Nevertheless, we felt comfortable launching a small cap fund, because the size effect was so persistent and pervasive. We didn't have a good explanation for the higher returns, but it seemed reasonable that the smaller the firm, the higher its costs of capital; and the return to an investor is the company's cost of capital.

Not long after we started Dimensional, Don Keim discovered another anomaly, "the January effect." His research showed that most of the size effect occurred in January. We could see no sensible equilibrium explanation for a January effect, so we disregarded it. As it turns out, there hasn't been a January effect since we began managing small cap strategies. This is what happens to most anomalies—they disappear when the data set is expanded.

Data mining is a big concern when we look for patterns in returns. As a result, we have more confidence when patterns are persistent across time periods and pervasive across markets. The multifactor research of Eugene Fama and Ken French is a good example. When Fama and French first presented their

research on the dimensions of equity returns in 1991, their evidence was based on US stocks from 1963 to 1990. Some people wondered if their results might be due to data mining, similar to the January effect. In response to that concern, Fama and French did two out-of-sample tests.

First, working with Jim Davis, they collected and analyzed the data in the US from 1926 to 1962. Second, they studied the performance of stocks in developed and emerging markets around the world. They found the return patterns in both the pre-1963 data and the non-US data were consistent with the patterns they had observed in the US returns from 1963 to 1990. More recent returns continue to support their earlier conclusions. As a result, we are confident that the size and value factors are, in fact, dimensions of expected returns.

The Fama/French research led us to create our value strategies, which increase the exposure to low-priced stocks relative to their weight in benchmarks used by our clients. Recent research on profitability by Robert Novy-Marx has identified another measure that appears to meet our standards for a dimension of expected returns. Using a measure of gross operating margin as the gauge of profitability, high profitability firms have higher average returns than low profitability firms. Our research team has replicated his work, and, once again, we find the results persistent and pervasive around the world.

Using valuation models

The finding that firms with high direct profitability have higher stock returns is not surprising to most people. But to some, a higher expected return must mean greater risk. A parallel may be drawn between direct profitability and term premiums for fixed income obligations. It is well known that buying 1-month Treasuries produces a lower return, on average, than buying 3-month Treasuries. For some investors, 3-month bills are less risky, or only slightly more risky, than 1-month bills. The higher return for the 3-month maturities is not due to mispricing; it is just the result of market forces.

Similarly, it is perfectly reasonable that equity markets have dimensions of returns that may be particularly attractive to some investors and not others. Our confidence that we have correctly identified a dimension goes up if we can connect it to a basic valuation model, such as the equation below.

$$\text{Price} = \frac{\text{Expected Cash Flows}}{\text{Discount Rate}}$$

Key breakthroughs in finding and pursuing dimensions of equity returns

1981	1992	2004	2012
Company Size Dimensional offers investors diversified, cost-efficient access to small companies.	**Relative Price** Fama/French research identifies market, size, and value factors as the principal drivers of equity returns.	**Total Market Solutions** Advancement in portfolio design provides value-added, efficient total market solutions that focus on dimensions of higher expected returns.	**Direct Profitability** Research identifies a robust proxy for a new investable dimension of higher expected return—expected profitability.
Small Cap Strategies	Value Strategies	Applied Core Equity Strategies	Opens the door to new strategies and potential enhancements to existing strategies

The value of a stock or bond is the sum of future cash flows discounted back to present value. For example, the price of a bond is determined by the stream of coupon payments and principal repayment, discounted back at various interest rates. A high-yield bond must either have a higher coupon or sell at a lower price than a low-yield bond.

Generally, the greater the risk of an investment, the higher the discount rate and lower the price. The discount rate is the investment's expected return. Reworking the equation to solve for expected return gives us:

$$\text{Expected Returns} = \frac{\text{Expected Cash Flows}}{\text{Price}}$$

Expressing the relation this way highlights two of the dimensions of expected returns for equities—relative price and direct profitability. Higher expected returns are the result of having either higher expected cash flows or a lower price. The direct profitability dimension is tied to the numerator and the relative price dimension to the denominator. Stated another way, if two stocks sell at the same price, then the one with higher expected cash flows must have a higher expected return.

These two dimensions, relative price and direct profitability, can be combined to improve portfolio structure. For example, the explanatory power of direct profitability is fairly weak. However, when conditioned on the relative price dimension, the explanatory power becomes much stronger.

Our growth and value strategies are not contradictory. They both are structured around the same dimensions of size, relative price, and direct profitability. The difference is that one focuses on stocks selling at high relative prices, and the other focuses on stocks selling at low relative prices. In our view, value and growth are not opposite ends of one dimension, but two different dimensions.

Momentum

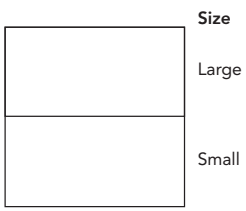
Momentum is an example of a factor that does not meet our criteria as a dimension of returns but still impacts portfolio returns.

Research suggests that there is momentum in stock prices in most markets around the world. Stocks that have underperformed in a past period are more likely to underperform in the next period; stocks that have outperformed have a tendency to continue

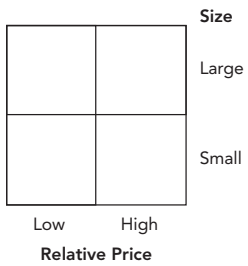
Advancements in research

Single-Factor Model, 1963

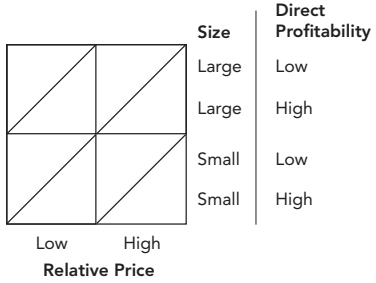
Size Effect, 1981



Value Effect, 1991



Direct Profitability, 2012



to outperform. If the momentum effect were large enough to trade on profitably, then it would be evidence of market mispricing.

We believe that momentum is a factor affecting returns, but it is too small and sporadic to actively induce trading. Momentum is stronger in small cap stocks than in large cap stocks, which is consistent with our view that it is best considered a trading cost rather than a trading rule. Momentum is also quite variable; in 2009, it was sharply negative for US stocks.

THE BEST WAY TO ADD VALUE IS TO STRUCTURE PORTFOLIOS ALONG THE DIMENSIONS OF EXPECTED RETURNS.

However, by trading carefully, it is possible to use momentum to increase returns. For example, momentum has explained most of the outperformance of our small cap strategies relative to small cap indices.

Contrast with conventional management

Dimensional's investment philosophy is centered on an equilibrium, or efficient market, view of public markets. In this view, the best way to add value over conventional benchmarks is to structure portfolios along the dimensions of expected returns. For equity portfolios, expected returns are increased by giving greater weight to small cap, low relative price, and high direct profitability firms.

A competing philosophy dominates conventional money management. In that view, value can be added through tactical shifts. For example, behavioral finance proponents argue that low-priced stocks have higher returns than high-priced stocks because of market mispricing. Interestingly, they use much of the same data to support their view that we use to support ours. Clients who want to hire a money manager to capture mispricings have a difficult challenge: First, they have to be able to identify successful managers in advance, and second, they have to hope that any such managers don't raise their fees to keep the bulk of any alpha for themselves.

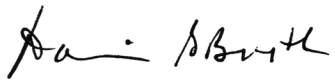
We believe that our philosophy provides a better investment experience. Our approach is transparent and easy to explain because it relies on basic valuation methods and extensive empirical research, and it is validated by a long track record of implementation.

Looking forward

Dimensional will continue to evolve as research on the dimensions of returns progresses. When we started the firm in 1981, academic research used the single-factor market model to explain average returns. The size effect was viewed as an anomaly because small cap returns were too great to be explained by beta. Nevertheless, we sponsored a small cap fund because the size effect was persistent and pervasive, and because it gave institutional investors a tool to efficiently diversify beyond large cap stocks.

In our view, the size effect went from being an anomaly to a dimension of returns in the Fama/French three-factor model, even though there is still no robust explanation of why it exists. Their research also identified the value effect as a dimension and led to the creation of our value funds.

The latest research has identified profitability as a dimension of expected returns, with highly profitable firms having higher average returns than can be explained by the three-factor model. So the evolution of financial science continues. We are very excited about this new research and plan to incorporate it into the investment policies of many of our existing strategies. We also have developed new portfolios based on this research—the first of these were two US growth strategies and two international growth strategies.



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