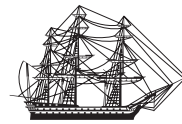


# The Case for Structured Equity: An Active Quantitative Investment Strategy

Vanguard® Investment Counseling & Research



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## Executive summary

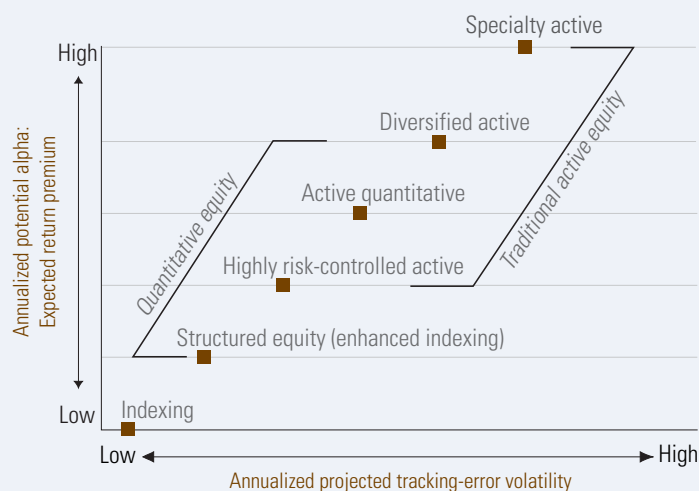
A structured equity investment strategy combines market-level risk with the opportunity for above-market returns. The strategy's defining characteristics—rigorous risk control and a disciplined, theoretically sound approach to stock selection—place it between pure indexing and active investment strategies and make it an attractive alternative to both. Although structured equity and indexing strategies share an emphasis on tracking error relative to a market benchmark, structured equity is nevertheless an active management strategy, with all of the risks and opportunities implied by an active approach.

A portfolio manager using a structured equity strategy must have impeccable analytical and quantitative skills to develop superior stock selection models. In addition, these technical abilities must be complemented by hard-to-define qualities such as skepticism, judgment, and experience—traits that can help a manager to recognize when apparent statistical “certainties” warrant further investigation.

Author

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Figure 1. The spectrum of equity management strategies



Source: Vanguard Investment Counseling & Research.

## Introduction

Quantitative equity management is distinguished by its use of complex statistical techniques to build risk-controlled portfolios. Most quantitative strategies rely on computer models to control portfolio-level risk and to select individual stocks. A smaller number of quantitative strategies emphasize traditional stock selection (based on analysts' subjective judgments), while applying rigorous quantitative risk control at the portfolio level.

Figure 1 illustrates the differences between quantitative equity management and traditional active equity management. The investment strategies are plotted according to risk (the expected volatility of tracking error relative to a benchmark) and the expected return premium (potential alpha, or the expected excess return versus the benchmark). Indexing is at the base of the equity-management spectrum, simply seeking to mimic the return of

an unmanaged benchmark. Indexing uses quantitative risk-control techniques to replicate the benchmark's return with minimal tracking error (and, by extension, with no expected alpha). Structured equity and active quantitative management accept some degree of tracking error in exchange for expected alpha. They use quantitative criteria to select a sample of stocks expected to outperform a market benchmark. At the riskiest end of the equity management spectrum are traditional active strategies, which typically emphasize individual stock selection with less regard for formal risk control versus the benchmark.

## Structured equity: Disciplined stock selection and risk control

An analysis of structured equity illustrates the opportunities and challenges of quantitative active management. Structured equity has tight risk controls and attempts to outperform a market benchmark by permitting a large number of limited deviations from the benchmark's company weightings. (Active quantitative management, the other primary quantitative strategy, incorporates looser risk controls and allows greater deviations from the benchmark, with the goal of providing greater excess returns.) Structured equity is broadly defined as a quantitative active management strategy with an annualized projected tracking error of less than 2.5%.<sup>1</sup> Traditional stock selection techniques can be considered structured equity strategies if they include a quantitatively based approach to risk control that provides an annualized projected tracking-error volatility that is less than approximately 2.5%.

The goal of structured equity investing is to select a broad, diversified sample of stocks that is expected to outperform a benchmark, while

<sup>1</sup> Frequently, tracking-error volatility is limited to 2.0% for large- and mid-capitalization benchmarks and to 2.5% for small-capitalization benchmarks.

minimizing tracking-error volatility relative to the benchmark. In broad terms, structured equity investing merges the risk control of an index fund with the stock selection techniques of active management. This strategy is only attractive, however, as long as its stock selection techniques produce positive tracking error. Table 1 presents three common approaches to a structured equity strategy.

This report concentrates on the stock-based quantitative approach to illustrate the process of developing a successful structured equity portfolio and on the opportunities and risks of these quantitative investment strategies. The primary opportunities presented by structured equity investing are:

- To structure a broadly diversified investment that is designed to provide consistent performance relative to a market benchmark, much like an index fund.
- To adopt an objective, disciplined approach to stock selection that provides the potential to outperform a market benchmark.
- To define characteristics, such as robust portfolio risk controls, that enhance a portfolio's prospects of outperforming the majority of traditional active management strategies.

Despite its index-like characteristics, structured equity is ultimately an active strategy, which implies not only opportunities, but also risks:

- A portfolio's risk controls may not be comprehensive, permitting inadvertent—but potentially large—losses relative to a market benchmark.

**Table 1. Structured equity approaches**

	Alpha process	Risk control
Stock-based quantitative approach	Quantitative assessment of fundamental characteristics.	Optimization process that trades off potential alpha against a portfolio's risk characteristics.
Stock-based traditional approach	Analyst-based assessment of stocks.	Optimization process that trades off potential alpha against a portfolio's risk characteristics.
Derivatives-based	Usually an "enhanced" fixed income portfolio.	Futures overlay that equitizes the process of diversifying a bond portfolio.

Source: Vanguard Investment Counseling & Research.

- Historically successful quantitative stock selection strategies may be sample-dependent, reflecting unrecognized risk factors and resulting in potentially large underperformance relative to a market benchmark.
- Historically successful quantitative stock selection strategies may become less effective as others discover and employ similar strategies.
- The proprietary nature of the stock selection and risk-control approaches creates a lack of transparency that may make it difficult to evaluate their role in and risk to an investor's overall portfolio.

Our review of this highly quantitative strategy also yields a paradoxically "soft" conclusion: Although developing a sound structured equity strategy demands statistical and analytical rigor, a good measure of skepticism, judgment, and experience is necessary to produce a consistent, replicable strategy.

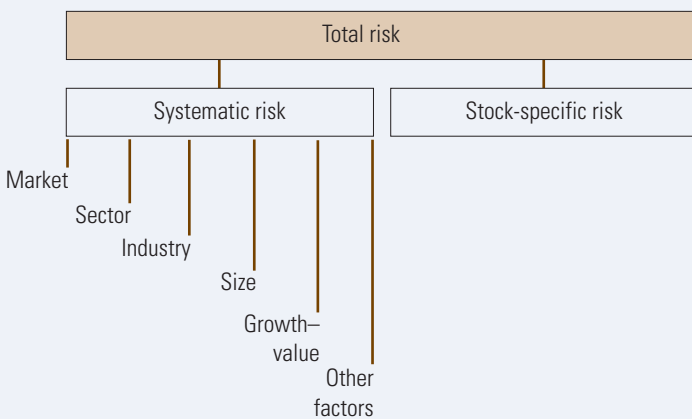
## Defining risk

Financial market theory states that stock-specific risk can be diversified away, reducing portfolio risk to the level of systematic, or economywide, risk. Typical systematic risk factors include:

- Marketwide risk.
- Sectorwide risk.
- Industrywide risk.
- Market-capitalization risk.
- Style (growth and value) risk.

Figure 2 is a schematic representation of the quantitative risk factors typical of a risk model.

Figure 2. Quantifying risk



Source: Vanguard Investment Counseling & Research.

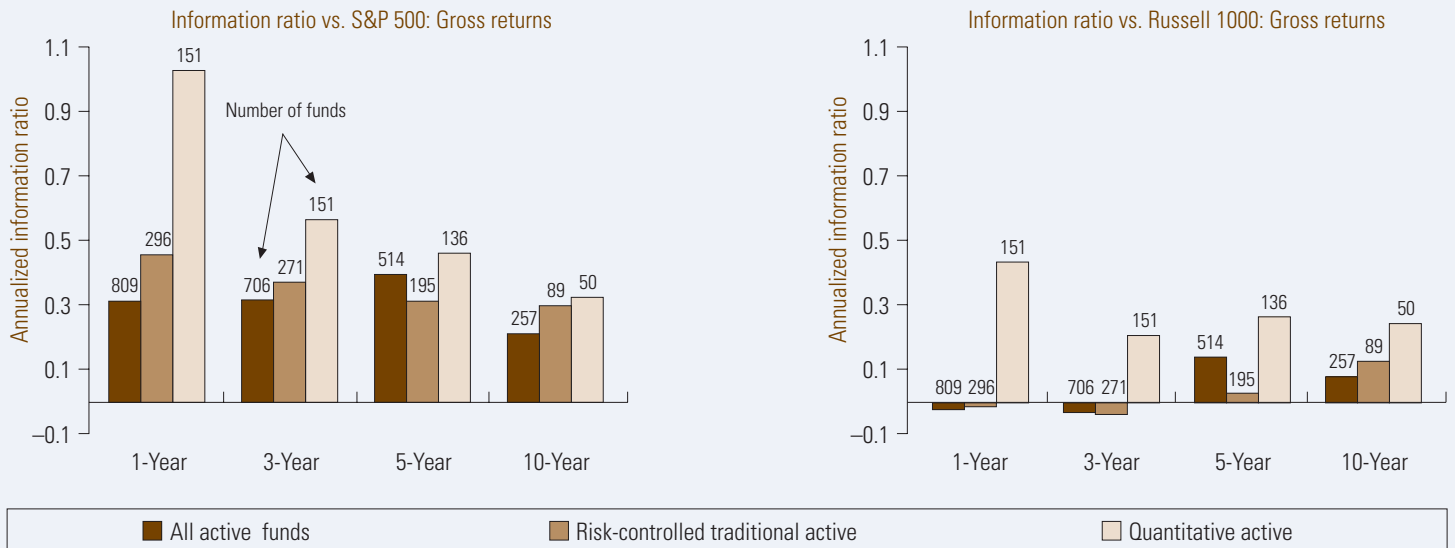
There are two basic approaches to modeling risk. One is to use a multivariate regression model in which a stock is evaluated according to many different risk factors, with the results of these evaluations captured in a single number. The stocks within a universe are then optimized according to this single multivariate-regression value to build portfolios that minimize the variability of tracking error. However, while theoretically correct, and providing a “precise” trade-off between estimates of potential alpha and tracking-error variability, regression-based risk models reflect the sample period during which they are estimated. They are time-period dependent. As a result, actual tracking-error volatility often exceeds projected tracking-error volatility.

Alternatively, risk can be modeled using “multi-dimensional stratified sampling.” In general, this approach divides the benchmark into segments based on specific risk parameters. Portfolios are constructed to match the risk characteristics of each benchmark segment. For example, the benchmark could be divided into industry and market-capitalization groups, and the portfolio formed to match the benchmark weighting for each industry and market-capitalization group.

Regardless of the specific approach, risk control is important to provide consistency in any investment management process.

**Figure 3. Quantitative management techniques have outperformed fundamental counterparts**

Information ratio versus benchmark: Periods ended 12/31/2005



Source: Möbius.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

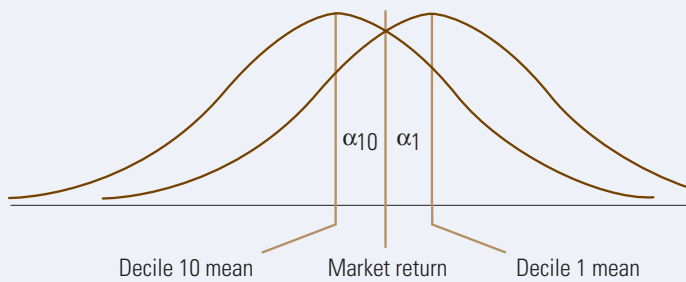
### Evidence of the success of structured equity strategies

Figure 3 helps quantify the historical success of quantitative structured equity managers. Using data covering the last 10 years, we examined the 1-, 3-, 5-, and 10-year information ratios (a measure of risk-adjusted return) of three categories of managers. The first category consists of all active funds benchmarked to either the Russell 1000 index or the S&P 500 index employing a fundamental investment process. To form the second category, we added two criteria: tracking error of less than 2%, and an investment universe restricted to large-cap core investments. These criteria convey a degree of risk control employed in the portfolio management process. The final category identified all *quantitatively* oriented portfolios.

The results are instructive—in all cases the quantitative portfolios outperformed both the traditional active universe as well as the risk-controlled active funds. On average, the quantitative fund managers produced higher, more consistent excess returns than traditional active managers.

A review of the empirical methodology used to develop consistent, replicable quantitative stock selection strategies can provide a sense of whether a structured equity manager will track a benchmark with a positive margin. Risk control is the defining characteristic, of course, but a structured equity strategy ultimately succeeds or fails based on the stock selection framework—the key to outperformance relative to the majority of active managers. Our review of the methodology used to develop a stock selection framework also underscores the importance of managerial judgment and experience as complements to the quantitative skills necessary for success.

Figure 4. Conceptual composite alpha return distributions



The distributions plotted above are hypothetical and do not necessarily reflect the experience of any particular portfolio.

Source: Vanguard Investment Counseling & Research.

### Stock selection methodology: The source of objective, consistent, and replicable alpha

Figure 4 illustrates that structured equity strategies seek to identify “samples” of stocks, rather than individual securities, in pursuit of consistent outperformance. (In contrast, traditional active management strategies usually emphasize individual stocks.) The highly ranked sample of stocks is expected to have a return, on average, that is slightly higher than the market return. Conversely, the low-ranked sample of stocks is expected to have a return, on average, that is slightly lower than the market return. A structured equity strategy that holds a large sample dominated by the high-ranked stocks, while matching the systematic risk characteristics of a benchmark index, stands a good chance of consistently generating excess returns relative to the index and the majority of traditional active managers.

The behavioral finance hypothesis<sup>2</sup> provides theoretical justification for most structured equity strategies. In contrast to the efficient market hypothesis,<sup>3</sup> the behavioral finance hypothesis posits several reasons that financial markets may not

reflect pricing information effectively and completely. Observed exceptions to market efficiency are thought to be the result of the psychological biases of market participants. Behavioral theorists argue that market participants systematically overreact and underreact to certain events, which creates small, but exploitable, mispricing opportunities. Likewise, information may disseminate more slowly than the efficient market hypothesis suggests, creating small, but exploitable, opportunities to process information quickly, systematically, and consistently. Combining disparate pieces of information from vast amounts of financial market data in nonobvious or complicated ways can also reveal small, exploitable inefficiencies. Because mispricings rarely persist for long periods, most quantitative investment strategies involve high levels of portfolio turnover.

### Event study methodology

Structured equity strategies are developed through empirical research in steps referred to as the “event study methodology.”<sup>4</sup> Once a stock selection strategy is formulated in theory, stocks are ranked according to the strategy over a particular period of time and then grouped into portfolios. Subsequent excess returns relative to the market or a risk model are calculated and then analyzed statistically to determine whether the mean excess return associated with the stock-ranking idea is statistically different from zero. If the strategy is sound, the mean excess return for each of the grouped portfolios ought to be statistically different, and the pattern of mean excess returns should descend consistently from high- to low-ranked stocks. Based on the groups’ rankings, the undervalued stocks are overweighted, and the overvalued stocks underweighted, relative to the benchmark.

<sup>2</sup> Thaler and Mullainathan (2000).

<sup>3</sup> Fama (1991).

<sup>4</sup> Ball and Brown (1968); Fama, Fisher, Jensen, and Roll (1969); Campbell, Lo, and MacKinlay (1997).

## Event study methodology: Quality controls

A disciplined research process can lead to a quantitative strategy characterized by measurable, consistent, and repeatable value-added results, but only if care is taken to minimize development risks such as “back-test bias,” the inadvertent implementation of false positives, or strategies that are easily arbitrated away. Steps that can be taken to counter these risks include:

- Requiring that a strategy be supported by sound economic theory and plausible market behavior.
- Conducting an in-sample test on a segment of the data to determine whether a model works.
- Insisting that out-of-sample statistical results be as impressive as in-sample results.
- Evaluating issues such as turnover to assess implementation feasibility.
- Creating a composite strategy to minimize the possibility that a single strategy will be arbitrated away and to diversify the risk that any one stock selection strategy will experience periods of underperformance.

An examination of how proposed stock selection methodologies are tested clarifies the importance of the event study methodology in helping portfolio managers to identify viable strategies. It also illustrates the importance of judgment and experience. Statistical analysis can sometimes suggest that a strategy is ready for implementation while a manager’s judgment of the quality of the underlying data, or maybe skepticism of what appear to be statistical “certainties,” suggests further testing.

## Risk factors and excess returns

Although many structured equity strategies seek to capitalize on observed “behavioral finance anomalies,” it is almost impossible to determine with complete confidence that a strategy is generating true “excess return” (that is, a return earned without the assumption of higher risk). “Earnings surprise”<sup>5</sup> (the observation that stock prices may take several quarters to fully reflect earnings announcements that exceed—or fail to meet—analysts’ expectations) was one of the first reported anomalies. Subsequent studies<sup>6</sup> reported that market capitalization, value variables, return momentum, earnings revision, and certain financial-statement variables are all relevant when predicting future excess return.

However, Fama and French<sup>7</sup> demonstrated that many of these anomalies reflected bets on unrecognized risk factors that dominated the samples used in the empirical studies. Once these risk factors were accounted for, excess returns dissipated. Value and growth investment styles are considered two primary risk factors. Most reported value anomalies, such as dividend yield, can be shown to be tightly linked to the value risk factor. Certain momentum anomalies have been shown to be tightly linked to the growth risk factor.<sup>8</sup> Long-term momentum is highly correlated with the market-capitalization risk factor.<sup>9</sup> Many industry models extend these results and produce small excess returns after accounting for the appropriate market risk factor. It’s possible, too, that those strategies that appear to produce excess returns after adjusting for all known risks are being rewarded for a risk that hasn’t yet been identified.

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5 Latane and Jones (1977).

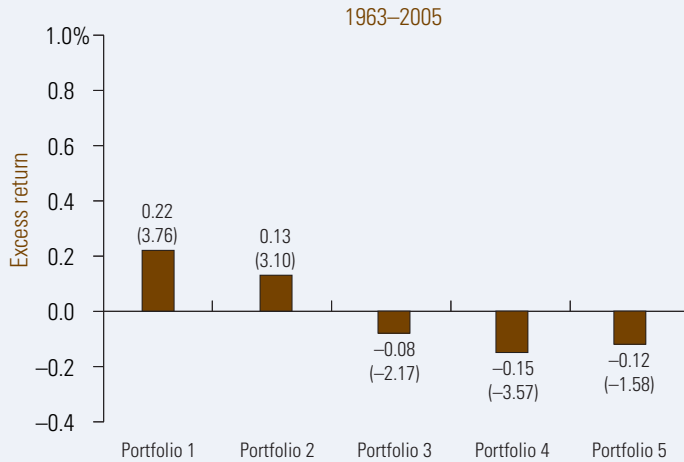
6 Reinganum (1983); Peavy and Goodman (1983); Jegadeesh and Titman (1993); Givoly and Lakonishok (1979); Holthausen and Larcker (1992).

7 Fama and French (1996).

8 The Vanguard Group internal investment-management research.

9 De Bondt and Thaler (1987); Zarowin (1990).

Figure 5. Dividend yield mean monthly excess returns, mid-cap equity universe, monthly rebalance



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
Source: Vanguard Investment Counseling & Research.

### The importance of in-sample and out-of-sample tests

Ranking stocks by dividend yield<sup>10</sup> provides an example of how adhering to in-sample and out-of-sample testing is important to avoid false positives and inconsistent strategies. Stocks ranked by dividend yield were grouped into five portfolios.<sup>11</sup> Portfolio 1 contained the stocks with the highest dividend yields. Portfolio 5 contained the stocks with the lowest dividend yields.

Figure 5 presents results for the mid-cap universe for the 1963–2005 period, demonstrating that, on average, Portfolio 1 generated 22 basis points a month in excess return. (Average excess return is denoted at the top of each bar and the t-statistics<sup>12</sup> are denoted in parentheses.) These results are

impressive, and the portfolio’s generally high t-statistics indicate that the returns are statistically significant.

To determine whether the strong results of the dividend-yield strategy are likely to persist, the theory was tested by dividing the study period into an in-sample period (the period in which the pattern was first recognized), and an out-of-sample period (a subsequent period used to confirm the pattern). To avoid a “false positive” strategy, such as one with an unspecified risk factor, the out-of-sample results should be as impressive as in-sample results. Figure 6, on the following page, presents results for the dividend-yield strategy during the in-sample (1963–1984) and out-of-sample (1985–2005) time periods.

Although the pattern of returns across the portfolios was similar in both the in-sample and out-of-sample periods, the statistical results from the 1985–2005 period were considerably weaker. The mean returns were lower, and the t-statistics indicated that the results were less reliable. If dividend yield were a strategy that could be exploited consistently and reliably, the mean returns and t-statistics in both periods would, ideally, be much closer. Even so, the strategy still appeared to produce excess returns during the out-of-sample period. The strategy might be viable, but further analysis was warranted.

The next step was to investigate the returns generated by this process on a calendar-month basis. This perspective revealed that the cautious assessment of weaker out-of-sample results was wise. Figure 7 shows that the results generated by the dividend-yield strategy were largely “turn of the year.” It’s theoretically possible to devise trading strategies that exploit this turn-of-the-year effect, but judgment would urge caution. Most of the excess returns appeared in just one month. If an attempt

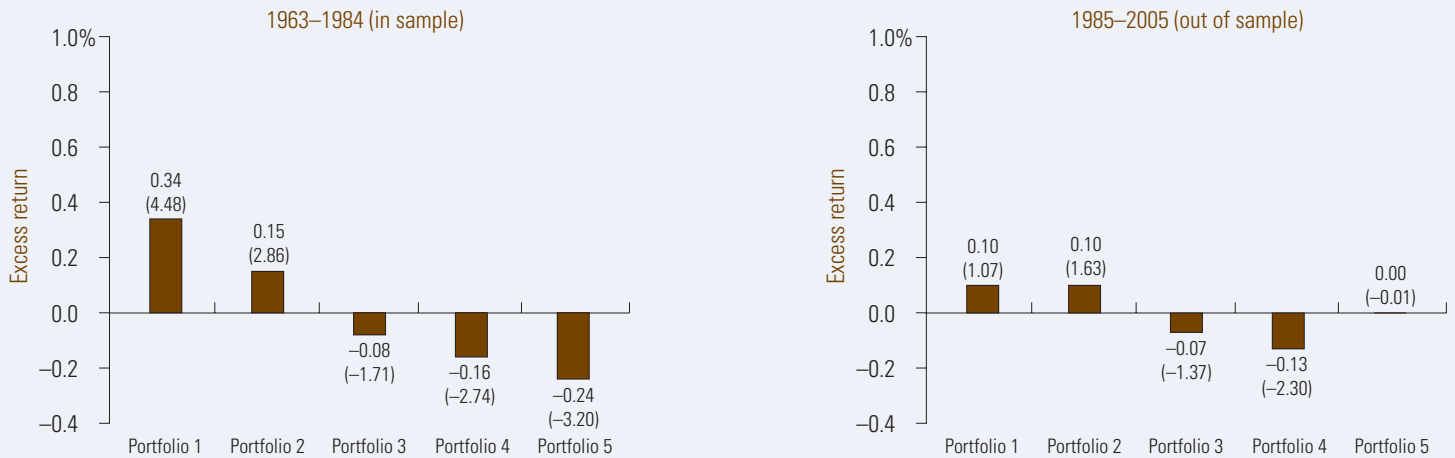
<sup>10</sup> This study replicates Keim (1985).

<sup>11</sup> Stocks were ranked within groups of similar firms. Portfolios were formed incorporating risk control.

<sup>12</sup> T-statistics provide a statistical test for the hypothesis that the mean excess return is different from zero. If the t-statistic is greater than (or less than) 2 (or -2), the conclusion that the actual mean is different from zero can be inferred from the data with a high degree (≥95%) of confidence.



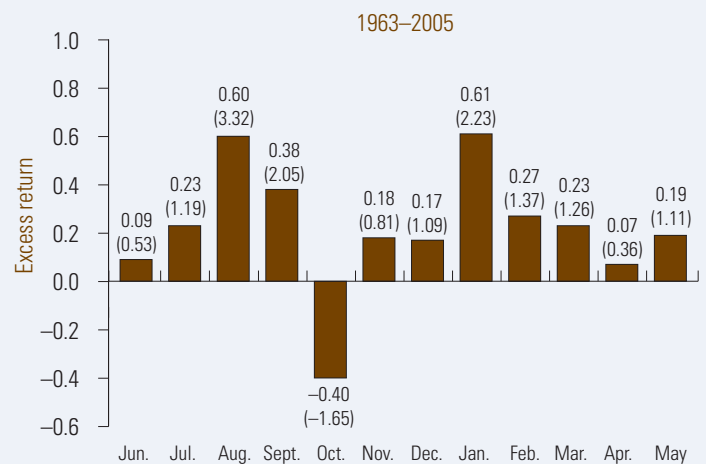
Figure 6. Dividend yield mean monthly excess returns, mid-cap equity universe, monthly rebalance



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
Source: Vanguard Investment Counseling & Research.

were made to capitalize on the dividend-yield strategy in other months, the costs generated by portfolio turnover would be largely uncompensated. Even a strategy that confined turnover to just January might not be viable. Although the average results for January were strong, the actual result for every January may not be. There could be years in which the turn-of-the-year effect doesn't materialize and a strategy designed to exploit the effect would incur transaction costs without any compensating return. The result could be a large tracking error relative to the benchmark, and in the structured equity arena, a strategy that can't be expected to consistently produce positive relative results is really no strategy at all.

Figure 7. Dividend yield for portfolio 1 mean monthly excess return by calendar month, mid-cap equity universe



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
Source: Vanguard Investment Counseling & Research.

## Issues of portfolio turnover

This turn-of-the-year effect raises some important issues about the implementation of a strategy. An implementable quantitative strategy must have a consistent pattern of returns. With a quantitative strategy, portfolio turnover is a function of changes in the underlying data. High turnover occurs when the underlying data change rapidly. Turnover generates transaction costs that erode excess return. An empirical study can demonstrate a statistically significant result—the high mean return and t-statistic for a dividend-yield strategy executed in December support such a conclusion—but the associated transaction costs can preclude implementation. A consistent excess-return pattern, with moderate turnover relative to transaction costs, indicates that a quantitative strategy can reap more-than-compensating returns for its portfolio turnover.

Turnover considerations become especially important—and complex—as distinct stock selection strategies, each with its own turnover rate, are combined into a single, composite stock selection strategy. Strategies that attempt to exploit fundamental characteristics, such as market capitalization or changes in dividend yield, create relatively low levels of turnover. In contrast, models based on more volatile price-related characteristics, such as stock prices and returns, can create high turnover. If a composite strategy is dominated by low-turnover components, the addition of a high-turnover model, even one that by itself implies large excess returns, may simply add noise to the composite, degrading overall excess return.

## Composite strategy provides diversification and durability

Although a composite strategy can complicate the management of portfolio turnover, a multisignal framework is critical to developing a stock selection strategy that can endure. The principal objective of a composite stock selection model is to group correlated quantitative indicators into signals. Each signal should capture a distinct piece of information about a security's value and possess low correlation with the other signals. Combining these distinct, uncorrelated "information signals" into a composite signal enhances the likelihood that the structured equity strategy will consistently add value within a risk-controlled framework. Not only can a multisignal composite enhance the strength of any one signal within the composite, but it also helps to ensure that at least one information signal is contributing to excess return at any point in time, reducing the risk of underperformance.

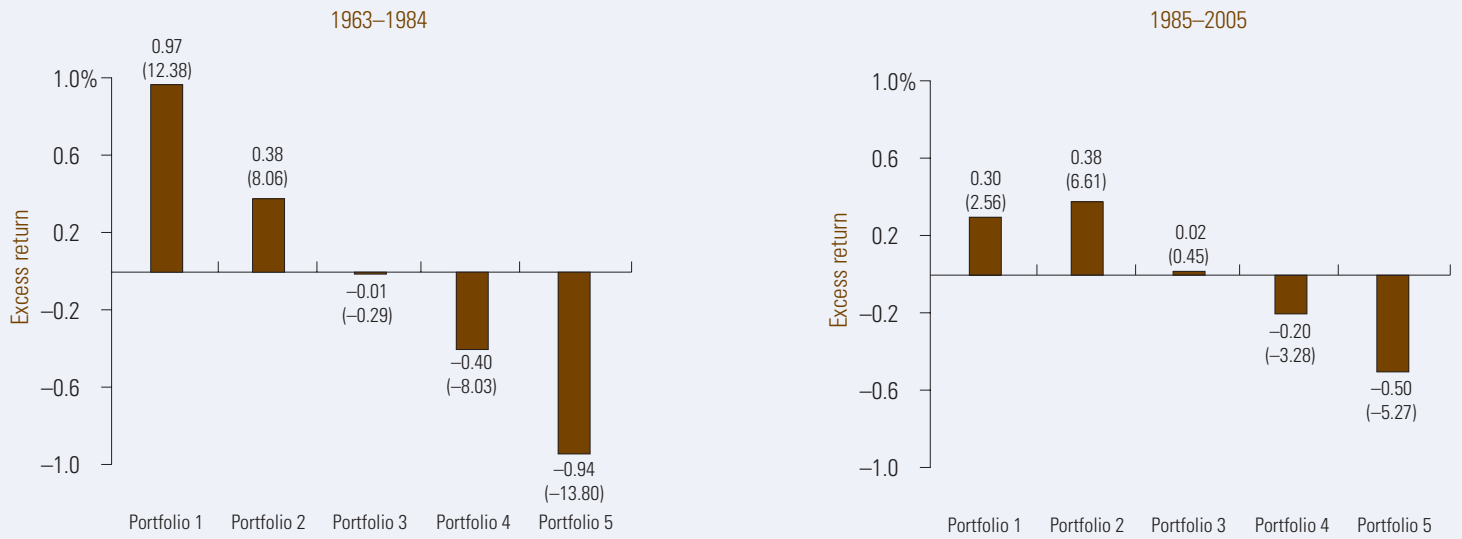
A strategy based on one stock selection signal may be effective for a short time, but once a signal enters the public domain, it often is arbitrated away. One-month momentum,<sup>13</sup> also referred to as the "short-term reversal effect," provides a good example of a strategy that worked well but became less effective once it was published.

Figure 8 presents the results for the one-month momentum strategy during two sample periods. On first examination, the strategy appeared to work well in both periods. The pattern of returns was similar, and the t-statistics in both periods suggested that the results were significant. One worrying sign, however, was that the mean return of Portfolio 1—the portfolio with the highest return in the first period—was much lower in the second period. This change called for further investigation. Figure 9 presents the results for subperiods to demonstrate that the excess return substantially dissipated after the late 1980s (and, not coincidentally, after Rosenberg, Reid, and Lanstein published the one-month momentum effect in 1985).

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13 Rosenberg, Reid, and Lanstein (1985).

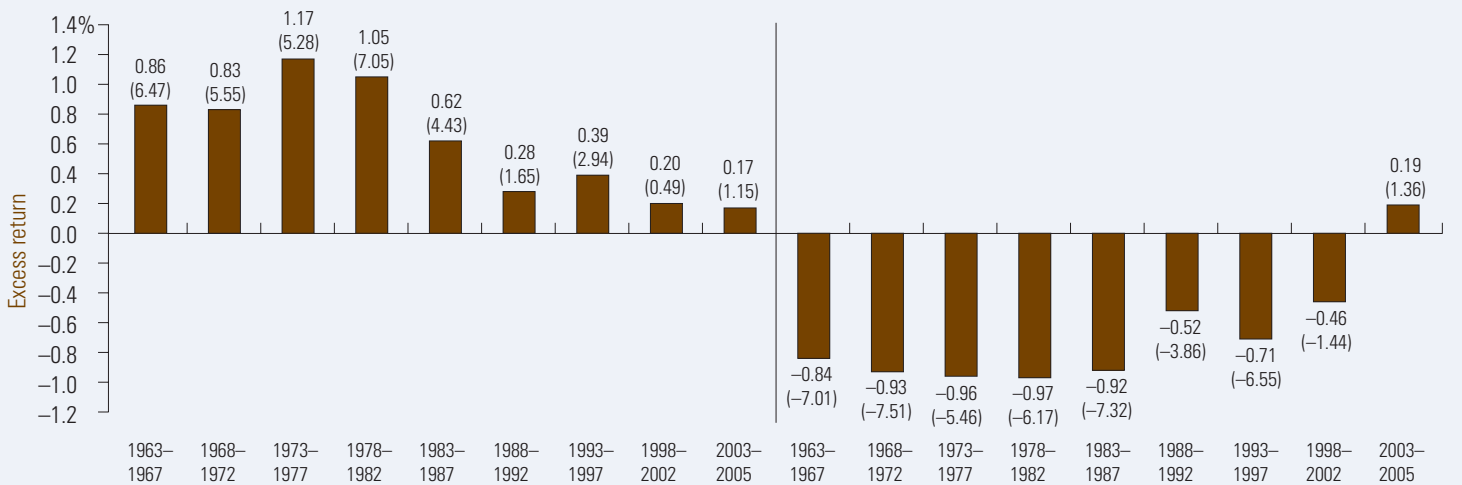
Figure 8. One-month momentum mean monthly excess returns, mid-cap equity universe, monthly rebalance



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.

Source: Vanguard Investment Counseling & Research.

Figure 9. One-month momentum subperiod analysis mean monthly excess returns, mid-cap equity universe, monthly rebalance



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.

Source: Vanguard Investment Counseling & Research.

## Managing transaction costs

While less than the average 110% turnover rate of traditional active managers, the turnover rates of structured equity strategies are high, averaging approximately 80% a year. High turnover is to be expected since market participants quickly recognize the slight mispricing upon which a structured equity strategy is based. To capture the strategy's excess return upon its implementation, it is essential to minimize transaction costs and to trade skillfully. High turnover also means that structured equity is most appropriate for tax-deferred or nontaxable accounts because of the potential for a strategy to realize net capital gains.

As mentioned previously, once a strategy enters the public domain, its effectiveness is quickly arbitrated away. The only defense against this inevitability is to develop a composite strategy that is refined with constant research and innovation to ensure that it always contains robust, truly proprietary components. Just as each component of a composite stock selection strategy must thrive in both in-sample and out-of-sample tests, so must the composite strategy as a whole. This requirement helps avoid back-test bias.

Back-test bias is the result of overfitting the data, whereby a data sample is repeatedly used to test a particular stock selection strategy. After each pass through the data sample, the idea is modified to "improve" the results. Statistical theory assumes that alternative models are chosen randomly, with no regard to the statistical significance of the previously estimated models. Adjusting a model so as to improve out-of-sample returns undermines the integrity and reliability of the empirical results. Back-test bias almost ensures that a significant but overfitted in-sample strategy will perform poorly out-of-sample and, most important, will perform poorly when implemented in real time.

During the in-sample period, a researcher is free to repeatedly evaluate the data to determine an optimal strategy. Once the optimal strategy is determined, however, the out-of-sample period can only be used once to test the repeatability of the strategy. If the strategy fails, there is limited recourse unless another out-of-sample period has been reserved.

## The Vanguard composite strategy

The benefits of rigorously adhering to these methodological practices can be seen by examining the performance of a composite structured equity strategy developed according to these protocols. Figure 10 presents results for the July 1976–May 1992 in-sample period, that was used to develop Vanguard's composite structured equity strategy. Figure 11 presents the results for the U.S. market from June 1992 to December 2005 as an out-of-sample period.<sup>14</sup> In both periods, the excess returns were similarly high. And in both periods, the t-statistics were exceptionally high (especially in Portfolios 1 and 5), suggesting that the stock selection methodology used to generate these returns can be expected to produce similar results in the future with a high degree of confidence.

Additional out-of-sample periods can be reserved by using results from international markets to confirm or challenge those observed in the U.S. out-of-sample period. Figures 12a, 12b, and 12c on page 14 present composite models for the United Kingdom, the Eurozone, and Japan, respectively, for the 1995–2005 period. For the international test, the universe was defined by stripping out the small number of extremely large companies that are typically indexed since few sample-based relative comparisons can be made when there are only a few large names to be compared.

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<sup>14</sup> This period also coincides with the actual implementation of the strategy in 1994.

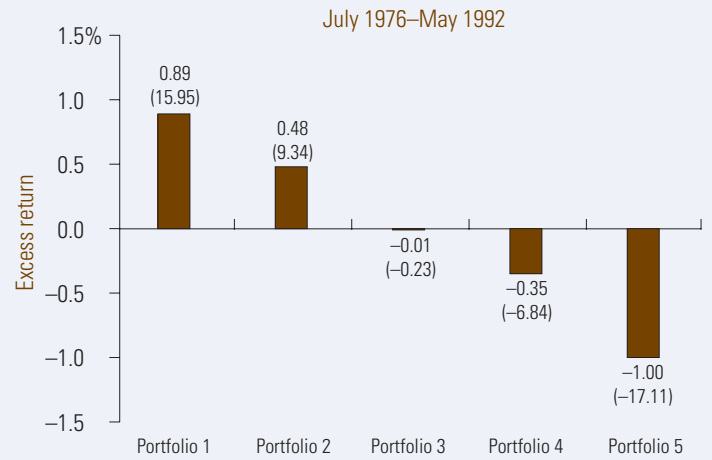
Again, the results (mean returns and t-statistics) were generally strong, enhancing the confidence that the stock selection strategy used in the U.S. market can be expected to exploit some inefficiency inherent to stock markets throughout the world.

**Incorporating structured equity in a portfolio: Considerations and caveats**

Structured equity’s defining characteristics—quantitatively based stock selection and tight risk controls—may suggest that it is an attractive substitute for indexing. Risk control provides consistent performance relative to a benchmark, while a quantitatively based stock selection process allows for objectivity and discipline. Those attributes seem to argue that there is much to be gained, and little to be lost, by using structured equity, rather than indexing, as the core of a diversified portfolio.

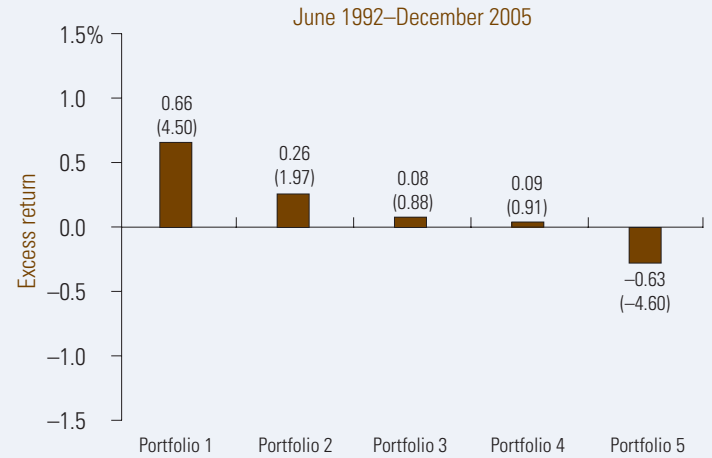
However, structured equity can also be thought of as a quantified, risk-controlled application of active management strategies. Many of the stock selection strategies are similar to the strategies used by traditional active managers. If the degree of performance variation among active strategies is considered excessive for a particular objective, structured equity can quantify and limit the expected variation going forward. To fully appreciate the active management nature of structured equity, consider the following arguments for and against strategy persistence.

**Figure 10. Quantitative Equity Group U.S. composite strategy mean monthly excess returns, mid-cap equity universe, monthly rebalance**



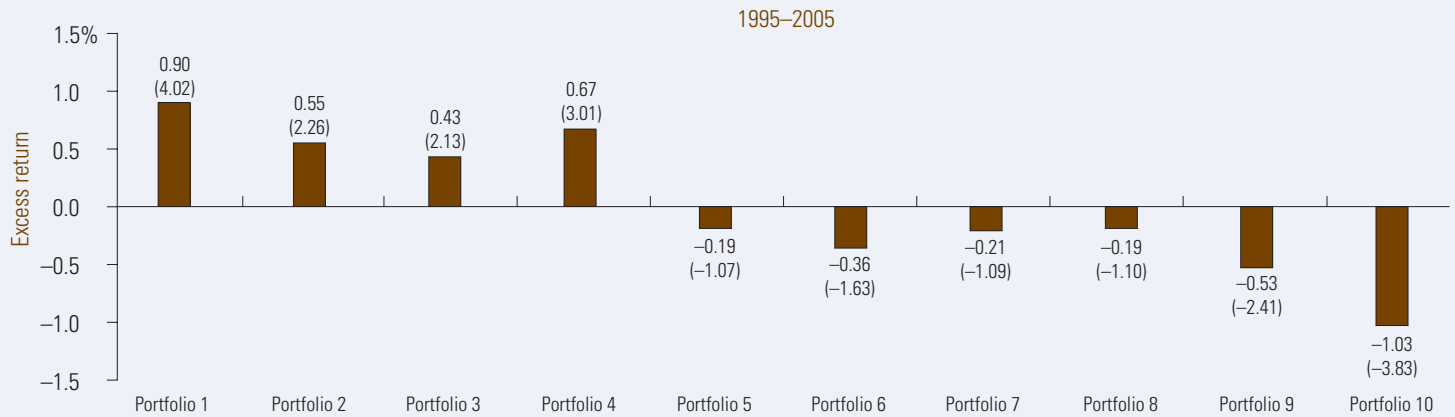
Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
Source: Vanguard Investment Counseling & Research.

**Figure 11. Quantitative Equity Group U.S. composite strategy mean monthly excess returns, mid-cap equity universe, monthly rebalance**

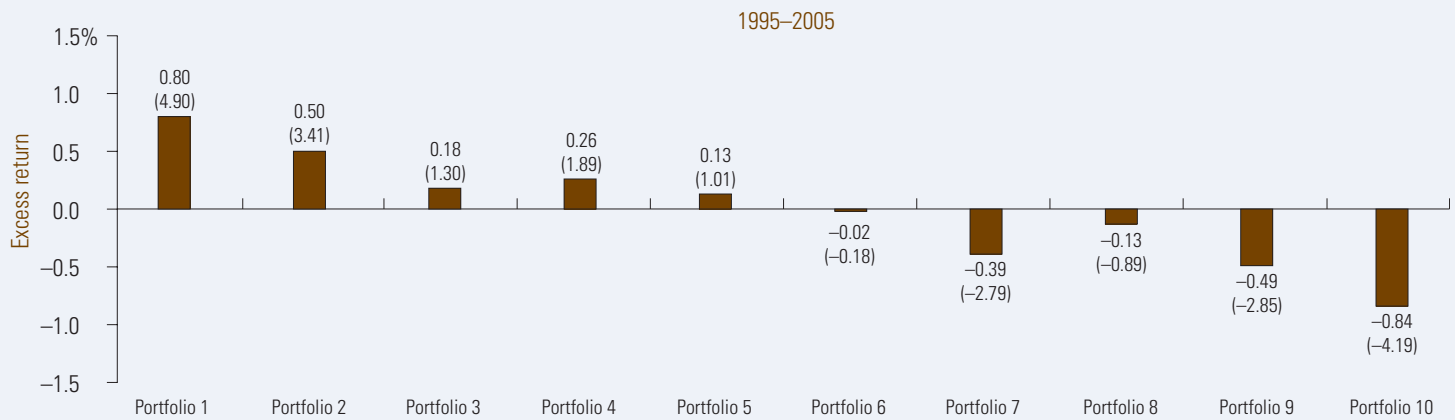


Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
Source: Vanguard Investment Counseling & Research.

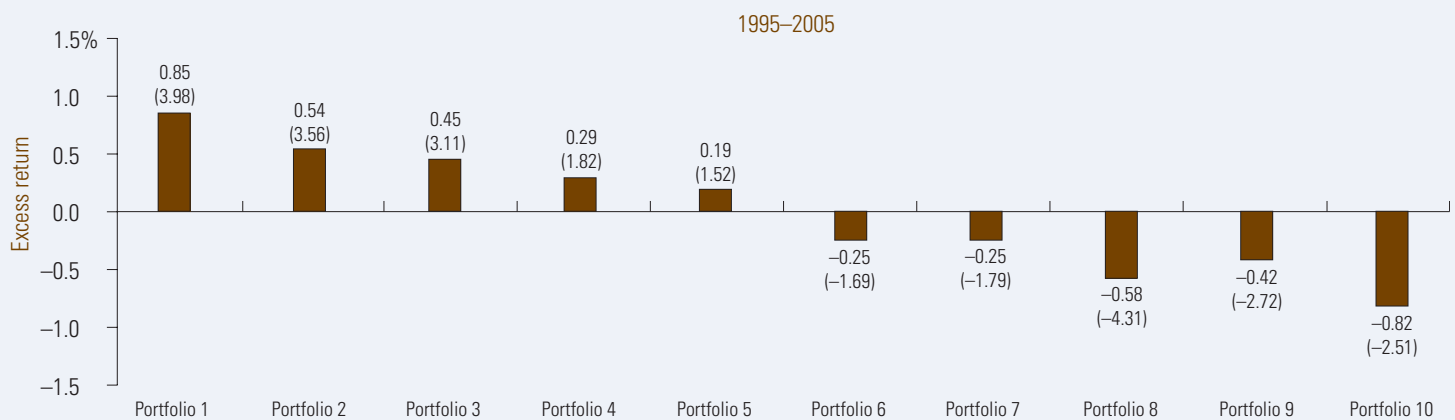
**Figure 12a. U.K. composite**  
**Mean monthly excess returns, mid-/small-cap equity universe, monthly rebalance**



**Figure 12b. Eurozone composite**  
**Mean monthly excess returns, mid-/small-cap equity universe, monthly rebalance**



**Figure 12c. Japan composite**  
**Mean monthly excess returns, mid-/small-cap equity universe, monthly rebalance**



Note: Average excess return is denoted at the top of each bar and the t-statistics are denoted in parentheses.  
 Source: Vanguard Investment Counseling & Research.

### **Structured equity and active management: Shared risk of strategy persistence**

While structured equity can mitigate many of the risks associated with pure active management, the two strategies have risks in common.

Despite the proprietary nature of quantitative structured equity models, their effectiveness can dissipate over time as a result of the independent discovery of similar strategies by academics and practitioners and as the market becomes more efficiently priced. Technological advances in computing and the Internet have made the processing and dissemination of vast amounts of financial data much easier. As a result, the proprietary components of any industry model are constantly threatened with discovery and publication, which will cause their investment value to be potentially arbitrated away. Consequently, dedication to constant innovation is an integral component of any quantitative investment-management process.

### **Sound strategy or factor risk?**

Structured equity has also been challenged as simply a bet on risk factors other than replicable alpha. Fama and French (1996) showed that many apparent quantitative signals can subsequently be considered risk factors—a reasonable concern. Specifically, most quantitative stock selection approaches have a distinct value bias. In the United States this bias is not surprising given that value issues have outperformed growth in the majority of the historical sample periods for which data are available. This argument gained particular attention during the late 1990s during the

U.S. “bubble” in technology stocks, which resulted in a dramatic, growth-dominated market. Many U.S. structured equity strategies experienced substantial negative tracking error during this period. The recent post-bubble period, dominated by value equities, has exacerbated the debate. During this period, many structured equity strategies have substantially outperformed the market (that is, have had positive tracking error), restoring their long-term track records. The counterargument is that most successful structured equity managers have some proprietary components that are independent of risk factors. Combining multiple structured equity managers is a way to mitigate these risks and create a portfolio dominated by their respective proprietary components. Despite these cautions, the limited evidence—and the financial theory and methodological practice that undergird structured equity—suggests that these strategies are still a reasonable form of active management to incorporate in a well-diversified portfolio. Just as with other forms of active management, there is also a benefit to diversifying among structured equity managers to minimize manager risk.

While having tremendous potential as a substitute for or complement to traditional active management, structured equity (as well as active quantitative strategies) is active management subject to the basic fundamental risks associated with traditional active strategies.

## Conclusion

Structured equity is a natural extension of indexing. As with indexing, risk control is critical to produce consistent long-term performance relative to a market benchmark. Careful empirical analysis yields a stock selection framework with risk control that is somewhat less restrictive than that of indexing, creating the opportunity to track a benchmark with a consistent, replicable positive margin and to outperform the majority of active managers. In this way, structured equity investing merges the risk control of an index fund with the stock selection techniques of active management.

A disciplined research process to develop stock selection signals is essential to successful structured equity strategies. This process must minimize development risks such as back-test bias, the inadvertent implementation of false positives, and the implementation of strategies that are easily arbitrated away. "Soft" qualities such as judgment and experience are critical complements to the "hard" technical skills used to develop stock selection models. A competent research process requires:

- Strategies motivated by sound economic theory and plausible market behavior.
- In-sample and out-of-sample tests to prevent overfitting the data and to ensure the future of strategies after they are implemented.
- Consistent statistical results in both in-sample and out-of-sample periods.
- A composite strategy to diversify strategy-specific risk.

Structured equity can best be thought of as a quantified, risk-controlled application of active management strategies. Under certain circumstances, structured equity might be an appropriate substitution for indexing, while others might call for using it as an alternative to traditional active management.

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