Executive summary. Since the 1990s, the investment management industry has witnessed unprecedented change in the portfolio management process. Technological and computing advancements, increases in the number and quality of competitors, lower leverage costs, innovations in financial engineering, and changes in regulatory structures have led portfolio managers to implement new processes for trading, security and strategy analysis, and implementation. As a result, quantitative investment strategies have taken off, fueled by the ability to screen, manage, sort, and evaluate thousands of securities at previously unavailable frequencies.

The combination of widely available technology and seemingly limitless investment strategies has not only given rise to quantitative investing, but has also naturally led to an expansion of the traditional long-only portfolio to include shorting, leverage, derivatives, and alpha porting. For many investors, these new strategies are most often recognized as one of a range of new products including, but not limited to, market-neutral, 130/30 (or 120/20, 150/50, etc.), and long-short funds.

In this paper, we explore the rationale behind moving from a traditional long-only active quantitative portfolio to a similar strategy that permits short selling\(^1\) and leverage. We also explore the challenges associated with such a strategy, including the risks, costs, and implementation hurdles. We conclude that:

- Removing the long-only constraint theoretically permits managers to apply information more symmetrically and efficiently.
- The decision to remove the long-only constraint is grounded in the expectation that a given manager will consistently produce excess returns, net of cost.
- Because of the higher costs and implementation risks associated with short selling and leverage, diligent risk control is necessary, and even then long-only managers may still outperform unconstrained managers.

\(^1\) Short selling involves the sale of a security that the seller does not own, or a sale that is completed by the delivery of a security borrowed by the seller. Short sellers are bearish on a stock and assume that they will be able to buy the stock at a lower amount than the price at which they sold it short.
The rationale for expanding an investment strategy

The objective for investors in actively managed portfolios is to outperform a given benchmark after costs. However, historically, such cost-adjusted excess returns have proved difficult to deliver consistently (Philips and Ambrosio, 2007). As a result, the investment industry strives to uncover and deliver new processes and to refine existing processes to increase the chances of achieving excess returns more consistently.

These processes can be boiled down to three fundamental tenets—often referred to as the fundamental law of active management (Grinold, 1989). The fundamental law of active management says that the primary drivers of consistent outperformance (as measured by a manager’s higher information ratio) are forecast accuracy (skill), breadth of forecast (the opportunity to apply skill), and efficiency of execution (cost). Intuitively, the law suggests that to obtain the highest information ratio, a manager must have the ability to efficiently implement a skill-based strategy across as large a sample as possible. Failure in any one of these areas can lead to underperformance.

Traditionally, investors have focused only on finding a manager with skill, as skill is the most apparent factor in potential success or failure. Indeed, a long-only manager with exceptional skill would likely be difficult to beat, even by managers employing long and short strategies. For those managers with less obvious talents, however, breadth and execution are just as important—particularly since skill can be difficult to untangle from luck and exposure to size and style factors. For example, a manager with modest skill and the ability to apply that skill across a broad set of securities may still fail if the costs to execute that strategy are too steep. Similarly, a manager may fail if the opportunity set is too constrained.

With the rise of technology and increased access to information, managers have been able to refine the three tenets of investment success. The time and cost involved in developing valuation models have been cut, models are now efficiently applied across broader opportunity sets, and execution has been improved. This has resulted in generally higher information ratios, as the fundamental law of active management would suggest. ²

But while quantitative techniques may be used to improve the breadth and execution of active management, most managers continue to be constrained in the application of their investment strategies. Traditionally, the implementation of a given asset allocation strategy has included only long investments—portfolios consisting of securities with weights greater than or equal to 0%. This means that while a strategy may have delivered a certain amount of excess returns, that strategy has been limited in its implementation because unfavorable views on stocks cannot be exploited to the same degree as favorable views. This raises an important question: If a manager has demonstrated skill at beating a benchmark, why not relax the long-only constraint to enable a more effective application of his information content?

2 See, for example, Nelson Wicas (2006).
Figure 1 demonstrates the primary implication of the long-only constraint. Most benchmarks are weighted according to market capitalization, where the current weight is a function of the security price multiplied by the number of shares outstanding. In practice, particularly for large-cap benchmarks, this has meant that relatively few securities have significant weights while a vast majority of securities have relatively minor weights. An active manager can therefore take significant negative positions in only a small fraction of securities.³

For example, in Figure 1, 16 stocks in the Standard and Poor’s 500 Index have weights greater than or equal to 1%. If a manager has an unfavorable view of one of these stocks, she may underweight the stock by the benchmark weight, resulting in a relatively significant impact to the portfolio. A manager may underweight ExxonMobil, for example, by its benchmark weight of 3.3%.⁴ Most stocks, though, possess relatively insignificant weights. In fact, the remaining 484 stocks have weights of less than 1%, meaning that any individual underweighting has much less influence on the performance of the portfolio.

When short selling is permitted, the 92% of securities with weights of less than 50 basis points may receive significantly larger underweights relative to the benchmark. Of course, other benchmarks have different distributions than the S&P 500 Index. For example, in the S&P 600, the largest 50 stocks account for 21% of the total market capitalization, while the next 50 largest stocks account for 15%. Certain international indexes, on the other hand, may have an even greater concentration of benchmark weight in the largest stocks.

Figure 1. Market-cap-weighted indexes constrain underweights

Distribution of security weights in the S&P 500 Index

- Greater than 3.50%
- Between 3.25% and 3.50%
- Between 3.00% and 3.25%
- Between 2.75% and 3.00%
- Between 2.50% and 2.75%
- Between 2.25% and 2.50%
- Between 2.00% and 2.25%
- Between 1.75% and 2.00%
- Between 1.50% and 1.75%
- Between 1.25% and 1.50%
- Between 1.00% and 1.25%
- Between 0.75% and 1.00%
- Between 0.50% and 0.75%
- Between 0.25% and 0.50%
- Between 0% and 0.25%

0.6% of stocks have weights of greater than 200 basis points
92% of stocks have weights of less than 50 basis points

Source: Authors’ calculations using data from Thompson Datastream. Holdings represent the weights of the stocks in the Standard & Poor’s 500 Index as of March 31, 2007.

³ A similar example is used by Bruce Jacobs and Kenneth Levy (2006).
⁴ As of March 31, 2007.
Removing the long-only constraint within a quantitative investment framework

Quantitative equity managers rank stocks based on the likelihood that they will produce excess returns compared with the benchmark, using algorithms based on finance, mathematics, statistics, and economics. Because managers attempt to match the benchmark’s primary risk factors (size, style and sector), they tend to use many, if not all, of the benchmark securities, resulting in many small overweights and underweights.

We attempt to simulate this approach to demonstrate the asymmetry of information application and the potential value of removing the long-only constraint. For simplicity, in Figure 2 on page 5 we grouped the stocks in the S&P 500 into deciles, with decile 1 representing the basket of stocks with the best prospects for outperformance and decile 10 representing the basket of stocks with the worst prospects. Rather than sort by a quantitative forward return signal, to simulate a hypothetical investment approach we ranked the stocks alphabetically to form our deciles. Decile 1, representing our hypothetical 50 best-ranked stocks, includes 3M Co. through Autodesk, Inc. Decile 10 represents the hypothetical 50 worst-ranked stocks, from Tyco International Ltd. through Zions Bancorp.

While each individual quantitative manager may apply overweights and underweights differently, our example illustrates the challenges associated with a constraint on short investments. In this example, we ranked the S&P 500 stocks by name and graphed the benchmark weights of the first and last 50 with the brown bars. The total benchmark weights of the stocks in deciles 1 and 10 are 12% and 12.4%, respectively (a truly even distribution would allocate 10% to each decile). In the top panel on page 5 we show potential overweights to the decile 1 stocks based on the manager’s information in blue. In this example we applied an overweighting of 50 basis points equally across all 50 stocks, representing a 25% total overweight to decile 1. As demonstrated by the top panel, every stock may be overweighted to the maximum extent of the information content provided by the manager’s valuation models. As a result, the total weight of the decile 1 stocks now stands at 37% of the portfolio.

The impact is quite different for the decile 10 stocks, shown in Figure 2 by the lower panel. In this graph, we underweighted each stock by 50 basis points, or to the maximum extent permitted by the benchmark. While seven stocks were underweighted by 50 basis points, 43 stocks were underweighted by less, some significantly less, because their starting benchmark weight was less than 50 basis points. The end result is that while each of these stocks is viewed in an equally unfavorable light, the manager is constrained in the degree to which he can act on that information.

For example, stock number 452 has a benchmark weight of just 4.1 basis points while stock number 457 has a benchmark weight of 55 basis points. Although the manager views the stocks as equally unfavorable investments, stock number 452 can be underweighted by only 4.1 basis points, while stock number 457 can be underweighted by the entire 50 basis points suggested by the information content. However, if the decile 10 stocks were instead decile 1 stocks, the manager could apply equal overweights to stocks 452 and 457. The asymmetry is clear—the decile 1 stocks were overweighted by a total of 25%, while the decile 10 stocks were underweighted by only 10.3%.5

---

5 It’s important to note that managers of concentrated funds are not as restricted in their overweights and underweights. For example, a portfolio of 50 stocks would hold only those stocks identified as “buys” and would not hold in any capacity any other stocks. So the benchmark weights are not as constricting for the manager of a concentrated fund as for the manager of a broadly diversified quantitative fund.
Figure 2. The asymmetry in applying information

Benchmark weights and portfolio overweights of hypothetical decile 1 stocks within the S&P 500

Benchmark weights and portfolio underweights of hypothetical decile 10 stocks within the S&P 500

Source: Authors’ calculations using data from Thompson Datastream. Holdings represent the weights of the stocks in the S&P 500 Index as of March 31, 2007.
In a long-only investment framework, managers are constrained in applying their strategies. Modifying or eliminating the constraints contained in a fund’s prospectus as it relates to short selling, overweight limits, and leverage allows managers to take full advantage of any information they may possess. In Figure 3, we demonstrate this in a purely theoretical example, using an equal-weighted benchmark, where the blue bars signify 10% weights to each benchmark decile. The brown bars represent the traditional long-only portfolio, which is constrained to 0% weights in the worst-ranked deciles. The gray bars represent the theoretical 1×0/×0 framework, where the manager not only underweights the least attractive securities in deciles 8, 9, and 10, but is able to further increase the bets against those securities by selling them short. The manager is then able to use the capital received from the short sales to place additional bets on the most attractive securities in deciles 1, 2, and 3. We will provide a more explicit example of this process later.

In practice, this means that the worst-ranked stocks may be sold short to “free up” additional investment in the top-rated stocks. The manager is now able to exploit negative information on decile 10 stocks to the same extent she is able to exploit positive information on decile 1 stocks.

Figure 4 on page 7 uses this theoretical framework and applies it to our S&P 500 example. In Figure 4 we modify the bottom graph in Figure 2 to include short selling. We apply a similar methodology in that we underweighted each position by 50 basis points as a result of our information signal. However, because we have eliminated the restriction on shorting stocks, we are able to underweight each stock by 50 basis points regardless of its starting benchmark weight. For example, because stock 452 had a benchmark weight of 4.1 basis points, we first reduced the benchmark weight to 0% and then sold short an additional 45.9 basis points worth of the stock to bring the total adjustment from the starting benchmark weight to –50 basis points. Because stock 457 started with a benchmark weight of 55 basis points, no short sales were required as –50 basis points of information could be applied with 5 basis points to spare.
As a result of these short sales, the decile 10 stocks now have a net portfolio weight of −12.6%, a change of 25 percentage points from the 12.4% weighting in the benchmark. This extra information applied to the worst-ranked stocks increases the manager’s opportunities to use information more efficiently. In addition, the manager now has an extra 12.6% of weight to allocate among the best-ranked stocks, further increasing the information opportunity (demonstrated in Table 1 on page 12). So as the hypothetical example in Figure 3 illustrates, the manager is able to apply information in the optimal manner on the best-rated stocks, adding additional amplification to the investment signals implemented in the portfolio. Finally, when short sales of the worst-ranked stocks are permitted, the manager can diversify the idiosyncratic risk inherent to heterogeneous benchmark weights. In our example, the application of information is concentrated in those stocks where we are able to underweight by the full 50 basis points. Shorting permits even application of information, diversifying this concentration risk.

![Figure 4. Permitting short sales expands the opportunity to apply information](image)

Benchmark weights, portfolio overweights, and additional short sales of hypothetical decile 10 stocks within the S&P 500

Source: Authors’ calculations using data from Thompson Datastream. Holdings represent the weights of the stocks in the S&P 500 Index as of March 31, 2007.
Applying the theoretical framework

More and more, managers are taking advantage of the opportunity to modify or eliminate the long-only constraint. According to data from Evestment, the number of quantitative funds employing long and short positions had jumped from 17 in 1990 to 231 as of 2006. In addition, the number of hedge fund strategies employing short selling grew from approximately 90 in 1990 to approximately 2,900 in 2006. These numbers are further corroborated by the increase in the dollar value of short positions over the years. According to research by Empirical Research Partners, the value of short interest has nearly tripled since 2003, and increased from less than $50 billion in 1993 to almost $500 billion as of January 2007 (Goldstein, 2007). But while the managers, strategies, and dollars focused on the short side have all increased, what distinguishes one set of strategies from the next?

The primary differences among the various strategies that use both long and short positions have to do with the degree of shorting and leverage used and the final net exposure of the portfolio. Figure 5 demonstrates these basic differences. Moving beyond the long-only portfolio, at one end are the 1x0/x0 strategies, here represented by a 130/30 portfolio. With 130/30 funds, managers fully invest 100% of the available dollars according to their investment processes, and then use a prime broker to sell short unfavorable stocks up to an amount equal to 30% of the portfolio. The proceeds received from the short sales are then reinvested in stocks with a favorable outlook. As a result, the 130 represents the long positions accounting for 130% of the invested dollars, and the 30 represents the short positions accounting for –30% of the invested dollars. The final portfolio therefore has 160% worth of positions (100% long, plus 30% short, plus another 30% long), but as with traditional long-only portfolios, it maintains a net exposure, or investment, of 100% long dollars.

Of course, in practice, creating a 130/30 strategy is not nearly so simplistic. For example, in order to actually sell securities short, a prime broker requires collateral to fund the positions. The 130/30 manager will therefore coordinate with a prime broker to calculate the collateral needed to fully support the 30/30 portion of the portfolio. Under Federal Reserve Board Regulation T, the broker requires collateral equal to 150% of the current market value of the shorted securities. And section 18(f) of the Investment

---

6 We include only market-neutral and long-short equity funds in this comparison. Data were provided by Hedge Fund Research and Tremont.
7 There is ongoing debate in the industry as to the causes and implications of the increase in short interest.
8 While 130% long and 30% short is the most common framework and serves as a compromise among the increased opportunity for excess return, additional tracking error, and additional costs to incur the additional excess returns, funds vary widely in the percentage of dollars shorted (Alford, 2006, and Patel, et al., 2007).
Company Act of 1940 may require 300% of the shorted assets to be covered if those proceeds are subsequently reinvested. Funds are also subject to a Securities and Exchange Commission requirement to set aside in a segregated account liquid assets equal to the current market value of the short positions.9

In Figure 6 we diagram the process a fund must undertake to implement a 130/30 strategy. First, the fund holds a portfolio of liquid equity securities, in this example worth $100 (1). The fund then sells short a basket of equity securities worth $30 (2). The fund enters a tri-party agreement among the prime broker and custodian bank for short sale collateral (3). Because the fund is reinvesting the proceeds from the short sale, the collateral will be 150% of the $30 short sale, or $45. This collateral will be held pursuant to the tri-party agreement at the fund’s custodian bank (4).

The fund invests the cash proceeds of the short sale in additional liquid portfolio equities (5). As a result, the custody arrangement will include $45 held at the fund’s custodian bank subject to a tri-party agreement and $85 held at the custodian bank not subject to the tri-party agreement (6).

Through the short sales, the reinvestment of the short proceeds, and the original investment process, the fund hopes to earn a positive return on the original $100, plus a positive spread between the basket of short stocks and the additional long positions. It’s this spread that results in the extra alpha attributed to the information content of the fund manager. Finally, if over time the value of the securities sold short increases, the fund will have to deliver additional collateral while the short position remains open to remain in compliance.

Market-neutral strategies are different in structure from 130/30 funds. Market-neutral strategies eliminate the short constraint entirely, allowing managers to short up to 100% of the portfolio value (adjusted, of course, for any cash reserve or margin requirements). In this case, where the short proceeds are held as cash and not reinvested, additional collateral is typically not required. However, to facilitate redemptions and portfolio transactions, the strategy may be closer to 95% short. The collateral earns a cash yield—typically the federal funds rate—which is returned to the market-neutral manager less a servicing fee that is retained by the broker.

---

9 These assets may not be used to cover other obligations and may not be sold or disposed of unless other qualifying assets (e.g., cash or liquid securities) are substituted. The segregation stipulation is intended to place a practical limit on the amount of leverage a fund may undertake (and so to limit potential increases in the speculative nature of the fund’s outstanding securities) and to ensure that adequate funds are available to meet the obligations arising from the instrument or practice that created the leverage.
Managers typically offset long positions with short positions in similar securities, hoping to capture a spread between the two (expectations for positive excess returns assume that valuation information on one or both securities is correct). In this way, market-neutral managers hope to achieve stable net exposure and stable beta. But instead of targeting a beta of 1, market-neutral managers target a beta to the market of 0, relying instead on the information content of the investment model to exceed the return on the benchmark Treasury bill.

The basic idea is that if an investment process works on the long side as well as the short side, limiting a portfolio to a 30% short position, limiting leverage, and restricting overweights simply adds constraints back in, but at a higher threshold. The market-neutral manager is freed from these constraints and applies the investment strategy across all available opportunities. The idea of eliminating these constraints is not unique to market-neutral managers, however. As we will discuss, repositioning a 130/30 portfolio to a 200/100 portfolio theoretically would permit the manager to operate free of restrictions on short selling, leverage, and position overweights, in a process similar to that used by the market-neutral manager.

Traditional long-short hedge funds differ from both market-neutral and 1x0/x0 portfolios in that they may fall anywhere with respect to the dollar value of short positions as well as the final net exposure of the portfolio. Long-short funds may make significant active bets on the long side and short side, and as a result often look quite different from a long-only benchmark. The primary implication is that investors lose control over their investment policy with respect to reporting, transparency, and asset allocation.

Is there an optimal framework for long and short positions?

While a 1x0/x0 approach expands both the short and long capabilities of a portfolio, the magnitude of overweights and underweights remains constrained. Indeed, if managers have demonstrated skill, should they not be free to apply that skill to the greatest extent possible? This is the primary attraction of market-neutral portfolios within a portable alpha framework. In such a framework, market-neutral managers are free to apply the information process to the fullest extent possible on both the long and short sides. The market-neutral return is then applied by way of financial engineering to the beta return of a given index. The final result is the index return plus or minus the alpha return of the market-neutral manager.

However, in theory a fully unconstrained portfolio may also be employed within the 1x0/x0 framework, as demonstrated in Figure 7 on page 11. Here we illustrate the range of potential short limits as well as the subsequent additional potential long positions. Below the bars we also show the total dollars invested. Looking at the right two bars, we see that the 200/100 and market-neutral portfolios are similar except that the 200/100 portfolio maintains full market exposure (while taking active positions), while the market-neutral portfolio eliminates exposure to the market. In fact, as we have discussed, the 200/100 fund represents an information-based investment process applied to 200% of long positions and 100% of short positions, resulting in expected excess returns across 300% of the portfolio. The portable alpha framework results in an information process applied to 200% of positions, instead applying that information process to a low-cost beta investment.
As a result, for investors confident in the information process of a given manager, a 200/100 strategy may be preferable to a portable alpha strategy that makes use of a market-neutral fund because the 200/100 strategy is implemented with one fund, uses one investment process, and applies information across more positions (Jacobs and Levy, 2006).

Of course, since market-neutral managers maintain a portfolio of cash obtained from selling short the worst-ranked stocks while 200/100 managers use those proceeds to make additional investments in the best-ranked securities, market-neutral managers inherently have less active risk (and by extension less expected active return) than 200/100 managers.

In addition, while theoretically appealing, a 200/100 portfolio would be difficult to construct.

First, because short positions may require collateral equivalent to 300% of the short proceeds (if the proceeds are to be reinvested), the maximum a fund could achieve without borrowing additional capital would be 150/50. For example, $50 in short positions would require $150 of collateral, which would be the entire long portfolio plus the $50 in reinvested short proceeds.

Second, most funds will concentrate the short and additional long positions in the security baskets where the most information is available. In our examples, this would be baskets 1 and 2 on the long end and 9 and 10 on the short end. To move from 130/30 to 150/50 to 200/100 would require increasingly large bets on (against) these baskets of securities. Operationally, the more leveraged the portfolio, the less risk control is possible. As a result, depending on how much information, turnover, or leverage the 130/30 manager wishes to employ, the final portfolio may actually look quite different from 160% of invested positions. Finally, maintaining a 130/30 portfolio requires significantly more turnover than maintaining a 100/0 portfolio.

Moving from a 130/30 to a 150/50 or a 200/100 portfolio may be theoretically optimal, but in practice, the costs associated with the significant turnover would likely eat away any additional benefits gained from additional leveraging of the manager’s information.
Table 1 expands on Figure 7 by detailing the portfolio weights across the various deciles for several strategies. In this table, we use the same methodology employed in Figures 2 and 4, where we sort the S&P 500 stocks alphabetically and split them into 10 portfolios with 50 stocks in each. The first row of the table lists the benchmark weights for each decile. The second row shows our hypothetical overweights to deciles 1, 2, and 3 and underweights to deciles 8, 9, and 10 for a long-only manager. Because we have no information on deciles 4 through 7, we maintain the benchmark weighting for risk control. As a result of the long-only constraint, the manager may overweight the top and bottom deciles by a maximum of ±19.8%, respectively (As discussed with Figure 2, we could not take deciles 8, 9, and 10 to 0% and still apply information symmetrically across each decile.)

Row 3 in Table 1 demonstrates the potential information leverage of a 130/30 strategy. Since short sales of up to 30% of the portfolio are permitted, deciles 8, 9, and 10 are allowed considerably larger underweights to the benchmark, while deciles 1, 2, and 3 are permitted additional overweights. As a result of modifying the long-only constraint to 30% short, the manager can increase the overweights and underweights to ±50.8% from ±19.8%. Again, because we have no information on the middle deciles, we maintained the benchmark weight for risk control.

Rows 4 through 6 show the differences among the market-neutral product, portable alpha product, and theoretical 200/100 product. The most significant difference is that the market-neutral manager eliminates allocations to the middle deciles and instead uses that capital to overweight securities in the top decile. The market-neutral manager also shorts the bottom-decile securities up to 100% of the value of the portfolio, and uses that additional capital to add to the weights of the top-ranked securities.

---

Table 1. Comparing the portfolio allocations

<table>
<thead>
<tr>
<th>Deciles</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–10</td>
<td>Deciles 1–3</td>
</tr>
<tr>
<td>Benchmark weights</td>
<td>12.00%</td>
</tr>
<tr>
<td>Long-only portfolio</td>
<td>24.50</td>
</tr>
<tr>
<td>130/30 portfolio</td>
<td>42.00</td>
</tr>
<tr>
<td>Market-neutral portfolio</td>
<td>54.50</td>
</tr>
<tr>
<td>Portable alpha strategy</td>
<td>66.50</td>
</tr>
<tr>
<td>200/100 portfolio</td>
<td>74.50</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations using data from Thompson Datastream. Holdings represent the weights of the stocks in the S&P 500 index as of March 31, 2007.

Notes: For each portfolio where shorting is permitted, we applied the information content equally across each security in a given decile. In addition, we constrained the total short positions to be no more than the stated objective—30% for the 130/30 portfolio, for example. The portable alpha strategy represents the sum of the market-neutral portfolio and the benchmark weights. Percentages may not add up exactly because of rounding.

---

10 In application, managers must ensure that the total short positions do not exceed 30% of the total portfolio weight. This often means implementing an optimization process throughout portfolio construction.
This methodology results in a much more concentrated portfolio, with the potential for less risk control. Of course, any manager may incorporate more risk control by increasing the weighting to stocks in deciles 4–7; however, adding weights in these deciles reduces the potential application of information in the best and worst deciles, a direct implication of the tradeoff between risk control and active share.

Finally, within this market-neutral framework, the benchmark weights of deciles 1, 2, and 3 necessarily account for a percentage of the long portfolio. Therefore, the manager can apply only 65% of information beyond the benchmark allocations. For example, if the manager allocates 2% to stock 1, and stock 1 has a benchmark weight of 1%, half of the allocation represents the benchmark weight and not an information-based overweight.

The 200/100 and portable alpha managers, in contrast, are able to apply 100% of information (in theory) on top of the decile 1, 2, and 3 benchmark weights. However, while the portable alpha strategy applies the alpha strategy to any information-less benchmark, the 200/100 manager continues to apply information to the original 100% of the portfolio. This represents a fundamental but significant difference between the two strategies.

**Implementation risks for eliminating the long-only constraint**

**The difficulty of selecting winning managers**

The primary risk for investors in portfolios that include short selling and leverage is the risk of active management—the chance that the manager may not consistently pick winners on both the long and short sides. It’s well-documented that the returns provided by active managers form a distribution around the market benchmark, with some outperforming over a given period and others underperforming (Philips and Ambrosio, 2007). This holds true for quantitative managers as well as those employing a fundamental valuation process.

In Figure 8 on page 14 we show the 12-month gross excess returns for first-quartile, median, and third-quartile quantitative managers relative to the S&P 500 Index. For this figure we used only quantitative managers within a large-cap core investment universe. We used gross returns to remove any negative impact of management fees and expenses. At the narrowest point, the 12-month spread between the 25th percentile and 75th percentile was 6.3%, while at the widest point the spread exceeded 22.4%. The median spread was 10.9%, indicating substantial variation among very similar managers.

A second point worth noting is that the median manager did not consistently post positive gross excess returns. Only the top-quartile managers consistently post positive gross excess returns. Therefore, the obvious risk for investors in quantitative funds is that they might select a lower-quartile manager or that a top-quartile manager might subsequently produce returns in the lower quartiles going forward.

---

11 The ability to port a market-neutral strategy onto any benchmark can be an important portfolio feature for investors looking for a beta different from that of the equity market. For example, the strategy may be ported onto a fixed income benchmark.
Because most short extension strategies replicate the long process on the short side, excess returns would be expected to be magnified both to the upside as well as the downside. Therefore, the average spread in Figure 8 would likely be much wider than the 10.9% reported. This amplification concept is illustrated in Figure 9, where we show the hypothetical change in the return distribution for quantitative managers if 100% of the managers in this universe moved to a 200/100 portfolio instead of a long-only portfolio.

While the distributions in Figure 9 are symmetrical, most quantitative funds engender significant trading frictions (such as bid/ask spreads, commissions, opportunity costs, and cash drag) in part because of the high turnover associated with applying the information content across the portfolio. As a result, while removing portfolio constraints would increase the range of gross expected excess returns for the aggregate universe of managers, the cost drag associated with achieving those expected excess returns would also increase. The net distribution in Figure 9 would therefore be likely to also shift to the left, perhaps significantly.
The risk of factor biases
While quantitatively based short extension strategies remain subject to the signals and information of the manager or the manager’s model, quantitative funds may also have risks that are not reflected in net dollar exposure or average beta to the market. For example, Figure 10 demonstrates the average 5-year factor exposures for the universe of large-cap core quantitative funds from the five years ended December 1991 through the five years ended December 2006.

There are two clear points of interest in this figure. First, even large-cap core quantitative funds have historically been focused on value. Second, from 2000 through 2006, these quantitative funds shifted from a large-cap bias to a neutral bias. In fact, performing the same regression for the 3-year period from 2004 through 2006 shows that while the value bias remained strong, these quant managers shifted to a distinctly smaller-cap bias. The obvious implication is that in markets dominated by large-cap growth companies, quantitative strategies focused primarily on value and small-cap factors would be expected to underperform. This is true for long-only structured equity products as well as for 1x0/x0 or market-neutral products built on quantitative models. And funds with additional leveraged positions would have greater absolute exposure to any inherent factor biases.

But while Figure 10 identifies the factor weightings of the large-cap core quant universe, it is important to remember that this is for the entire group of quantitative funds. The performance of individual managers should be evaluated carefully across various market cycles to identify manager-specific skill relative to potential factor loadings.

Figure 10. Quantitative funds tend to focus on value risk factors

Source: Authors’ calculations using data from Evestment and Eugene Fama and Kenneth French. Quantitative funds represent mutual funds and separate accounts benchmarked to a large-capitalization core benchmark. We excluded funds benchmarked to small-cap, mid-cap, growth, or value benchmarks, as well as quantitative long-short portfolios.
The difficulty of succeeding while short

Selling stocks short also comes with another set of concerns. For one, the process is not as simple as the process for purchasing stocks long. For example, to create short positions, a manager must work with a prime broker to borrow the stocks, to manage the margin requirements, and to actually sell the borrowed stocks as well as distribute any dividends. Because the manager must work with a prime broker, the manager is subject to the broker’s inventory of shortable stocks. As a result, the liquidity and breadth of stocks available to short may be limited relative to long investments. Also, the costs for shorting are higher because of the more complicated process. And, importantly, the costs involved in shorting may change substantially if a given security becomes more, or less, available to borrow.

Second, investors should be aware of the additional risks involved with a portfolio that includes short positions. For instance, while a traditional long investment is limited to a 100% loss, the short positions theoretically have unlimited loss potential. Obviously a well-diversified short portfolio would be less exposed to large losses from individual securities, but investors must be aware of the heightened risk control requirements for a short portfolio.

As Table 2 on page 17 demonstrates, stock returns are asymmetrically distributed above and below 0%. Intuitively, the results presented in this table suggest that it is much easier to lose money on short positions (by earning positive returns) than to lose money on long positions (with negative returns). For example, looking at the weekly frequency column, we see that there were 189 instances in which stocks lost more than 30% in one week. On the flip side there were 328 instances in which stocks gained more than 30% in one week. Similar results are observed across the time periods analyzed. Finally, it’s important to note that Table 2 uses the stocks in the S&P 500, typically considered a large-cap benchmark. Even within the large-cap space, there is significant volatility among securities. Of course, one would expect even greater volatility and dispersion of returns within a small-cap benchmark such as the S&P 600, Russell 2000, or MSCI 1750.

While the 1x0/x0 portfolio remains net 100% long and thus benefits from upward-trending markets, there is a dedicated short component to the portfolio that must be managed with care. For example, even the worst-ranked decile 10 securities may realize positive returns. They may simply return much less than the decile 1 securities. Finally, it should not be assumed that a process that is successful on the long side will be similarly successful on the short side. As a result of the unique risks involved in shorting, the managers of 1x0/x0 or market-neutral portfolios must include risk control as a major component of the portfolio management process.

12 A similar analysis using valuation multiples was performed by Peter Xu (2007).
13 By comparison, we performed a similar analysis using the first 500 names ranked alphabetically in the Russell 2000 (we used the first 500 names for a like comparison to the S&P 500). For these smaller stocks, there were 1,544 weekly observations where stocks gained more than 30% in a week, and 585 observations where stocks lost more than 30%. We see similar higher volatility in smaller stocks for daily returns: 329 observations of daily returns of less than –30% and 750 observations of daily returns of greater than 30%. (Fifteen of those 750 observations involved returns of greater than 100% in a single day.)
Table 2. Short-term stock returns are positively skewed

<table>
<thead>
<tr>
<th>Return Interval</th>
<th>Daily</th>
<th>Weekly</th>
<th>Bi-Weekly</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between –10% and –20%</td>
<td>3,259</td>
<td>6,020</td>
<td>12,135</td>
<td>4,852</td>
</tr>
<tr>
<td>Between –20% and –30%</td>
<td>281</td>
<td>689</td>
<td>1,842</td>
<td>1,057</td>
</tr>
<tr>
<td>Between –30% and –40%</td>
<td>63</td>
<td>138</td>
<td>373</td>
<td>299</td>
</tr>
<tr>
<td>Between –40% and –50%</td>
<td>18</td>
<td>42</td>
<td>109</td>
<td>96</td>
</tr>
<tr>
<td>Between –50% and –60%</td>
<td>4</td>
<td>7</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Between –60% and –70%</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Between –70% and –80%</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Between –80% and –90%</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Less than –90%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total negative observations</strong></td>
<td>645,551</td>
<td>129,771</td>
<td>124,826</td>
<td>27,382</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Return Interval</th>
<th>Daily</th>
<th>Weekly</th>
<th>Bi-Weekly</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 10% and 20%</td>
<td>5,175</td>
<td>8,503</td>
<td>17,037</td>
<td>7,371</td>
</tr>
<tr>
<td>Between 20% and 30%</td>
<td>367</td>
<td>1,053</td>
<td>2,857</td>
<td>1,778</td>
</tr>
<tr>
<td>Between 30% and 40%</td>
<td>53</td>
<td>225</td>
<td>691</td>
<td>531</td>
</tr>
<tr>
<td>Between 40% and 50%</td>
<td>16</td>
<td>68</td>
<td>254</td>
<td>196</td>
</tr>
<tr>
<td>Between 50% and 60%</td>
<td>4</td>
<td>17</td>
<td>86</td>
<td>104</td>
</tr>
<tr>
<td>Between 60% and 70%</td>
<td>2</td>
<td>12</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>Between 70% and 80%</td>
<td>2</td>
<td>2</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Between 80% and 90%</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Between 90% and 100%</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Greater than 100%</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total positive observations</strong></td>
<td>660,216</td>
<td>145,902</td>
<td>151,692</td>
<td>36,557</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations using data from Thomson Datastream.

Conclusion

The investing process has fundamentally changed over the last two decades, coinciding with the exponential growth in computing power and access to information. Using this computing power, investment managers are able to implement their processes across previously unattainable data. A natural outcome of this shift toward quantitative investing is a move to reduce or eliminate portfolio constraints involving leverage, short selling, and investment limits. While these new mandates are theoretically promising, investors must be aware of the risks, including risk factor exposure, the difficulty in achieving sustainable alpha, the risk of active management, and the unique characteristics of the short market.

In the end, if one believes in an active manager’s ability to apply skill efficiently and to realize excess returns net of costs, removing the long-only constraint makes sense. However, because there are many ways to relax the long-only constraint within a portfolio, the end product should match the desired combination of alpha and beta. For example, a market-neutral fund may be thought of as alpha plus cash, a portable alpha fund as alpha plus a range of betas, and a 130/30 fund as alpha plus a long active strategy.

Going forward, the success of a manager without the long-only constraint depends on the security selection process, the quality of information, and the costs of execution. Consistently succeeding across market cycles has been, and will continue to be, difficult; however, increasing the opportunity set for managers to apply information permits them to operate with the best chance of capitalizing on their information content.

References


For more information about Vanguard® funds, visit www.vanguard.com, or call 800-662-2739, to obtain a prospectus. Investment objectives, risks, charges, expenses, and other important information about a fund are contained in the prospectus; read and consider it carefully before investing.

Vanguard, Connect with Vanguard, and the ship logo are trademarks of The Vanguard Group, Inc. CFA® is a trademark owned by CFA Institute. All other marks are the exclusive property of their respective owners.