Integrated Equity Solutions

By Joseph Chi, CFA®, and Jed Fogdall

The application of financial theory to the practical world of investing began approximately 40 years ago. Theoretical and empirical work in finance in the past few decades has led to an evolution in our understanding of how financial markets work. For instance, 40 years ago, most financial economists and some market participants thought there was only one dimension of expected returns in equity markets—the market itself. That one-dimensional world was best explained by the capital asset pricing model (CAPM). Today, we recognize several dimensions of expected returns and believe multifactor asset pricing models do a better job of explaining the behavior of stock returns than single-factor models. Economists also have done much work related to financial intermediation and the institutions of exchange. This work is relevant to financial market participants because it has improved our understanding of the price formation and discovery process, and of how trading and transaction costs vary in different markets and under different market structures.

For investors, the existence of several dimensions of expected returns presents additional challenges to their asset allocation decisions. In the past, those decisions were relatively simple. Investors had to decide 1) how to split money between fixed income and equities and 2) whether to invest in index funds, traditional active funds, or individual securities to build portfolios. Today, investors still need to make those decisions. But they can make better decisions by taking into account, among other things, the additional dimensions of expected returns in the equity markets and how those dimensions interact with each other, as well as how much exposure to each of those dimensions they have or want. While a multifactor world presents better opportunities to tailor investment decisions that match investors’ risk preferences and hedging needs more accurately, this complex exercise requires a greater degree of expertise to evaluate and manage the tradeoffs between risks and costs, on one hand, and expected returns, on the other.

This article shows how we can apply the main findings from the theoretical and empirical research in finance to structure and implement investment solutions that target the dimensions of expected returns in a cost-efficient way in a multifactor world with frictional markets.

Asset Pricing Models: From a Single-Factor to a Multifactor World

About 50 years ago, financial economists began to identify commonality in the behavior of stocks. Building on the work of Harry Markowitz (1952a,b) on portfolio selection and the efficient diversification of investments, William Sharpe (1964) and others initially developed a single-period, single-factor model: the capital asset pricing model.¹ The CAPM postulates that an asset’s expected return is a linear function of its tendency to covary with the market portfolio, which is measured by beta. Beta represents an asset’s amount of market risk—that is, the risk that cannot be eliminated through diversification. This is the risk for which investors expect to receive compensation. In a CAPM framework, beta is all that is needed to explain differences in expected returns. High-beta assets are expected to have high average returns, while low-beta assets are expected to have low average returns, and the average return spreads between high- and low-beta assets can be fully explained by the spreads in their betas.

The CAPM is a single-period, single-factor model. In the early 1970s, Robert Merton (1973) built on the intuition of the CAPM to develop a more sophisticated model, the intertemporal capital asset pricing model (ICAPM). The ICAPM modifies the CAPM in two key aspects. First, it is a multiperiod model, which more accurately reflects the intertemporal nature of investing. Second, in addition to the market factor, the ICAPM recognizes that investors also care about how the investment/consumption opportunity set might change in the future. Because labor income or human capital is one of the factors investors should consider when evaluating the investment/consumption opportunity set, investors are likely to care about the covariance between asset returns and labor income. That gives rise to hedging demands against negative changes in the investment/consumption opportunity set, which in turn gives rise to additional factors, state variables, or sources of priced risk. Merton did not specify the additional factors beyond the market factor or how many there were. However, we know that these factors represent the commonality behind the variance in the performance of stocks with similar characteristics. Because it is often difficult to identify and measure those state variables directly, financial economists have used more indirect ways to link asset prices to changes in the investment/consumption opportunity set. One way of doing this is by creating factor-mimicking portfolios—zero-investment portfolios that...
have long exposure to stocks with certain characteristics (e.g., stocks with a low relative price) and short exposure to stocks with the opposite characteristics (e.g., stocks with a high relative price)—that contain the same pricing information as the true factors and act as proxies for those factors.

The empirical work that started in the 1970s confirmed the need for additional price factors to explain differences in average returns (e.g., Davis 2001; Cochrane 2005a). This work showed that, contrary to the predictions of the CAPM, differences in beta could not explain differences in average returns. In particular, small-cap stocks and stocks with a low relative price with respect to some measure of fundamental value—such as book value, earnings, or cash flow—tended to have higher average returns than indicated solely by market betas. Researchers found other patterns in the cross section of average returns also unrelated to beta, such as the tendency of short-term winners (losers) to continue to do better (worse) than indicated by their market betas for a few months after portfolio formation.

In an influential paper, Eugene Fama and Kenneth French (1992) synthesized much of the previous empirical work and showed that, controlling for market capitalization, there was no relation between beta and the cross section of average stock returns. They also found that, controlling for market capitalization, variation in relative price—measured, for instance, by the ratio of book-to-market equity—captured substantial variation in the cross section of average stock returns. Companies with a low relative price (i.e., a high relative book-to-market ratio) historically have had higher average returns than companies with a high relative price. Controlling for relative price, market capitalization also captured substantial variation in average returns. Small-capitalization companies historically have had higher average returns than large-capitalization companies.

**The research breakthrough in this case is not the discovery of expected profitability as a dimension of expected returns per se . . . it is the discovery of reasonable proxies for expected profitability, which allow us to use profitability as another dimension of expected returns in the creation of investment solutions.**

Those results led Fama and French to conclude that there were at least two additional dimensions of expected returns in equity markets: one related to market capitalization or company size and the other related to relative price, as measured, for instance, by the ratio of book-to-market equity. Thus, in the spirit of Merton’s ICAPM, Fama and French (1993) proposed a multifactor model to explain the average returns of stocks: the Fama/French three-factor model. According to that model, the expected return of an asset in excess of a risk-free rate is a function of that asset’s sensitivity to three common risk factors:

1. A market factor, as measured by the excess returns of a broad equity market portfolio over a risk-free rate (in the case of the United States, the 30-day U.S. Treasury bill usually is considered the risk-free asset).
2. A market capitalization (or size) factor, as measured by the return difference between a portfolio of small-capitalization stocks and a portfolio of large-capitalization stocks.
3. A relative price (or value) factor, as measured by the return difference between a portfolio of value stocks or stocks with high financial ratios (high book-to-market stocks, in our case) and a portfolio of growth stocks or stocks with low financial ratios (low book-to-market stocks).

More recent research (e.g., Fama and French 2006, 2008; Novy-Marx 2013; O’Reilly and Rizova 2013) shows that expected profitability—as measured by the direct profitability of book equity, for instance—is another reliable and robust dimension of expected returns. Controlling for the previously mentioned dimensions of returns, more-profitable firms have higher expected returns than less-profitable firms. The research breakthrough in this case is not the discovery of expected profitability as a dimension of expected returns per se, something that financial economists have suggested for some time and a finding that is well-established in different versions of theoretical stock valuation formulas; rather, it is the discovery of reasonable proxies for expected profitability, which allow us to use profitability as another dimension of expected returns in the creation of investment solutions.

In short, here are the main lessons of the theoretical and empirical research conducted over the past few decades:

- There are multiple dimensions of expected returns, and, therefore, multifactor asset pricing models are needed to explain differences in the cross-section of average returns.
- Four factors—the market, size, relative price, and expected profitability—capture much of the common variation in average stock returns in a way that is consistent with multifactor asset pricing models.
For any given portfolio, the higher the exposure to those factors or dimensions, the higher the expected returns, all other things being equal. Thus, portfolios can be structured and managed to obtain the desired exposure to those dimensions (and capture the expected premiums associated with them), resulting in either a portfolio with a higher expected return than the market or a portfolio that satisfies some specific hedging needs.

Before thinking about how to create optimal and cost-efficient investment solutions, however, we need a better understanding of the characteristics and behavior of those factors, how they interact with one another, and how best to gain or avoid exposure to them. First, we need to determine the conditions under which markets incorporate information about fundamental values and expectations into prices, and the implications for investors when that happens.

Expected Returns

The expected performance of any stock is driven mainly by its exposure to the factors that determine expected returns. Each individual stock, however, has an idiosyncratic component of performance that is associated only with that stock. This component is commonly called abnormal return and is not shared by companies with similar characteristics. The expected return or premium associated with this idiosyncratic component is zero. This raises two important and related questions. First, why do market prices reflect available information about fundamental values in a manner such that factor exposure is the main driver of expected returns? And, second, is it possible to determine a priori when the premiums associated with those factors are expected to be high or low? In other words, are those factors predictable?

Financial markets are characterized by competition. There is competition among firms for investors’ capital, and between buyers and sellers of securities to execute at the most attractive prices. In competitive markets with many independent buyers and sellers, it is extremely difficult for one trader to significantly influence prices, especially if those markets are also very liquid. Given their preferences and needs, buyers think purchased securities will add to their portfolios by more than what they paid for them. Similarly, given their preferences and needs, sellers have the opposite view—the money received is worth more to them than the securities sold. Buyers and sellers meet their opposite expectations at the traded price, which they both see as fair, without anyone being forced to trade. This competition between opposite views in liquid markets is what makes prices reflect the expectations of market participants and drives them toward equilibrium.

In liquid and competitive markets, the price system acts as a mechanism to aggregate and disseminate dispersed bits of information. As F. A. Hayek (1945) pointed out, there are two types of knowledge or information: 1) general knowledge widely available to all market participants and 2) specific knowledge of the particular circumstances of time and place, including the preferences and needs of each investor, which vary by investor. The price system aggregates both types of information, including the knowledge about the specific circumstances of all market participants, into one general statistic—the price—so that investors have the knowledge necessary to make decisions for themselves. Because both types of knowledge can move prices, market participants compete with one another to be the first to bring information not yet reflected in prices to the market and profit from it, but no participant has the full set of information because each participant has some specific knowledge not generally available to others. That competition and interaction among market participants makes market prices reflect information about fundamental values and expectations, with no single participant able to interact with the market in isolation, up to the point at which the marginal benefit of acting on information that is not reflected in prices (that is, the profits to be made) is at best equal to the marginal cost of gathering that information and acting on it.

Market frictions, such as trading and borrowing costs, and taxes may delay the convergence of market prices to their fundamental values or, in extreme cases, prevent prices from converging to a utopian fair price, particularly in less-competitive markets. However, in most public equity markets, competition is vigorous enough to drive price movements quickly, and thus most investors always should act as if prices reflect information about fundamental values at all times and invest based on longer-term expectations (e.g., Chordia et al. 2005). Crucially, because the market price of a security reflects its expected return, having a good investment experience does not depend on attempting to participate in the price discovery process.

The competitive nature of markets and the existence of widely dispersed information also make it unlikely, if not impossible, that any investor consistently can be the first to incorporate information and expectations not yet reflected in prices and thus obtain abnormal profits on a regular basis. If any investor had a persistent informational advantage, the existence of abnormal returns or economic profits associated with that advantage would drive additional investors into the information-gathering business. Because barriers to entry in financial markets are relatively low, market participants would continue to enter that business until those abnormal returns disappeared. Second, the existence of widely dispersed information makes persistence unlikely because it is impossible to know in advance which bits of information are going to be relevant for the formation of prices or for making prices converge to their fundamental value.
A third reason that a persistent informational advantage is unlikely, if not impossible, has to do with trading. To be useful, informational advantages have to be large enough to overcome trading costs and other market frictions. Thus, the greater the frictions, the greater the informational advantage required to generate abnormal returns. If the same investors could persistently identify deviations of market prices from their “true” value, eventually the true value forecasted by those investors would become the market value. By trading, those investors would reveal their informational advantages to other market participants, and market prices would start to incorporate that information. The more trading they do, the more information they reveal and the closer market prices get to their true fundamental value. What’s more, if market participants perceive that their counterparties have informational advantages, liquidity is likely to dry up, bid/ask spreads probably will widen, or the depth of the book probably will become thinner to hedge the possibility that some of those counterparties may have information, further increasing the costs of acting on information.

In regard to the second question, whether factor performance is predictable, the theoretical and empirical research indicates that state variables should forecast returns and that expected returns vary over time (e.g., Cochrane 2005b, 2011). Investors demand a higher expected return to hold risky assets; this expected return should be higher during times of greater uncertainty. But that variation in expected returns and the predictability associated with it occur over very long horizons, such as business cycles, whose turning points and lengths are unpredictable. Furthermore, the predictability derived from standard regression analysis is so weak and the noise-to-signal ratio is so high that, for all practical purposes, it is of no use. Over shorter horizons such as daily, monthly, yearly, and multi-year periods, stock and factor returns are essentially unpredictable. For that reason, the best approach is to assume that, a priori, premiums have the same expected return every day and that abnormal returns are close to zero (i.e., that factor performance is unforecastable). From a practical perspective, this approach implies that no day is better than any other day to target those market premiums, and therefore, market premiums should be targeted on a daily basis.

Below we consider the sources and magnitudes of those premiums to better understand why targeting those premiums on a daily basis is the optimal approach.

Sources of Investable Premiums
By no means do market participants demand the same rate of return for all securities when setting prices. Securities with different characteristics will have different expected returns, so it is important to identify those dimensions of higher expected returns that may offer investable portfolios excess returns relative to the market as a whole.

Theoretical and empirical research conducted over decades has identified four dimensions of expected returns in equity markets: the overall market, market capitalization or size (small/large), relative price (value/growth), and profitability (high/low).

The market dimension reflects the premium demanded by market participants for investing in a broadly diversified portfolio of equity securities without any style bias. A common way to assess the level of the expected premiums is to look at historical data and compute how those premiums have performed in the past (see table 1). From 1927 to 2011—a period that includes up and down markets, economic expansions and recessions, wars, and extraordinary technological and medical breakthroughs, among other developments—the U.S. equity premium had an annual average of 7.94 percent and was reliably different from zero, as indicated by a t-statistic of 3.51. Because the premium is reliably different from zero, we can say with a high level of confidence that the positive equity premium was not a random event.

The size dimension reflects the excess premium demanded by market participants for investing in small-capitalization stocks relative to large-capitalization stocks. From 1927 to 2011, the U.S. small-cap premium had an annual average of 3.66 percent and was reliably different from zero, as indicated by a t-statistic of 2.37.

The relative price dimension generally is used to differentiate value from growth securities. The premium associated with this dimension reflects the excess expected performance investors demand from securities with a low relative price (value stocks) in excess of the return demanded from securities with a high relative price (growth stocks). From 1927 to 2011, the U.S. relative price premium had an annual average of 4.73 percent and was reliably different

### TABLE 1: HISTORICAL U.S. PREMIUMS, 1927–2011

<table>
<thead>
<tr>
<th>Premium Type</th>
<th>Annual</th>
<th>Daily</th>
</tr>
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<tbody>
<tr>
<td>Equity Premium (1927–2011)</td>
<td>7.94</td>
<td>0.032</td>
</tr>
<tr>
<td>Size Premium (1927–2011)</td>
<td>3.66</td>
<td>0.015</td>
</tr>
<tr>
<td>Value Premium (1927–2011)</td>
<td>4.73</td>
<td>0.019</td>
</tr>
<tr>
<td>Profitability Premium (1975–2011)</td>
<td>4.68</td>
<td>0.018</td>
</tr>
</tbody>
</table>

Daily premiums are calculated by dividing the annual premiums by 250, the approximate number of trading days in one year. Past performance is no guarantee of future results. Asset class and profitability filters were applied to data retroactively and with the benefit of hindsight. Returns are not representative of indexes or actual portfolios and do not reflect costs and fees associated with an actual investment.

Source: Profitability premium data provided by Dimensional. All other premium data provided by Fama and French, available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
from zero, as indicated by a t-statistic of 3.13.

All the aforementioned dimensions use price, but the market forms the price to achieve a desired expected return. To transform price to expected return, it is necessary to take into account the expected cash flows to investors. The profitability dimension provides a way to discern expected returns of companies with similar price-driven characteristics; if two companies trade at the same relative price, the one with higher profitability will have a higher expected return, all other things being equal. From 1975 to 2011, the annualized U.S. profitability premium was 4.68 percent on average and was reliably different from zero, as indicated by a t-statistic of 2.74. (Data availability precludes extending the analysis beyond 1975.)

Research has shown that the premiums associated with each dimension are more or less driven by stock migration—that is, stocks moving across size, relative price, and profitability portfolios from one period to the next. In the case of the size premium, for instance, it is primarily driven by the extreme positive performance of a random subset of small-cap stocks that unpredictably moves to the mid- or large-cap space from one period to the next. The relative price premium, on the other hand, is mainly driven by three factors: 1) the extreme positive returns of a random subset of stocks with low relative prices that migrate to neutral or growth portfolios; 2) the poor performance of a random subset of stocks with high relative prices that migrate to neutral or value portfolios; and 3) stocks with low relative prices that remain in the same category that historically have had higher average returns than stocks with high relative prices that remain in the same category from one period to the next (Fama and French 2007).

The analysis of the drivers of the premiums performed by Fama and French (2007) has important implications for investors because it highlights the importance of diversification in the creation of reliable investment solutions. Let’s assume, for instance, that we have two portfolios with the same factor exposure and, therefore, the same expected return. One portfolio is broadly diversified across the universe of eligible stocks, while the other is heavily concentrated on a few of those stocks. As Fama and French (2007), among others, have shown, not all securities contribute equally to the premiums. Some securities do extremely well, while others have average returns or perform poorly. Research also has shown that it is not possible to reliably predict which of these securities that share common factor exposure are going to do well, because in many cases news about why they will do well has not arrived yet (e.g., a new discovery or a new need by some other company), so it is not yet in the price. For that reason, the most reliable way to capture the premiums is to have a diversified strategy with full exposure to the segments of the market expected to provide those premiums. Concentrated portfolios may inadvertently exclude from their holdings the companies that ultimately generate most of those premiums, whereas broadly diversified portfolios have a better opportunity to include those securities and capture those expected premiums.

Just as it is almost impossible to reliably predict which securities will make the largest contributions to the factor returns, it is also difficult to reliably determine when the premiums will be realized. Under these conditions, it is useful to expect the premiums to be earned every day. Thus, to increase the reliability of outcomes and the likelihood of capturing different market premiums on a daily basis, strategies should be exposed continuously to those premiums, instead of being rebalanced at arbitrarily defined frequencies or dates.

What is the best way, then, to design and implement investment strategies that aim to capture those premiums over any period?

Continuous Capturing Market Premiums

Successful investing requires expertise in identifying and managing tradeoffs between risk and costs, on the one hand, and sources of expected returns, on the other. It also requires expertise in managing competing premiums because stocks often are exposed to more than one dimension of expected returns. Pursuing one premium without taking into account how that pursuit will impact a stock’s exposure to the other factors can result in a stock having a net negative impact on a portfolio, even if that stock has captured a premium along one dimension of expected return. It is difficult, yet essential, to properly account for the interaction among the different dimensions and the costs associated with implementing investment solutions along several dimensions. Managers who can perform this exercise well and consistently likely will add value to their portfolios.

To maximize the chance of earning those premiums, portfolio managers need to constantly monitor strategies to ensure they have the right exposure on a daily basis and that trading costs, which are a function of turnover and cost per trade, are low. The expected contribution of any stock to a strategy’s return will be equal to its daily return, which will be a function of its exposure to the different premiums multiplied by the number of days that stock remains in the strategy, minus the costs of buying and selling the stock.

Expected Contributed Performance = Sum of Daily Premiums × Number of Days in Portfolio – Cost of Buying & Selling

Before deciding whether a premium is worth pursuing, the following three questions should be answered for every stock we consider: 1) What is the expected return on a daily basis? 2) How long do we expect the stock to remain in the portfolio? 3) What is the
expected cost we will need to incur to get that return?

As indicated above, a priori market premiums should have the same expected magnitude every day, so the expected annual premium for each of the factors can be assumed to be the composite of equal daily premiums. Using the historical annual data shown in table 1 and assuming 250 trading days per year, the U.S. historical daily premiums are 3.1 basis points for the equity premium, 1.5 basis points for the size premium, 1.9 basis points for the value premium, and 1.8 basis points for the profitability premium.

Because the magnitude of the daily premiums is small, it is important to understand how the premiums associated with each factor are achieved. A low-turnover factor whose premium is produced by a large and stable set of stocks is going to be much more attractive than a high-turnover factor whose premium is produced by stocks constantly coming in and out of the factor for short periods of time, even if the high-turnover factor has a higher expected premium.

To illustrate that point, let’s compare, for instance, the relative price and momentum factors. Historically, the expected relative price premium is about 5 percent per year and has comparatively low turnover. The expected momentum premium, on the other hand, is about 10 percent per year, but it has very high turnover. Although on paper the momentum factor may appear to be the more attractive of the two because it has the higher expected return, this is not the case once we understand how the premiums associated with each factor are achieved and take trading costs into account. Our typical relative price strategy has an annual turnover of around 25 percent. So, on average, a value stock will remain in the strategy for about four years. If the relative price premium is 5 percent per year, that stock’s expected gross return will be approximately 20 percent, assuming the stock is fully exposed to the relative price premium for the whole period. Because the security is expected to be in the strategy for a long period, implementation can be done with enough patience and flexibility to avoid paying for liquidity in the market, something that, as we will see below, can be expensive. The break-even trading cost when buying and selling that will make the strategy unprofitable is high, around 10 percent, taking into account a round-trip trade. In contrast, a long-only momentum strategy may have an annual turnover of around 300 percent. So, on average, a stock will remain in upward momentum for about four months. If the momentum premium is 10 percent per year, that stock’s expected return will be approximately 3.3 percent, assuming that the stock is fully exposed to the momentum premium for the whole period.

For the momentum strategy, the break-even trading cost for each stock is much lower, around 1.7 percent, because of the high turnover. If the high turnover increases the need to demand liquidity when trading, that break-even number will be even lower.

The preceding hypothetical example shows the difference between investable premiums and noninvestable premiums that are fragile or not robust after taking into account trading costs. A good portfolio design will recognize the difference and invest in those factors whose securities have a high daily expected premium and are expected to make a large contribution to performance after taking costs into account. Targeting investable premiums makes implementation more efficient because it allows us to treat securities with similar characteristics as close substitutes for one another, at least over short time frames, which in turn increases our ability to capture the premiums in a cost-effective manner. Good portfolio design will recognize that noninvestable premiums must be taken into account when managing and implementing strategies to screen out stocks that may have detrimental effects on the performance of the portfolio.

Implementation and Trading

Once we decide which premiums are worth pursuing, we can focus on implementation and trading. In the absence of market frictions, the best way to capture those premiums over time is to ensure that portfolios constantly hold only those stocks that have the desired exposure to the factors associated with those premiums. Because stock prices continuously move, stocks’ exposures to the factors also move (stocks migrate). So to continuously maintain the desired exposure to the targeted factors, we need to sell stocks that no longer have the desired exposure and expected return and purchase stocks that have the desired exposure and expected return. That turnover increases our ability to capture the expected return differential between those stocks.

But, because markets are not frictionless, it is important to balance the benefits of achieving the desired exposure to the factors that determine expected returns against the expected costs of achieving that exposure; otherwise, trading costs could more than offset the expected return differential. So, for instance, small differences in expected returns due to stocks moving along the dimensions of expected return should not drive a trade if the expected return pickup is small compared to the costs of implementing the trade. It is important to be confident that, when selling a security, it has moved well outside the dimension of expected returns targeted and that, when buying a security, it has moved well inside that dimension. By having a hold range that has high enough expected returns for us not to sell a security, but not so high that we continue to buy securities in that region, we balance the need for consistent factor exposure against the concern that high turnover generates costs that detract from actual returns.
The economics of transaction costs—in particular, the relationship between trading costs and immediacy of execution (Demsetz 1968; Wahal 2010)—and more than 30 years of experience trading stocks that are difficult to trade have informed our approach to implementation and trading. As stated above, trading costs are equal to turnover times the cost per trade. We have discussed some ways to minimize turnover and make all turnover meaningful. In regard to the cost per trade, that will be a function of the desire to complete an order and the need for immediacy in trading. Seeking liquidity moves prices and increases trading costs. The higher the immediacy and quantity needed to execute, the higher the price paid. At the very least, a liquidity seeker will pay the bid-ask spread (see table 2 for bid-ask spreads in different markets and different market capitalization segments for notional amounts of shares). More often, however, demanding liquidity will impose higher trading costs because traders will move prices in addition to incurring the costs of that spread.

If immediacy is expensive, why do people trade with immediacy? First, some investors may have personal views about future prices and will seek immediacy in their trades. As long as the price paid is lower than their assessment of the future price, those investors will not mind demanding liquidity and paying a premium for it, even if those trading costs are greater than many days’ worth of expected returns.

Second, other investors, such as index investors, will demand immediacy in their trades to satisfy low tracking error constraints. Indexes usually control turnover by rebalancing infrequently, sometimes only once per year, but that turnover all happens in one day or over a handful of days, instead of being spread out over the whole year.

And that makes their trading expensive because it unnecessarily imposes huge liquidity demands over a limited number of rebalancing days. Index investors control turnover but not the cost of each trade, which can make their trading costs very high.

Another problem for index investors is that low or zero tracking error does not guarantee they will have the desired or correct exposure at all times (see table 3). Indexes that, in theory, represent the same asset class have meaningful tracking error with respect to one another. So none of those indexes has the perfect exposure, partly because of infrequent rebalancing and the migration of stocks. Indexes may hold securities that used to have the desired exposure instead of securities that currently have that exposure, which introduces unnecessary uncertainty into an investor’s asset allocation as the investor tries to capture the premiums.

To avoid immediacy in trades and keep trading costs low, good portfolio design creates flexibility and patience in the portfolio implementation process through broad portfolio diversification, a desire and ability to spread turnover over time, and a focus on aggregate portfolio characteristics. We can design portfolios with built-in flexibility if we are willing to accept some tracking error with respect to a target portfolio, which does not imply a negative effect on expected returns, and focus on the overall characteristics of a portfolio, not on having a specific number of securities from a precise set of issuers. The immediate consequences of that flexibility are twofold: First, over short periods, we can look at securities with similar characteristics and exposures as close substitutes for one another. Therefore, we can be somewhat indifferent over the short term with respect to the individual stocks that we trade on any day, as long as those stocks fit the overall strategy and are expected to contribute to the investment goals of a portfolio, and the portfolio maintains the diversification

<table>
<thead>
<tr>
<th>TABLE 2: SEIZING OPPORTUNITIES TO ADD VALUE</th>
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<tbody>
<tr>
<td><strong>Market-Cap Range (USD millions)</strong></td>
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<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td><strong>UNITED STATES</strong></td>
</tr>
<tr>
<td>&gt; 5,000</td>
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<tr>
<td>1,500–5,000</td>
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<td>200–500</td>
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<tr>
<td>50–200</td>
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<tr>
<td><strong>INTERNATIONAL (23 markets)</strong></td>
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<tr>
<td>&gt; 5,000</td>
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<td>1,500–5,000</td>
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<td><strong>EMERGING MARKETS (20 markets)</strong></td>
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<td>200–500</td>
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<td>50–200</td>
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U.S. data from January 26, 2011. Data provided by Instinet. © 2013, Instinet Incorporated and its subsidiaries. All rights reserved. International and emerging markets data from January 1, 2011, to January 15, 2011. Data provided by Bloomberg. Developed international markets are Dimensional’s eligible universe (Canada, Europe, Japan, Asia Pacific, United Kingdom). The bid/ask spread generally is regarded as an indication of the cost of liquidity.
returns, such as value, small cap, and/or high direct profitability securities, while underweighting lower expected returns securities to achieve an expected excess return relative to the market. Figure 1 shows this integrated solution, which should reduce turnover because there is no need to fully sell securities that migrate from asset class to asset class. Turnover also is reduced by the ability to use dividends or other cash flows from one asset class to rebalance the overall portfolio or fill needs in other asset classes, even ones that did not produce the cash flows. This integrated solution also facilitates better risk controls at the overall asset allocation level, because it controls the overall asset allocation, and

Investment Solutions

Some investors may decide to satisfy their investment needs by allocating assets to different asset classes using a building-block approach. The process of identifying reliable and investable dimensions of expected returns and finding the most efficient way of capturing those premiums can be applied at the asset class level. Because the expected return of a portfolio before costs is the weighted average of the expected returns of the securities in the portfolio—expected returns that are driven by the factor exposures of each security—many different sets of holdings can achieve similar levels of expected returns. A concentrated portfolio can have a pre-cost expected return like that of a diversified portfolio in the same asset class, but the reliability of the outcomes can be very different. Moreover, if the diversified portfolio is managed for consistent exposure to the desired premiums, instead of being artificially rebalanced at predetermined frequencies to arbitrary security weights, expected transaction costs and turnover should be lower, which implies that post-cost expected returns should be higher.

Other investors may prefer to integrate all the different asset class exposures in one portfolio and eliminate the artificial barriers among the different components of a portfolio to create a more fluid structure, which can increase net expected returns in markets with frictions. This portfolio can overweight securities with higher expected returns, such as value, small cap, and/or high direct profitability securities, while underweighting lower expected returns securities to achieve an expected excess return relative to the market. Figure 1 shows this integrated solution, which should reduce turnover because there is no need to fully sell securities that migrate from asset class to asset class. Turnover also is reduced by the ability to use dividends or other cash flows from one asset class to rebalance the overall portfolio or fill needs in other asset classes, even ones that did not produce the cash flows. This integrated solution also facilitates better risk controls at the overall asset allocation level, because it controls the overall asset allocation, and

**TABLE 3: TRACKING ERROR AND CORRELATIONS AMONG INDEXES**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Russell 2000 Value</td>
<td>0.98</td>
<td>0.97</td>
<td>0.98</td>
<td>0.97</td>
<td>0.97</td>
<td>0.98</td>
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<tr>
<td>Dow Jones US Small Cap</td>
<td>3.50</td>
<td>0.99</td>
<td>0.97</td>
<td>0.99</td>
<td>0.99</td>
<td>0.99</td>
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<tr>
<td>Value</td>
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<tr>
<td>S&amp;P Small Cap Value</td>
<td>4.91</td>
<td>3.24</td>
<td>0.96</td>
<td>0.98</td>
<td>0.98</td>
<td>0.98</td>
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<tr>
<td>Value</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S&amp;P/Citigroup Small</td>
<td>4.20</td>
<td>4.90</td>
<td>5.65</td>
<td>0.95</td>
<td>0.97</td>
<td>0.97</td>
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<tr>
<td>Cap 600 Value</td>
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</tr>
<tr>
<td>MSCI US Small Cap</td>
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<td>2.72</td>
<td>3.65</td>
<td>6.30</td>
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<td>0.98</td>
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<tr>
<td>Value</td>
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<tr>
<td>MSCI USA Small Value</td>
<td>4.00</td>
<td>2.56</td>
<td>3.83</td>
<td>4.80</td>
<td>3.92</td>
<td></td>
</tr>
</tbody>
</table>

Russell 2000 Value Index, Dow Jones US Small Cap Value Index, S&P United States Small Cap Value Index (gross dividends), S&P/Citigroup 600 Value Index, MSCI US Small Cap Value Index (gross dividends), and MSCI USA Small Value Index (gross dividends). Russell data copyright © Russell Investment Group 1995–2013, all rights reserved. Dow Jones data provided by Dow Jones Indexes. The S&P data are provided by Standard & Poor’s Index Services Group. MSCI data copyright MSCI 2013, all rights reserved. It is not possible to invest directly in an index.

**FIGURE 1: AN INTEGRATED SOLUTION**

Provides marketwide exposure with greater emphasis on risk premiums

Provides sharp exposure to limited segments of the market

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considers and oversees all the over- and underweights using an integrated methodology. For example, in a globally integrated solution, overweights of a sector in a given region can be taken into account when deciding sector allocations in other regions, something more relevant in recent years given the higher integration of some sectors across markets.

Conclusion

Research has shown that several dimensions of expected returns are related to the market, size, relative price, and expected profitability. Research also has shown that actual returns related to these expected premiums are largely unpredictable, both in terms of when any dimension might outperform and which individual stocks will drive the performance.

For those reasons, the best way to invest is to structure portfolios along the different dimensions of expected returns and target those dimensions continuously. This approach maximizes the likelihood of capturing the expected premiums associated with each dimension.

That requires expertise in managing competing premiums, because stocks often are exposed to more than one dimension of expected returns. It also requires expertise in managing trading costs and other market frictions.

Integrated equity solutions that combine continuous exposure to the dimensions of expected returns with a portfolio design that facilitates patient trading and low turnover maximize an investor’s chance of capturing the higher expected returns predicted by financial theory.

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Endnotes

1 Financial economists John Lintner, Jan Mossin, and Jack Treynor developed different versions of the CAPM at around the same time.

2 The sample mean of a random variable is more likely to be close to the true mean of that variable the larger the sample size used to estimate that average. For that reason, to assess premiums and their reliability, it is important to use as large a sample as possible. To determine the reliability of an estimated value, we use statistical analysis. A t-statistic tests whether the estimated value of a random variable with unknown variance is reliably different from zero in a statistical sense. It is calculated by dividing the estimated mean by its standard error, which is computed by dividing the standard deviation of a random variable by the square root of the sample size.

3 With a 10-percent annual momentum premium, the expected momentum premium over four months is equal to 3.3 percent.

References


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