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Multifactor Investing

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People who attend my lectures on Fama and French's multifactor model often request copies of my slides. Rather than distribute just the slides, it seems sensible to include text explaining the ideas. That way, conference participants won't have to reconstruct the argument from memory and a pile of graphs.

The Model's Key Benefit

For most financial advisors, the three-factor model is not a useful selling tool. Few sales calls afford time for a lesson in multiple regressions (understatement, right?). The real advantage of the model is that it gives the advisor himself a framework for his investment strategy. It identifies the sources of risk that compensate investors with premium returns. This clarifies decisions. Portfolios are based on research and rational expectations rather than hunches. The model also promotes a belief system. In a world where—let's face it—most investors are guessing which managers or asset classes will have excess returns, a strong opinion backed by the best technology is a competitive advantage. Questions and problems are answered using a consistent philosophy. This increases self-confidence as well as client confidence. Clients grow to rely on your opinion.

The model can enhance your business profoundly. It has had a revolutionary effect on Dimensional Fund Advisors at a key time in the history of the investment industry. Often, when industries grow, division of labor causes firms to specialize more and more. For example, a single company used to make an entire car. Now, a single company might make only the car's radiator hose. The investment business has been following an opposite pattern. As the industry grows, plan sponsors are reducing the number of managers they hire (Smith 1996). Managers who offer multiple asset classes are replacing managers who specialize in a single asset class. This means the sponsor has fewer manager relationships, so he wants these relationships to be productive. Today, a manager is hired for the quality of his advice as well as the quality of his investment line. A clear, consistent overall strategy is crucial.

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* Dimensional Fund Advisors Inc. The comments of Samuel Adams, David Booth, David Butler, Truman Clark, Robert Cornell, Robert Dintzner, Eugene Fama, Ken French, Rex Sinquefield, Christopher Sullivan, Weston Wellington, and Daniel Wheeler are gratefully acknowledged.

How the Model Helps

Dimensional started as a boutique manager of small capitalization (“small cap”) stocks. The niche was specific and unique. The firm believes markets are efficient, and its small cap vehicle was the only passive investment of its kind. It was also one of the only strategies backed by the latest academic research. Throughout the eighties, as managers of multiple asset classes began to dominate the industry, Dimensional’s academic directors set to work creating new investment strategies. The firm introduced fixed income, international, and other asset class portfolios, all backed by research and all consistent with a belief in rational pricing and market efficiency.

In 1990, Fama and French began their groundbreaking work on the dimensions of stock returns (Fama and French 1992), which led to Dimensional’s value strategies and the three-factor model as a consulting tool. The model provided guidelines for assembling the various portfolios. It also enhanced the firm’s ability to consult with clients. Dimensional enjoyed unprecedented asset growth. Simultaneously, the firm developed its Financial Advisor Services, which further enhanced its ability to discuss multiple asset class portfolios.

In a sense, managers like Dimensional have evolved to resemble financial advisors. Advisors form portfolios of multiple asset classes based on client risk parameters. Their job requires them to form strategy and evaluate performance.

Advisors can experience the growth Dimensional experienced using the Fama/French model. Just as it did for Dimensional, the model can give advisors the latest investment technology and help them form a consistent and clear philosophy. It can help make an advisor indispensable to his or her clients.

Asset Pricing Models

Single-Factor Market Model

In 1990, Fama and French sought to determine which economic traits describe the variation in stock returns. What sources of risk does the market systematically reward with higher returns? Prior to the Fama/French research, academics and investors typically believed a single-factor model did the best job (Sharpe 1964; Lintner 1965). The idea, for which William Sharpe won the Nobel prize in 1990, has intuitive appeal. It suggests that investors are rewarded for the amount of risk they take relative to their greater opportunity set, that is, all the other things they could have invested in. In the realm of US equities, this means the entire stock market. So the expected return for a subset of the market (in other words, any US stock portfolio) is proportionate to the subset’s market risk.

Let's illustrate this with an example. Suppose you hold a portfolio of small cap stocks. In the past, when market returns were "up" by 1.00, let's say on average your small stock portfolio returns were up by 1.20. When market returns were down by 1.00, let's say on average your small stock portfolio returns were down by 1.20. In other words, when the market moved, the average movement of your returns was 20% more. This portfolio would be said to have a "beta" on the market of 1.20. The single-factor model's estimate for your expected return would be 120% of the market's expected return, which was usually assumed to be the market's historical average return. If a manager over- or underperformed this estimate, the "excess return" achieved would be deemed "alpha." Alpha is any return that isn't due to common variation with the factor(s). It is therefore the amount by which a portfolio outperformed an index of its exact risk exposure. Because it measures the return that couldn't have been "indexed," alpha is often used to measure a manager's skill, or value added. Active managers are paid lots of money to achieve alpha.

The single-factor model is grounded in an elegant theory. The rationale is sensible. It's a great model in every respect except for the fact that it doesn't work. It did a decent job when the world of investments was mostly managed versions of the market, but the further portfolios got from the market, the less the model explained their returns. The small stock portfolio mentioned above is a good example. Around 1984, small stocks had a historical beta of about 1.20, as in the example. The market had average annual returns of 13.6% in the following period, 1984-1990. Our expectation based on the single-factor model would be for small cap stocks to return about 16.3% (=13.6% x 1.20) over this period. But, in fact, small cap stocks returned only 6.2% per year on average. A crude estimate of alpha for the small stock portfolio is the return experienced minus the return expected, or 6.2%–16.3% = -10.1%. Since alpha is used to evaluate a manager's skill, even index managers of small cap stocks seemed unskilled, earning huge negative alphas (-10.1% per year) over this period. Yet this result wasn't due to inadequate management (after all, an index portfolio isn't "managed" in the classic sense). It was due to an inadequate model.

Three-Factor Model

Fama and French were the latest in a series of academics who attempted to find a model to replace the CAPM. They tried many variables in their search for the traits that bring higher returns. Price/earnings, leverage, cash flow, book/market, and size were among these variables. They concluded that three factors together—the classic market beta, firm size (market capitalization), and book-to-market (BtM)—do the best job explaining returns. Alphas go to zero for indexed portfolios using these factors. In academia, this is taken as evidence that the factors are "risk factors," sources of risk the market seems to reward over the long run. The stock market is riskier than Treasury bills, therefore the market has an expected premium over Treasury bills. Small cap stocks are riskier than large cap stocks, so they have an expected premium (Banz 1981). High book-to-market stocks are riskier than low book-to-market stocks, so they have an expected premium.

Most people readily agree that the stock market is riskier than Treasury bills and that small stocks are riskier than large stocks. The notion that high book-to-market stocks are riskier and have greater returns than low book-to-market stocks is tougher to accept. What's so special about book-to-market? It's just a fundamental measure. On the surface, there's no economic reason book-to-market should relate to differences in returns.

The short answer is that there is nothing special about book-to-market. It does not describe risk. However, sorting stocks by BtM also seems to sort them by their true underlying source of risk—the level of their distress. The key to book/market lies in the denominator, market price. High book/market stocks are lower-priced stocks. It doesn't matter so much what accounting measure we use to "scale" these lower prices. Fama and French use book value. Earnings over price works too. Another way to think of it is that high book/market ratios suggest that the market (denominator) values a stock less than the stock's accountants (numerator), when compared to lower book/market stocks. This is usually because the stock has greater uncertainty of earnings, which makes it riskier. Riskier means higher returns. The connection between BtM and returns begins to make sense when we focus on the denominator, the market price.

How to Beat the Market

In addition to pinpointing the sources of stock returns, Fama and French found another interesting result: adding size and BtM factors to a single-factor model causes the market betas of stock portfolios to converge on 1.00. All stock portfolios have about the same beta. You will not outperform another stock portfolio by taking more market risk. Differences between portfolios are largely due to different exposures to size and BtM factors. When beta itself differs, it's usually because a non-stock component of the portfolio, such as fixed income or cash, causes interest rate sensitivity. If you have a higher beta than the market it usually means you are less interest rate sensitive, and if you have a lower beta it usually means you are more interest rate sensitive. If you are all equity, you get the full shot of market risk and return. This means the only way to beat or underperform the next guy, and the market itself, is to take more or less size and/or BtM risk. If your goal, for instance, is a greater expected return than the market, the only systematic way to achieve it is by overweighting small cap stocks, high BtM stocks, or both, relative to their market proportions.

The Cost of Capital Is Paid to the Investor

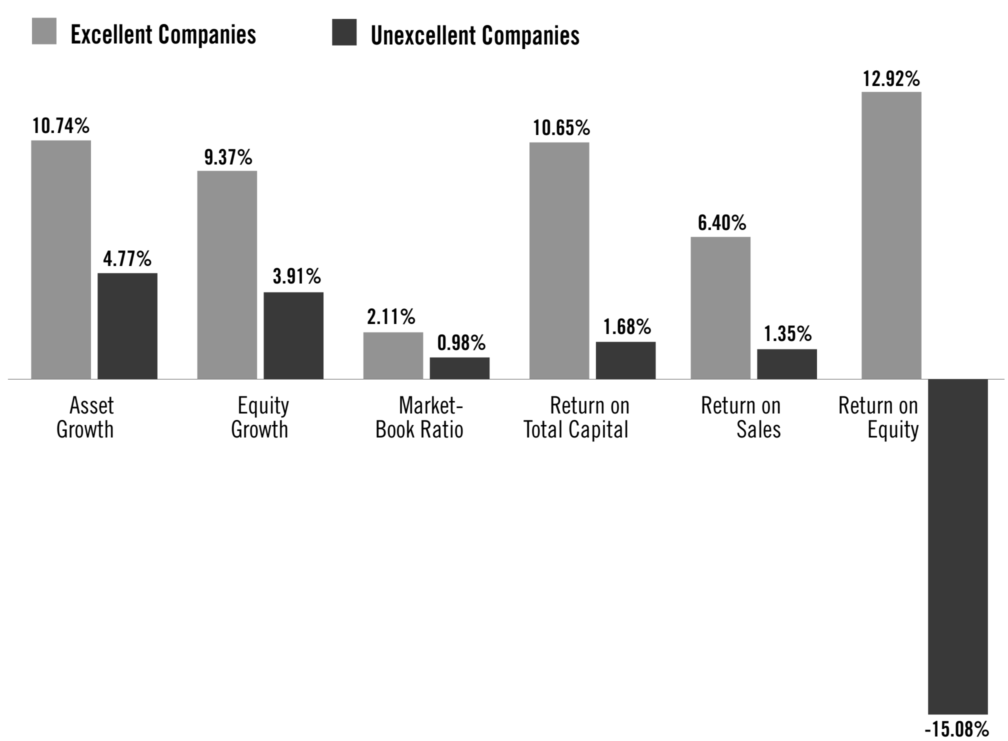
In Search of Unexcellence

In 1987, Michelle Clayman published a study that illuminates the value story. She based the study on a book by Tom Peters and Bob Waterman called *In Search of Excellence* (1982). Peters and Waterman's book was a *New York Times* bestseller, not a financial economics text. It was a sort of entrepreneur's bible, describing the successes of twenty-nine companies so armchair moguls across the country could take a lesson on what makes a company "excellent." The primary criterion for inclusion was profitability, but Peters and Waterman also included companies for warm-and-fuzzy criteria, like whether they used Far Eastern management strategies and the like. Clayman visited the book from an academic angle. She made a value-weighted portfolio of the twenty-nine stocks Peters and Waterman examined. She called this portfolio the "Excellent Companies." Next, for comparison, she compiled the twenty-nine worst companies based on the same criteria: companies with terrible profitability, Dark Ages management, and the like. She called these the "Unexcellent Companies."

Exhibit 1 shows the economic health of the two portfolios based on their fundamental measures. Peters, Waterman, and Clayman all seem correct as to what an excellent (or unexcellent) company is. The excellent companies are stronger and healthier than the unexcellent companies by every economic measure. Their return on assets shows a huge disparity. A modern day example of an excellent company would be one that has prospered economically, like Microsoft. An example of an unexcellent company would be one that has foundered economically, like JCPenney. (We might call financially healthy stocks "growth" and financially distressed stocks "value.")

Exhibit 1

Excellent vs. Unexcellent Company Ratios
US Companies
January 1981-December 1985



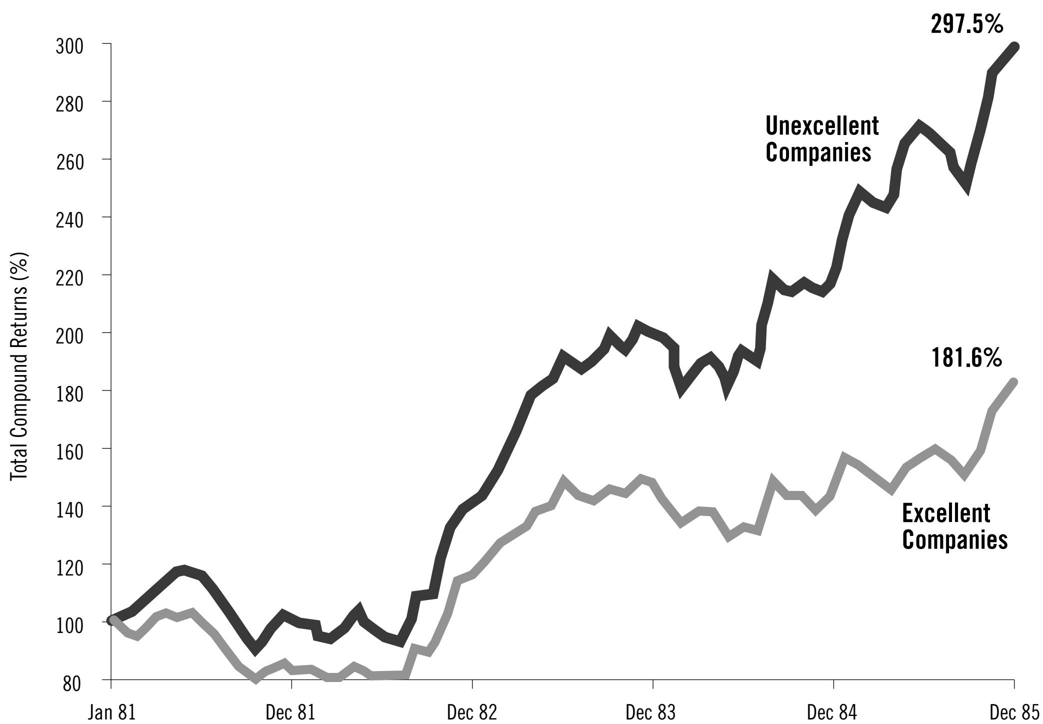
Source: Clayman, M., "In Search of Excellence: The Investor's Viewpoint," *Financial Analysts Journal*, May-June 1987, p. 63.

Exhibit 2 shows the investment return of the excellent companies vs. the unexcellent companies. It may seem counterintuitive, but the unexcellent companies outperform the excellent companies.

Exhibit 2

Excellent vs. Unexcellent Company Portfolio Returns
US Companies

January 1981-December 1985



Source: Clayman, M., "In Search of Excellence: The Investor's Viewpoint," Financial Analysts Journal, May-June 1987, p. 63.

If someone asks for a hot stock tip, they rarely expect you to recommend JCPenney or its ilk. They want you to tell them the next Microsoft. They expect you to name an excellent company. Maybe this mentality comes from our experiences in the work force. A healthy company is a nicer place to work than a distressed company. Perhaps we confuse the well-being of our human capital with the well-being of our investment capital, so we tend to think healthy stocks are stronger investments than distressed stocks.

Which Side Are You On?

This is where Merton Miller comes in. In 1990, when William Sharpe won the Nobel prize for the single-factor model, the late Dr. Miller, one of Dimensional's original directors, shared the prize. The award recognized Miller for his research into capital structure (Miller 1958). Miller often pointed out that when markets work, the cost of capital to a company is the expected return on its stock. This is a simple but profound notion. It means that companies use stock, like bonds, to fund operating capital. The return on the stock, even several hands down from the initial offering, reflects the current riskiness of the capital venture. It is the rate it costs the company to get capital.

Here's an example: If you are a bank and Microsoft and JCPenney approach you for a loan, who will have to pay the higher interest rate? JCPenney will, to compensate you for the risk of its financial distress. The story applies to stocks as well. The market expects a higher return from JCPenney stock than from Microsoft stock. This induces investors to purchase JCPenney even though Microsoft is safer. If the two companies had the same expected return, no one would buy JCPenney. As a stock investor, you are in the bank's shoes in the above example, not JCPenney's or Microsoft's. Microsoft may be the better place to work, but JCPenney has the higher expected investment return.

Here's an interesting aside. People who work at growth companies like Microsoft make good livings and often wind up as financial advisor clients. These people are especially strong candidates for value stock portfolios. Value stocks diversify their human capital. In other words, suppose the market suddenly favors value stocks over growth stocks. A growth company employee holding a growth stock portfolio gets a double whammy. The economic force that causes his shares to plummet is the same economic force that puts him out of work. If he has a value portfolio, he may have more time to find another job.

The Fama/French Value Strategies

Dimensional's live value strategies are not based on the unexcellent portfolio in Clayman's study. Clayman's paper is included in this discussion to illustrate the general principle of value versus growth. Fama and French find that value and growth are most strongly defined by book-to-market. The value portfolios are structured the way Dimensional structures its other portfolios: to maximize exposure to the risk factor and diversify that exposure as much as possible. This means holding far more than the twenty-nine names Clayman examined.

Construction

Dimensional originally created a small cap value portfolio and a large cap value portfolio based on size and price characteristics. Although the methodology has since changed, to segregate the small cap stocks from the large cap stocks, Fama and French ranked every NYSE stock by market cap and the resulting list was divided into ten groups, each with an equal number of names. These were called "size deciles." All AMEX and NASDAQ stocks were included in the appropriate NYSE decile based on their size. The smallest five deciles (6-10) were deemed small cap, and the largest five deciles (1-5) were deemed large cap.

To segregate the value stocks from the growth stocks, every eligible NYSE, AMEX, and NASDAQ stock was ranked by BtM. This value screen was applied to stocks that have a market capitalization in the largest 90% of the total market universe. Large cap stocks with a BtM ratio in the upper 10th percentile of the value-weighted universe ranked by BtM were eligible for the Fama/French Large Cap Value Strategy. The value screen was also applied to stocks with a market capitalization in the smallest 8% of the total market universe. Small cap stocks with a BtM ratio in the upper 25th percentile of the value-weighted universe ranked by BtM were eligible for the Fama/French Small Cap Value Strategy.

Dimensional does not currently offer growth portfolios because the market itself is dominated by growth stocks. Most investment portfolios are similar to the market. Dimensional offers the opportunity to tilt further toward value and small cap. A growth strategy with a lower expected return than the market would be counterproductive to this goal. It would be like "riding the brakes."

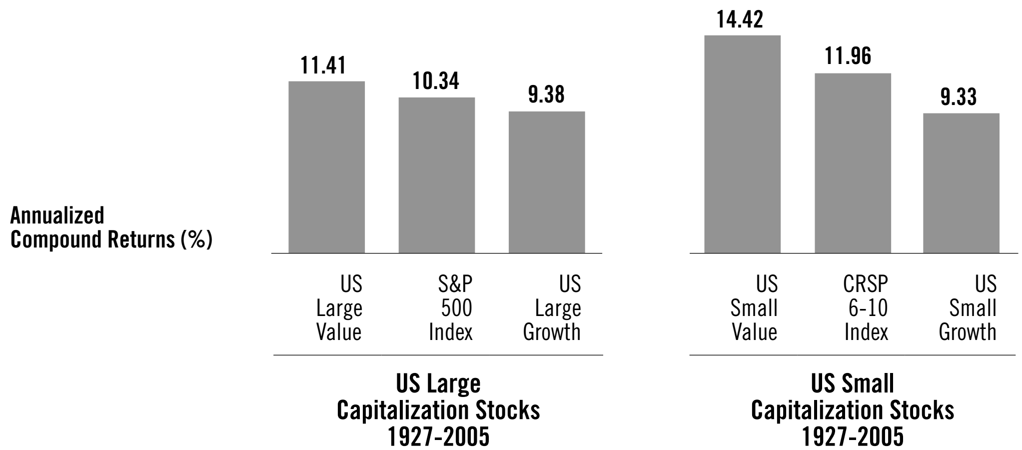
You may have noticed that Fama and French divide the whole market of stocks into small and large, but only take the top and bottom thirds of the market (by BtM) to determine value and growth. This is because the BtM effect seems stronger historically than the size effect. A finer BtM subdivision therefore has greater potential to explain the variation in returns. There are additional benefits, as well. As mentioned above, investors accept the idea of small cap stock risk more readily than the idea of value risk. They might be hesitant to invest large portions of their portfolio in a value strategy. Dimensional's value strategies are more focused. An investor can commit half the dollars he commits to a typical value strategy (which divides the market in half by value and growth) and achieve the same increase to his plan's expected return.

Performance

Exhibit 3 shows historical returns and standard deviations for the Fama/French strategies. The chart is divided into two groupings, large cap on the left and small cap on the right. Each grouping shows the result for value, neutral (or "market"), and growth. You'll notice the returns for the neutral strategies (S&P 500 Index for large cap and CRSP 6-10 Index for small cap) are closer to the returns for the growth strategies than to the returns for the value strategies, part of the reason Dimensional believes market strategies are growth dominated.

Exhibit 3

Historical Returns: Annual Data
January 1927-December 2005



	US Large Value	S&P 500 Index	US Large Growth	US Small Value	CRSP 6-10 Index	US Small Growth
Average Return (%)	14.74	12.31	11.58	19.58	16.26	14.32
Standard Deviation (%)	26.47	20.33	21.65	34.73	31.14	34.33

In US dollars.
Value and growth index data provided by Fama/French. CRSP data provided by the Center for Research in Security Prices, University of Chicago.
Indexes are not available for direct investment. Their performance does not reflect the expenses associated with the management of an actual portfolio.

There has been a size effect. Except for growth, the small cap bars are taller than their large cap counterparts. All three have higher standard deviations. This increased volatility explains the beta of 1.20 mentioned earlier. We also observe a BtM effect. The value bars are taller than the growth bars for both small and large cap size groups. In small cap, the value standard deviations are not much higher than the growth standard deviations. This result seems to fly in the face of rational expectation! Aren’t risk and return supposed to be proportionally related?

The Flavors of Risk

This brings up a tricky aspect of the research. Let’s review. Fama and French identified three independent sources of risk in stock market returns. For these risks to be truly independent, we expect them not to manifest themselves in the same way. If the return differences could all be explained by a shared source of risk like standard deviation, we’d be back to a single-factor model.

Let's suppose there are different sources of equity risk. What if you only care about one of them, standard deviation? In this case the jargon would dub you a *mean-variance preferenced* investor. If the only risk you fear is fluctuation of returns, you could use a mean-variance optimizer, and the optimizer would tell you to overweight value. This is a perfectly legitimate approach. However, very few investors care only about standard deviation.

If you care only about standard deviation, you don't care about tracking drift. You don't mind if the market is going strong for several months and your portfolio is flat, or negative. You don't care if your portfolio is dominated by bank stocks and has no technology stocks. You don't care if your portfolio has the same negative return of 2% every quarter for two years. That portfolio has a standard deviation of zero.

Sarcasm aside, investors care about a lot more than just standard deviation. Questions from clients will reveal their true risk preferences, and the concerns above are not unusual. The Fama/French model proves investors care about other risks besides just standard deviation.

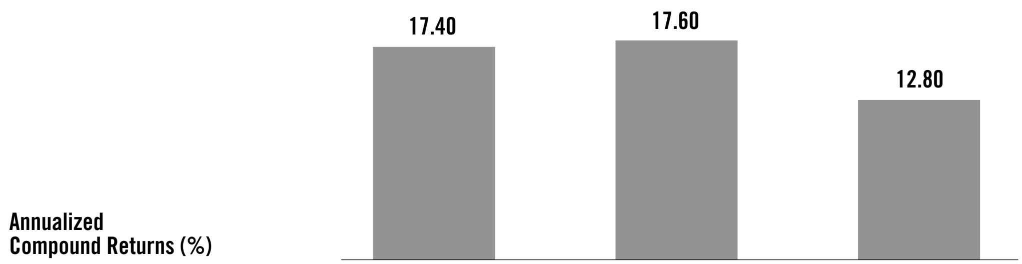
But Is This Real?

The Fama/French study fell under scrutiny and criticism from researchers when it was first published. It was such a short time period (1963-1990), and only included US stocks. It could have been a fluke. Some believed the BtM effect existed but was the result of mispricing rather than compensation for risk (Lakonishok, Shleifer, and Vishny 1994; Haugen 1995). The market saw their lousy earnings and guessed value stocks were poorer investments than they actually were. In so doing, it assigned them erroneously low prices; it "undervalued" them. When the stocks bounced back, the market was surprised, value investors pleasantly so. Fama and French argued that the three-factor model, discussed in the next section, explained the risk. Whether you believe the value effect is the result of systematic mispricing (market inefficiency) or rational risk compensation (market efficiency), the conclusion is the same. You should have value in your portfolio. Dimensional prefers the argument that value is risk, because systematic mispricing is too weak an idea around which to build portfolios. If the market guessed wrong in the past, why wouldn't it learn from its mistake and guess correctly in the future? You don't want to stake your investment strategy on the idea of a chaotic, irrational market replicating its mistakes in the future.

The second big criticism of Fama/French is that it is the result of *data dredging* (Black 1993). I'll try to illustrate what this means and why it's a concern. In most sciences, observation can lead to theory and then further observation can confirm the theory. For instance, the apple falls on Newton's head, he figures out why, and then he proves the theory with scientific tests. In economics, observation isn't supposed to lead to theory. The theory is supposed to come first. If it makes sense, you back it up with evidence. The Fama/French research came from examining the evidence with no theory in hand. Data dredging happens at the stage of examining the evidence. Scores of academics across the country routinely spin the data tapes at the Center for Research in Security Prices searching for some pattern in the returns. With all those academics poring through the data, what are the chances one or two won't find a pattern randomly? It's like the "thousandth-monkey principle." If you have infinite monkeys sitting at typewriters slamming away randomly at the keys, one may type a Shakespeare play, provided there are enough monkeys. The monkey didn't think up the play, it just typed it.

Exhibit 4

Historical Returns: Annual Data
Non-US Developed Market Stocks
January 1975-December 2005



	International Value	International Small Index	MSCI EAFE Index
Average Return (%)	19.49	20.60	14.70
Standard Deviation (%)	22.78	27.49	21.28

In US dollars.
Value index data provided by Fama/French. International Small Cap Index: 1970-June 1981: 50% UK Small Cap Stocks and 50% Japan Small Cap Stocks. July 1981-present: Simulated by Dimensional from StyleResearch securities data. Includes securities of MSCI EAFE countries, market-capitalization weighted, each country capped at 50%.
Indexes are not available for direct investment. Their performance does not reflect the expenses associated with the management of an actual portfolio.

Exhibit 4 disproves the data dredging criticism. The size and BtM effects Fama and French observed in the US happen in every observable market outside the US (Fama and French 1993a; Capaul, Rowley, and Sharpe 1993; Sinquefield 1996). Small cap outperforms large cap (represented by EAFE on this chart) and value outperforms growth (also EAFE, due to data availability). The standard deviations follow the US pattern. Small cap has a standard deviation much higher than that of large cap, but value has a standard deviation closer to that of growth. If it were a fluke or just the time period and region that caused Fama and French's result, why would we see identical results everywhere else in the world?

Portfolio Analysis Using the Model

Because the Fama and French model is an asset-pricing model, investors can perform the classic portfolio analyses of asset-pricing models. These include analyzing manager styles and successes, profiling portfolios, and calculating expected returns based on past exposure to the factors as well as on present exposure. Candidate portfolios and reallocations can be analyzed for their expected effects as well. Because of the increased explanatory power of the three-factor model over the single-factor model, these applications are done with greater accuracy than before.

Exhibit 5

The Models

Average explanatory power (R^2) for Fama/French equity benchmark universe.

Single-Factor Model

$$R(t) - RF(t) = a + b[RM(t)-RF(t)] + e(t)$$

average expected return minus T-Bill = **excess return** + **average beta [market return]** minus T-Bill

- **Explains 70% of the variability of returns.**

Three-Factor Model

$$R(t) - RF(t) = a + b[RM(t)-RF(t)] + sSMB(t) + hHML(t) + e(t)$$

average expected return minus T-Bill = **average excess return** + **sensitivity to beta [market return]** minus T-Bill + **sensitivity to size [small stocks minus big stocks]** + **sensitivity to BtM [high BtM minus low BtM]**

- **Explains 95% of the variability of returns.**

Five-Factor Model

$$R(t) - RF(t) = a + b[RM(t)-RF(t)] + sSMB(t) + hHML(t) + tTerm(t) + dDef(t) + e(t)$$

average expected return minus T-Bill = **average excess return** + **sensitivity to beta [market return]** minus T-Bill + **sensitivity to size [small stocks minus big stocks]** + **sensitivity to BtM [high BtM minus low BtM]** + **sensitivity to term risk [LT Govt minus T-bills]** + **sensitivity to default risk [LT Corp minus LT Govt]**

Equity (beta, size, BtM) — **Fixed Income** (term risk, default risk)

The Models, Again

Exhibit 5 reviews the models. The single-factor model proposed that a portfolio's expected return is the portfolio's percent sensitivity to the market factor (the amount by which the market of US stocks beats Treasury bills) times the historical average market premium. If your portfolio bounces around to within 80% of the market premium's fluctuations, you have a beta of 0.80 and your expected return is 80% of the market's historical average premium over bills. Any return your portfolio achieves above or below this expectation constitutes alpha. The single-factor model explains about 70% of returns for a cross-section of equity portfolios of various sizes and styles. The further you get from the market, the less it explains.

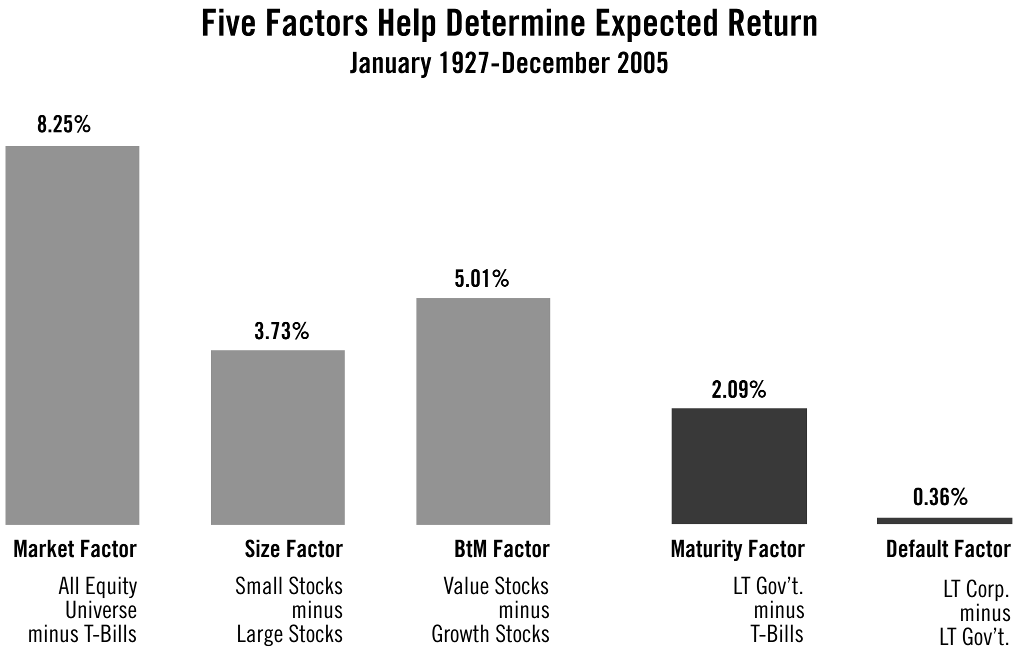
The three-factor model is similar. It simply adds a size factor (the amount by which small cap stocks beat large cap stocks) and a price factor (the amount by which high BtM stocks beat low BtM stocks) to the market factor. Any return your portfolio achieves above or below the sum of expected returns due to all three factors constitutes alpha. The three-factor model explains upward of 95% of returns for a cross-section of equity portfolios of various sizes and styles. Unlike the single-factor model, it continues to explain returns as a portfolio gets further from the market.

"For people whose brains aren't sufficiently stretched by the three-factor model" (Perez 1994), Fama and French propose a five-factor model (Fama and French 1993b). This is simply the equity factors from the three-factor model, plus two additional fixed income factors. The term factor (the amount by which long-term government bonds beat Treasury bills) measures sensitivity to the risks of extending fixed income maturities. The default factor (the amount by which long-term corporate bonds beat long-term government bonds) measures sensitivity to the risk of purchasing lower-quality instruments. These two factors describe the risks of fixed income investing. The only systematic way to take more risk and increase returns is by going into longer maturities and/or junkier quality. All five factors together do a good job describing balanced portfolios and stock/bond hybrid strategies like convertible bonds or interest-sensitive utility stocks (Fama Jr. 1995).

The Price per Unit of Risk

Exhibit 6 describes the historical average returns for each of the five risk factors. This is the amount of return you can expect for taking a "unit" of each type of risk. A unit of risk simply means a beta, or sensitivity, of 1.00 on a factor. It means your portfolio experiences the full measure of fluctuations in the factor. Suppose you have a portfolio of the smallest cap, most distressed stocks. Let's say this portfolio fluctuates one-to-one with the small cap and value premia. Your expected return on size will be 1.00 x 3.73% (the historical size premium). Add to this your expected return on value, 1.00 x 5.01% (the historical value premium). Finally, add 1.00 x 8.25% (the historical market premium—remember, all equity portfolios take about a unit of market risk). Your expected return is the sum of all three. This is the expected premium over the Treasury bill rate (which is almost 4% currently).

Exhibit 6



Equity factors provided by Fama/French. Fixed income factors provided by © Stocks, Bonds, Bills and Inflation Yearbook™, Ibbotson Associates, Chicago (annually updated work by Roger G. Ibbotson and Rex A. Sinquefield).
Indexes are not available for direct investment. Their performance does not reflect the expenses associated with the management of an actual portfolio.

If you hold the market, forget the size and value premia. Your expected return is about 8.25% per year over T-bills (if you believe the historical market premium is a reasonable forward-looking expected premium). The market expected return, as mentioned, is a "gimme." Any diversified portfolio of stocks gets it. Your true equity investment decision once your stock/bond allocation is set is the amount of small cap or value stocks you hold.

This chart illustrates another interesting point. The equity factors pay 4%-8% per risk unit a year, but the fixed income factors pay much less. If your goal is to pursue returns, don't bother taking a lot of fixed income risk. Keep your fixed income short and high-quality to dampen portfolio volatility. This will allow you to "spend" the extra risk units among the three stock factors, where the expected return payoff is bigger.

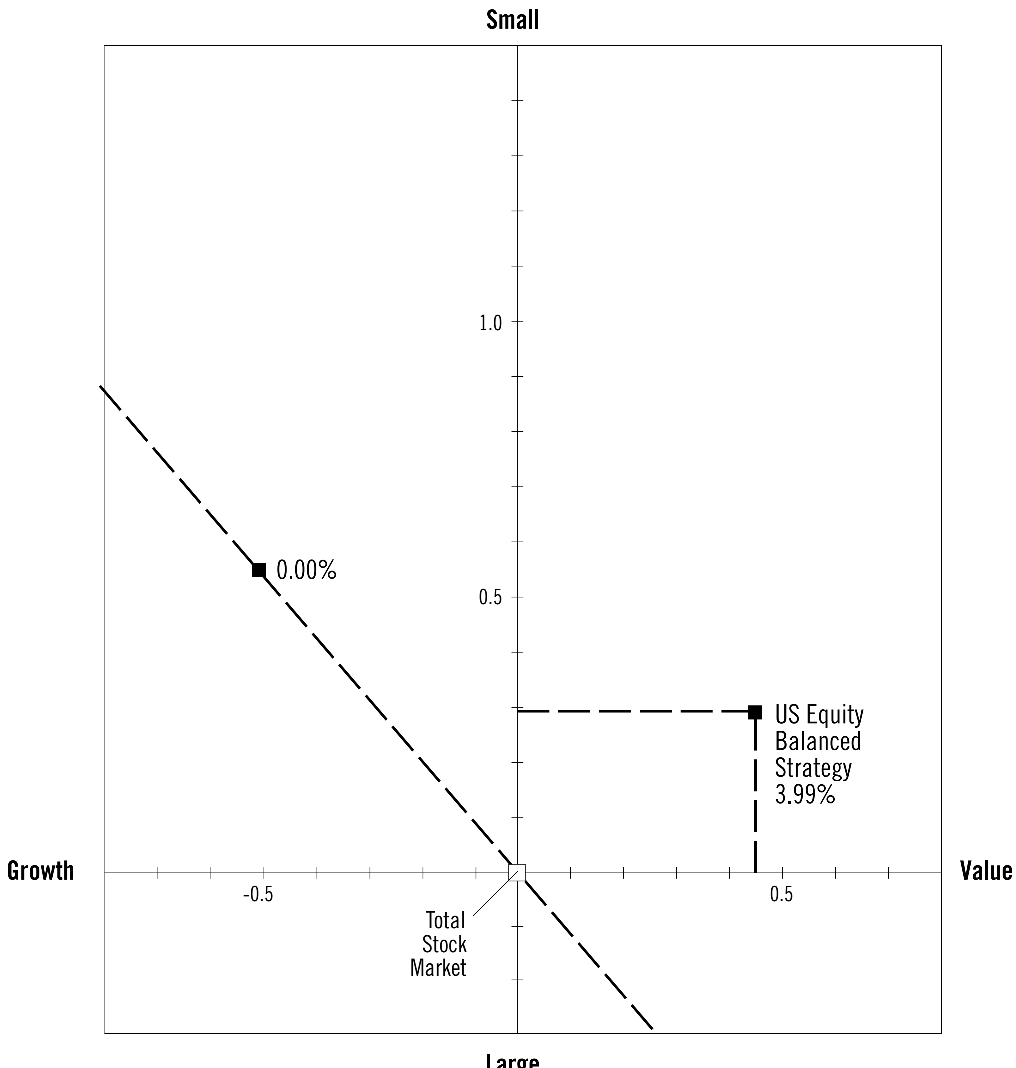
Profiling Portfolios

The model allows us to measure the way portfolios take different types of risk and calculate their expected returns based on these risks. Exhibit 7 shows how we plot portfolios for their factor exposures. The crosshair has two dimensions, size along the vertical axis and BtM along the horizontal axis. The axes represent "exposures" to the two factors. Portfolios that take a lot of size risk plot higher along the size axis and portfolios that take a lot of BtM risk plot farther right along the BtM axis. Because all equity portfolios take similar market risk, we don't need a third axis for beta. The market sits at the crosshairs. All portfolios are plotted relative to the market.

Exhibit 7

Three-Factor Model: Expected Premium over Market

January 1927-December 2005



US Equity Balanced Strategy:
S&P 500 Index 33%, Fama/French US Large Cap Value simulated strategy 33%, Fama/French US Small Cap simulated strategy 17%, Fama/French US Small Cap Value simulated strategy 17%.

Average Historical Return
Market Factor = 8.25
Size Factor = 3.73
BtM Factor = 5.01

Example Asset Regression Results
US Equity Balanced Strategy
Market Beta (β)= 1.08
Size Loading (s) = 0.29
BtM Loading (h) = 0.45

Example Calculation:		
Market Beta × (Market Factor)	1.08 × (8.25)	**8.91**
Size Loading × (Size Factor)	+ 0.29 × (3.73)	**1.08**
BtM Loading × (BtM Factor)	+ 0.45 × (5.01)	**2.25**
Minus Market Excess Return	–	**8.25**
Expected Premium over Market		**3.99**

For example's sake, the plot shows a hypothetical balanced equity strategy. This portfolio is comprised of twice as much large cap as small cap in size, and half value, half neutral in BtM. The monthly simulated returns of this portfolio were run through the three-factor model and the results are shown. This (equity) portfolio has a beta around 1.00 (1.08, to be exact), a size exposure of 0.29 (which makes sense because the portfolio is one-third small cap), and a BtM exposure of 0.45. The portfolio is plotted at 0.29 on the size axis and 0.45 on the BtM axis. The table beneath the chart demonstrates how to calculate this portfolio's expected return. Each percent exposure from the regression result is multiplied times the respective factor's historical average return, shown earlier in Exhibit 6. The expected returns due to each factor are totaled and the market return is subtracted out, to show the return as an expected premium over the market. In this case, the recommended balanced strategy is expected to outperform the market by 399 basis points per year to compensate for its additional small cap and value exposures.

Keep in mind that expected return in the sense we describe it is anything but a prediction. Markets and returns, even over the longer term, resist forecasting and bring with them a huge element of uncertainty. A return is only "expected" in an abstract sense: we accept the risk factors as bearing systematic compensation and *assume* relative and reasonable levels of return in exchange for exposure to these risks. With these assumptions intact, expected return is simply a reasonable guesstimate of the cost of capital based on rational markets and principles of asset pricing.

The crosshair "map" is a universe of opportunities. A portfolio can land anywhere on the plot and it's easy to calculate a reasonable expected return. The amount by which actively managed portfolios historically outperformed or underperformed this expectation constitutes their "alpha." Except for the fact that the marketplace uses them, performance benchmarks are rendered obsolete by this technology. The model compares a manager to an indexing of his actual factor exposures, rather than to a benchmark that may or may not reflect what he invested in. A small cap manager, for instance, may overweight value stocks relative to his benchmark, the Russell 2000 Index. As a result, he outperforms it.

Judged against the benchmark, he had a premium return that he uses to justify his large fee. But if the extra return was simply compensation for taking additional systematic (value) risk, why should he get credit? His job is to provide additional returns that can't be indexed, which is exactly what his alpha *is* in the three-factor model. In this example, the model would place him somewhere to the right of the Russell 2000 along the value spectrum and expect him to have outperformed *that* position before crediting him with a premium return. Active manager fees are supposed to pay for smart stock selection, not additional returns that only compensate for additional risk.

The farther up and to the right of the market you go in Exhibit 7, the higher your expected return. The lower and farther left you go, the lower your expected return. The diagonal dotted line shows the set of points at which the size and BtM factors cancel each other out. All points along this line have the same expected return as the market, because the expected return gain from increased small cap exposure is canceled out by the expected return loss from increased growth exposure, and so on. If you want to beat the market, you should position your portfolio to the right of the dotted line. All points left are expected to underperform the market.

Is Alpha Everything?

Structure determines the vast majority of investment returns. The way you position your portfolio on the crosshair map tends to largely determine your outcome. The amount of return typically due to alpha from stock selection or timing is negligible (Brinson, Hood, and Beebower 1986; Brinson, Singer, and Beebower 1990; Fama Jr. 1996). Yet active managers focus more on alpha and are less concerned with how consistently and strongly they expose their portfolios to the compensated risk factors. This would be okay, except they typically fail to provide reliable exposure to the factors *and* they typically fail to provide reliable alphas.

It makes sense that alpha is key in the world of plan sponsors, where a plan hires so many managers it ends up with a portfolio that looks like the market. If most managers fail to achieve alpha, a plan sponsor might as well buy a market index fund. The only other possible benefit of hiring so many managers is the perception of safety from having the plan's eggs in several baskets instead of one.

Exhibit 8 shows regression results for active managers financial advisors often ask about. These managers all have data going back to 1976 in Morningstar. I ran their returns through the model, with no information about their market caps or BtM ratios. The plot reflects the managers' average exposures to the factors from 1976 to 2005.

Everything lands about where expected based on what we know about the managers. A CRSP 9-10 strategy, which includes only the tiniest two deciles, plots higher and slightly more toward value (because tinier stocks tend to be more distressed) than a CRSP 6-10 strategy, which includes the smallest half of the deciles. The S&P 500 plots below the market, because it contains some of the heftiest stocks, and the CRSP 1-10 Index at the crosshair used for the market includes all the small companies. The American Century Growth Fund has been mid cap (about S&P 400 in size) with a strong growth tilt since 1976. Pennsylvania Mutual was small cap with a strong value tilt. Fidelity Magellan was market-like in terms of both size and value exposure.

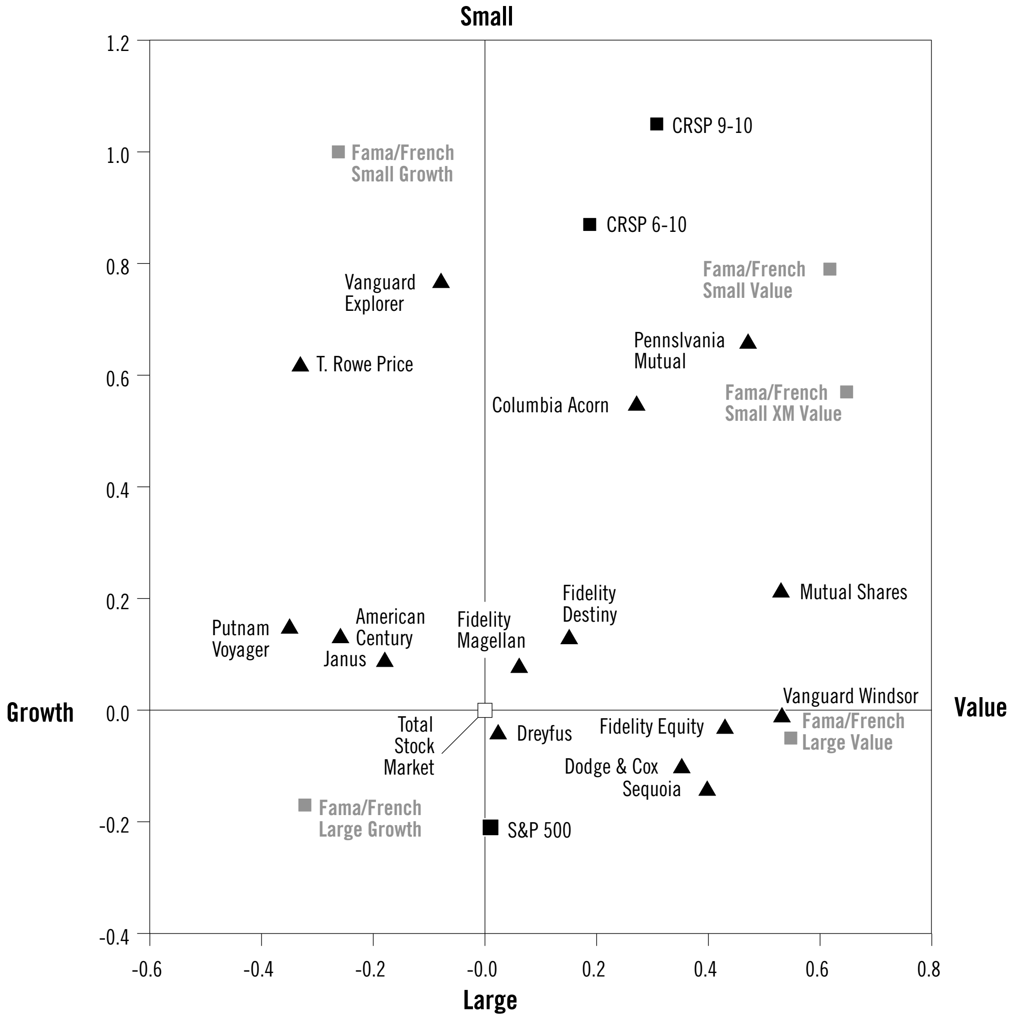
The table beneath the plot ranks the managers in order of expected return. The smallest cap value managers have the highest expected returns and the largest cap growth managers have the lowest expected returns. The alpha displays the amount the manager has beaten this expectation—the amount that could not have been delivered by an index fund.

Magellan had the largest alpha of any fund over this period, and its story is legend. What's more interesting is the fact that most of the other managers didn't score alphas, especially since this "study" is fraught with bias. Remember, these are the managers advisors ask about most (*selection* bias). Advisors don't ask about lackluster, obscure

Exhibit 8

Three-Factor Model: Manager Profiles

January 1976-December 2005



Index	Alpha (α)	Market Factor (β)	Size Factor (s)	Price Factor (BtM)	Expected Premium over Market
■ Fama/French US Small Value	-0.05	1.10	0.79	0.63	6.98
■ Fama/French US Small XM Value	-0.10	1.17	0.57	0.66	6.86
■ CRSP 9-10 Index	-0.14	1.06	1.05	0.32	5.98
■ CRSP 6-10 Index	-0.07	1.08	0.86	0.19	4.81
▲ Pennsylvania Mutual Fund Investment	-0.06	0.91	0.66	0.48	4.16
■ Fama/French US Large Value	-0.21	1.17	-0.05	0.55	3.98
■ Fama/French US Small Growth	-0.21	1.13	0.99	-0.26	3.49
▲ Columbia Acorn Z Fund	0.18	0.95	0.55	0.27	2.98
▲ Vanguard Windsor Fund	-0.10	1.05	-0.01	0.53	2.97
▲ Vanguard Explorer Fund	-0.02	0.95	0.76	-0.09	2.00
▲ Mutual Shares Z Fund	0.14	0.81	0.21	0.53	1.85
▲ Fidelity Destiny I Fund	0.06	1.07	0.13	0.14	1.80

Index	Alpha (α)	Market Factor (β)	Size Factor (s)	Price Factor (BtM)	Expected Premium over Market
▲ Fidelity Equity-Income Fund	-0.01	0.96	-0.04	0.43	1.68
▲ Fidelity Magellan Fund	0.38	1.12	0.07	0.06	1.52
▲ Dodge & Cox Stock Fund	0.05	1.01	-0.10	0.34	1.43
▲ T. Rowe Price New Horizons Fund	0.09	1.07	0.61	-0.33	1.19
▲ American Century Growth Fund Investor	0.33	1.19	0.13	-0.26	0.73
▲ Sequoia Fund	0.34	0.79	-0.14	0.40	-0.22
■ S&P 500 Index	0.04	1.00	-0.21	0.01	-0.75
▲ Dreyfus Fund	-0.14	0.90	-0.04	0.03	-0.86
▲ Putnam Voyager Fund	0.29	1.04	0.14	-0.36	-0.90
▲ Janus Fund	0.21	0.94	0.08	-0.17	-0.99
■ Fama/French US Large Growth	0.12	0.95	-0.18	-0.33	-2.74

Columbia Acorn Z formerly Liberty Acorn Z (ACRNX).
Expected premium over market computed using Fama/French average annual returns (1927-2005): Market minus One-Month T-Bill, 8.25%; Size Factor, 3.73%; Price Factor, 5.01%.
Highlighting in above table indicates significant result (t-stat greater than 2.0).
CRSP data provided by the Center for Research in Security Prices, University of Chicago. Fama/French and multifactor data provided by Fama/French. The S&P data are provided by Standard & Poor's Index Services Group. Mutual fund universe statistical data and non-Dimensional money managers' fund data provided by Morningstar, Inc.

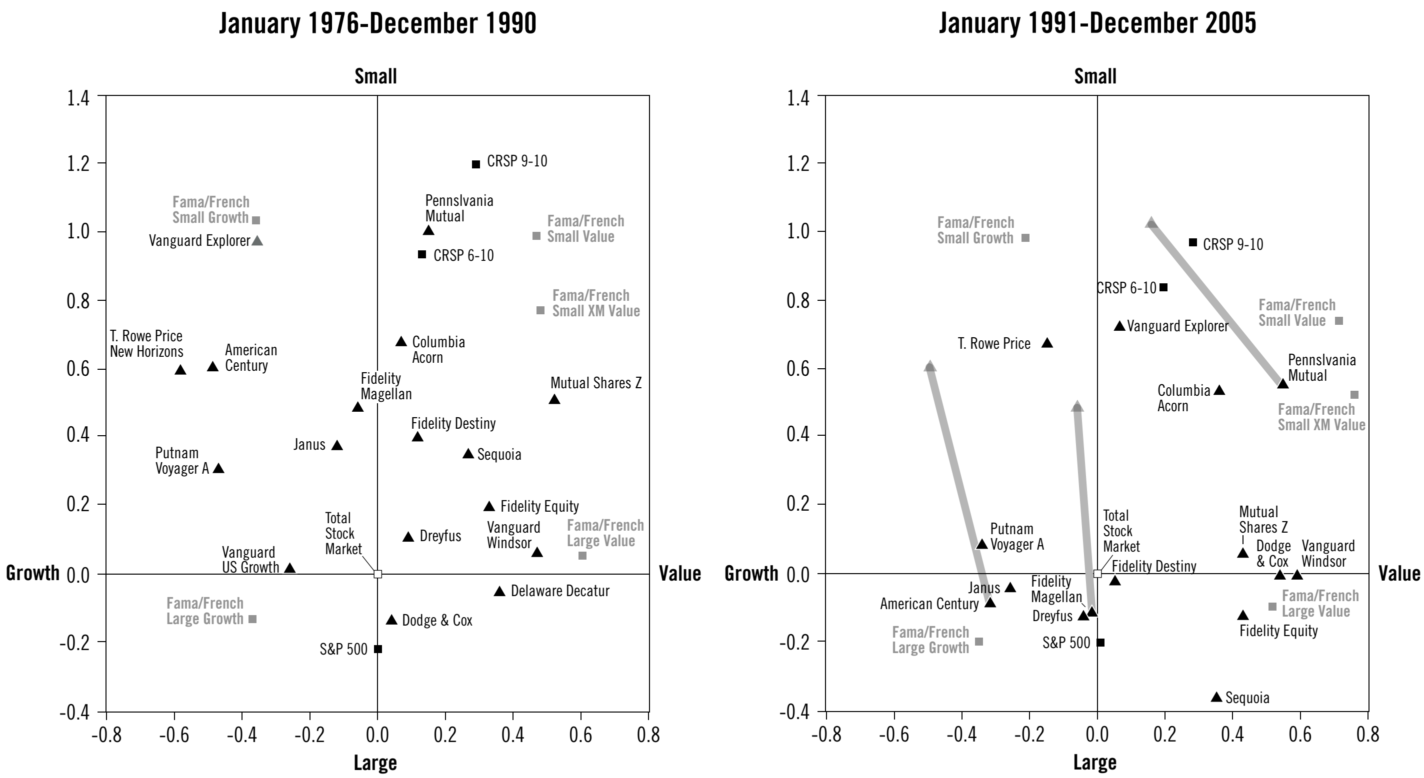
funds. These funds also go back to 1976 (*survivor* bias). Staying in business this long requires good performance because lousy performance leads to business failure and deletion from the database. If you bought a portfolio of all the stocks around today that existed fifty years ago, you'd probably be paying someone to read this for you instead of reading it yourself.

Given that the biases favor the managers, it's amazing there are only four significant alphas (with t-stats over 2.00 in absolute value). They should all have outperformed their factors. Actually, a broader, "survivor-free" database produces a random distribution of alphas (Carhart 1996). Active managers seem to perform about as well as expected by chance. Besides, it's easy to find past winners and hard to find future winners. Even Magellan, with its huge alpha, missed out on much of the 1996 stock market rally by timing out of stocks. As investors, it behooves us to focus our energy on portfolio structure instead of picking winners.

Exhibit 9

Three-Factor Model: Manager Profiles

Monthly: 1976-2005



Columbia Acorn Z formerly Liberty Acorn Z (ACRNX).
CRSP data provided by the Center for Research in Security Prices, University of Chicago. Fama/French and multifactor data provided by Fama/French. The S&P data are provided by Standard & Poor's Index Services Group. Mutual fund universe statistical data and non-Dimensional money managers' fund data provided by Morningstar, Inc.

Paint a Perfect Picture

Active management is a bad way to achieve alpha and a worse way to achieve structure. Exhibit 9 shows the managers from Exhibit 8, but with the period (1976-2005) broken in half. On the left we see the managers' average exposures for the first half of the period (1976-1990) and on the right we see the managers' average exposures for the second half of the period (1991-2005). Look how the positions shifted over time. Let's check the funds we discussed in Exhibit 8. American Century Growth spent the first half of the period, on average, as a growth fund with a mid cap size. In the second half it was still a growth fund, but closer to a market-sized growth fund. Pennsylvania Mutual used to be micro cap in size, but moved to a mid cap (S&P 400) size in the latter half of the period. Even Magellan went from a neutral mid cap fund to looking larger than the market.

Funds tend to migrate toward the market. We can speculate why. The market is still the general benchmark they're compared to; they don't want to be too different. Also, as funds get more and more popular, they often increase the size of their holdings to accommodate new investment dollars. Whatever the reason, the market seems to have a "tractor beam" sucking managers toward it over time. When they move enough, it constitutes nothing less than a change of asset class.

The days when managers should make asset class decisions are long gone. When you hire a small cap manager, it's because you want small cap in your plan. As a financial advisor, you decide what amount of small cap or value risk fits your client's risk profile and investment horizon. If you hire a small cap manager who changes to a large cap manager, he's usurping a big part of your responsibility. Structuring an investment portfolio is like making a painting: you combine different factors to create an overall picture. Managers are most useful for the vivid, consistent way they deliver the factors. If one day you squeeze the cadmium red tube and green comes out, how can you paint the picture you want?

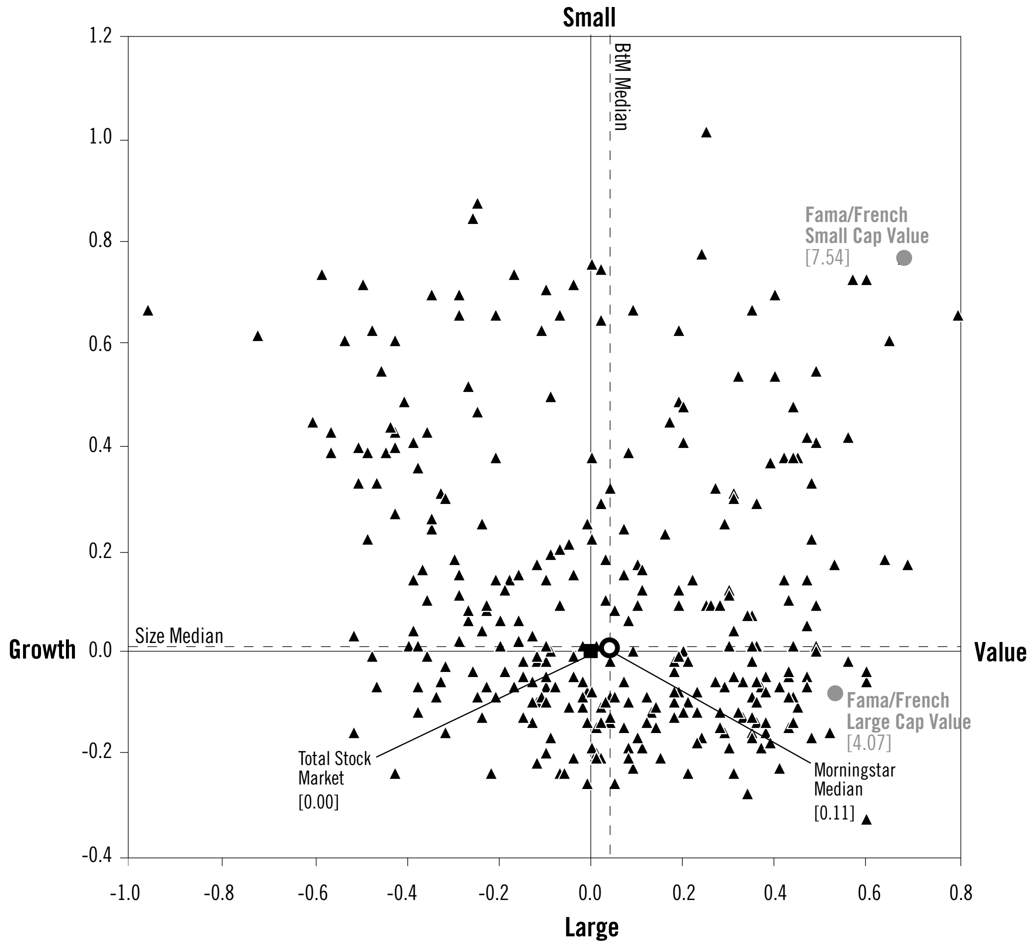
It Takes a "Passive" Manager

It's often the so-called passive managers that discover important asset classes. Active managers, in their search for alpha, don't address the structure issue because they strive to add returns without taking commensurate risk. Structured investing is the strategic opposite. It's about earning a return based on your willingness to *take* risk. Dimensional built its relationship with academics to develop and refine its ability to identify the dimensions of risk. The firm offered its International Small Cap Strategy almost twenty years ago, and only ten years ago did numerous international small cap funds and an index emerge from the active management arena. Active managers don't seem to identify all the risk dimensions and they don't seem diligent about delivering the risk dimensions they manage to identify.

Exhibit 10 shows every Morningstar manager with at least twenty years of data for their entire available history run through the model. The Fama/French series occupy the smallest and most value-tilted regions of the map, areas that are otherwise sparsely populated. Few active managers have identified or delivered true value strategies.

Exhibit 10

Three-Factor Model: All Morningstar US Equity Funds (304)
January 1985-December 2005



Source: Morningstar Inc., January 2006. Includes all domestic, distinct Morningstar funds with inception dates earlier than October 1985 in Large Blend, Large Growth, Large Value, Mid Blend, Mid Growth, Mid Value, Small Blend, Small Growth, and Small Value categories.
Expected premiums over market shown in brackets are computed using Fama/French average annual returns (1927-2005): Market minus T-Bill = 8.25%; Size Factor = 3.73%; Style Factor = 5.01%.

This isn't surprising. An active manager's primary directive, hard-wired into his psyche, is to *pick winners.* Value investing is about picking losers. Picking the big potential earners from the value stock universe is similar to picking the almost-large small cap stocks. It dilutes the effect. The poorest earners have the highest costs-of-capital and therefore the highest expected returns. A portfolio of value stocks with bright prospects is a growth-biased portfolio.

Active managers have the additional disadvantage of being able to buy whatever they want. They aren't forced by a strict charter to stay within a certain size range or certain levels of relative price. They have more personal accountability because of this freedom. They have to explain the ugly stocks in their value strategies. Some of these stocks are hard to look in the eye, and harder to justify to an investment committee long steeped in the notion that big earners get higher returns.

Factor Trade-Offs

Fama and French did not invent value investing any more than Benjamin Franklin invented electricity. They simply discovered the risks people have always cared about. Managers who were willing to take one type of risk would trade off against the other type. If a manager was willing to buy small cap stocks, he'd typically want the robust, big-earning small cap stocks. If he were willing to buy distressed stocks, he'd want the largest, most entrenched distressed stocks. It seems that managers instinctively traded off between the two risk factors long before Fama and French published their findings.

Managing Factors

The trade-off among factors is simpler in a multifactor world than managing asset classes the old way. Investors must decide how much of each type of risk they are willing to tolerate, and structure their portfolios to achieve the risk exposures in an effective manner. Before the model, they had to decide from among a Byzantine array of managers and asset classes. Managers and asset classes are interchangeable when the central problem is in managing five simple factors.

The model presents solutions that would never have occurred in its absence. A summary of how Dimensional consulted with a large client using the three-factor model follows. The summary is included for illustrative purposes only and is not a recommendation of any of the strategies mentioned or an endorsement of a specific plan to increase a portfolio's size or BtM exposures.

Dimensional was one of fifty managers in the client's plan. The managers were spread across the map in size and value-growth orientations. Still, in spite of the number and range of managers, the client had managed to nail the market perfectly in its combined equity plan. It had a 1.00 loading on the market and 0.00 loadings on both size and BtM. This was deliberate. The client wanted a market portfolio in total and had a staff that analyzed the manager holdings and allocated the assets to achieve perfect market exposure.

Dimensional analyzed the client's managers. Of the fifty managers, none had statistically significant alphas (not unusual) and seven approximated the S&P 500 in their factor exposures. Here were seven redundant S&P 500 index managers, for all practical purposes, because they resembled the index and added no alpha. The client also had a large investment in Dimensional's US Small Cap Strategy.

After reviewing the Fama/French research, the client decided it was mean-variance preferenced and believed the value story. The plan wanted to move all of its US Small Cap (neutral) Portfolio assets to the US Small Cap Value Portfolio. This seemed reasonable, if a little counterintuitive. It seemed less than optimal to reallocate passive small cap assets, which are relatively strong diversifiers because of their size exposure, while ignoring so many redundant large cap managers. Dimensional analyzed the proposed change and suggested another option.

With the proposed shift of all the small cap assets to Small Cap Value, the entire portfolio gains an additional BtM exposure of 0.03 and no additional size exposure (because both portfolios reside in the same size universe). This translates to an expected return increase of 18 basis points per year over the current portfolio. Not bad for a multi-billion dollar plan.

Dimensional asked what would happen if, instead of moving the Small Cap assets, the client moved 20% of its S&P 500 exposure to *Large* Cap Value. This seemed appealing in light of the seven or so S&P 500 managers without alphas. BtM exposure increases by the same amount as with the small cap shift, 0.03. In addition, the size exposure increases by 0.01 (because S&P 500 stocks are larger than large cap value market sized stocks). This translates to an expected return increase over the current portfolio of 22 basis points per year, a full four basis points over the small cap shift.

The S&P 500 transfer is preferable to the small cap transfer for a number of reasons. First is the advantage mentioned above: the size exposure increased in addition to the value exposure. Second, the S&P 500 managers were more redundant and typical to the overall plan than the Small Cap Portfolio. Transferring assets made more sense for diversification. Third, and most importantly, changes among large cap stocks are cheaper than changes among small cap stocks because of lower trading costs and management fees.

The client wanted to change his small cap portfolio. The model showed how he could accomplish the same impact for less cost using large cap assets, and increase his *small cap* exposure in the bargain. The desired goal was increased small cap value *factor* exposure, not increased small cap value *product* exposure. Before the model, it's hard to imagine the client or Dimensional would have identified this subtlety, or considered making the change using large cap stocks.

The Advantages of This Technology

By focusing our attention on factors instead of asset classes and managers, the model frees us to think of thrifty and imaginative solutions to complex portfolio problems. The client in the above example might not have considered how it was changing its combined US equity portfolio. They just wanted to change the small cap piece. The model expanded their view to show the impact such a change would have over their entire portfolio. This freed them to think of a better way to achieve the same impact, and then some.

It would be hard to hire a consultant for this sort of advice. The model is more advanced than most professional consulting tools. In fact, we really can't underestimate its advantages. It provides the ability to view portfolio problems clearly, solve them, and measure manager factor exposures and performance. It also provides the research and framework to structure well-engineered small cap and value investment strategies. Finally, it gives us guidelines to allocate these strategies effectively in a portfolio.

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