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## Effective Diversification in a Three-Factor World

**Overview:** Following is a discussion of professors Eugene F. Fama's and Kenneth R. French's three-factor model, which appeared in the landmark 1992 *Journal of Finance* article, "The Cross-Section of Expected Stock Returns."

### Introduction

The June 1992 *Journal of Finance* article "The Cross-Section of Expected Stock Returns" revolutionized the way many individuals think about investing. Prior to the study's publication by professors Eugene F. Fama and Kenneth R. French, many believed that the risk and return of a portfolio was largely determined by one factor: its beta. Beta is a measure of equity-type risk (or market risk) of a stock, mutual fund or portfolio, relative to the risk of the overall (U.S.) stock market. An asset with a beta greater than one has more equity-type risk than the overall market, while an asset with a beta less than one has less equity-type risk than the overall market.

Fama and French demonstrated that we actually live in a three-factor world — the risk and return of a portfolio is explained by not only beta, but also by its exposure to two other risk factors: 1) size and 2) price. Fama and French hypothesized that while small-cap and value stocks have higher beta (they have more equity-type risk), they also have *additional* risk unrelated to beta. Thus, small-cap and value stocks are riskier than large-cap and growth stocks, which would explain their higher historical returns and also imply that such stocks should have higher expected returns in the future. Studies have confirmed that the three-factor model explains an overwhelming majority of the returns of diversified portfolios.

For the period 1927–2005, the average annual returns to these three risks factors are as follows:

- ▲ Market Factor (the return of the all-equity universe minus the return on one-month Treasury bills): 8.08 percent.
- ▲ Size Factor (the return of small-cap stocks minus the return of large-cap stocks): 3.17 percent.
- ▲ Price Factor (the return of high book-to-market [value] stocks minus the return of low book-to-market [growth] stocks): 5.03 percent.

### Independent Risk Factors

It is important to understand that size and price are independent (unique) risk factors in that they provide investors with exposure to different risks than exposure to market risks would provide. We can see evidence of their independence when we examine the historical correlations of the size and price factors to the market factor. If the correlations were high, the risk factors would be relatively good substitutes for each other. If that were the case, then while investors could increase the expected return (and, of course, risk) of the portfolio by increasing their exposure to these risk

factors, there would be no real diversification benefit. On the other hand, if the correlations are low, not only can investors increase expected returns for a given level of risk, but they will also gain a diversification benefit.

For the period 1927–2005, the correlation of the market risk factor to the size risk factor was 0.408 and its correlation to the price risk factor was 0.091. The correlation of the size risk factor to the price risk factor was almost zero (0.026). In other words, we can effectively diversify equity risks by diversifying across the three independent risk factors. Each of the three risk factors has the potential for increasing investment returns. Following are two recent examples demonstrating that size and price are independent risk factors.<sup>1</sup>

- ▲ In 2001, small-cap stocks returned 18 percent and small-cap value stocks returned 40.6 percent while the S&P 500 Index produced a negative return of 11.9 percent.
- ▲ In 1998, while the S&P 500 rose 28.6 percent, small-cap stocks fell 2.3 percent and small-cap value stocks fell 10 percent.

### **Diversifying Risk**

In the one-factor world there seemed to be only two ways to expect to increase returns — either increase the allocation to stocks or buy higher beta stocks. In either case, investors were taking more of the exact same type of risk they were already taking. The Fama and French research indicated that there are other ways to increase the expected return of a portfolio. Instead of adding more of the same type of risk, investors could add different types of risk to achieve more effective diversification. The following simplified example (which ignores the diversification return) will illustrate this point.

Let's assume that we expect equities to provide a future annualized return of 7 percent, and we have current bond yields of about 5 percent. Now let's consider a portfolio that is 50 percent bonds and 50 percent stocks. This allocation results in an expected portfolio return of 6 percent. If the portfolio's objective is to achieve a return of 6.5 percent, one way to increase the expected return to 6.5 percent is to increase the allocation to stocks from 50 percent to 75 percent.

$$(75\% \times 7\%) + (25\% \times 5\%) = 6.5\%$$

Let's now consider an alternative strategy; one that diversifies risk to other risk factors. For the period 1927–2005, small-cap value stocks achieved an annualized return that was 5.4 percent higher than the market's annualized return, as proxied by the CRSP 1–10 (15.5 percent versus 10.1 percent). Let's assume that same relationship will continue in the future. (Note that since size and price are risk factors, we do not know that this relationship will continue.) Thus, if we are hypothetically forecasting returns to the market of 7 percent, we would also forecast that small-cap value stocks would return 12.4 percent. Using this information we can look at the expected returns for a few different portfolio allocations.

Let's first consider a portfolio that takes half of the equities and allocates them to small-cap value stocks. The expected return would now be:

$$(25\% \times 7\%) + (25\% \times 12.4\%) + (50\% \times 5\%) = 7.35\%$$

By increasing the allocation to riskier stocks we increased the expected return. However, we also increase the risk of the portfolio. The result might be more risk than the investor has the ability, willingness or need to take. So let's consider another alternative. This time while we will shift some of the equity allocation to small-cap value stocks (increasing risk), we will also lower the overall

equity allocation to just 32 percent (lowering risk). The new allocations are 16 percent total market index, 16 percent small-cap value stocks and 68 percent bonds. The expected return would now be:  
$$(16\% \times 7\%) + (16\% \times 12.4\%) + (68\% \times 5\%) = 6.5\%$$

We now have a portfolio with a 32 percent allocation to stocks that has virtually the same expected return as the portfolio that had a 75 percent allocation to stocks. However, consider that in this case, instead of increasing the expected return by taking more of the same type of risk (market risk), we increased returns by adding different types of risk — the risk factors of small-cap and value stocks. Thus we diversified our equity risks across these two independent factors. We believe that this is a more effective form of diversification. While the expected returns of the two portfolios are the same, in fact, their risks are different.

### **Risk Aversion**

There is another consideration that is especially important to risk-averse investors (and most investors are risk averse). Since bonds are safer investments than stocks, if we were to experience a severe bear market, the maximum loss the portfolio could experience would likely be far lower with a 32 percent equity allocation than it would be with a 75 percent equity allocation. Thus while the expected returns of the two portfolios are the same, there is less downside risk with the portfolio with the lower equity allocation. Of course, the upside potential during a strong bull market is correspondingly lower as well. For an investor for whom the pain of a loss is greater than the benefit of an equal-sized gain, reducing downside risk at the price of reducing upside potential is a good trade-off.

### **Considerations**

There are several factors that should be given careful consideration when deciding on the appropriate portfolio mix. First, an investor should consider how his or her intellectual capital (earning power) correlates with the greater economic cycle risks that small-cap and value stocks have, as compared to large-cap and growth stocks. Thus, a tenured professor or doctor, with a low correlation to those risks, can prudently take greater small-cap and value risks. In contrast, it may not be prudent for a construction worker or auto worker, with a high correlation to economic risks, to increase exposure to those risk factors.

The second consideration is a psychological one. It is a risk called tracking error regret. For equities, tracking error is the amount by which the performance of a portfolio varies from that of the total market or other broad market benchmark, such as the S&P 500 Index. By diversifying across risk factors, investors take on increased tracking error risk. While very few investors care when tracking error is positive (their portfolio beats the benchmark), it appears that many investors care when the tracking error is negative.

To have a chance for positive tracking error, investors must accept the likelihood that negative tracking error will appear from time to time (or there would be no risk). Otherwise, emotions associated with negative tracking error can lead many investors to abandon their carefully developed investment plan. Thus, only those investors who are willing and able to accept tracking error risk should consider diversifying across the other risk factors.

### **Summary**

Fama and French showed us that there were two additional risk factors that we should consider when constructing portfolios. We can either use those risk factors to try to increase the expected

return (and risk) of a portfolio, or we can maintain the expected return of the portfolio by diversifying across these independent risk factors while lowering the equity allocation. For many investors, we believe that diversifying across these independent risk factors is a more effective way to diversify portfolio risk.

<sup>1</sup> **The Dimensional Matrix Book 2006.** Dimensional Fund Advisors Inc., 2006.

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