

MULTIFACTOR ASSET PRICING MODELS
AND THE RATIONALE FOR
INVESTING IN VALUE STOCKS

MARCH 2006

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THE DISCOVERY OF A VALUE FACTOR

A 1993 article co-authored by Nobel Prize winner William Sharpe¹ suggests that stock returns should be categorized along two dimensions:

1. Growth: stock returns generated by firms with excellent earnings, sales growth and profits; and,
2. Value: stock returns generated by firms that are relatively distressed and which have low share prices.

The article demonstrates that the return pattern of each group differs substantially (i.e. the time series of returns for growth stocks is not highly correlated to the time series of returns for value stocks), and that investors in value stocks have the expectation, on average, of receiving higher returns.

In many respects, this hypothesis is controversial not only because it is counterintuitive (it seems reasonable to believe that high returns would accrue to the owners of financially attractive firms; and that investors should avoid stocks of poorly performing companies), but also because the underlying explanation for the high return expectation (i.e., “the return-to-value” premium) remains elusive. Although, over various time periods, one can demonstrate that value stocks have outperformed growth stocks across both domestic and international stock markets, it is difficult to say why this should be so.

THE TRADITIONAL SINGLE FACTOR ASSET PRICING MODEL

Academic research in financial economics emphasizes the building and testing of mathematical models to explain the factors that drive asset returns. These models are referred to as asset pricing models, the most famous of which is the Capital Asset Pricing Model (CAPM) developed independently by Sharpe and several others in the mid 1960s. CAPM measures the relationship between the rewards that an investor might reasonably expect in terms of the risk that the investor undertakes. Simplistically, the return on any stock equals:

$$\text{Expected Return of Stock A} = (\text{Price of Time}) + (\text{Price of Risk})(\text{Amount of Risk})$$

where:

Price of Time is the minimum return required to compensate the investor for investing rather than consuming [normally represented by the Treasury Bill or ‘risk-free rate’, which incorporates the expected rate of inflation];

Price of Risk is the return offered in the marketplace that is in excess of the risk free rate [this is the ‘risk premium’]; and,

Amount of Risk is the volatility of a stock relative to the volatility of the market as a whole [this is the stock’s ‘Beta’].

CAPM uses the stock market as a single ‘factor’ to determine the amount of risk in any investment, and, hence, the amount of expected return for any investment. Consequently, Sharpe’s model is also known as a ‘single-factor asset-pricing model.’ Securities earn more than the risk-free rate only because they bear additional market risk. Another way of saying this is to state that market

¹ Sharpe, William, “International Value and Growth Stock Returns,” Financial Analysts Journal (January/February, 1993) pp. 27-36.

risk [Beta], under the CAPM, is the only priced risk factor—the only factor that will generate an expected reward over and above the risk-free rate.²

Following Sharpe, economists wished to know if there were factors other than the general market that could explain the return generating process for securities. If other factors could be identified and measured, portfolios might be formed to capture the risk premiums from a variety of factor exposures. Factor analysis might lead to better measurement and management of investment risk as well as to higher expected investment returns.³ The hunt for priced risk factors began; and the multifactor investment portfolio was about to be born.⁴ [Please see the Appendix for more information about the mathematical dimension of the investment term, “factor”.]

MULTI-FACTOR MODELS

Factor analysis in the investment world follows three broad avenues of research:⁵

- Factors that determine asset prices are identifiable macroeconomic forces (inflation, growth in the gross national product, interest rates and yield curve data, energy costs, unemployment, etc.);
- Factors that are not ‘exogenous’ but are fundamental characteristics of the assets themselves (these factors can be related to market, industry or accounting characteristics such as financial ratios); and,
- Factors that cannot be specified (i.e. unobservable factors), but that are implicit to the matrix of time series returns. Once the unobservable factors are found it may be difficult to determine what they represent (i.e. they are abstract mathematical constructs); and, they must be “re-translated” into known factors (macro-economic or fundamental factors) by various advanced statistical techniques.

Although the mathematical techniques and approaches of each area of research may differ, a common goal is to identify priced factors, identify the risk premium to be expected for assuming the factor risk, and to determine the extent to which an asset has an exposure to one or more of the

² Sharpe developed an analytically derived CAPM based on rigorous mathematics. He asked what the consequences for asset pricing might be if the expected rewards for individual stocks were not “calibrated” or risk-adjusted to the rewards offered by the market in general. The mathematics lead to a theory of arbitrage that assures that asset prices adjust according to the predictions of CAPM. Simply: if General Motors offers a better reward-to-risk ratio than the market in general, then investors will sell their positions in the general stock market (lowering market prices) to buy shares of GM (raising the price of GM). This process will continue until such time that the two are in equilibrium with respect to both their prices and their risks. This process happens quickly (people do not want either to leave money on the table or to remain in inferior investments) with the result that, for the most part, the risk-adjusted price of any investment is calibrated to the risks and rewards of the general market.

³ To a great extent, bond portfolio management has traditionally assumed a multifactor return-generating model. Bond return factors include interest-rate sensitivity (Duration), Credit Risk (Probability of issuer default), changes in yield spreads (relative yield advantage of corporate v. government bonds) and changes in the shape of the yield curve.

⁴ Investors seek to hold multifactor efficient portfolios rather than mean-variance efficient portfolios. Cochrane, John H., “Portfolio advice for a multifactor world,” Economic Perspectives, Federal Reserve Bank of Chicago (Third Quarter, 1999), pp. 59-78.

⁵ This discussion draws heavily on Chapter Six of Portfolio Theory and Performance Analysis by N. Amenc & V. Le Sourd (John Wiley & Sons, 2003) and on Zangari, Peter, “Equity Risk Factor Models,” Modern Investment Management, Bob Litterman, (John Wiley & Sons, 2003) pp. 334 – 395.

factors.⁶ Investing under a multifactor model portfolio construction approach follows the principles of modern wealth management. These principles suggest that the relevant unit of analysis is the portfolio as opposed to the individual stock or bond, and that the primary task of the asset manager is to understand and manage risk (in the expectation that returns and risk are linked—perhaps linearly) rather than to forecast price targets for individual securities.

FUNDAMENTAL FACTORS: THE THREE-FACTOR MODEL

The second group of factor models (fundamental factors) is particularly interesting to investors. In this group, risk factors are identifiable because they are functions of a firm's attributes. Fundamental factors might be related to leverage, liquidity, profitability & turnover, sales and earnings growth, market capitalization, level of book value, etc. These factors can be incorporated into portfolio design relatively easily because they relate directly to firm characteristics. The model assumes that each firm reflects one or more factors depending on the firm's financial attributes. The risk premium for each factor is estimated through a regression analysis or through construction of a mimicking portfolio. The historical realization of the factor is, therefore, the average risk premium that the investor can expect for tilting the portfolio towards stocks bearing the attributes of the factor.

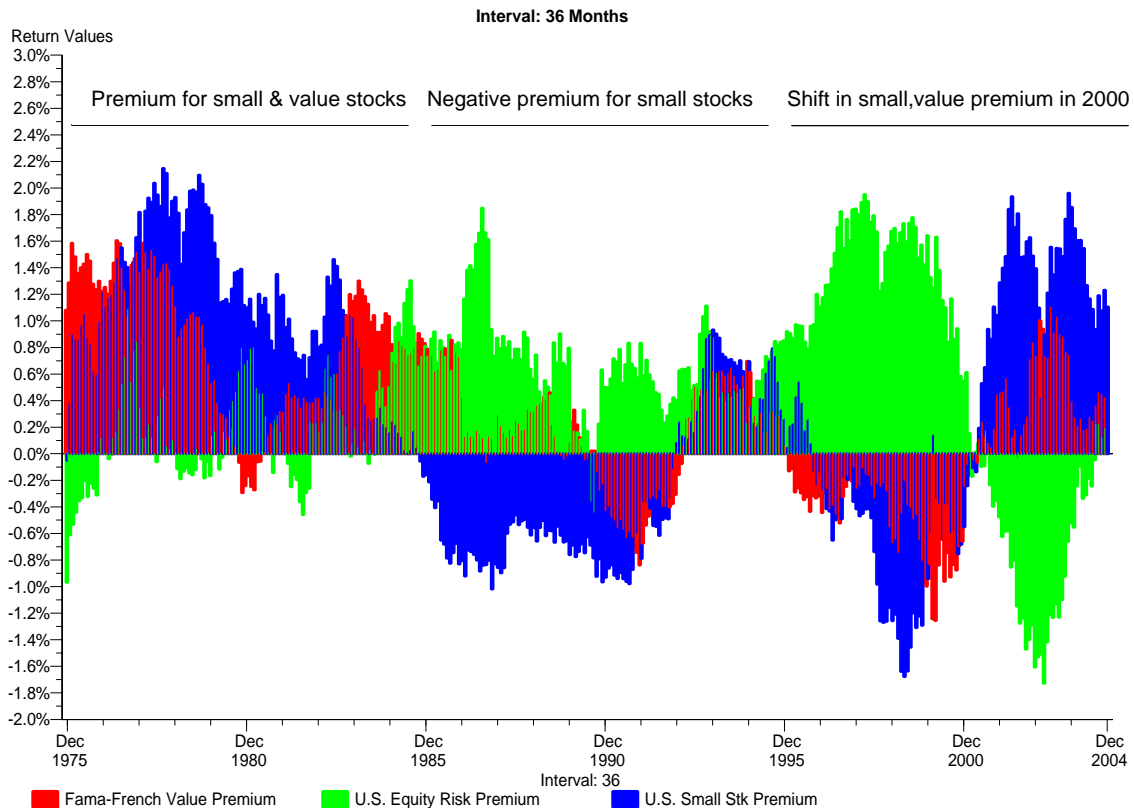
Perhaps the most well-known fundamental factor model is the "three factor model" developed by Fama and French in a series of studies throughout the 1990s.⁷ Fama & French argue that the cross-section of security returns (i.e., the factors that best explain why the return of stock A differs from that of stock B in any given period) is attributable to three identifiable firm attributes:

- (1) Beta (the single factor explanation of the CAPM),
- (2) Size (the returns to small company stocks are, on average, higher than the returns to large company stock); and,
- (3) Value (the returns to stocks with market prices close to the book value of the firm's assets are higher, on average, than the returns to stocks selling at larger multiples of price to book).

⁶ In addition to the problems of identifying relevant factors, the problem is complicated by the necessity of determining the time series of factor returns, the time series of individual stock returns, and, most importantly, the sensitivity or 'factor loading' of each stock return to each factor return. It is relatively straightforward to obtain the series of factor returns for certain macroeconomic variables such as the default risk premium (difference between government guaranteed and corporate bonds holding other factors such as yield and maturity constant). In this case, it is easy to observe the factor return but difficult to know how each stock loads on the factor. However, if we examine a fundamental factor, such as a stock's book to market value ratio, we know how each stock loads on the factor, but there is no way we can directly observe the factor return. This problem may be partially overcome either through regression analysis techniques or through the technique of forming "mimicking portfolios" designed to mimic the returns of the unobservable underlying factor. For example, all stocks under evaluation can be ranked according to their book value to market price ratio. Stocks exhibiting a high ranking (i.e., Value Stocks) form a portfolio that is held long. Stocks exhibiting a low ranking on the value factor form a portfolio that is held short. The return to the value factor is then defined as the differential return between the two portfolios.

⁷ Fama, E.F. & French K.R., "The Cross Section of Expected Returns," *Journal of Finance* (June, 1992); "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics* (1993), "Size and Book-to-Market Factors o Earnings and Returns," *Journal of Finance* (March, 1995), "Multifactor Explanations of Asset Pricing Anomalies," *Journal of Finance* (March, 1996), and "Value versus Growth: The International Evidence," *Journal of Finance* (December, 1998). In a 1993 article Fama and French propose a five-factor model that adds two fixed income factors: a credit risk factor (Long Term Corporate Bonds – Long Term Government Bonds) and a maturity risk factor (Long Term Government Bonds – T-Bills), Fama, E.F. & French K.R., "Common Risk Factors in the Returns On Stocks and Bonds," *Journal of Financial Economics* (February, 1993), pp. 3-56.

In the Fama-French world, rational portfolio design takes place in an efficient market—there is little opportunity for market timing and stock picking strategies to succeed.⁸ Having identified priced factors and having identified the expected reward for loading on these three factors (CAPM’s market risk premium, the small stock minus big stock premium, and the value premium), investors can determine the extent to which they wish to tilt the portfolio to capture these extra rewards or to limit overall portfolio risk.⁹ The following chart demonstrates the average monthly incremental return for the three factors over rolling 36-month periods between January 1973 and December 2004:



The three factors are:

- The **Value Premium** (calculated as the return differential between growth and value stocks);
- The **Market Premium** or U.S. Equity Risk Premium (calculated as the return differential between the S&P 500 U.S. stock index and the 30 day T-Bill); and,
- The U.S. **Small Stock Premium** (calculated as the return differential between the S&P 500 U.S. stock index and the CRSP 9-10 decile of small stock returns).

⁸ Additionally, the multifactor model approach demonstrates that many money managers who advertised that they “beat the market” because of timing and selection skills, merely tilted towards stocks with priced risk factors. Recalibrating their returns to the proper benchmark (i.e. indexes of large or small company value or growth stocks) often shows that the managers, in fact, underperformed relative to the appropriate measuring index. People who fish in the ocean will, on average, catch larger fish when compared to people who fish in ponds—this has more to do with the fact that the ocean has larger fish than it has to do with the skill of the fisherman.

⁹ For example, a portfolio with a tilt towards value stocks in its equity positions may be able to capture a reward of ‘x’ with a smaller overall allocation to equity (i.e.; larger allocation to T-Bills) than a portfolio without such factor loading. This may result in a more efficient portfolio.

The graph illustrates the average monthly incremental return to factors over rolling 36-month periods. It is interesting to observe that the investor was rewarded for tilting the portfolio towards small and value factors for the 10-year period beginning in 1973. For the 10-year period beginning in 1983, the return to small was strongly negative; and for the decade of the 1990s, the returns to both small and value were often negative and were dominated by the market factor. During this period, a few large company stocks (General Electric, Enron, as well as telecommunications, internet, and computer companies) dominated the market. This was the age of “new paradigm” investing. However, starting in 2000, investors tilting the portfolio towards small and value risks were amply rewarded; and, of perhaps even greater significance, investors were cushioned against the catastrophic meltdown of the NASDAQ and in the S&P 500 stock indexes. Finally, the realization of the value and small premiums are not perfectly correlated. This suggests that, even in the absence of excess returns, portfolio construction might benefit from the attempt to load for the value and small risk factors when viewed from the objective of risk control benefits.

THE VALUE FACTOR

The Fama-French multifactor model is one of several such models that have been used in portfolio design and implementation for over a decade. Given this time span, it is interesting to ask two questions:

1. Currently, how credible are ‘fundamental’ multi-factor models in the academic community?
2. How have portfolios formed on these models performed empirically?

We sketch out a preliminary answer to these questions by looking at some recent academic discussions on the value premium. The value premium appears as a priced risk in many multifactor models currently in use including a risk factor model developed by the BARRA consulting firm and a four-factor model (beta, small, value and momentum) developed by Mark Carhart.¹⁰

The good news, in a nutshell, is that there is almost a consensus opinion in the academic community that the value risk factor is helpful in the design of investment portfolios. The value factor seems to be an identifiable attribute of publicly traded firms across global stock markets; it is a factor that, on average, yields a positive excess expected return that is statistically and economically significant; and, that it is a factor that can readily be incorporated into practical investment strategies. The bad news is that there is a total lack of consensus on what the value premium is, how it works, how best to identify it, whether it will work in the future (i.e. has “mathematical necessity”), and whether it is a proxy for some other factor that has yet to be fully understood.

WHERE’S THE RISK?

Rational markets assume that investors expect to receive compensation for risk; and, the asset pricing models that lie at the heart of Modern Portfolio Theory assume that there is a (possibly linear) relationship between risk and reward. Therefore, if value is a priced factor in the marketplace, there must be a ‘value risk.’ But herein lies a problem...the traditional measures of risk (standard deviation, performance in negative markets, semi-variance or downside risk) fail to appear in the cross-section of stocks with value characteristics. The original hypothesis regarding value stocks put forth by Fama and French argued that the value risk was a “distressed” stock risk. Value factor attributes are found in companies with poor earnings and profits and, hence, these stocks were highly susceptible to

¹⁰ The BARRA model is discussed in Farrell, James L., *Portfolio Management*, Second Edition, (Irwin McGraw-Hill, 1997), pp. 92-107. The model decomposes stock risk into thirty-nine components grouped into six factors: (1) Size, (2) Financial Risk, (3) Growth Aspects, (4) Low Valuation/Unsuccess, (5) Earnings Variability, and (6) Market Variability. See also, Carhart, Mark, “On Persistence in Mutual Fund Performance,” *Journal of Finance* (March, 1997).

bankruptcy during recessionary periods. Ken French described value stocks as “dog stocks.” But examinations of risk and actual market performance failed to confirm this hypothesis. For example, a 1994 study looked at returns to value and growth stocks over the period May 1968 through April 1990.¹¹ Forming portfolios of growth and value stocks and measuring their subsequent five-year performance, the authors discovered that the annual size-adjusted value stock premium was a substantial 8.7%, but that the standard deviation in value stock returns (24.1%) was not significantly greater than the standard deviation in the returns of growth stocks (21.6%). Furthermore, other tests examined returns generated in poor market conditions. If value stocks load on a “distressed company” risk factor, then investors should expect value stocks to perform poorly in recessionary economies. However, during the worst 25 stock market months value stocks actually outperformed growth stocks (-8.6% compared to -10.3% for growth stocks). Returns during the best 25 stock market months were 12.4% for value stocks and 11.0% for growth stocks. Relative to growth stocks, value stocks had a positive risk premium under all market conditions.

The 1994 study was the first of a continuing series of research papers co-authored by Josef Lakonishok and others that argue that the value premium reflects anomalous market pricing caused by irrational investor behavior. The explanation for the persistence of the value premium is found in “cognitive biases underlying investor behavior and the agency costs of professional investment management.”¹² In brief, this explanation rests on psychological or behaviorist finance principles; and not on priced risk factors that are attributable to the firms themselves. If correct, this position would reduce the value factor to a mere academic curiosity.

However, Lakonishok and colleagues suggest that the value premium is likely to persist because of an “agency” problem—those responsible for forming institutional portfolios prefer to play it safe. They avoid buying stocks of companies lacking decent fundamentals: “the nobody ever got fired for buying IBM syndrome.” Furthermore, individual investors exhibit a persistent cognitive error of “extrapolation.” They are likely to buy growth stocks because such stocks exhibit high growth rates in earnings, sales and cash flow. Investors become attracted to the recent performance success and purchase these “glamour” firms believing that the good performance manifested in the recent past will continue (“extrapolate”) into the future. However, economic theory suggests that this is unlikely because “in competitive markets, abnormal profits tend to be dissipated over time.”¹³ Thus, the behaviorist / irrational investor hypothesis takes the position that the value premium exists across global markets, but that its existence does not represent a priced risk factor (i.e., Lakonishok et al. do

¹¹ Lakonishok, J., Shleifer, A., & Vishny, R., “Contrarian Investment, Extrapolation, and Risk,” Journal of Finance (December, 1994).

¹² Chan, Louis K.C., & Lokonishok, J., “Value and Growth Investing: Review and Update,” Financial Analysts Journal (January/February, 2004), p. 71.

¹³ Chan, Louis K.C., Karceski, J., & Lakonishok, J., “The Level and Persistence of Growth Rates,” Journal of Finance (April, 2003). P. 655.

not support its use in a multifactor fundamental asset pricing model approach). The value premium reflects a persistent flaw in investors' valuation approaches, not a priced fundamental risk factor.¹⁴

John Cochrane, a University of Chicago economist, explains that if every investor tilted his or her portfolio towards value or small stocks in an attempt to capture the anticipated risk premiums, the “premiums from these strategies will disappear and the CAPM [single factor], random walk view of the market will reemerge.” Cochrane argues that the premiums “...can only work if the average investor is leery about buying financially distressed and illiquid stocks.”¹⁵ He continues to develop a theory of asset pricing based on theories of risk-transfer and hedging (insurance) demands that the market fulfills for a large number of investors. In a nutshell, the payoffs to multifactor risk strategies occur as compensation for holding “real, aggregate risks that the average investor is anxious not to hold.”

The implications of Cochrane's argument are most interesting. Investors with large amount of “human wealth” (i.e., the present value of their future labor income) may well wish to avoid small and value stocks because these stocks have a greater likelihood of poor performance in recessions. Recessions are economic environments that could trigger job losses or compensation cutbacks.¹⁶ However, investors with large amounts of “financial wealth” (i.e. approaching or in retirement) are better able to take advantage of the higher expected returns for bearing financial distress / liquidity risks. These investors, in effect, sell insurance to investors who wish to hedge or avoid job loss / labor income risks and, therefore, can expect to receive a premium for the insurance sale.

THE FAMA-FRENCH RESPONSE

To complicate matters, Fama and French appear, to date, to be unsuccessful in relating the value factor to corporate earnings. This is important because earnings, ultimately, are the primary determinant of stock prices; or, as Fama and French state: “rational stock prices are discounted expected future earnings (net cash flows).”¹⁷ Thus, if stock returns reflect size and value factors, analogous traces of such factors should also be found in corporate earnings. Cross-sectional tests indicate a persistent relationship between value stocks and profitability. That is to say, Growth stocks tend to be stocks of companies that manifest profitability prior to portfolio formation and continue to manifest relatively superior profitability thereafter; value stocks tend to be stocks of companies manifesting low profitability prior to portfolio formation and continue to manifest relatively inferior

¹⁴ On a more technical basis, it is interesting to note that Fama-French and Lakonishok et al. look at the same evidence but draw very different conclusions. In the “Level and Persistence of Growth Rates” article, the authors note the fact that high rates of growth in earnings and sales tend not to persist for any identifiable group of securities (tech stocks, pharmaceuticals, growth stocks, etc.). Thus, investors who buy stocks with good performance in the recent past are “tricked” into thinking that such performance will continue. This is “irrational.” Fama and French look at the evidence and conclude that the convergence of earnings growth (i.e. growth stock earnings growth rates slow down while value stock earnings growth rates speed up with the result that, in future years, the earnings rates become more similar) is evidence of a rational market. They reason that once a stock is allocated to a growth stock or a value stock category, the market makes unbiased forecasts of earnings growth: “We suggest a simple economic story for the behavior of earnings, book equity, and assets (which behave much like book equity). Sometime prior to portfolio formation, low-BE/ME [i.e., Growth] firms experience a demand or supply shock that increases their average return on capital. The profit-maximizing response is to expand output and investment until, at the margin, earnings on investment return to competitive-equilibrium levels. Conversely, high-BE/ME [i.e., Value] firms experience a demand or supply shock that decreases their average return on capital. The profit-maximizing response is to restructure, that is, to let output and investment contract until, at the margin, earnings on investment return to competitive-equilibrium levels.” Fama & French, “Size and Book-to-Market Factors in Earnings and Returns,” *Op. Cit.*, p. 137

¹⁵ Cochrane, *Op. Cit.*, p. 70.

¹⁶ This argument is developed further by Davis, Steven J. & Willen, Paul, “Income Shocks, Asset Returns, and Portfolio Choice,” *Innovations in Retirement Financing*, Olivia S. Mitchell, Zvi Bodie, P. Brett Hammond & Stephen Zeldes eds., (University of Pennsylvania Press, 2002), pp. 20-49.

¹⁷ *Ibid.*, p. 132.

profitability thereafter. However, although the absolute superiority is, on average, maintained by Growth stocks, the rate of earnings growth *slows* for the group of glamour stocks and *increases* for the group of value stocks. In the world of Fama and French, a forward-looking stock market makes rational adjustments to the projected earnings, and stock prices change accordingly. The higher equilibrium returns on value stocks following portfolio formation reflects the new market expectations regarding the earnings of these stocks relative to their growth-stock counterparts.

So far, so good. However, despite the fact that the *level* of earnings unfolds as expected, there is little evidence that the *pattern* of corporate earnings increases and decreases matches up well with the effects of the value premium on corporate stock prices. The delta in stock returns attributable to the value factor is not well explained by the delta in earnings attributable to a value factor: “we find no evidence that returns respond to the book-to-market factor in earnings.... we intend to pursue these issues, but we are not confident they can be resolved. Most candidate state variables (gross national product, consumption, employment) have measurement problems as severe as earnings.” Fama and French suggest that the value factor is difficult to explain in terms of earnings; and, it will be very difficult to explain in terms of macroeconomic variables. If this is the case, then it may well be that the value premium is merely a ‘metaphysical risk’ that is best explained by behaviorist finance.

ECONOMETRIC STUDIES: ADVANCED DATA MINING OR BRILLIANT EXPLANATION?

On the other side of the value-as-priced-risk-factor debate lies a number of research studies that are strongly econometric in tone and which concentrate either on explicit macroeconomic risk factors¹⁸, or on unobservable ‘statistical’ factors. An interesting example is the study entitled “News related to future GDP growth as a risk factor in equity returns.”¹⁹ The thesis of this study is that the Fama-French value (HML = high book to market minus low book to market) and small (SMB = small minus big) three factor model inputs are, themselves, merely proxies for macro-economic risks.

Vassalou, a professor at Columbia University, points out that although the three factor model does a good job explaining stock returns, the small and value factors lack “any economic interpretation.” If, however, under the assumption that the market is a forward-looking rational pricing mechanism, then it is reasonable to assume that the Fama-French factors are also forward looking and may be proxy variables incorporating news related to future growth in the gross domestic product—a macroeconomic variable. However, there is a serious methodological problem: future GDP growth is (currently) unobservable. After reviewing the economic literature (topics include Generalized Methods of Moments, stochastic discounting versus deterministic or probabilistic discounting, predictive control variables, and construction of mimicking portfolios), Vassalou sets about building a mimicking portfolio of equity and fixed income assets that will enable her to study how the returns of the mimicking portfolio reflect certain control variables that have been shown to be predictive of future

¹⁸ Models that concentrate on the evolution of exogenous macroeconomic variables (industrial production, interest rates, unemployment, inflation, etc.) assume that stock returns reflect the state of the underlying economy. These models are often termed ‘Arbitrage Pricing Theory’ models. It is, however, difficult to determine the (ever-changing) functional relationships between the variables of interest. Identification of relevant variables is highly sample dependent. See, for example, Chen, N.-F., Roll, R. & Ross, S. “Economic Forces and the Stock Market,” *Journal of Business* (Vol. 59 #3, 1986). Models that concentrate on unobservable statistical facts rely on techniques such as Principal Component Analysis. This technique takes advantage of the fact that any return (or, directional) vector can be decomposed (through a Graham-Schmidt process) into a subset of orthogonal vectors (so many steps to the north, so many steps to the west, etc., if you are working on a map). The researcher ends up not with a matrix of returns but with an orthonormal matrix from which the important factors (lines of direction) can be more easily estimated. If two or three eigenvalues dominate, then the analysis indicates that there are three factors that account for the variation in returns. One check on the validity of a factor model, therefore, is to verify that the identified factors have a high standard deviation.

¹⁹ Vassalou, Maria, “News related to future GDP growth as a risk factor in equity returns,” *Journal of Financial Economics* (Vol. 68, 2003), pp. 47-73.

GDP growth.²⁰ The mimicking portfolio contains the macroeconomic variable information, but the information is expressed in asset price returns.

The mimicking portfolio's returns are regressed on portfolios formed by using Fama and French's small and value criteria. If there is a close fit, the Fama-French factors can be considered proxies for fundamental economic forces—i.e. priced risk factors. By using the control variables (information published on the yield curve, consumption, asset wealth, labor income, etc.), she can “translate” the macroeconomic information into asset price changes and, thereby avoid problems related to measurements of unobservable economic variables. Finally, this information can be re-extracted from the asset returns of the mimicking portfolio and compared to the Fama-French factors.

Vassalou concludes that the Fama-French factors are highly correlated to the future GDP growth factor. The GDP growth factor is the market's expectation concerning the opportunity set of investments that, given current interest rates, determines the risk-reward climate faced by investors. Therefore, the study “provides an economic interpretation, based on empirical evidence, for the ability of HML and SMB to explain the cross-section of asset returns.”

RECENT RETURNS TO VALUE AND GROWTH

One of the more thorny issues vexing research on the value premium is how to define and measure a value stock. This is known as the “benchmark issue”²¹ and refers to the lack of comparability between, for example, the S&P/BARRA value style indices, which use inclusion/exclusion criteria significantly different from either the Russell value indices or the CRSP value indices. Depending on your choice of a benchmark, the relative advantages of either growth or value style investing may differ significantly.

One survey of recent returns, using primarily the S&P/BARRA Large Cap Index and Russell 1000 Large Cap Index²², notes that the returns to growth and value indices fall, roughly speaking, into three periods:

- (1) Prior to the 1990s, the return to growth was negatively correlated to the return to value. During some periods, growth lagged value by a small margin; and, during other periods, value lagged growth by a small margin.
- (2) During the period 1991 through 1997, both the return to growth and the return to value converged towards zero (i.e. investor's were not compensated for tilting towards either factor);
- (3) The last decade has seen periods where either the return to growth has greatly exceed the return to value; or, the return to value has greatly exceed the return to growth.²³

²⁰ For a definition of ‘mimicking portfolios,’ see footnote #8.

²¹ See the article on the SCLC website, “Does Index Selection Matter?” [Investment Quarterly](#) Volume 9, Issue 1 (2003).

²² Both index manufacturers subdivide the stock universe into style indices representing growth and value. The S&P BARRA indexes, however, have no overlap. Russell, by contrast, has some stocks that are included in each of the indexes. Likewise, the recipe for inclusion in the value/growth indexes also differs. S&P sorts on price to book (P/B) ratio only, while Russell sorts on price to book and IBES earnings forecasts. Not surprisingly, growth indexes contain a bias towards large cap stocks exhibiting high P/E and P/B. The dividend yield, however, is larger in value style indices.

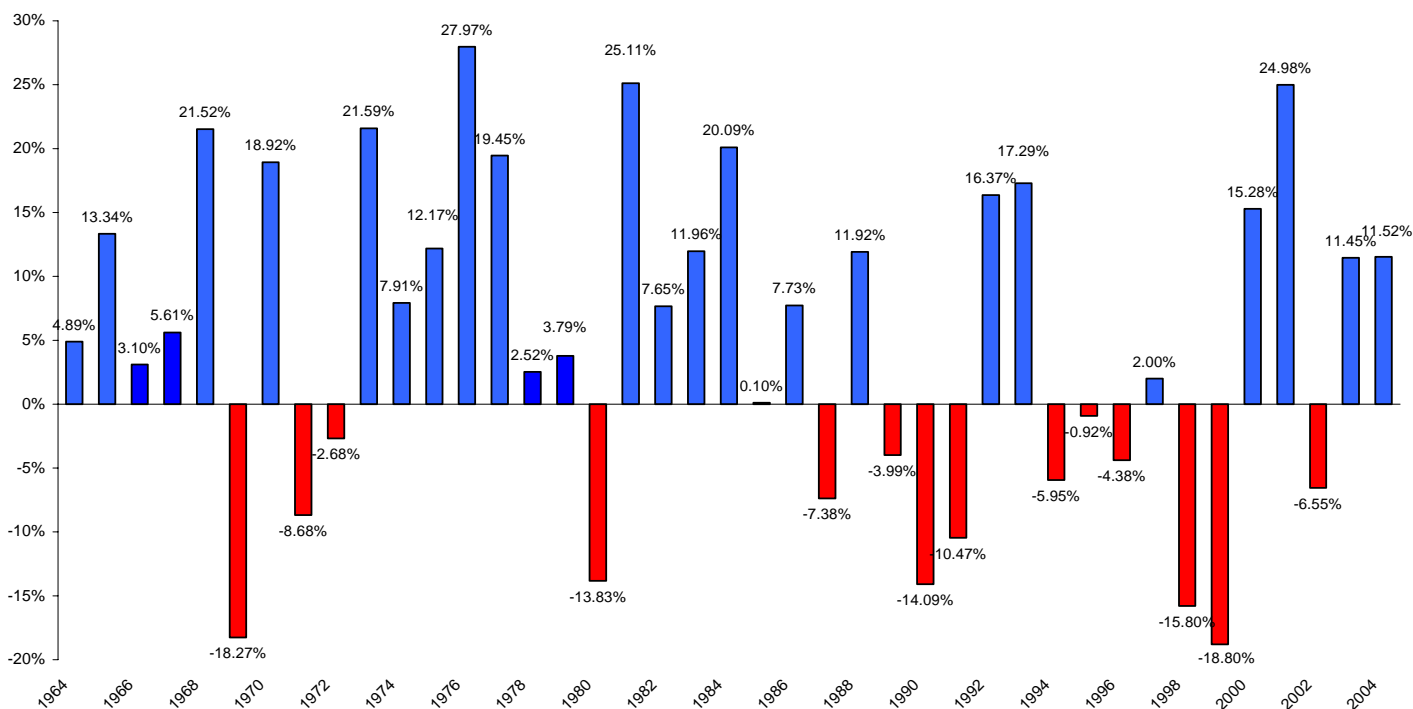
²³ Hill, Joanne M., “Trading (and Investing) in “Style” Using Futures and Exchange-Traded Funds,” [The Handbook of Equity Style Management](#) 3rd Edition (2003), pp. 455-482.

Likewise, the volatility of the return differential follows, roughly, the same pattern (although the historical volatility of value is lower). One possible reason for the recent increase in the volatility of the return differential is the greater weighting of tech stocks in growth-oriented indexes. Growth and Value indices exhibit strong sector tilts. Growth indexes, during the late 1990s and early 2000s had high exposure to technology, health-care, financials, and consumer (cyclical and noncyclical) stock sectors. During the same period, value indexes were heavily weighted in energy, telecom and consumer services. Industry weights have been more stable in value indexes, and have shown greater fluctuation in growth indexes. One cannot ignore the possibility that a strong portfolio tilt towards either value or growth stocks results in a portfolio the returns of which share characteristics of a contrarian sector rotation strategy.

The following chart depicts the comparative performance of value vs. growth over the period 1964 through 2004. The blue columns represent the extent to which value stocks outperformed growth stocks; the red columns represent the extent to which value stocks underperformed growth stocks over the period. The data is derived from the CRSP index of stocks across all deciles of the New York, American and NASDAQ exchanges. It is interesting to note that value style investing, using the CRSP index measurements and index construction principles, generated superior returns in only eight of the last eighteen years. However, a value stock position held in 2001 - 2003 helped mitigate the ravages of the NASDAQ market meltdown.

THE VALUE PREMIUM

An investment in US stocks with a value orientation outperformed an investment in US stocks with a growth orientation by an annual compounded return of 4.44% from 1964 through 2004. In 27 out of 41 of those years, an investment in value stocks generated a higher rate of return than an investment in growth stocks.



CONCLUSION

Research on the value risk premium has developed along rich and often contentious paths since the initial publication of the Fama-French three-factor model in 1992. One of the benefits of the ongoing academic research, however, is that it makes valuable contributions to investors wishing to increase the probability of a good outcome. In many respects, investors are not so much interested in the professoriate's debate concerning the nature of priced risk factors and the mathematics of asset-pricing model building, as they are about how to capture investment rewards and effectively manage risks. Whereas the value premium fails to appear consistently in every period under evaluation, it is doubtful that it forms a strong basis for a theory of asset pricing. However, research suggests that the value premium concept is helpful as a tool for describing a set of investment opportunities that is richer than heretofore described under the more classical single index asset pricing models. Evidence indicates that a value tilt increases the probability for future investment success but does not guarantee it.

APPENDIX: DEFINITION OF A FACTOR

Multifactor portfolios incorporate strategic exposures to certain factors in the expectation that such exposures will enhance return, control risk, or both. Although the dictionary lists many uses for the word “factor”, for purposes of this article, we use the mathematical definition for factor.

In mathematics, as a general rule, multiplication represents synthesis, while factoring represents analysis. For example, multiplication of 3 times 3 (resulting in the single number of 9) is a form of synthesis. However, one way of analyzing the number 12 is to break it up into component parts. Twelve can be factored into 12 times 1, 2 times 6, 3 times 4, the cube root of 8 times the square root of 36, etc. Depending on the type and context of the problem and depending on the usefulness of various factoring options, there is a wide range of choices with respect to analyzing this number. In terms of simple algebra [$a^2 + b^2 + 2ab = (a + b)(a + b)$], equations can also be factored into various terms.

Consider, next, the following situation. You own one unit each of two assets, In time period one, the return on asset A equals 2 and the return on asset B equals 2; in time period two, the return on asset A equals 3 and the return on asset B equals 1. In matrix form, this can be expressed as:

$$\begin{vmatrix} 2 & 2 & | & 1 \\ 3 & 1 & | & 1 \end{vmatrix}$$

It is easy to see that this “system” tends towards the value of 4. In the first period, each asset produces returns of 2 ($2+2=4$) and in the second period, the returns of 3 plus 1 also sum to four. If we factor the returns matrix on the left, we perform an operation known as solving for the eigenvalue of the matrix. Without going into great detail on matrix factorization, the eigenvalue (signified by the Greek letter lambda) is found as follows:

$$(2-\lambda)(1-\lambda)-(3)(2) = 0$$

$$\lambda^2-3\lambda-4 = 0$$

$$(\lambda-4)(\lambda+1) = 0, \text{ and the dominant eigenvalue is } \lambda = 4.$$

Thus, for the above matrix, we can perform a factorization and deduce that the dominant eigenvalue is 4 and that the eigenvector corresponding to the eigenvalue of four is the vector [1 1]. If (1,1) represents a point in a Cartesian coordinate plane, the eigenvalue “stretches” the point by a factor of four in each direction. In Matrix algebra, eigenvalues and eigenvectors are also known as ‘characteristic’ values and ‘characteristic’ vectors of the matrix. Factoring a matrix is an analytical process that allows a decomposition of potentially vast amounts of time series data showing where any complex system (such as an investment portfolio) is heading. If there are vectors of returns for many assets over many periods, we are presented with complex matrices that are n-dimensional data clouds. To get a handle on where such systems are tending, complex operations are needed to calculate the eigenvectors (the principal axes of the n dimensional cloud) as well as the associated eigenvalues. The number of axes (called the basis of the system), represent the number of priced factors while the eigenvalues represent the factor loadings (given the factors, which way will the system of returns tend to head—i.e., how the factors are priced determines, ultimately, the returns of

your portfolio).²⁴ Thus, for any complex system of asset returns, the factor analysis task is threefold:

1. Identify the relevant factors²⁵
2. Determine the risk premium for each factor
3. Determine the degree of exposure of any asset to the relevant factor(s).

Moving from a mathematical to a finance context, factors, according to John Cochrane, a finance professor from the University of Chicago, are equivalent to "...state variables or sources of priced risk, beyond movements in the market portfolio." Cochrane states: "It is vital that the extra risk factors affect the *average* investor. If an event makes investor A worse off and investor B better off, then investor A buys assets that do well when the event happens and investor B sells them. They transfer the risk of the event, but the price or expected return of the asset is unaffected. For a factor to affect prices or expected returns, it must affect the average investor, so investors collectively bid up or down the price and expected return of assets that covary with the event rather than just transferring the risk without affecting equilibrium prices. Inspired by this broad direction, empirical researchers have found quite a number of specific factors that seem to explain the variation in average returns across assets."²⁶

²⁴ For readers more comfortable with calculus, in an expression such as:

$$\text{Growth of wealth} = Ae^x + Be^y + Ce^z,$$

where e is the compound growth factor or exponential, the values of x , y & z are the eigenvalues of the system. The exponents stretch or shrink the multivariable growth function according to their values. Much recent research is devoted towards determining possible correlation relationships between the eigenvalues. The research leads towards building cointegration models of asset pricing relationships where, in a dynamic process setting, cointegration is equivalent to the existence of common stochastic trends. This approach to money management has proven especially useful in the operation of several kinds of quantitatively driven funds. See, for example, Focardi, Sergio M. & Fabozzi, Frank J., [The Mathematics of Financial Modeling & Investment Management](#) (Wiley Finance, 2004), pp. 538-543.

²⁵ Factors are not "stable" in the sense that important factors in one period may have little explanatory value in a different period. Think of the national debt factor. During the early 1990's this was a topic discussed by every economist and financial analyst. During the prosperity of the Clinton years, it became a less important 'factor' in financial decision-making. Recently, with the recession, tax cuts and the war, it is again assuming some importance.

²⁶ Cochrane, [Op. Cit.](#), p. 39.