Multifactor Explanations of Asset Pricing Anomalies

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Journal of Finance, 1996

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Outline

I - Purpose of the Paper

Fama and French (FF) address two questions:

- Can the three-factor model explain stock returns anomalies?

- Are the factors, SMB, and HML unique?

I - Purpose of the Paper

Asset Pricing Anomalies

- What are pricing anomalies?
  - Patterns in average stock prices, usually related to firm characteristics, not explained by the Capital Asset Pricing Model of Sharpe (1964) and Lintner (1965)

- What are the identified anomalies in average stock prices?
  - DeBondt and Thaler (1985) find a reversal in long-term returns; stocks with low long-term past returns tend to have higher future returns.
  - Jegadeesh and Titman (1993) find that short-term returns tend to continue; stocks with higher returns in the previous 12 months tend to have higher future returns.
  - Others have shown that a firm's average stock return is related to its size, BE/ME, E/P, C/P, and past sales growth. (Banz, (1981), Basu (1983), Rosenberg, Reid and Lanstein (1985), and Lakonishok, Shleifer, and Vishny (LSV)(1994).)

I - Purpose of the Paper

Multifactor Model

- The three factor model used by FF in JFE 1993 is:

$$E(R_{it}) - R_{ft} = b_i[E(R_{Mt})-R_{ft}] + s_iE(SMB_t) + h_iE(HML_t), \qquad \textbf{(1)}$$

  where $E(R_M)-R_f$, $E(SMB)$, and $E(HML)$ are expected premiums, and the factor sensitivities b_i, s_i, and h_i, are the slope coefficients in the time-series regression.

- Assuming rational expectations,
  $R_{Mt} = E(R_{Mt}) + \eta_{Mt}$; $SMB_t = E(SMB_t) + \eta_{SMBt}$; $HML_t = E(HML_t) + \eta_{HML}$, where the error terms are orthogonal to the information at time t-1.

- And so, (1) can also be written as:

$$R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt}-R_{ft}) + s_iSMB_t + h_iHML_t + \varepsilon_{it} , \qquad \textbf{(2)}$$
  where $\alpha_i = - b_i\eta_{Mt} - s_i\eta_{SMBt} - h_i\eta_{HMLt}$

II - Portfolio Methodology & Main Results

Creation of SMB, HML, R_M Factors

- At the end of June of each year, NYSE, AMEX, and NASDAQ stocks are allocated to groups based on its size (S, B), and BE/ME (H, M, L).
- Six portfolios are constructed as the intersection of the 2 size and 3 BE/ME portfolios. Value-weight monthly returns on portfolios are calculated from July-June. SMB is the difference between the monthly average returns of the small and big stock portfolios. HML is the difference between the monthly average returns of the high and low stock portfolios.
- R_M is the value-weight return on all stocks in the size-BE/ME portfolios.

Creation of Stock Portfolios – Why?

- Idiosyncratic noise makes it difficult to detect the presence of predictable components.
- Isolate firm characteristics.

II - Portfolio Methodology & Main Results

LSV Deciles

- At the end of June of each year, stocks are allocated to 10 portfolios, based on their deciles breakpoints for E/P, C/P, BE/ME, and past 5-year sales rank.

- To reduce the influence of small stocks in the (equal-weight) monthly returns, use only NYSE stocks.

- The 5-year sales rank is the weighted average of the annual sales growth ranks for the prior five years.

LSV Double-Sort Portfolios

- Sorting stocks based on two accounting variables more accurately distinguishes between strong and distressed stocks and produces larger spreads in returns. LSV suggest combining sorts on sales rank with sorts on BE/ME, E/P or C/P.

II - Portfolio Methodology & Main Results

Portfolios Formed on Past Returns

- At the beginning of each month all NYSE firms with returns from t-x to t-y are allocated to deciles based on their continuously compounded returns between t-x and t-y. Portfolios are reformed monthly.

- Example: Portfolio formation period 12-2
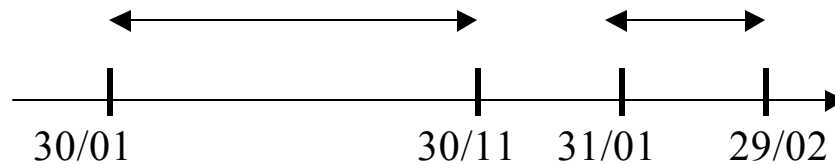
II – Main Results

- The 3-factor model explains the pattern in returns that is observed when portfolios are formed on E/P, C/P, and sales growth.
  - Low E/P, low C/P, and high sales growth are typical of strong firms that have (--) slopes on HML (similar to the slopes for low BE/ME) ⇨ low expected returns;
  - High E/P, high C/P, and low sales growth are typical of weak firms that have (+) slopes on HML (similar to the slopes for high BE/ME) ⇨ high expected returns.

- The 3-factor model captures the reversal of long term returns.
  - Stocks with low long-term past returns (losers) tend to have (+) SMB and HML slopes (look like small and relatively distressed stocks) and higher future average return;
  - Stocks with high long-term past returns (winners) tend to have (--) SMB and HML slopes (look like big and strong stocks) and higher future average return.

II – Main Results

- But, it can not explain continuation of short-term returns.
  - Stocks with low short-term past returns tend to have (+) slopes on HML (like long-term losers)

- The pattern on HML predicts <u>reversal</u> instead of continuation for future returns. Continuation is left unexplained.

- In summary, the evidence suggests that SMB and HML mimic combinations of two underlying risk factors or state variables of special concern to investors.

III – Exploring Three-Factor Models

What 3 factors?

- FF test other combinations of 3 portfolios, to check whether the description of returns is as good as using R_M, SMB, and HML portfolios.

- Fama (1994) shows that a generalized portfolio-efficiency concept drives Merton's (1973) ICAPM.

- ICAPM investors are concerned with hedging specific state-variable risks. In the usual representation of a three-factor ICAPM, the 3 explanatory portfolios are the value-weight market and Multifactor Minimum Variance (MMV) portfolios that mimic the two state variables of special hedging concern to investors.

- In a two-state-variable ICAPM, MMV portfolios are spanned by the R_f, and any three linearly independent portfolios.

IV – Possible Limitations

Economic interpretation of the results is contentious. FF distinguish between three different stories:

- Asset pricing is rational and conforms to a 3-factor model;

- The 3-factor model describes returns, but it is investor irrationality that prevents the 3-factor model from collapsing to the CAPM. (irrationality causes the high premium for relative distress);

- CAPM holds but is spuriously rejected.

IV – Possible Limitations

Perhaps CAPM holds and the high relative distress premium in average returns is the spurious result of:

- *Survivor Bias (Kothari, Shanken, and Sloan (KSS), 1995)*
  - Average returns on high-book-to-market portfolios of COMPUSTAT stocks like H are overstated, because it is more likely to include distressed firms that survive.
  - This argument is refuted by Chan, Jegadeesh, and Lakonishok (95). Moreover, KSS concede that survivor bias is not a major problem for value-weight portfolios.

- *Data Snooping (Black (1993), MacKinlay (1995))*
  - Average returns exhibiting size and BE/ME effects, as an example, are sample specific.
  - As counter examples: (i) Davis (1994) shows that distress premium is not special to post-1962 period studied in FF (1992, 1993). (ii) Tests on international data (out-of-sample) produce same type of relations between average return and size, BE/ME, E/P, and C/P. (iii) Ball (1978) argues that scaled versions of price are proxies for expected return.

- *Poor Proxy for the Market Portfolio*
  - If the market portfolio is unobservable, multifactor models may provide better estimates of CAPM expected returns.

V – Suggestions

- Tests for Heteroskedasticity and autocorrelation of residuals should be performed. Evidence of heteroskedasticity in residuals has shown that it plays an important role in CAPM tests. (Schwert and Seguin 1990).

- Include HML squared in the model could capture non-linearities in stock return behavior. If a large negative loading on HML squared is estimated, then we could see continuation of short-term returns for some portfolios. Another alternative would be to allow for the use of time varying betas. (Schwert and Seguin 1990).

- Another point, is that since expected average returns seem to be explained by the three-factor risk return relation, it would be interesting to analyze whether it is the time variation in expected premiums or time variation in the factor sensitivities that capture most of the predicted variation in the portfolio returns.

- The model has been shown to be robust. It would be interesting to apply the model to explain returns of each firm. Why, why not?