Equity Factor Returns Revisited

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Motivation

- Empirical research into factor returns has long dominated the efforts of both quantitative equity managers and many academics.

    – Whether done in the orthogonalized manner of commercial risk models (e.g. Northfield US Fundamental) or overlapping as typified by Fama and French (1992), factors are the *lingua franca* of modern equity investing.

    – Unfortunately, many investors fail to appreciate how factor return histories differ when viewed from the simple or orthogonal perspective, or when the factor returns are estimated conditionally on an asset pricing model (e.g. CAPM).

    – These differences in perspective can entirely change an investor's perspective of the returns associated with strategies (e.g. momentum, value, or low volatility).

Outline for Today

- In this presentation we will reconcile factor returns among three prominent style factors: Value, Size, and Momentum

- We will compare and contrast three different approaches to estimating factor returns and the cross-sectional variation in the observed factor return outcomes.
    - The regular version of the Northfield US Fundamental Risk Model
    - A new version of the Northfield Fundamental model that has been modified to reflect investor attention to large events (e.g. pandemics, wars) as described in diBartolomeo and Kantos (*Journal of Asset Management*, 2020).
    - Fama-French factors as they are available free and are widely used in academic research.

Data

- All factor return data used is in monthly frequency

- The sample period used was from December of 1991 through May of 2020, a total of 342 observations.

- All time periods within the sample are equally weighted as we are only observing differences rather than trying to make any kind of prediction of future factor return outcomes.

- The data for Fama-French factors was obtained from [Kenneth R. French - Data Library (dartmouth.edu)](dartmouth.edu).

- All factor returns are based on US market results, and are thereby *inclusive of large, international firms traded in ADR form*.

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Data Preparation

- Our three subject factors were chosen because they are popular in quantitative strategies, have been widely studied in academic research, and their *definitions are outwardly similar* across the Northfield and FF models.

- The FF factor return data are quintile spreads while the reported Northfield factor returns are statistically estimated for one standard deviation active exposure in the cross-sectional Z-score.
  - We changed the sign on the FF data to reflect differences in definition for "Smallness" versus "Size"
  - The FF factor return magnitudes were rescaled to reflect the fact the distance between quintiles of a normal distribution is larger than one standard deviation.

Key Differences in Estimation

- The Fama French factors are obtained from quintile spread portfolios (e.g. Small caps – Large Caps)

  - The spread returns are not statistically orthogonal to other factors as the quintile portfolios will have many other differences (e.g. mix of industries).

  - The returns for quintiles are value weighted (i.e. by capitalization).

- The estimation of factor returns for the Northfield model is done by cross-sectional regression intended to operate on a *ceteris paribus* (all else equal) basis, inclusive of all firms with market cap > $250 million

  - Regressions are weighted by square root of capitalization to balance more numerous small firms with the fewer number of large firms.

  - See Active Portfolio Management (Grinold and Kahn, 1995, page 59 footnote) for a parallel statistical rationale.

Differences Between Northfield Versions

- The original Northfield US Fundamental model has been in use since 1990.

- The new version of the US Fundamental model was presented in diBartolomeo and Kantos (Journal of Asset Management, December 2020)
  - This version assumes that investors pay particular attention to "large events" like pandemics and wars but are relatively indifferent to small differences in portfolio risk (e.g. nobody cares about the difference between a .98 portfolio beta and a 1.01 portfolio beta).
  - The difference is the return we estimate for a zero beta asset
    - In the traditional CAPM (Sharpe 1964), the zero beta asset is risk-free and earns the risk free rate.
    - In the new version we follow a modified CAPM (Black, 1972) where the zero beta asset can be volatile but has zero correlation with the market, resulting in a less steep security market line.

Does Size Matter?

SIZE

	US Fundamental	Zero Beta Fundamental	Fama French Transformed
Mean	-0.09	-0.12	-0.07
Median	-0.15	-0.15	-0.06
Min	-3.13	**-12.29**	**-10.88**
Max	2.59	**12.72**	**9.11**
StDev	**0.87**	**2.68**	**1.82**
Skew	0.04	0.63	-0.40
Excess Kurt	0.36	7.43	4.85
T	-1.96	**-0.82**	**-0.72**
AR1	0.03	-0.01	-0.07

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Size Returns Correlation Matrix

SIZE

	US Fundamental	Zero Beta Fundamental	Fama French Transformed
US Fundamental	1.00		
Zero Beta	**0.15**	1.00	
FF	0.82	**0.10**	1.00

Size Factor Returns Discussion

- Both mean and median are negative for all three definitions of size.

- The mean negative monthly return to size is NOT statistically significant for the "zero beta" (ZB) and "Fama French" (FF) definitions.

- All measures of the volatility of size factor returns are much larger for the ZB and FF definitions.
  - Much larger ranges from minimum to maximum, standard deviation and positive excess kurtosis.

- First order autocorrelation is minimal for all three, so each period's return is not predictive of the next period.

- Return correlation across definitions is *insignificantly different from zero in two cases*, very different from what we would expect. Pairwise average = .36

Is There Value in Value?

	B/P		
	US Fundamental	Zero Beta Fundamental	Fama French Transformed
Mean	-0.07	-0.07	0.07
Median	-0.04	-0.05	0.00
Min	-4.89	-4.39	**-8.30**
Max	2.69	2.75	**7.38**
StDev	0.92	0.96	1.87
Skew	-0.75	-0.54	0.03
Excess Kurt	**4.31**	**3.05**	**2.67**
T	**-1.41**	**-1.31**	**0.70**
AR1	0.07	0.04	**0.17**

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Book/Price Return Correlations

B/P

	US Fundamental	Zero Beta Fundamental	Fama French Transformed
US Fundamental	1.00		
Zero Beta	0.57	1.00	
FF	0.60	0.40	1.00

Book/Price Discussion

- Measures of central tendency (mean and median) are negative for both versions of the Northfield models, while the central tendency for the FF time series is slightly positive.

  - We attribute the difference to the fact that the Northfield model has other valuation factors (e.g. E/P, dividend yield) so the return to a "value" strategy will effectively be shared across multiple factors.

- The range between minimum and maximum returns and standard deviation are both much higher for the FF definition.

  - We attribute this to the FF factors capturing the impact of micro-cap stocks which are effectively ignored in Northfield models.

  - All measures exhibit positive excess kurtosis.

- The correlation of returns across definitions is lower than expected but statistically significantly different from zero in all cases. Pairwise average = .53

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Is the Trend Really Your Friend?

Momentum

	US Fundamental	Zero Beta Fundamental	Fama French Transformed
Mean	0.31	0.01	0.29
Median	0.33	0.08	0.28
Min	**-8.39**	**-11.23**	**-20.30**
Max	**9.30**	**6.58**	**10.77**
StDev	1.74	1.74	2.85
Skew	0.04	**-1.93**	**-1.47**
Excess Kurt	**4.22**	**10.99**	**10.80**
T	3.29	0.13	1.86
AR1	0.00	0.08	0.04

Momentum Return Correlation

Momentum

	US Fundamental	Zero Beta Fundamental	Fama French Transformed
US Fundamental	1.00		
Zero Beta	0.37	1.00	
FF	0.64	0.30	1.00

Momentum Return Discussion

- All measures of central tendency across the three definitions are all positive.

- Mean returns are statistically significant for the traditional Northfield model, borderline significant for FF time series, but essentially meaningless for the ZB Northfield model.

- *All three times series have very large minimum to maximum range values*

- *All three have very large positive values for excess kurtosis.*

- All pairwise correlations are statistically significantly different from zero, but far lower than what you might expect. Average pairwise = .44

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A Word About Factor Returns in Risk Models

- The high degree of positive excess kurtosis that are exhibited in the majority of the nine series studied might lead investors to believe that risk models are underestimating "tail risk" of factor bets.

- The observed kurtosis is not necessarily indicative of a non-normal return distribution.

  - Positive excess kurtosis can arise from a distribution which is normal at each moment in time but has time-varying volatility.

  - Northfield models use RMS rather than standard deviation as the volatility measure and exponential weighting to less this effect.

  - See diBartolomeo ("Fat Tails, Tall Tales, Puppy Dog Tails", *Professional Investor*, 2007).

  - Northfield also uses our text analytics method Risk Systems That Read® to capture time variation in volatility.

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Conclusions

- Quantitative equity investors must be very rigorous in understanding exactly how a particular factor is constructed and how the returns to that factor are estimated.

- The same factor in concept (e.g. Size, Value, Momentum) may deliver significantly different outcomes, and in many cases are *seemingly unrelated when estimated in different ways.*

- While today's presentation focused on three of the most commonly used factor concepts, we observe the same sort of differences across other sources of factor returns as well as when we consider international equities, emerging markets, and "battery" factors (i.e. industry groups).