Abstract

- We consider a continuous-time version of the Fama-French (2015) five-factor model, allowing stocks’ exposures on the factors’ continuous, jump, and overnight movements to be different.
- Our results show that stocks’ continuous, jump, and overnight betas with respect to a given factor can be very different and are only weakly related.
- Strong evidence for positive pricing of continuous and negative pricing of overnight market betas, contradicting the findings of Bollerslev et al. (2016) that indicate positive pricing of jump and overnight but no pricing of continuous market betas.
- Continuous size, value, profitability, and investment factor betas mostly negatively priced while overnight betas positively priced.
- Our results give an indication on the source of the factors’ documented return premia.

Motivation

- Factor pricing models predict a positive linear relation between expected (excess) returns and factor exposures.
- Empirically, this relation is much weaker than predicted or does not hold for the factors of the Fama-French (2015) five-factor model (e.g. Jegadeesh et al. (2019)).
- We investigate the following explanation:
  - Stocks may have different exposures to continuous, jump, and overnight factor movements.
  - Exposure to different types of risk factors may carry different risk premia.
  - Monthly/daily factor betas do not differentiate between stocks’ exposures to continuous, jump, and overnight movements in the factors and may thus be unable to accurately reflect the exposure to the priced type of factor risk.

Data

- Sample period: 1993 - 2019
- Monthly and daily stock data on all common US stocks from CRSP
- High-Frequency stock data from TAQ
- Firm fundamentals data from Compustat
- Construction of high-frequency and overnight versions of the five Fama-French factors (market (MP), size (SMB), value (HML), profitability (RMW), investment (CMA))

Beta Estimation Methodology

- Estimation of individual stocks’ betas:
  - At the end of each month from June 1993 to December 2019
  - Six-month estimation window
  - Individual sampling frequencies (15-, 30-, or 75-minutes) depending on stocks’ microstructure noise
- Continuous beta of stock i on factor k ($\beta_{i,k}^{c}$): from a multivariate regression of the stock’s high-frequency returns on the five factors’ high-frequency returns, using only observations for which none of the factors exhibits a jump.
- Jump beta of stock i on factor k ($\beta_{i,k}^{j}$): from a univariate regression of the stock’s adjusted high-frequency returns on factor k’s high-frequency returns, using only observations for which factor k but none of the other factors exhibits a jump (the stock’s returns are adjusted for its continuous exposures to the other factors).
- Overnight beta of stock i on factor k ($\beta_{i,k}^{o}$): from a multivariate regression of the stock’s overnight returns on the five factors’ overnight returns.
- Identification of jumps based on the TOD estimator of Bollerslev et al. (2013): high-frequency returns that exceed, in absolute terms, three times a local volatility estimate are classified as jumps (accounting for the time-of-day volatility pattern).
- Cross-Sectional correlations between betas (averaged across the five factors):
  - Cont(continuous, jump): ca. 0.35
  - Cont(continuous, overnight): ca. 0.25
  - Cont(jump, overnight): ca. 0.15
  - Only weak positive relation between betas

Decomposition of Factor Returns

- Market premium earned in overnight returns; average continuous and jump returns close to zero.
- Size, value, profitability, and investment premia earned in continuous returns; average overnight returns strongly negative, jump returns close to zero.
- Consistent with results of Lou et al. (2019).

Risk Premia

- Factor pricing models imply a contemporaneous expected return-beta relation. Thus, we investigate the pricing of the factor betas in contemporaneous returns.
- Estimation of the following cross-sectional Fama-MacBeth regression in each month from June 1993 to December 2019:
  \[ r_{it} = \beta_{i1} + \beta_{i2} \cdot \bar{R}_{kt} + \beta_{i3} \cdot \bar{R}_{tk} + \epsilon_{it} \]
  \[ \bar{R}_t = \text{stock } i \text{'s average excess return from month } t-5 \text{ to month } t \]
  \[ \beta_{i1}, \beta_{i2}, \beta_{i3} \text{ are estimated from month } t-5 \text{ to month } t \]
  \[ \bar{R}_{kt}, \bar{R}_{tk} \text{ are stock characteristics as measured at the end of month } t-6 \]
  \[ \text{Regression estimates are weighted least squares (weights are stocks’ market capitalizations)} \]
- **Risk Premium Estimates:**
  \[ \beta_{ij} = 1 \int_{C, J, N} \bar{R}_{kt} \text{ for } \forall x \in \{C, J, N\} \]

Data

<table>
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<tr>
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<td><strong>Coefficients</strong></td>
<td><strong>t-statistics</strong></td>
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Table: Risk premium estimates in percent per month.
(1) No additional controls.
(2) Controls: size, book-to-market, operating profitability, investment, momentum, short-term reversal, idiosyncratic volatility, illiquidity, coskewness, realized skewness, realized kurtosis.
(3) Controls: size, book-to-market, operating profitability, investment, momentum, short-term reversal, idiosyncratic volatility, illiquidity, coskewness, realized skewness, realized kurtosis.

References


Conclusion

- Market betas: Continuous beta positively priced, overnight beta negatively priced, jump beta not priced.
- Size, value, profitability, and investment betas: Continuous betas mostly negatively priced, overnight betas positively priced, jump betas hardly priced.
- Overall, we cannot document a clearly upward sloping (multivariate) security market line: negative risk premia for continuous factor exposures mostly overcompensate positive risk premia for overnight factor exposures.

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