Quantitative Portfolio Management

Assignment #8

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Instructions for each assignment . . . I

- Assignment #1 should be done individually.
- The other assignments are to be done in groups of 4 or 5 students.
  - This means that groups of 1, 2, 3, 6, etc. are not allowed.
  - Diversity in groups is strongly encouraged
    (people from different countries, different genders, different finance knowledge, and different coding ability, etc.)

Instructions for each assignment . . . II

- Each assignment should be emailed as a Jupyter file
  - To Raman.Uppal@edhec.edu
  - The subject line of the email should be: "QPM: Assignment n," where $n = \{1, 2, \ldots, 8\}$.
  - Assignment n is due before Lecture n, where $n = \{1, 2, \ldots, 8\}$.
  - Assignments submitted late will not be accepted (grade $= 0$), so please do not email me assignments after the deadline.

Instructions for each assignment . . . III

- The Jupyter file should include the following (use Markdown):
  - Section "0" with information about your submission:
    - Line 1: QPM: Assignment *n*
    - Line 2: Group members: listed alphabetically by last name, where the last name is written in CAPITAL letters
    - Line 3: Any comments/challenges about the assignment
  - Section "*k*" where $k = \{1, 2, \ldots\}$.
    - First type Question *k* of Assignment *n*.
    - Then, below the question, provide your answer.
    - Your code should include any packages that need to be imported.

Data for Assignment 8

- The data file for this assignment has monthly returns for nine firm-specific characteristics: Market, SMB, HML, RMW, CMA, UMD, ROE, IA, BAB.
  - This data is the same as the one for the last assignment.
- The first five characteristics (Market, SMB, HML, RMW, CMA) are from Fama and French (2015), the sixth (UMD) is from Carhart (1997), the profitability (ROE) and investment (IA) factors are from Hou, Xue, and Zhang (2015), and the betting-against-beta (BAB) factor is from Frazzini and Pedersen (2014).
- All factors are returns in excess of the risk-free rate.
  - In particular, every factor (besides MKT and BAB) is the return of a long-short portfolio of stocks with \$1 in the long leg and \$1 in the short leg, and thus, their returns equal their excess returns.
  - The MKT and BAB factors are also long-short portfolios because they are returns in excess of the risk-free rate.

Instructions for Assignment 8

- Use an estimation window of 120 months. Therefore, to facilitate comparison, the in-sample and out-of-sample performance should be evaluated from January 1977 to December 2020.
- In the original papers on volatility timing, volatility is computed using daily returns data. Because I have not given you daily data, please estimate current volatility using monthly data for the last 12 months.
- Define f_{t+1} to be an excess return
- Construct a new volatility-managed factor, whose return is

$$f^{\sigma}_{t+1} = \frac{c}{\sigma^2_t(f)} \times f_{t+1}, \quad \text{where}$$

  - $\sigma_t(f)$ is the previous 12 month's realized volatility, estimated using monthly data
  - choose c so f^{σ} has the same unconditional volatility as f; (if it is difficult to understand how to compute c, set $c = 1$).

List of questions

Q8.1 Please use mean-variance optimization to combine

- The original (without timing) factor, f_{t+1};
- The volatility-managed version of this factor, f^{σ}_{t+1}.

Q8.2 Compare the Sharpe ratios of

- the portfolio with just the original factor and
- the portfolio that includes the volatility-timed factor.

Q8.3 What do you conclude from your analysis above?

Q8.4 Please list the limitations of your analysis. Could one implement this volatility-timing policy in practice?

Bibliography

Brandt, M. W., P. Santa-Clara, and R. Valkanov. 2009. Parametric portfolio policies: Exploiting characteristics in the cross-section of equity returns. *Review of Financial Studies* 22 (9): 3411–3447.

Carhart, M. M. 1997. On persistence in mutual fund performance. *Journal of Finance* 52, no. 1 (March): 57–82. (Cited on page 5).

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Fama, E. F., and K. R. French. 2015. A five-factor asset pricing model. *Journal of Financial Economics* 116 (1): 1–22. (Cited on page 5).

Frazzini, A., and L. H. Pedersen. 2014. Betting against beta. *Journal of Financial Economics* 111 (1): 1–25. (Cited on page 5).

Hou, K., C. Xue, and L. Zhang. 2015. Digesting anomalies: An investment approach. *Review of Financial Studies* 28 (3): 650–705. (Cited on page 5).

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End of questions