Quantitative Portfolio Management

Assignment #7

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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 7

- In this question, we apply the parametric portfolio policies developed by Brandt, Santa-Clara, and Valkanov (2009).
- The data file for this assignment has monthly returns for nine firm-specific characteristics: Market, SMB, HML, RMW, CMA, UMD, ROE, IA, BAB.
- Assume that these returns were generated by $N_t = 2000$ stocks and that the number of stocks is constant over time.
- 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.

Questions for Assignment 7

Q7.1 Explain why one might expect these nine factors to be related to stock returns. Write only a few sentences (2 or 3 sentences) for each factor. (Feel free to use ChatGPT, but reading the original paper would be much more educational.)

Q7.2 Find the optimal θ vector (of dimension 9×1) for a mean-variance investor with risk aversion of $\gamma = 5$ if the investor can invest in only these nine factors. Use the entire dataset to estimate the nine factors' mean and covariance of returns (i.e., we do not need to do out-of-sample analysis).

Q7.3 Find the Sharpe ratio for each of the nine factors and compare it to that of the parametric portfolio you have identified in the previous question.

Q7.4 Having obtained the optimal θ vector, please explain how one would obtain the optimal portfolio weights for each of the $N_t = 2000$ assets that are used to form each of the nine factors.

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. (Cited on page 5).

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

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).

End of questions