FIN41360 Portfolio and Risk Management

Group Work Assignment 1
(Please read all instructions and notes very carefully)

Portfolio Choice and Performance Evaluation

January 22, 2026

Required tasks:

1. Familiarize yourself with the content of the data library on Professor Kenneth French's webpage by reading the online legends and help. The web address of the data library is the following: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

2. Then, select monthly returns data for the sample period from January 1980 to December 2025 on the 30 industry portfolios. Using the average value-weighted returns on these 30 portfolios, carry out the following analysis:

   a. Sketch the monthly minimum variance (MV) efficient frontier of these portfolios using (i) the sample estimates of the required expected returns/means and variance-covariance matrix of returns; and (ii) subsequently their Bayes-Stein counterparts by first by shrinking only the expected returns and then shrinking both the expected returns and the variance-covariance matrix of returns. [*Note: Combine all plots in the same axes*].

   b. On the frontiers you constructed, highlight the points corresponding to the global minimum variance portfolio and to the tangency portfolio. Assuming a risk-free rate equal to its average over the sample period, compute and report the expected/mean excess return, volatility (standard deviation) and Sharpe ratio for these portfolios. [*Note: The risk-free rate data is included among the so-called "Fama and French factors" and available for download from the same data library.*]

   c. Compare and contrast the three frontiers you constructed (the frontier based on sample estimates and the two based on their Bayes-Stein counterparts). How would you explain their differences?

3. Next, choose one stock from each of the 30 industries and repeat the analysis in Question 2 above. Compare and contrast the two pairs of MV efficient frontiers you constructed (those based on the 30 industries and those based on the individual stocks.), first when using sample estimates and then when using their Bayes-Stein

counterparts. How would you explain their differences? [*Hint: To make any meaningful comparison between the stock and industry frontiers, it is important that you estimate the frontiers using the returns for same sample period keeping in mind a lack of data on some of the individual stocks going as far back as January 1980. That is, match the sample periods for the two datasets*].

4. Select data for the appropriate sample period on the risk-free rate (included among the so-called "Fama and French factors" and available for download from the same data library) and sketch the monthly MV efficient frontier for the 30 industry portfolios and the risk-free asset, using sample estimates of the required expected returns and variance-covariance matrix of returns.

    Compare and contrast this frontier to the one previously constructed (based on only the 30 industry portfolios), after having explained the sample period for which you obtained data on the risk-free rate.

5. Repeat the analysis required in the item just above (i.e., in question 4) using the Fama and French factor-mimicking portfolios, also available from the webpage of Prof Kenneth French, in place of the industry portfolios. Do so first using the so called "Fama/French 3 Factors" and then the "Fama/French 5 Factors (2x3)" mimicking portfolios (See Fama and French, 1993, "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics, and Fama and French, 2014, "A Five-Factor Asset Pricing Model" for a complete description of the factor returns).

    Compare the resulting efficient frontiers to the ones previously obtained in question 4. How would you explain their differences? [*Hint: The Fama and French factors data are in excess return format. So, to make any meaning comparisons, you must also use excess returns for the industry portfolios.*]

6. Repeat the above analysis (as specified in the item just above, namely question 5) using suitable "practical proxies" for the Fama and French factor-mimicking portfolios in place of the Fama and French factor-mimicking portfolios themselves. These practical proxies should be highly investable, keeping transaction and execution costs in mind. That is, they should be investable by the average portfolio manager, not necessarily the highly sophisticated portfolio manager capable of replicating the actual factor-mimicking portfolios. You may look for such proxy portfolios by checking out the websites of the main futures exchanges (e.g., look for futures on small caps, such as the Russell 2000 Index mini futures, and value/growth stocks) or even look for suitably focused ETFs (exchange traded funds).[1] For ideas,

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[1]See, for example, the approach adopted by Faff (2003) [Faff, R.W., 2003, "Creating Fama and French Factors with Style". Financial Review 38(2), 311-322].

check out this web-article: https://money.usnews.com/investing/articles/2016-06-07/why-investors-should-consider-small-cap-stocks. Do so at least for "practical proxies" for the "Fama/French 3 Factors" and, ideally, also for the "Fama/French 5 Factors (2x3)" mimicking portfolios, for as long a sample period for which you can find data, making sure that the last observation is for December 2022 or later (i.e., do not work with 'dead' series). To work around the lack of long time series on suitable "practical proxies" (e.g., the Russell 2000 Index mini futures), you may use the time series on a closely correlated asset or portfolio (e.g., the stock index underlying the Russell 2000 Index mini futures, available since 1978), possibly after showing some evidence on the strength of the correlation.

Compare and contrast the resulting efficient frontiers for the "practical proxies" to the ones for the corresponding factor mimicking portfolios (make sure both frontiers are estimated using the same sample period), explaining and/or commenting as appropriate.

7. Re-estimate the monthly frontiers for the 30 industry portfolios and for the "Fama/French 5 Factors (2x3)" mimicking portfolios over two contiguous, one ending in December 2002 and the other one ending in December 2025, including the risk-free asset in the investment opportunity set.

   Pick at least one portfolio from each of the frontiers estimated in the first period (in-sample period) and, for the portfolios thus selected, compare the performance during this period to the performance during the second period (out-of-sample period). Do these portfolios remain on the efficient frontier out-of-sample? Conduct the comparison using the 'all-time classic" Jobson and Korkie (1981) test for the equality of the Sharpe ratios (the test statistic is defined in footnote 20, page 271 of the Jorion (1985) article) as well as the more modern test that does not require either the i.i.d. assumption or normality (check out the article by Ledoit and Wolf (2008) and the accompanying Matlab code available on the Brightspace page of the module).

8. Then, for at least some of the assets previously considered, repeat the above analysis subject to any constraint and/or by applying any method, approach or technique (e.g., adding assets to better exploit the benefits of diversification, relying on the global minimum variance portfolio, resampling, etc.) that you believe might be of interest and might offer valuable insight from an investment management point of view.

9. Use the market portfolio, the practical proxies, and the tangency portfolios (as appropriate) on the various efficient frontiers you constructed above to assess the performance of three mutual funds of your choice, commenting on the results. A

good source of data on mutual funds is on Yahoo Finance. Please see the Appendix for help on how to access data on Yahoo Finance.

Provide a soft copy report containing your findings, which should be appropriately tabulated so as to maximize their legibility, any required evaluation and discussion of your findings and, when appropriate, a description of the methodology adopted. The soft report should be submitted via the submission folder on Brightspace and a hard copy in a dedicated mailbox in the Smurfit Foyer by **Thursday, 5th March 2026 at 5pm**. The submitted report should be attached to the appropriate submission form, which should closely adhere to the template provided in Brightspace and clearly provide all information required therein, including the assignment number, the team number, the name and student number of each team member and details on their individual contribution.[2]

The **maximum** length of the report should be 3000 words, including tables and figures (and everything else). Do not neglect to cite references as appropriate (the bibliography is excluded from the word count). To stay within the word count, it will be important to organize your report appropriately (e.g., making appropriate use of tables, avoiding repetitions, etc.).

Workings by way of MS Excel spreadsheets, Matlab code or Python code (or combinations) and data should be sent to my e-mail address: emmanuel.eyiah-donkor@ucd.ie. Although grades are solely based on your report, the workings are required to verify all calculations. In the email title, you should indicate FIN41360: Assignment 1, followed by the Group number in bracket.[3]

Notes

- The required tasks in the above list are, to a large extent, in a sequential order, in the sense that the initial ones are necessary for the subsequent ones. Hence, if you run out of time, it is better to carry out the earlier ones to the best of your ability rather than trying to do everything to a lesser standard

- Clarity is of paramount importance and lack thereof will be penalized heavily. Essentially, as in real world endeavours, unclear answers and discussions will amount to not having provided the required answer/discussion. Hence, try and privilege clarity and quality over quantity. For example, if you are running out if time, it is better to address well a few questions than to attempt to address them all in a poor and, hence, necessarily obscure manner.

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[2]Please note that this is a requirement and, if not fulfilled, I will not accept the submission, applying any relevant late submission penalty until a proper submission is made.

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- All the relevant information for the assignment is provided in this document and the module outline. If an aspect of the analysis is not specified in either document, it means that it is left for students to make a choice on it, in light of the theory covered in the course.

- Students are required to make and motivate any such choice relying on the insight offered by the theory covered in the module and relevant references. The soundness of such choices, evaluated in the light of available theory and empirical evidence, will be assessed and contribute to the overall mark. The more advanced aspects of the assignment also require a certain amount of autonomous research, which will play an especially important role in the assignment of higher marks.

- Submissions should contain, as appropriate, a literature review. The latter should strive to offer a comprehensive and systematic, yet succinct, review and discussion of academic and practitioners contributions to the body of knowledge on issues and topics examined during the module that are relevant to address the issues at hand, with the aim to expand and offer additional substantial insight compared to the insight and level of knowledge developed by the module material (including lectures).

- In this regard, keep in mind that the assignment is designed so that only a small fraction of the teams will be able to address all questions well, because marking practice in serious Universities (such as UCD, which has this enshrined in official marking rules) dictate that the highest marks be awarded with parsimony.

- In preparing the report, try and replicate as closely as possible the layout and structure (though subject to the applicable maximum length restriction) of academic papers that evaluate the performance of alternative portfolio construction methodologies. A good yet nice and readable example is the article by Stevenson (2002) titled "Ex-Ante and Ex-Post Performance of Optimal REIT Portfolios" (among the readings in Brightspace). You might also take heed from industry reports that do something similar, which often have nice and witty ways of making insightful points, though strive to aim at a level of clarity and rigor comparable to the academic papers. The paper by Rob Arnott of Research Affiliates (titled "How Can Smart Beta Go Horribly Wrong") is a good example of clear and compelling industry report: https://www.researchaffiliates.com/publications/articles/442_how_can_smart_beta_go_horribly_wrong.

  Please keep in mind however that, if you lack the insight of an industry maverick (that comes with many years of first-hand experience), the academic format might be a safer option as it is designed to facilitate making a point in an effective way

relying only on research, without needing any special experience of the subject matter. An academic researcher gains insight from research, not necessarily experience, so it is a situation closer to the one of a typical student.

- Appropriate use of tables and figures, as in academic papers and rigorous industry reports, is of crucial importance to attain the required clarity. They should be thoughtfully designed to maximize clarity and impact. For example, annotate your tables and figures to help the reader gain an immediate understanding of the findings reported therein. Also, try and condense your findings in as few tables and figures as possible, to help the reader see the overall picture emerging from your study.

- *Mutatis mutandis* (i.e., with the appropriate adaptation) and unless otherwise specified, all the above notes apply to subsequent assignments too.

- Teams are strongly encouraged to appoint an "editor" whose job should be to coordinate the efforts of the team and make sure that the final report is coherent and well organized.

Appendix - Accessing data in Yahoo Finance

On Yahoo Finance, find two ETFs (Exchange Traded Funds) that have been listed for at least a year and download the time series of closing prices for the last 251 trading days (if any one of the ETFs does not trade on a given trading day, assume that the closing price is the same as for the previous trading day).

To get this data, you need to go to https://finance.yahoo.com. Then, under the "Research" tab, select the "Screeners" tab and click "+ Create". When the "+ Create" dialog box opens, select "Mutual Funds" and add or remove filters according to your own preference. When you are done, press "Apply". A selection of Mutual Funds will be shown. Choose the ones you want by clicking on the symbol of each. In the screen that opens when you click each Mutual Fund symbol, select the "Historical Data" tab and, in the screen that opens next, select, for example, the "Daily" frequency (from the dedicated drop-down menu) and then click "Download Data".