**## Proposed plan for final project**

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The main goal is to show whether the skewness factor has significant explaining power for risk premium, or the excess return, which can be firstly examined

in the Fama-French model in an in-sample way. After that if time permits, we can also build up some strategy (or predicting) model by adding the skewness factor to existence

ones to see its out-of-sample performance.

Workflow：

1. Sharpe Ratio and Skewness

\* Use the portfolio daily PnLs from HW2, generate the skewness for each strategy, and have a check on its relation with the corresponding Sharpe Ratio.

Also, if we can get the daily PnLs then we will be able to calculate the monthly SR and skewness.

\* And with this available, an alternatively while potentially more sophisticated way is to investigate the co-integration relation between the monthly Sharpe Ratio and skewness. If the skewness does have

explaining power, the correlation between them should be significant (and hopefully positive). Then we can set out for a stable co-integration model

by some statistical hypothesis test.

\* If we do have the co-integration, then it's possible to evaluate the performance of the strategy during a certain period, since we can compare the realized

Sharpe Ratio with that given by model prediction.

For now, I propose the following way to train and apply the co-integration model

1) Randomly choose training and testing sample.

2) Use training sample to train the model and apply it to the testing sample to both predict the mean and provide the stddev to the mean. (interval estimate)

3) check if the true dependent variable (in this case, the Sharpe Ratio) falls into the interval, and decide if it is risk premia.

2. Skewness as a Factor

Under Fama-French factor model framework, three factors (Market, SMB and HML) have already explained a descent amount of the portfolio excess return, and in

fact porfolio manager will also use it to get a sense of how a portfolio is composed. Based on this, I would like to investigate on the feasibility of adding

a factor that shows the market's tail risk in general, since according to the paper the tail risk should account quite a bit for the risk premia.

The tail risk is measure by the skewness which is the third order of the market return variable, and of course we can also include the second order,

the variance of the market return during the same period as the skewness.

We can build up regression models using monthly returns and calculate the skewness by daily returns within the corresponding month.

Also, to see the explaining power we should have some portfolio monthly performance data at hand to start with. It seems that we can download some existing

strategy/portfolio's data from CRSP, but as well we can come up with other self-defined strategies.

Once we have the portfolio's return time series, what we can do is the following:

1. reg ret ~ MKT

2. reg ret ~ VAR

3. reg ret ~ SKW

4. reg ret ~ MKT + VAR

5. reg ret ~ MKT + SKW

6. reg ret ~ MKT + SKW + VAR

to evaluate the importance of the addition factors VAR and SKW. If in line with the paper, 5) should be the best

Extension to 3-factor Fanma-French, reg ret ~ MKT + SMB + HML + SKW to see if there is some in-sample improvement

Then it's the out-of-sample prediction part...