

Group Homework Assignment

Portfolio Management - Fall 2024

This assignment focuses on analysis of stock returns, factor investing and portfolio choice. It counts for 30 points of your final grade. Please hand in the assignment as a pdf and xls file via Canvas by the announced date. Late assignments cannot be accepted.

There are four datasets for this assignment:

1. The first file, HW_Factors.xls, contains monthly returns of four empirical factors (Market, SMB, HML and MOM) and the 1-month Treasury-bill rates from Jan 1927 to May 2023. The market returns are reported in excess of the 1-month Treasury-bill rates. All returns in this file are in percentage.
2. The second file, HW_Hedge Fund.xls, contains the monthly rate of return of seven Hedge Fund Indexes (from HFRI).
3. The third data file, HW_World.xls, contains the monthly equity returns of 20 developed countries. The equity returns in this dataset have all been converted to U.S. dollar-based returns. In other words, you need not worry about exchange rate fluctuations.
4. The HW_DJIA Prices.xls file contains historical stock price data from June 2004 to December 2022 of 30 stocks that today belong to the Dow Jones Industrial Average, including their name, ticker, and high-level industry classification. It also includes the number of shares outstanding as of June 2004 and Dec 2022. The last column of the file contains the DJIA index over the same period.

Part 1: Hedge Funds (30%)

The main objective is to get you familiarized with the hedge fund industry: the overall performance of the industry, as well as the various styles of hedge funds.

1. CAPM (5%)

Report the CAPM beta, alpha, t-stats, and R-squared of each hedge fund index.

Pick two of the hedge fund strategies and describe why they could be an attractive investment.

2. Four-Factor Model (10%)

Repeat the same analysis under a four-factor model (regression).

Comment on the effect of the four factors for the different Hedge Fund indices: Where do you observe some significant loadings and which of the four factors seems most important in explaining performance?

3. Time-Varying Beta and transfer to additional analysis (15%)

The market exposure for hedge funds might not be stable over time. Use the market factor to identify up and down markets, calculate the CAPM beta in the two cases and report your findings.

What would have been a desirable outcome of this analysis for hedge fund investors?

Assume you have unlimited access to additional data sets. Which analysis would you also like to perform when analyzing a portfolio of hedge funds? (please describe the data and methods you would use; no calculations needed)

Part 2: International long-term Momentum (20%)

It has been broadly discussed in the literature that there could be a positive medium term (1 year or “12-1 months”) momentum effect in several asset classes. To potentially provide a “longer term” momentum strategy we want to evaluate a 3-year period. The main objective is to investigate whether or not there are long term momentum profits in the equity markets across the 20 developed countries. Let’s use the following strategy to form our momentum portfolio:

1. In month t , sort the indices according to the 36-month cumulative return from month $t - 36$ to month $t - 1$.
2. Pick the four best and four worst performing countries according to the sort.
3. Form a long/short portfolio: long the four best performers and short the four worst performers. Equal-weight the portfolios in both cases.
4. Hold this long/short portfolio for three months. Then in month $t+3$, resort and rebalance using the same momentum strategy.

How does this strategy perform? (provide a plot, average annualized return, volatility and Sharpe Ratio) Summarize your findings and provide your comments.

Part 3: Portfolio Construction (40%)

The main objective is to get you familiarized with the data of the Dow Jones Industrial Average Index and different weighting methodologies. We use current index constituents for simplicity reasons. Use the data set HW_DJIA Prices.xlsx and assume costless monthly rebalance unless otherwise specified.

1. Different Portfolios (15%)

Compute the following portfolios (for the whole period Jun 2004 to Dec 2022) and report the weights of each stock in each index at inception.

- a) The value portfolio that uses as weights the market capitalisation (price x shares outstanding) in June 2004
- b) The equal-weighted portfolio
- c) The minimum variance portfolio, using the whole provided sample period to estimate expected returns and the variance-covariance matrix.
- d) The naive risk parity portfolio
- e) The tangent portfolio
- f) The portfolio that only buys the largest (as of 2004 market capitalization) stock of each industry group and equally weights the five stocks.
- g) The portfolio where each industry group has the same weight (since there are five groups, each has a weight of 20%). Keep an equal weighting to all stocks of the same group. For example, there are ten manufacturing companies with a weight of 10%, while the overall weight to manufacturing in the portfolio is 20%. Making the weight of each of these companies 2%.

2. Compare Portfolios (15%)

Please compare the above indices. Where do you see similarities, how do they differentiate in terms of index construction and use of data. Briefly describe, no calculations needed.

If you would start a new index, which weighting scheme would you apply (brief explanation, no calculations needed. It could be one of the above or another weighting scheme)?

3. Performance Measures (10%)

Using your constructed portfolios, and the DJIA index, compute the annualized return, volatility, skewness, maximum drawdown and Sharpe Ratio (assuming a risk-free rate of 2%). Please name

reasons that can explain the different performance and risk analytics. In which of them would you invest on January 1st 2019?

Part 4: Chat GPT (10%)

A member of your group decided to use Chat GPT to help construct an international value factor (similar to Part 2 of this Homework, but "Value" instead of "Momentum"). Identify five potential improvements possible in Chat GPT's response below.

Hi, can you help creating an international value portfolio. Please provide a short numerical example.

ChatGPT:

Creating an international value portfolio involves selecting assets based on valuation metrics, such as the price-to-earnings (P/E) ratio, price-to-book (P/B) ratio, or other value-oriented indicators. The aim is to invest in undervalued assets expecting that their prices will increase over time as the market recognizes their true value.

Steps to Create an International Value Portfolio

1 Data Collection:

Gather financial data for a range of international stocks, including their market prices and relevant valuation metrics (e.g., P/E ratio, P/B ratio).

2 Calculate Valuation Metrics:

Compute or collect the valuation metrics for each stock.

3 Rank the Assets:

Rank the stocks based on their valuation metrics. Lower P/E or P/B ratios indicate higher value.

4 Select Value Stocks:

Select the top-ranked stocks based on the valuation metrics. These are considered undervalued.

5 Form the Portfolio:

Allocate capital to the selected value stocks, potentially using equal weights or weights based on their valuation scores.

Numerical Example

Step 1: Data Collection

Let's assume we have the following data for 5 international stocks:

Stock	Price (USD)	Earnings (USD)	Book Value (USD)	Market Cap (USD)
A	100	10	50	1,000,000,000
B	150	5	80	2,000,000,000
C	80	8	60	800,000,000
D	200	20	100	3,000,000,000
E	50	2	40	500,000,000

Step 2: Calculate Valuation Metrics

Compute the P/E ratio and P/B ratio for each stock:

- **P/E Ratio** = Price / Earnings per Share
- **P/B Ratio** = Price / Book Value per Share

Stock	P/E Ratio	P/B Ratio
A	10	2
B	30	1.875
C	10	1.333
D	10	2
E	25	1.25

Step 3: Rank the Assets

Rank the stocks based on their P/E ratios (lower is better) and P/B ratios (lower is better). For simplicity, let's assume we use the P/E ratio primarily:

Stock	P/E Ratio	Rank
A	10	1
C	10	2
D	10	3
E	25	4
B	30	5

Step 4: Select Value Stocks

Select the top 3 stocks based on the P/E ratio:

- Stock A
- Stock C
- Stock D

Step 5: Form the Portfolio

Allocate equal capital to each of the selected value stocks. Assuming we have \$300,000 to invest:

- Invest \$100,000 in Stock A
- Invest \$100,000 in Stock C
- Invest \$100,000 in Stock D

Summary of the Value Portfolio

Stock	Investment Amount (USD)	Price (USD)	Number of Shares
A	100,000	100	1,000
C	100,000	80	1,250
D	100,000	200	500

GOOD LUCK!

Any questions, please ask during class.