main

Group 6¶

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Code is uploaded in Github: https://github.com/Jialin-Eddie/Portfolio_Managment

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Hello from test.py!
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Part 1: Hedge Funds¶

1.1 CAPM¶

	HF_name	Alpha	Beta	t-stat	R_squared
0	HFRI 400 (US) Fund Weighted Composite Index (H...	0.001592	0.302567	3.369407	0.658720
1	HFRI 400 (US) EH: Long/Short Index (HFRI4ELS)	0.001103	0.504403	2.722560	0.753347
2	HFRI 400 (US) EH: Equity Market Neutral Index ...	0.001200	0.088991	3.090874	0.202699
3	HFRI 400 (US) EH: Fundamental Value Index (HFR...	0.000427	0.559282	2.406636	0.814380
4	HFRI 400 (US) Event-Driven Index (HFRI4ED)	0.001279	0.355344	2.770996	0.591353
5	HFRI 400 (US) Macro Index (HFRI4M)	0.002180	0.055444	2.565769	0.027769
6	HFRI 400 (US) Relative Value Index (HFRI4RV)	0.002177	0.185218	4.128569	0.430078

Analysis¶

1. HFRI 400 (US) EH: Fundamental Value Index (HFRI4ELFV)¶ Alpha: 0.000427 Beta: 0.559282 t-stat (Signal-to-Noise Ratio): 2.406636 R-squared: 0.814380 Why It Could Be Attractive:

Moderate t-stat (2.406636): The t-stat of 2.41 indicates that the Alpha (or excess return) is relatively reliable. It suggests that the returns generated by this strategy are driven more by consistent signals rather than by random market fluctuations. R-squared (0.814380): The high R-squared value reinforces the idea that the returns of this strategy are closely tied to predictable market factors, which further supports the stability of the Alpha. The combination of a decent signal-to-noise ratio and a high R-squared value makes this strategy attractive for those who want steady returns with a reasonable degree of predictability in performance. It suggests that the managers have been able to extract value from the market while maintaining a good level of consistency.

2. HFRI 400 (US) Relative Value Index (HFRI4RV)¶ Alpha: 0.002177 Beta: 0.185218 t-stat (Signal-to-Noise Ratio): 4.128569 R-squared: 0.430078 Why It Could Be Attractive:

High t-stat (4.128569): The t-stat of 4.13 is significantly higher, indicating a strong signal relative to the noise. This means that the excess returns of this strategy are more consistently derived from reliable sources rather than random market movements. Investors can have higher confidence in the strategy's ability to continue producing positive Alpha. Low Beta (0.185218): The low Beta and relatively high signal-to-noise ratio make this strategy appealing for portfolio diversification. It suggests that even though the strategy has minimal correlation with the overall market, it is still able to deliver consistent excess returns. The high t-stat

is a strong indicator that the returns of this strategy are driven by more systematic factors, which makes it appealing to investors who want a strategy that can consistently add value, even when the market is volatile.

Summary:¶ The Fundamental Value Index offers moderate but reliable Alpha, appealing to investors looking for steady and predictable returns. The Relative Value Index demonstrates a high signal-to-noise ratio, suggesting consistent outperformance that can be more confidently relied upon, which is particularly attractive for those seeking reliable diversification.

1.2 Four-Factor Model¶

	HF_name	alpha	beta_Mkt_RF	beta_SMB	beta_HML	beta_
0	HFRI 400 (US) Fund Weighted Composite Index (H...	0.001590	0.299158	0.055125	-0.001514	0.017
1	HFRI 400 (US) EH: Long/Short Index (HFRI4ELS)	0.001108	0.492503	0.100759	-0.045447	0.004
2	HFRI 400 (US) EH: Equity Market Neutral Index ...	0.001092	0.103247	0.004230	0.027380	0.047
3	HFRI 400 (US) EH: Fundamental Value Index (HFR...	0.000676	0.528860	0.103597	0.025354	-0.02
4	HFRI 400 (US) Event-Driven Index (HFRI4ED)	0.001589	0.322813	0.125278	0.076528	-0.00
5	HFRI 400 (US) Macro Index (HFRI4M)	0.001902	0.092720	-0.052889	0.037374	0.082
6	HFRI 400 (US) Relative Value Index (HFRI4RV)	0.002375	0.161257	0.042065	-0.001394	-0.04

1. HFRI 400 (US) Fund Weighted Composite Index (HFRI4FWM)¶

- Beta_Mkt_RF (0.299158): This moderate sensitivity to the market risk premium indicates that the overall fund index moves with market trends but with less intensity than pure equity strategies.
- Beta_SMB (0.055125): The positive but small loading on SMB suggests a slight tilt towards smaller-cap stocks, though it's not a major return driver.
- Beta_HML (-0.001514): The near-zero loading on HML suggests a very limited exposure to value versus growth stocks.
- Beta_Mom (0.017035): The small positive loading on momentum indicates that there may be some tendency to benefit from trending assets, but this influence is minor.
- R-squared (0.665759): This value indicates that about 66.6% of the index's performance is explained by these factors.
- Key Takeaway: The most significant factor for this index is the market risk premium (Mkt_RF), as it has the largest loading. However, a considerable portion of returns is still driven by other factors or active management, given the moderate R-squared.

2. HFRI 400 (US) EH: Long/Short Index (HFRI4ELS)¶

- Beta_Mkt_RF (0.492503): This relatively high sensitivity to the market indicates that the Long/Short Equity strategy moves in line with the broader market, though with less intensity than a fully directional strategy.
- Beta_SMB (0.100759): The positive loading on SMB suggests a tilt towards smaller-cap stocks, indicating some exposure to smaller firms that can potentially generate higher returns.
- Beta_HML (-0.045447): The negative loading on HML suggests a slight preference for growth stocks over value stocks.
- Beta_Mom (0.004244): The near-zero momentum exposure indicates that momentum is not a significant driver of returns for this strategy.
- R-squared (0.764216): About 76.4% of the returns can be explained by the factor exposures, suggesting a strong alignment with the identified factors.
- Key Takeaway: The market risk premium (Mkt_RF) is the most significant factor here, driving much of the returns. The Long/Short strategy's positive SMB exposure also indicates that its managers may be seeking opportunities in smaller-cap stocks.

3. HFRI 400 (US) EH: Equity Market Neutral Index¶

- Beta_Mkt_RF (0.103247): The low Beta indicates a near-neutral stance towards the market, aligning with the strategy's objective to generate returns independently of market movements.
- Beta_SMB (0.004230): The near-zero loading on SMB indicates minimal exposure to small-cap stocks.
- Beta_HML (0.027380): A small positive HML loading suggests a slight tilt towards value stocks.
- Beta_Mom (0.047040): The small positive loading on momentum indicates a minor benefit from trends in asset prices.
- R-squared (0.247540): A low R-squared suggests that most of the strategy's returns are driven by factors outside the model, likely reflecting stock selection skill or other proprietary strategies.
- Key Takeaway: This strategy's low exposure to market risk and other factors means that it relies more on manager skill and stock-specific decisions. The small factor loadings indicate that traditional factor exposures are not major performance drivers here.

4. HFRI 400 (US) EH: Fundamental Value Index¶

- Beta_Mkt_RF (0.528860): The high sensitivity to market risk suggests that this strategy is significantly influenced by market movements, aligning with its long-biased nature.
- Beta_SMB (0.103597): The positive SMB loading indicates a tilt towards smaller-cap companies, which is consistent with many fundamental value strategies that seek undervalued opportunities among smaller stocks.
- Beta_HML (0.025354): A small positive HML loading suggests a preference for value stocks over growth stocks, which aligns with the value-oriented nature of this strategy.
- Beta_Mom (-0.022800): The slight negative loading on momentum indicates that the strategy may underperform during periods when momentum stocks outperform.
- R-squared (0.824782): A high R-squared indicates that over 82% of returns can be explained by the factor exposures, making it highly dependent on the identified market factors.
- Key Takeaway: The market risk premium (Mkt_RF) is the most significant driver, with some contribution from the SMB factor, aligning with the fundamental value strategy's focus on small-cap value stocks.

5. HFRI 400 (US) Event-Driven Index (HFRI4ED)¶

- Beta_Mkt_RF (0.322813): The moderate Beta indicates that the strategy is partially influenced by overall market movements, which is typical for event-driven strategies where outcomes often depend on broader market conditions.
- Beta_SMB (0.125278): The positive exposure to the size factor suggests a preference for smaller companies, which often undergo mergers, acquisitions, or restructurings.
- Beta_HML (0.076528): The positive HML loading indicates a tilt towards value stocks, suggesting that the strategy may target undervalued companies undergoing events.
- Beta_Mom (-0.003468): The near-zero momentum exposure suggests that trends do not play a significant role in this strategy's returns.
- R-squared (0.625908): About 62.6% of returns can be explained by these factors, indicating a balance between factor exposures and manager-specific strategies.
- Key Takeaway: The market risk premium (Mkt_RF) and SMB factors are the most significant, reflecting the strategy's focus on small-cap companies undergoing corporate events.

6. HFRI 400 (US) Macro Index¶

- Beta_Mkt_RF (0.092720): The low market sensitivity reflects the macro strategy's focus on economic trends and global opportunities rather than direct equity market exposure.
- Beta_SMB (-0.052889): The negative loading suggests a slight preference away from smaller-cap companies, possibly reflecting a focus on larger, more liquid positions.
- Beta_HML (0.037374): The positive HML loading indicates a mild value bias, though it is not a major return driver.

- Beta_Mom (0.082725): The positive momentum exposure suggests that the strategy may benefit from trends in global markets, such as currencies or commodities.
- R-squared (0.084845): The very low R-squared indicates that most of the returns come from factors outside the model, likely reflecting the unique nature of macroeconomic strategies.
- Key Takeaway: The low factor loadings highlight that this strategy is more influenced by macroeconomic trends than by the factors in the model, and momentum is the most relevant among the four factors.

7. HFRI 400 (US) Relative Value Index (HFRI4RV)¶

- Beta_Mkt_RF (0.161257): The relatively low Beta suggests that this strategy is somewhat insulated from overall market movements, consistent with the relative value approach that focuses on price discrepancies between related securities.
- Beta_SMB (0.042065): A slight positive loading on SMB indicates some exposure to smaller-cap opportunities, though it is not a major driver.
- Beta_HML (-0.001394): The near-zero loading on HML suggests little preference between value and growth.
- Beta_Mom (-0.042914): The negative momentum loading suggests that the strategy may underperform in trending markets, as it is likely more focused on mean-reversion trades.
- R-squared (0.456687): This moderate R-squared suggests that about 45.7% of returns can be explained by the factors, with a significant portion of returns likely due to manager skill and strategy-specific nuances.
- Key Takeaway: The market risk premium (Mkt_RF) plays a role in this strategy, but much of the value comes from idiosyncratic trades and price discrepancies that are not captured by these factors.

Summary:¶

- Across most strategies, the market risk premium (Mkt_RF) is the dominant factor, especially for those with higher Beta values, such as the Long/Short and Fundamental Value strategies.
- SMB (Size) is particularly relevant for strategies that focus on smaller companies, such as Event-Driven and Fundamental Value, which often find opportunities in smaller-cap stocks.
- Momentum (Mom) tends to have a minor influence, with some positive impact in macro strategies, while HML (Value) varies across strategies but is generally less significant as a driver.
- Strategies like the Equity Market Neutral Index and Macro Index are less reliant on traditional market factors, emphasizing the importance of manager skills.

1.3 Time-Varing Beta and transfer to additional analysis¶

	HF_name	Up_Beta	Down_Beta
0	HFRI 400 (US) Fund Weighted Composite Index (H...	0.265197	0.290951
1	HFRI 400 (US) EH: Long/Short Index (HFRI4ELS)	0.456934	0.500869
2	HFRI 400 (US) EH: Equity Market Neutral Index ...	0.097179	0.065544
3	HFRI 400 (US) EH: Fundamental Value Index (HFR...	0.540398	0.550278
4	HFRI 400 (US) Event-Driven Index (HFRI4ED)	0.301396	0.466590
5	HFRI 400 (US) Macro Index (HFRI4M)	0.049128	-0.083999
6	HFRI 400 (US) Relative Value Index (HFRI4RV)	0.139748	0.235709

Assume I have unlimited access to additional data sets. Which analysis I would like to perform when analyzing a portfolio of hedge funds (data + methods)?

Advanced Return Decomposition and Factor Analysis¶

Data Required:¶

- Daily/weekly/monthly returns of hedge funds and market benchmarks.

- Risk factor data (e.g., equity, bond, currency, commodity indices).
- Style factors like market, size (SMB), value (HML), momentum (Mom), quality, and liquidity.
- Economic indicators (e.g., interest rates, inflation, GDP growth).

Methods: Multi-Factor Regression Analysis¶

- Utilize advanced models such as the Fama-French five-factor model or the Carhart four-factor model to decompose hedge fund returns. This helps isolate Alpha, as well as the contributions from market and style factors.
- Machine Learning-Based Factor Discovery: Use methods like LASSO regression or Ridge regression to automatically identify additional factors that significantly explain the returns of hedge funds, including non-linear relationships.
- Principal Component Analysis (PCA): To extract common sources of risk and return across the portfolio, identifying underlying risk factors that may not be captured by traditional models.

Outcome:¶ The goal is to understand the precise drivers of returns, assess which factors are contributing to Alpha, and ensure that exposure to various market risks aligns with investor objectives.

Part 2 International Long-term Momentum¶

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Annualized return is : 0.8957%
Volitality is 0.06754301026228962
Shape Ratio is 0.07043569898138724
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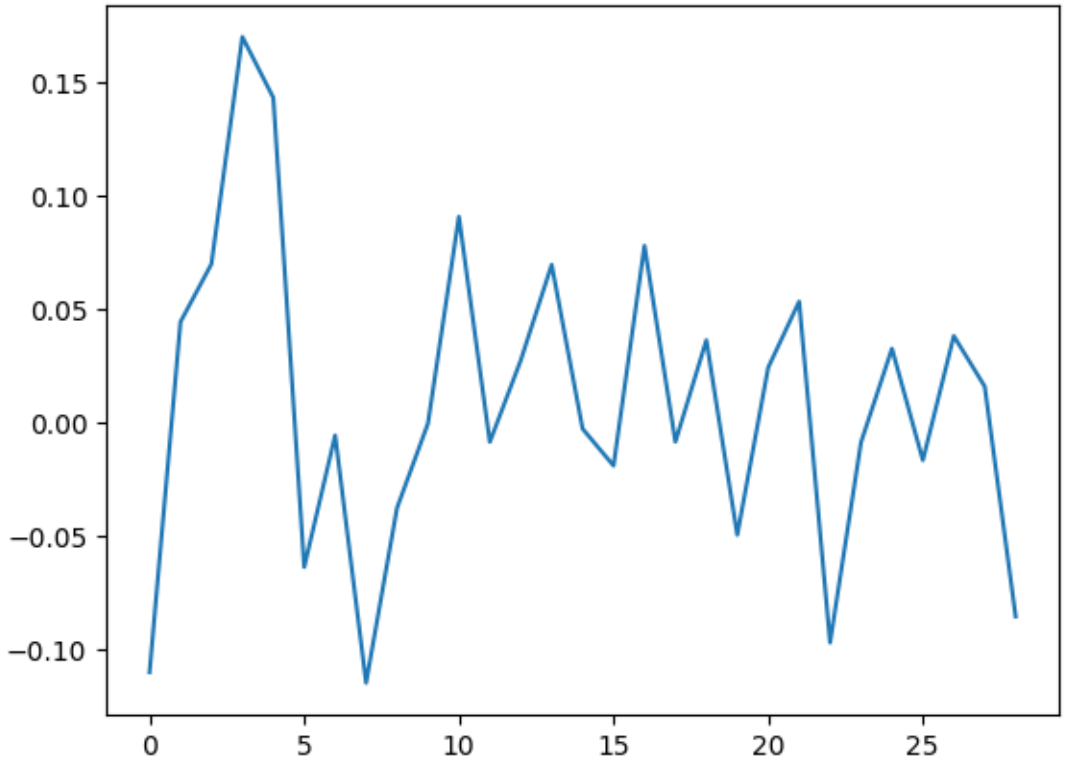

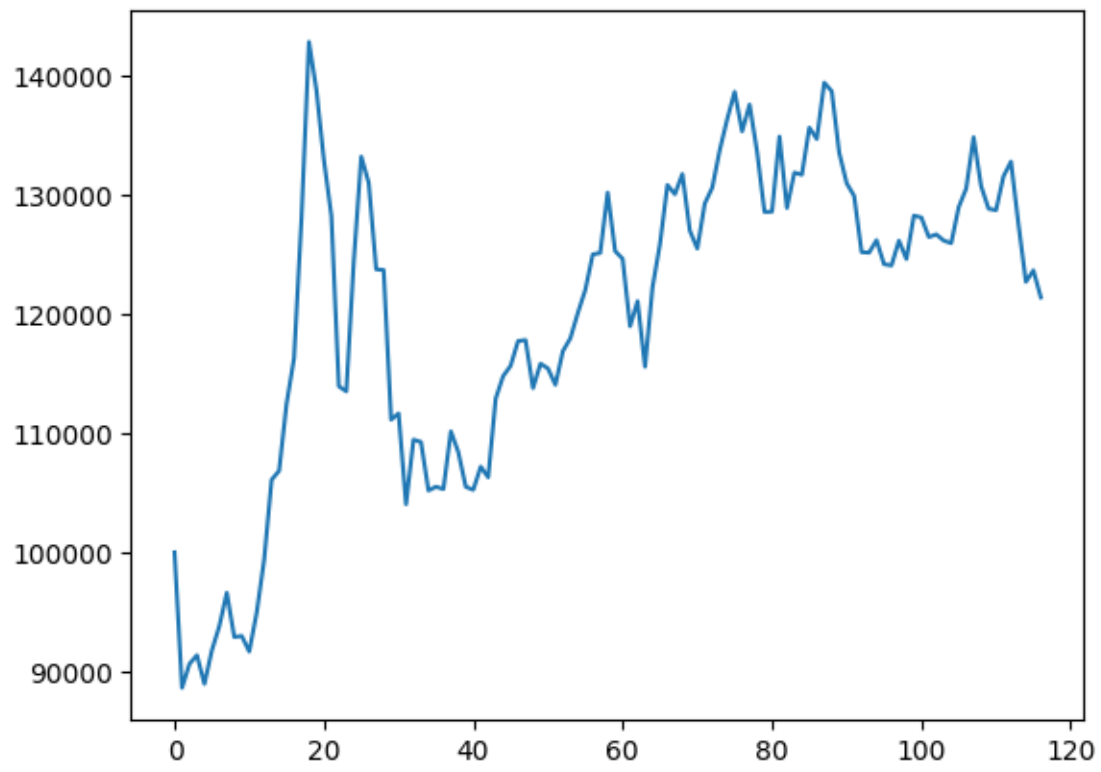

Summary of my findings:

Part 3: Portfolio Construction¶

3.1 Different Portfolios¶

	MMM	AXP	AMGN	AAPL	BA	CAT	CVX	CSCO	KO
value	0.058849	0.033593	0.035678	0.032092	0.033403	0.051938	0.061530	0.015495	0.033004
equal_weight	0.033333	0.033333	0.033333	0.033333	0.033333	0.033333	0.033333	0.033333	0.033333
min_var	-0.054223	-0.019520	0.006407	0.000233	-0.047194	-0.025272	-0.032463	0.204430	0.022964
naive	0.039922	0.024584	0.032634	0.024223	0.024914	0.024308	0.030633	0.030877	0.039531
tangent	-0.071317	0.024424	0.058171	-0.001104	-0.065691	-0.047037	-0.036765	0.433695	-0.049539
large5	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.200000	0.000000	0.000000
idustry_equal	0.020000	0.050000	0.020000	0.028571	0.050000	0.020000	0.050000	0.028571	0.020000

7 rows × 30 columns

3.2 Compare Portfolios¶

Compare above Portfolio and explain how they differentiate in terms of index construction and use of data.

If I would start a new index, shich weighting scheme I would apply(could be above or another)

3.3 Performance Measures¶

	3M CO	AMERICAN EXPRESS CO	AMGEN INC	APPLE COMPUTER INC	BOEING
Annu_return	0.046377	0.116188	0.082455	0.327667	0.121441

	3M CO	AMERICAN EXPRESS CO	AMGEN INC	APPLE COMPUTER INC	BOEING
Volatility	0.201671	0.327501	0.246711	0.332384	0.323155
Skewness	-0.275730	2.910560	0.841615	-0.210222	-0.142032
Maximum drawdown	-0.558882	-0.814404	-0.483751	-0.569114	-0.724793
Sharpe Ratio	0.079413	0.259827	0.382635	1.040970	0.325189

5 rows × 31 columns

Part 4: Chat GPT¶

5 potential improvements possible in Chat GPT

1.

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[NbConvertApp] Converting notebook main.ipynb to html
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export to pdf:

jupyter nbconvert --to html main.ipynb --TagRemovePreprocessor.remove_cell_tags remove-cell --no-input

pandoc main.html -V geometry:margin=1in -o main.pdf