Asset Allocation

Asset Allocation Simulation with AGG & VTI

Goal:

The Python script, main.py, simulates the portfolio construction and management process with the given weights for two ETFs, AGG and VTI, using historical price data from Yahoo Finance.

Four investment time horizons are considered: 1 year, 3 years, 5 years, and 10 years. The ending date for all periods is 2020-12-30.

After analysing the daily records generated, one portfolio strategy would be recommended for each time horizon.

Analysis:

One year:

strategy	rebalancing count	annual return	annual std dev	sharpe ratio	VaR
0.1_AGG_0.9_VTI_1y	0	18.36%	30.50%	0.5364	-2.74%
0.2_AGG_0.8_VTI_1y	2	19.25%	27.60%	0.6251	-2.54%
0.3_AGG_0.7_VTI_1y	2	17.54%	24.48%	0.6349	-2.18%
0.4_AGG_0.6_VTI_1y	2	15.99%	21.28%	0.6571	-1.81%
0.5_AGG_0.5_VTI_1y	2	14.74%	18.22%	0.6992	-1.46%
0.6_AGG_0.4_VTI_1y	2	13.43%	15.28%	0.7475	-1.13%
0.7_AGG_0.3_VTI_1y	2	12.39%	12.56%	0.8267	-0.87%
0.8_AGG_0.2_VTI_1y	2	11.99%	10.32%	0.9676	-0.64%
0.9_AGG_0.1_VTI_1y	0	8.37%	8.64%	0.7377	-0.40%

- SP 500 1-year annual return (from Yahoo Finance Website): 18.4%
- Strategy naming: for example, 0.1_AGG_0.9_VTI_1y is the portfolio that holds 10% AGG and 90% VTI for 1 year.
- Recommend 0.8_AGG_0.2_VTI_1y:
  The combination has the highest Sharpe ratio and the second-best VaR.

Three years:

strategy	rebalancing count	annual return	annual std dev	sharpe ratio	VaR
0.1_AGG_0.9_VTI_3y	0	13.24%	20.87%	0.5387	-1.95%
0.2_AGG_0.8_VTI_3y	0	12.42%	18.55%	0.5619	-1.68%
0.3_AGG_0.7_VTI_3y	3	12.15%	16.55%	0.6133	-1.47%
0.4_AGG_0.6_VTI_3y	3	11.13%	14.30%	0.6388	-1.26%
0.5_AGG_0.5_VTI_3y	3	10.22%	12.18%	0.6753	-1.04%
0.6_AGG_0.4_VTI_3y	3	9.50%	10.09%	0.7429	-0.78%
0.7_AGG_0.3_VTI_3y	3	8.62%	8.25%	0.8015	-0.61%
0.8_AGG_0.2_VTI_3y	0	7.24%	6.49%	0.8076	-0.41%
0.9_AGG_0.1_VTI_3y	0	6.33%	5.51%	0.7859	-0.31%

- SP 500 3-year annual return (from Yahoo Finance Website): 14.00%
- Recommend 0.8_AGG_0.2_VTI_3y:
  The combination has the highest Sharpe ratio and the second-best VaR.

Five years:

strategy	rebalancing count	annual return	annual std dev	sharpe ratio	VaR
0.1_AGG_0.9_VTI_5y	0	14.78%	17.64%	0.7243	-1.59%
0.2_AGG_0.8_VTI_5y	3	14.05%	15.45%	0.7798	-1.37%
0.3_AGG_0.7_VTI_5y	4	12.78%	13.70%	0.7874	-1.19%
0.4_AGG_0.6_VTI_5y	4	11.63%	11.77%	0.8179	-1.01%
0.5_AGG_0.5_VTI_5y	4	10.44%	10.01%	0.8431	-0.83%
0.6_AGG_0.4_VTI_5y	4	9.31%	8.30%	0.881	-0.66%
0.7_AGG_0.3_VTI_5y	2	7.94%	6.71%	0.8855	-0.51%
0.8_AGG_0.2_VTI_5y	1	6.82%	5.31%	0.9067	-0.36%
0.9_AGG_0.1_VTI_5y	1	5.73%	4.72%	0.7896	-0.30%

- SP 500 5-year annual return (from Yahoo Finance Website): 16.71%
- Recommend 0.8_AGG_0.2_VTI_5y:
  The combination has the highest Sharpe ratio and the second-best VaR.

Ten years:

strategy	rebalancing count	annual return	annual std dev	sharpe ratio	VaR
0.1_AGG_0.9_VTI_10y	1	12.85%	15.81%	0.6863	-1.48%
0.2_AGG_0.8_VTI_10y	4	12.01%	14.01%	0.7141	-1.32%
0.3_AGG_0.7_VTI_10y	7	11.12%	12.29%	0.7416	-1.15%
0.4_AGG_0.6_VTI_10y	8	10.08%	10.56%	0.7652	-0.97%
0.5_AGG_0.5_VTI_10y	8	9.09%	8.87%	0.7994	-0.80%
0.6_AGG_0.4_VTI_10y	8	8.11%	7.25%	0.8425	-0.63%
0.7_AGG_0.3_VTI_10y	6	7.04%	5.73%	0.8803	-0.46%
0.8_AGG_0.2_VTI_10y	3	5.90%	4.60%	0.8483	-0.35%
0.9_AGG_0.1_VTI_10y	1	4.94%	3.92%	0.7492	-0.30%

- SP 500 10-year annual return (from Yahoo Finance Website): 13.31%
- Recommend 0.7_AGG_0.3_VTI_10y:
  The combination has the highest Sharpe ratio and the third-best VaR.

Usage:

The historical price data generation code for ETFs is in data.py, and the reformatted data is saved in price.csv. The main.py imports data from price.csv.
The main.py is used to create daily portfolio balance records and the final analysis. The implementation and calculation details can be found in the main.py as comments.

Environment:

Python 3.8.2
Please check requirements.txt to install the libraries needed.
(Command: pip install -r /path/to/requirements.txt)