NOVA SCHOOL OF BUSINESS & ECONOMICS

Nova School of Business and Economics

Asset Management 2022/2023 - T3

Assignment - Instructions

- Please, read carefully the instructions on Moodle and follow them for the correct submission of your assignment.
- The submission is individual.
- The submission includes a single *.ipynb* Python notebook file. The answer to each question must be preceded by a text tab specifying the question answered below (e.g. 2.3 for sub-question 3 of question 2)
- Name the submission file with your university id number. Example: if your id is *1234*, the file should be named *1234.ipynb*. Different names of the file will imply a null score in the assignment.
- Good luck!

Question 1

1. Use the excel file named "Countries-data", which contains annualized monthly returns for different country indeces. In the file "Countries" you will find the set of six countries you must use for the analysis, labeled as your university ID number.

   Present annualized performance statistics (average return, standard deviation, Sharpe ratio, max drawdown, skewness, kurtosis) for an equal-weighted portfolio of the six countries (denoted EW6).

2. How does the performance of EW6 compare to a risk-parity portfolio of the six countries? To build the risk-parity portfolio, use the standard deviation of returns over the last year to determine the weight w_i in each of the six countries of your portfolio:

$$\text{weight in country } i := w_i := \frac{\sigma_{i,t-12,t}^{-1}}{\sum_{i=1}^{6} \sigma_{i,t-12,t}^{-1}},$$

   where $\sigma_{i,t-12,t}$ is the volatility of returns from month $t-12$ (included) to month $t-1$ (included) for country i.

3. Construct a constant re-balancing portfolio which at each period invests 60% in EW and 40% in the US risk-free rate (use data from Ken French website for the US risk-free rate). Further, construct a volatility-timing strategy that at time t invests $60\% + \Delta_t$ in EW and the remaining in the risk-free. Δ_t is computed starting with a volatility signal:

$$Signal_t = \sigma_{EW,t-24,t} - \sigma_{EW,t-6,t}.$$

If $Signal_t > 0$, then set $\Delta_t = \min(40\%, Signal_t)$. If $Signal_t < 0$, then set $\Delta_t = \max(-40\%, Signal_t)$. Hence, the volatility-timing strategy deviates from the constant re-balancing portfolio, yet it does not allow short-selling. How does volatility strategy perform relative to constant re-balancing?

4. Compute the portfolio turnover for each strategy considered so far as (EW, constant re-balancing and volatility timing), defined as:

$$Turnover = \frac{1}{T} \sum_{t=1}^{T} \sum_{i=1}^{6} |w_{i,t} - w_{i,t-1}|,$$

where T is the sample length. How do the different strategies rank according to the turnover metric?

5. Backtest the three strategies: EW, constant re-balancing and volatility timing. Comment the results in light of the performance statistics and of the turnover indicator. Discuss relative advantages and disadvantages of the strategies, both in general economic terms as well in the context of the results you have found.

Question 2

1. For this exercise use the file "Tickers", which specifies the tickers of the 50 stocks you should use, given your university ID. Further, use the file "ESG-score" to get the ESG score of each of the stocks in your portfolio of 50 stocks. Retrieve returns for your 50 stocks, for instance using YFinance API in Python, from 1990. Present annualized performance statistics.

2. The ESG scores are measured at the end of the sample period: does this fact potentially impact backtesting analysis and how?

3. Build an equal weighted portfolio EW. Further design an additional "Green" portfolio, where the EW portfolio is tilted toward stocks with high ESG scores. The "Green" portfolio is targeted to clients that care about ESG pillars, beyond the risk-return trade-off. As a portfolio manager, you are given full flexibility in designing such portfolio. Discuss your choice and the trade-off you face taking into account: performance, traction to ethics-driven investors as well as practical implementation issues.

4. Run performance analysis of your EW and Green portfolio, first against CAPM and then FF5. Compute alpha, tracking error and information ratio. Comment your results.