Group Assignment :

Estimating & evaluating ex-ante portfolio risk

This group assignment is about the estimation of appropriate risk measures for a US multi-asset Total Return fund and the evaluation of the resulting risk profile.

Due date research report :

- Sunday **May 4** 2025 before midnight. I will return your reports with my feedback.
- Submit your report in PDF format by email at winfried.hallerbach@EDHEC.com. Please let your file names start with your group number], for example "6 report.pdf", so I do not have to rename all your PDFs to ensure a proper sorting… 😊

The fund and the portfolio manager

Consider the following representative US asset mix of a "Yale-type" portfolio : 50% Equities; 30% Treasuries (Tsies) and 5% Corporate Investment Grade (IG) credits for the fixed income part; and 15% alternative investments. The latter investments consist of two parts : a 10% position in an Absolute Return (AR) long/short equity strategy fund, and a 5% position in oil. This default mix is shown in Table 1.

	Equities	Fixed Income			Alternatives		
portfolio :	Equities	Tsies	CorpIG	CorpHY	AbsReturn	Oil	Total
default	50%	30%	5%	0%	10%	5%	100%
active	-10%	10%	-5%	5%	5%	-5%	0%
augmented	40%	40%	0%	5%	15%	0%	100%

Table 1 : *The representative (default) portfolio mix, the active positions, and the resulting augmented portfolio composition of the US multi-asset Total Return portfolio.*

The representative mix portfolio is held without active positions until the morning of Thursday 12-Dec-2024. On the afternoon of that day, the portfolio manager (PM) plans to implement active over- and under-weights with respect to the default mix. These active positions and the resulting augmented portfolio weights are also shown in Table 1.

The active weights reflect the PM's beliefs that equities have performed well over the past year, but momentum is slowing down. Together with the head wind from geopolitical turmoil,

higher inflation, a looming recession, and the uncertainty towards the outcome of the US elections next year, the PM deems equities less attractive. For Treasuries, the PM thinks that the FED, in juggling its dual objectives of maximum employment and price stability, will announce further rate cuts in their 17-18 December meeting. This makes Treasuries more attractive and hence she wants to substantially increase the weight of Treasuries. Despite gearing for a risk-off scenario, the PM deems Corporate IG Credits too "Treasury-like" and she intends to shift the weight towards Corporate HY Credits. By increasing the exposure to lower grade and less liquid credits, the PM intends to slightly offset the planned reduction in Equities (and to earn a liquidity premium on the side). Although the AR fund has had a bumpy ride over the past year, the PM finds the evidence for factor premia convincing. She finds the AR fund also appealing because it has a long/short set-up, so increasing its weight does not increase the equity beta of her portfolio. Finally, to satisfy increasing sustainability & environmental (climate change) concerns, the position in oil will be reduced to zero.

Your role

As a team of junior quants, you are providing quant support to the PM of this fund. Each week on Thursday morning 11:00 am, the PM has a sparring meeting with you. In this meeting you are supposed to analyze and challenge the active trades the PM plans to implement in the course of Thursday afternoon. In that meeting you are expected to present your critical analyses & recommendations on the impact of the planned trades on the ex-ante risk profile of the fund. For the meeting on Thursday morning 12-Dec-2024, the PM expects your analysis on the impact of the active positions as discussed above.

Because the portfolio changes will be implemented on Thursday afternoon, you must consider Wednesday 11-Dec-2024 as the last day for which market close data are available.

Research questions (RQs)

Your analyses must address the following questions. The suggested set-up gives you a guideline for how to answer the RQs. You are free to surprise me with additional analyses !

> **RQ 1 – volatility :** what are the **ex-ante volatilities** of the **augmented & default portfolios** on Wednesday 11-Dec-2024 close and how does this compare against the course of these ex-ante volatilities **over time** ?

Notes to RQ 1 : For tackling this question you have to decide on what methodologies and what parameter settings to use in order to adequately estimate the **out-of-sample** ex-ante volatilities of these portfolios. Always motivate your choices and interpret the estimated risk statistics.

Suggested set-up for RQ 1 :

- select & motivate one (or multiple) volatility horizons;

- select some competing models, for example EWMAs with ex-cathedra or optimized parameters, GARCH(1,1), … and perhaps some more… Clearly discuss the settings (lookback window, estimation period, etc) and the (optimal) parameters;

- estimate the time series of **out-of-sample** volatilities of the default & augmented portfolios

- specify & motivate evaluation criteria, and perform a horse race to select the best performing model (per horizon, if relevant);

- given the best volatility model, show how the ex-ante volatilities vary over your out-of-sample period;

- from the time series of best ex-ante volatilities, focus on the ex-ante volatilities of both portfolios as per Wednesday 11-Dec-2024 close and explain the differences.

RQ 2 – downside risk : what are the **ex-ante VaRs** of the **augmented & default portfolios** on Wednesday 11-Dec-2024 close and how does this compare against the course of these ex-ante VaRs **over time** ?

Notes to RQ 2 : Again, you have to decide on what methodologies and what parameter settings you deem relevant to adequately estimate the ex-ante VaRs of these portfolios. Always motivate your choices and interpret the estimated risk statistics.

Suggested set-up for RQ 2 :

- consider the regulatory 1-day 95% VaR;

- consider and motivate parametric (see RQ 1) and non-parametric VaR specifications. Clearly discuss the applied methodologies and estimation settings (lookback window, etc.);

- for both portfolios, estimate the daily **out-of-sample** parametric & non-parametric VaRs and show how the ex-ante estimates of each of these VaRs vary over your out-of-sample period;

- explain the differences between the time series of the two types of VaRs over your sample;   (you may include a horse race among your different VaRs in order to select a best performing one);

- focusing on Wednesday 11-Dec-2024 close, explain the differences between the ex-ante 1-day 95% VaRs of both portfolios.

RQ 3 – risk decomposition : what are the **ex-ante** risk decompositions of the **augmented & default portfolios** on Wednesday 11-Dec-2024 close and how does this compare against the course of these decompositions **over time** ?

Notes to RQ 3 : You are free to choose a suitable ex-ante risk measure & lookback window – but motivate the choices you make. And always critically discuss your findings.

Suggested set-up for RQ 3 :

- decide on the portfolio risk measure to use (take into account your findings under RQs 1 & 2 !);
- show how the contributions of the portfolio components to the ex-ante total portfolio risk vary over time, and evaluate;
- explain the differences between the ex-ante risk decompositions of both portfolios as per Wednesday 11-Dec-2024 close.

RQ 4 – tail risk : As per Wednesday 11-Dec-2024 close, how do the tail risks of the default portfolio change after implementing the active positions ?

Notes to RQ 4 : choose and motivate a suitable methodology to evaluate the tail risk of both portfolios. Discuss your findings.

Regarding **time horizon(s)** you have the following information :

- for investors, the recommended holding period of the Total Return fund is 3-5 years;
- official fund performance reporting is monthly (or 4-weekly);
- the PM can implement (active) portfolio trades once a week;
- a regulatory daily 95% VaR must be reported on a daily basis.

It's up to you to decide and to motivate what the relevant horizon(s) are in your analyses.

The data

On Blackboard you find a spreadsheet with the daily total return index series of these components over the period 30-Dec-1994 through Wednesday 11-Dec-2024 (7,540 observations). You must use these data as your source data, but you are free to use additional data (up to Wednesday 11-Dec-2024 close). The data appendix at the end of this document contains details about these data series; for the sake of brevity, you don't have to repeat these sources in your assignment report (just refer to this doc). Note that you have to decide yourself (!) how to process these data (frequency, sample period etc.) before you start your calculations.

Instructions for the written report :

- Do the **empirical work** to answer these research questions. Always start with critically examining the data. You may surprise me with additional (relevant) analyses, but in any case do answer the **research questions** !

- Each group writes a **research report** with their findings. Each student in a group should be able to answer all questions regarding the research and the report : you have full ownership of the work. "I did not write that part" is not a valid excuse.

- **Document & explain** what you do in a clear way. **Motivate** your methodology. **Discuss** your results and draw clear **conclusions**.

- I will grade your report on the basis of both **content ànd form**. After all, if your report is badly structured or badly written, nobody will want to read it… The following instructions are comparable to those you have to comply with when submitting a journal article.

- The **outline** of your report should be : title page, table of contents, main text (in sections), reference list (if you refer to literature; use correct & consistent format), appendices (if any).

- The **title page** should (also) contain your names, student numbers - and don't forget the group number.

- The **main text** should contain ALL relevant information. You start with an introduction section which contains the research questions and which announces the following sections in which you answer the research questions. You end with a conclusion & summary section. Reading only your introduction and summary sections should give me a good idea of what you did, why you did it, and what you found (i.e. the answers to the research questions).

- **Appendices** should ONLY contain background or supplemental information. Ignoring them should go without consequences.

- Make sure your report has a **logical structure**; divide your report accordingly into sections.

- Hint : start writing your report in **bullet points** (short & simple). This makes it easier to keep an overview of the (structure of the) text, especially when you are working with 2 or 3 people on the text. In addition, it is much easier to revise the text by editing & shifting bullet points than by rearranging full sentences. Moreover, by postponing making full sentences you avoid having to "kill your babies". Finally, if you're happy with the bullets you can start adding articles and conjugating the verbs. The resulting text will be much more concise & much better structured compared to starting with full sentences right away !

- Be clear on what you did, why you did it, what the results are, and what the results mean.

- Be especially explicit about how you use the **data**, viz. the sample period and the data frequency. I should be able to replicate your calculations based on your report. To save space, you don't have to describe the data sources for the data set provided, you can simply refer to the data appendix of this case assignment. You do have to document any additional data you use.

- Do not include code snippets.

- Edit the final text to be consistent in terminology, layout etc (so it seems that it was written by only one person).

- Please aim at a **maximum effective size** of your report of about **8 pages**. Use document settings comparable with this document, so I have room to annotate your report with my comments.

- Do insert tables & graphs in the text where they belong (so NOT at the end of your report).

- Make your tables & graphs **self-contained** : each table/graph should have a number, a title, and an explanation.

- If you do not **refer** to a table/graph in the text & **discuss** it, I will NOT look at it. However, simple / small tables you can simply insert into the text, referring to them as "the table below (above)".

- **Number** all pages of your report. This is standard practice and allows me to refer to specific parts of your report when annotating.

Data appendix

- **Equities :** taken from Kenneth French's data library, this is the US market factor Mkt-RF plus the riskfree retun RF. Download from
  https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research.

- **Treasuries :** this is a synthetic returns series we constructed from the US Treasury 10-year constant maturity yield, available from https://fred.stlouisfed.org/series/DGS10. To derive the synthetic returns, we assume a par bond on time t (hence a market value of 100%) and revalue the bond using the yield on time t+1 (and the coupon [i.e. yield] of time t).

- **Corporate IG / HY credits :** these data represent the ICE BofA US Corporate / High Yield Index value, which tracks the performance of US dollar denominated investment grade rated / below investment grade rated corporate debt publicly issued in the US domestic market. Download from
  https://fred.stlouisfed.org/series/BAMLCC0A0CMTRIV and
  https://fred.stlouisfed.org/series/BAMLHYH0A0HYM2TRIV , respectively.

- **Absolute Return fund of equity strategies :** the return series is constructed from adding 70% exposures to the HML (High Minus Low value), RMW (Robust Minus Weak profitability), and CMA (Conservative Minus Aggressive investment) factors to the risk free return RF. Download from
  https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Research_Data_5_Factors_2x3_daily_CSV.zip .

- **Oil :** this series reflects the price in USD per barrel of West Texas Intermediate (WTI) oil, delivered at Cushing, Oklahoma, USA. Download from https://fred.stlouisfed.org/series/DCOILWTICO . This data series proxies the return on an investable oil ETF, giving exposure to changes in the oil price.