EDHEC
BUSINESS SCHOOL

FEN_842   Risk Measurement

**Lecture 4a
The Group Assignment**

Winfried G. Hallerbach PhD

March 26, 2025

Make an impact

Group Assignment

Estimating & evaluating ex-ante portfolio risk

- US multi-asset Total Return fund

- "Yale-type" default mix

- intended active trades as per afternoon Thu 12-Dec-2024

	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%

- role : team of junior quants, providing quant support to the PM

- each Thu morning 11:00 am : sparring meeting with PM

- task : critically analyze & challenge the active trades the PM plans to implement

- up to Wed 11-Dec-2024 market close data

Group Assignment

General Research Question

The PM wants to know from you :

- what is the **ex-ante risk profile** of the augmented portfolio on Thursday 30-Nov-2023 close

- how does this compare against the default mix ?

- how does this compare against the ex-ante risk profile over time ?

You have to decide on :

- what **horizon(s)**

- what **risk measures**

- what **parameter settings**

you deem relevant to capture the ex-ante risks of these portfolios

→ always motivate your choices, and critically interpret & evaluate the estimated risk statistics

Group Assignment

Research Questions

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

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

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

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

Data : spreadsheet with daily total return index series of portfolio components,
Fri 30-Dec-1994 thru Wed 11-Dec-2024 (7,540 index observations)

Always start with …. the data
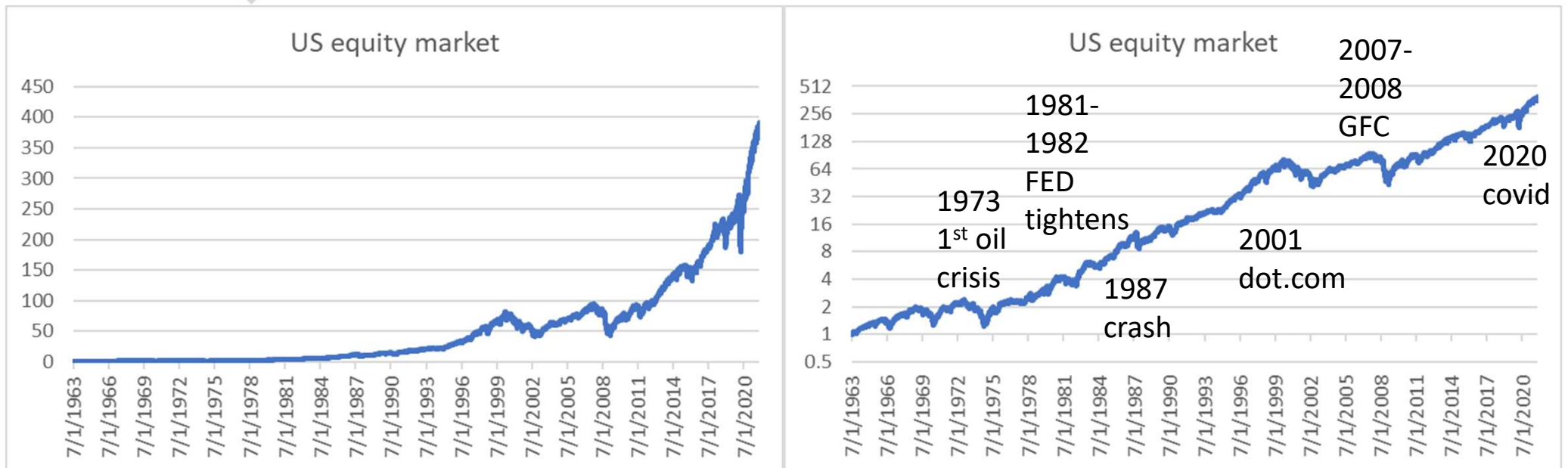
Garbage In, Garbage Out

- **inspection** → before any data processing, hence **original source data**
  → plot !
  → descriptive statistics : max/min   ~~mean, stdev, skewness, kurtosis~~
  → beware of mechanical rules (winsorizing etc) !

- **evaluation** of potentially suspect data points or missing values
  → explanation ?
  → be careful to identify "outliers"   → "influential observations"

- **handling** → deletion   → NaN, N/A ?
  → substitution   → forward-filling : use previous non-missing level value
  → **document in your report !**

"home work" :   what did you find in the assignment data set ?

Data inspection : plotting index series

US equity market

US equity market

US equity market

1973 1st oil crisis

1981-1982 FED tightens

1987 crash

2001 dot.com

2007-2008 GFC

2020 covid

- **use log axis, or plot ln(index)**

- especially for longer periods

Data inspection : don't pre-process

Results obtained from data for the assignment

- calculate returns

- calculate descriptive statistics :

Daily (%)	Mkt	Tsies	CorpIG	CorpHY	AR	Oil
Mean	0.0489	0.0042	0.0220	0.0274	0.0314	0.0074
Standard Error	0.0138	0.0056	0.0038	0.0035	0.0104	0.0534
Median	0.0820	0.0000	0.0318	0.0466	-0.0030	0.0894
Mode	0.7400	0.0000	0.0000	0.0000	-0.0770	0.0000
Standard Devia	1.1963	0.4820	0.3303	0.3016	0.9003	4.6362
Kurtosis	9.09	2.70	5.29	38.26	7.05	2459.79
Skewness	-0.26	0.00	-0.55	-2.21	0.14	-38.86
Range	23.3480	7.2359	5.7538	8.1057	15.0700	355.0526
Minimum	-11.9940	-2.7503	-3.7575	-4.7275	-8.9760	-301.9661
Maximum	11.3540	4.4856	1.9962	3.3782	6.0940	53.0864
Count	7539	7539	7539	7539	7539	7539

- **do not do this : always start with the original source data !**

Data : oil prices

- **inspection :** 20-Apr-2020 negative price !

- **evaluation :**
  > correct price :
  - wet oil : low demand (covid),
              high supply (OPEC dispute)
              → full storage facilities
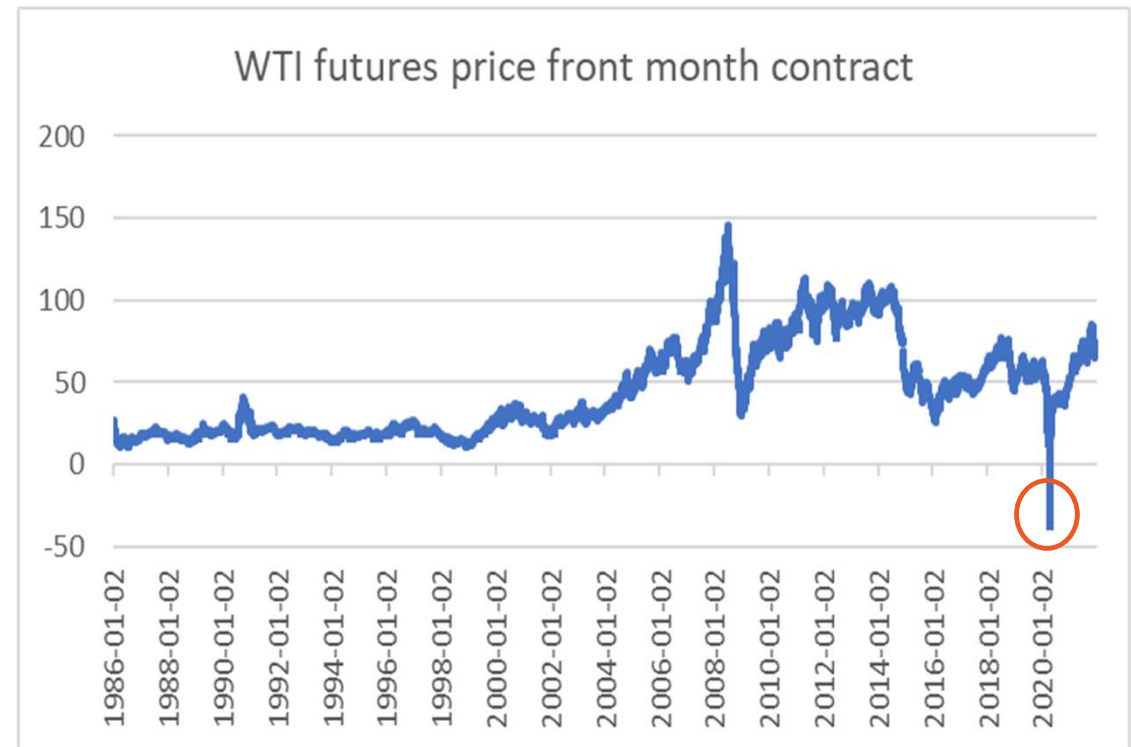 - paper oil : closing-out longs to avoid
               physical delivery :
               sellers had to pay buyers a
               premium of $ 37 / bl
  > but biases all return statistics

- **handling** of this influential observation ?
  convention :   repeat previous day's price if there is an issue,
               so as to preserve the whole data row   →   forward-filling

WTI futures price front month contract

Risk profile : metrics

Towards a multi-dimensional risk profile

decide on risk metrics :

- full domain, partial domain

- risk is one word, but not one number   → multiple metrics

- risk profile >> risk metrics   → also analyze risk contributions

what about ... :

- drawdowns   → very relevant in practice
  depend on a series of returns (cf average) → large estimation error
    → show average of 3 or 5 largest DDs
  → DDs change with vola level   → also show normalized DDS (DD/vola)

- betas ?   → with respect to what ? why ?

- Sharpe Ratios, IRs   → why ?

- correlations, TEV ?   → why ?

what is the underlying Q you hope to answer, why is it relevant to the RQ ?

Methodology

How to estimate & evaluate risk metrics ?

methodology – risk models :

- chose risk models : EWMA, GARCH(1,1), VaR, ES, parametric / non-parametric, ….

- chose risk forecast horizon(s)

- settings $\rightarrow$ confidence level of VaR, ES

methodology – estimation :

- data frequencies $\rightarrow$ time scaling Y/N ?

- estimation lookback window $\rightarrow$ overlap Y/N ?

- optimized vs fixed parameters $\rightarrow$ EWMA, GARCH, …., VaR multiplier for vola

methodology – evaluation :

- back test set-up $\rightarrow$ out-of-sample period
$\rightarrow$ evaluation criteria

Back testing

goal : find the models & settings that provide the best risk forecasts as per Wed 11-Dec-2024 close

- when using **pre-determined** parameters : rolling windows

apply the
4 criteria :
horse race
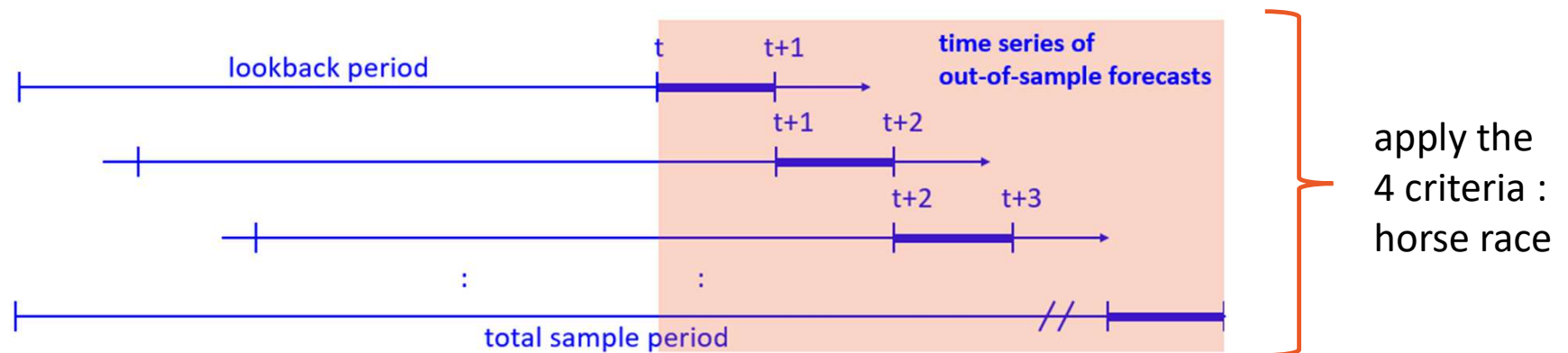
- when **estimating** parameters :   . rolling windows ?
  . full sample ?
  . separate in-sample & out-of-sample periods ?

Do's & don'ts ...

Do's :   . see previous slides
                . early plan writing your report !

Don'ts :

▪ Answer.The.Research.Questions.

▪ always think from the Q, not from the toolbox ← MC simulation

▪ always start simple, extend later   ← Occam's Razor

▪ always explain what you're doing & why

▪ always discuss & critically evaluate results

▪ always be clear & concise in your writing, edit your text

▪ do not come up with alternative strategies, portfolio optimizations

▪ do not include / attach excel sheets, notebooks, code etc