

## Guidelines

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- Submission Deadline: January 20, 2026, 10:00 AM
- Groups of 3 or 4
- Send the report and the Jupyter code at: [guillaume.monarcha.univ@gmail.com](mailto:guillaume.monarcha.univ@gmail.com) (zip file)
- Jupyter code:
  - Fully working code without any additional package (except the libraries and functions you developed for this work, that must be integrated in the zip file)
  - Well organized and presented
- Report
  - Pdf format
  - 5 pages max
  - Must contain the key explanations, justification of the models, figures and results
  - Well-presented and organized
  - Written (not only bullet points)

# Trend following strategy

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Datafile: “GROUP DATASET”

- daily prices of the S&P500 index (total return)
- daily time series of various macro data

## Definition and core model

Let  $\Delta_t$  be the spread at time  $t$ , defined as

$$\Delta_t = \ln(P_t) - T_t$$

With  $P_t$  the level of the S&P500 index at time  $t$ , and  $T_t$  its trend, defined by the following model:

$$\begin{cases} P_t = T_t + \varepsilon_t \\ T_t = T_{t-1} + S_{t-1} + u_t \\ S_t = S_{t-1} + v_t \end{cases}$$

in which  $S_t$  is the stochastic slope of the trend.

## Question 1

From what level of the spread  $\Delta_t$  could we consider that the difference between the S&P500 index and its trend is “abnormal”?

## Question 2

Are some of the macro factors provided good explanatory factors of the level spread level?

## Question 3

Build a trend following strategy consisting in taking long or short positions on the S&P500 index according to one or more of the following signals:

- the sign of the slope  $S_t$
- the sign of the expected slope  $\hat{S}_t = f(\text{macro factors})$
- potential crossing of the spread  $\Delta_t$  beyond the thresholds identified in question 1.

Note: the investment decision taken at time  $t$  depends on the information set at time  $t - 1$ .

## Question 4

Compute the average annualized performance of your strategy and its Sharpe ratio.

According to these two metrics, can you conclude that the performance of your strategy (positive or negative) is due to luck or not?