Exercise 4A: Expanding-Window Backtest

BUSI 722: Data-Driven Finance II

Load `merged.parquet`. Use the same ranked features and ranked target from Exercise 3.

Submission

Submit a **Jupyter notebook** (`.ipynb`) containing all code, output, and charts. Use markdown cells for any written discussion.

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1. Implement an **expanding-window** backtest with LightGBM (100 trees, learning rate 0.05, max depth 6).
   - Start training on the 12 months Jan-Dec 2023 and predicting from January 2024.
   - Each month: train on all months Jan 2023 through the prior month, predict the current month, record predictions.
2. For each month with predictions, sort predictions into deciles and compute equal-weighted mean returns.
3. Report the time-series average of each decile's monthly return.
4. Compute and report the annualized Sharpe ratio for each decile and for the D10 - D1 long-short portfolio.
5. Plot the cumulative return of each decile portfolio.