MGMT 638

Session 10

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Fall 2025

Agenda

- Evaluating portfolio performance
  - Mean, standard deviation, and Sharpe ratio
  - Drawdowns
  - Alphas
  - Attribution analysis
- Weekly trading
  - Data (and new skills)
  - Train-test script
  - Results
- Trading costs

Evaluating Portfolio Performance

Alphas and Portfolio Improvement

Suppose you're in wealth management. Should you (and your client) care about alphas? If so, what alpha?

Learn Investments page

Ask Claude

1. The risk-free rate is 2%. My portfolio has an expected return of 10% and a standard deviation of 15%. I'm considering moving some money to a new asset that has a standard deviation of 30%, a correlation with my portfolio of 60%, and an alpha relative to my portfolio of 5%. How can I combine the new asset and the risk-free asset with my current portfolio to get an expected return higher than 10% while maintaining the standard deviation at 15%?
2. Put this analysis in a Jupyter notebook, doing the calculations in Python.

When Does a New Asset Have Positive Alpha?

A new asset has positive alpha relative to the current portfolio if and only if:

$$\alpha > 0 \quad \Longleftrightarrow \quad \text{Sharpe}_{\text{new}} > \rho \times \text{Sharpe}_{\text{current}}$$

where:

- $\text{Sharpe}_{\text{new}} = \frac{E(R_{\text{new}}) - r_f}{\sigma_{\text{new}}}$ is the Sharpe ratio of the new asset
- $\text{Sharpe}_{\text{current}} = \frac{E(R_{\text{current}}) - r_f}{\sigma_{\text{current}}}$ is the Sharpe ratio of the current portfolio
- ρ is the correlation between the new asset and current portfolio

Key insight: Lower correlation makes it easier for an asset to have positive alpha.

Attribution Analysis

- Suppose a strategy has a positive alpha. We will want to know how the manager is getting it. **What risks is the manager taking on to produce alpha?**
- Can start with the Fama-French factors: SMB, HML, CMA, RMW.
- Is the manager betting on size? On value? On conservative stocks? On profitable stocks?
- Run regression of excess returns on 5 factors (including Mkt-RF). Analyze beta coefficients.
- Can add more factors: momentum, volatility, liquidity, ...

New Evaluation Notebook

analyze_portfolios.ipynb

Note: You can ask Claude to create a PowerPoint deck from the tables and figures produced in the notebook.

Weekly Data

Updated Skills

1. Replace your .claude folder with the .claude folder in `this zip file`
2. data5.parquet was created with this prompt:

   Use the Rice database to create a weekly dataset containing the variables in data4.parquet, but compute lag_week and lag_month instead of lagged_return. I want all stocks and all dates after Jan 1, 2010. Read the weekly dataset skill in its entirety and follow its instructions exactly. If anything is unclear, please ask for clarification.

Data, Train/Test Script, and Outputs

Download data5_pipeline.zip. It contains:

- data5.parquet (weekly version of data4.parquet)
- train_predict_data5.py (backtesting script for weekly data)
- outputs of the backtesting script
  - data5_predict.parquet - (ticker, week, predict) predictions
  - data5_portfolios.csv - (week, decile, return, predict) portfolio analysis
  - data5_current.xlsx - Current week predictions with features
  - data5_model.pkl - Trained LightGBM model

Train-Predict Script

- All features and return converted to percentile ranks (0-1)
- Train on most recent 52 weeks
- Use each trained model for 8 weeks, then retrain
- Out-of-sample predictions only (no look-ahead bias)
- 52 and 8 are adjustable parameters. Could train every week, but would be slower.

Results

- 2.35M predictions across 725 weeks (2012-02 to 2025-48)
- Average weekly spread (D10 - D1): 0.60%
- `data5_predict.parquet` - All predictions
- `data5_portfolios.csv` - Decile analysis by week

Trading Costs

Categories of Costs

- Commissions
- Bid-ask spread
- Price impacts
- Opportunity cost of trades cancelled due to price impacts

Cost Management

- Trade gradually in small amounts
- Use limit orders instead of or in addition to market orders
- Monitor the market and the limit-order book to decide when to submit and cancel orders (algorithmic trading)

Frazzini-Israel-Moskowitz, 2012

- PDF: *Trading Costs of Asset Pricing Anomalies*: Frazzini, Israel, and Moskowitz, 2012
- Video: *Trading Costs of Asset Pricing Anomalies*: Frazzini, Israel, and Moskowitz, 2012
- NotebookLM