BT4016 Final Presentation

Group 10

Chew En Ren Janson (A0183927R)
Ho Ying Rong (A0188843M)
Koh Kai Jie Bryan (A0183858L)
Lim Jermaine (A0187866E)
Timothy Lim Shyen En (A0167597H)

Introduction

The investor profile

- Young, working adult
- Long-term investment horizon
- **Aggressive investment attitude**
- **Up to 20% of portfolio losses tolerated**

The target category

- **Health and Biotech industry**
- Preference for growth stocks
- Rapid capital appreciation
- Higher risk

Benchmark Fund

- **NASDAQ Biotechnology Index (^NBI)**
- NASDAQ-listed companies, classified as Biotechnology or Pharmaceuticals

Best / Worst Portfolio

Compile Analyst Ratings	Analyse Historical Performance	Qualitative evaluation of fund

- Lipper leader ratings for **total returns** and **total consistent returns**
- Shortlist candidate funds as best / worst

- Sharpe Ratio based on 2019 returns
- Rank funds among the candidate best / worst

- Profile of companies invested in
- Analysts' reports on company prospects

Best / Worst Portfolio

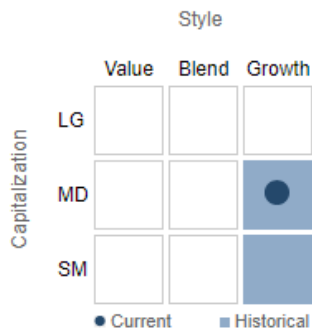**ETIHX (best)**
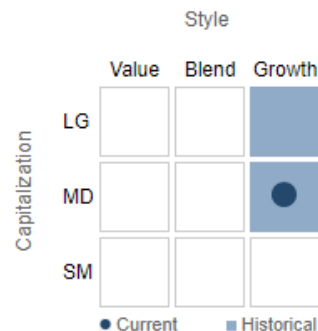2019 Sharpe Ratio: 2.21

Equity StyleMap®* 4 ⊙

AS OF 6/30/2020

Style

	Value	Blend	Growth
LG			
MD			●
SM			■

Capitalization

● Current ■ Historical

Mid-Cap Growth
*57.5% Fund Assets Covered

RYCFX (worst)
2019 Sharpe Ratio: 1.17

Equity StyleMap®* 4 ⊙

AS OF 9/30/2020

Style

	Value	Blend	Growth
LG			■
MD			●
SM			

Capitalization
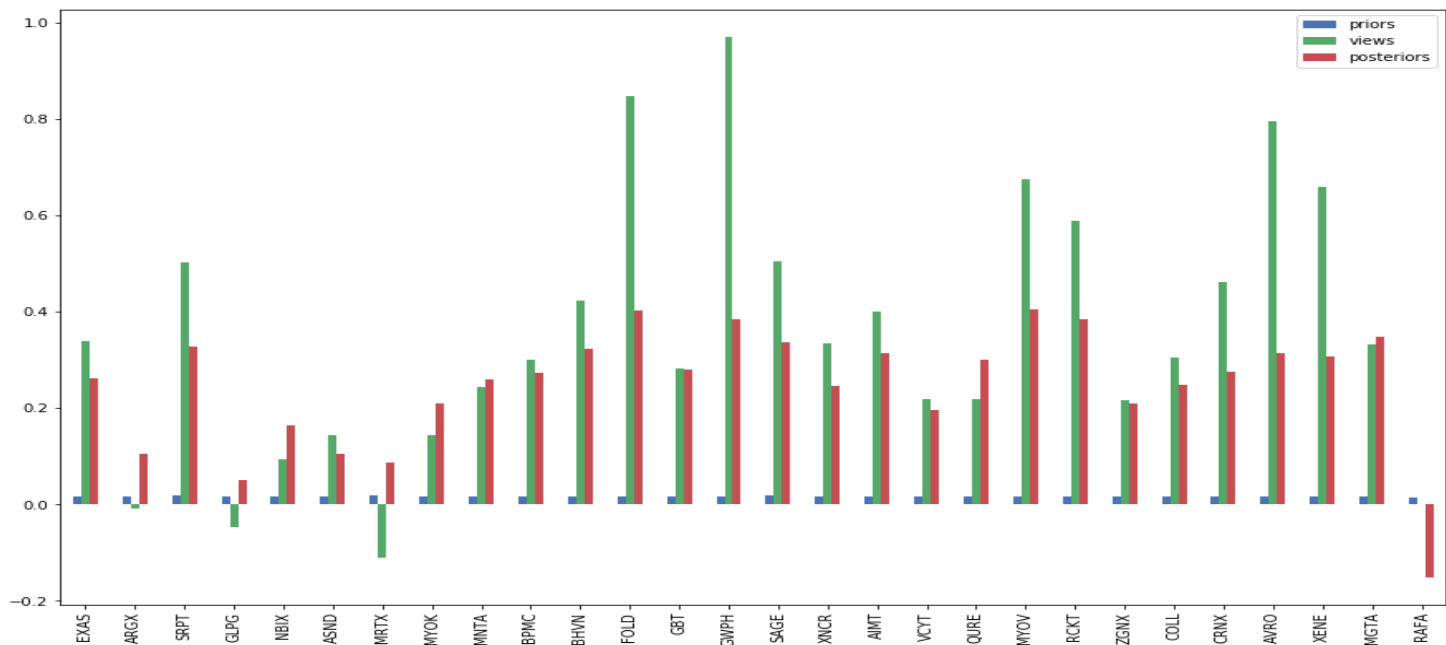
● Current ■ Historical

Mid-Cap Growth
*92.99% Fund Assets Covered

Optimisation & Results

Optimisation

- Adjustment of E(R)
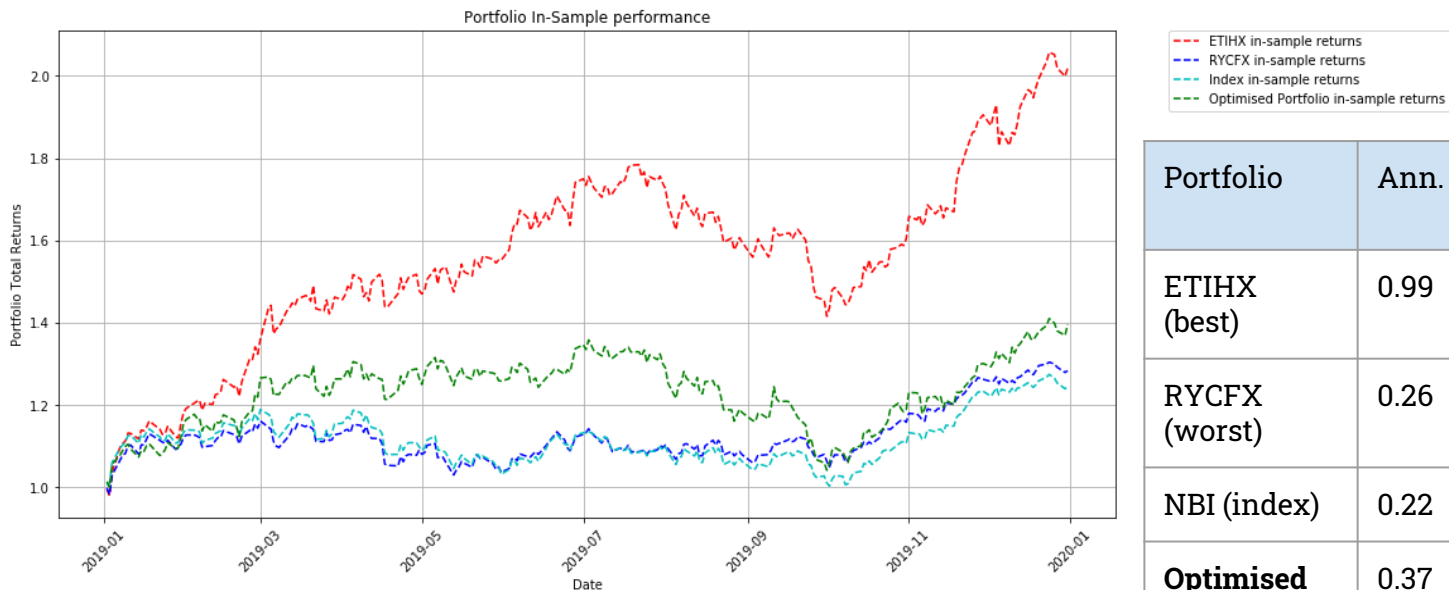- Black-Litterman Model: blend market-implied returns with market outlook

Optimisation

- Optimise mean-variance utility function
- Constraints based on minimum return, maximum risk and by market cap

Optimised Portfolio Weights

Portfolio Performance (2019)

Portfolio In-Sample performance
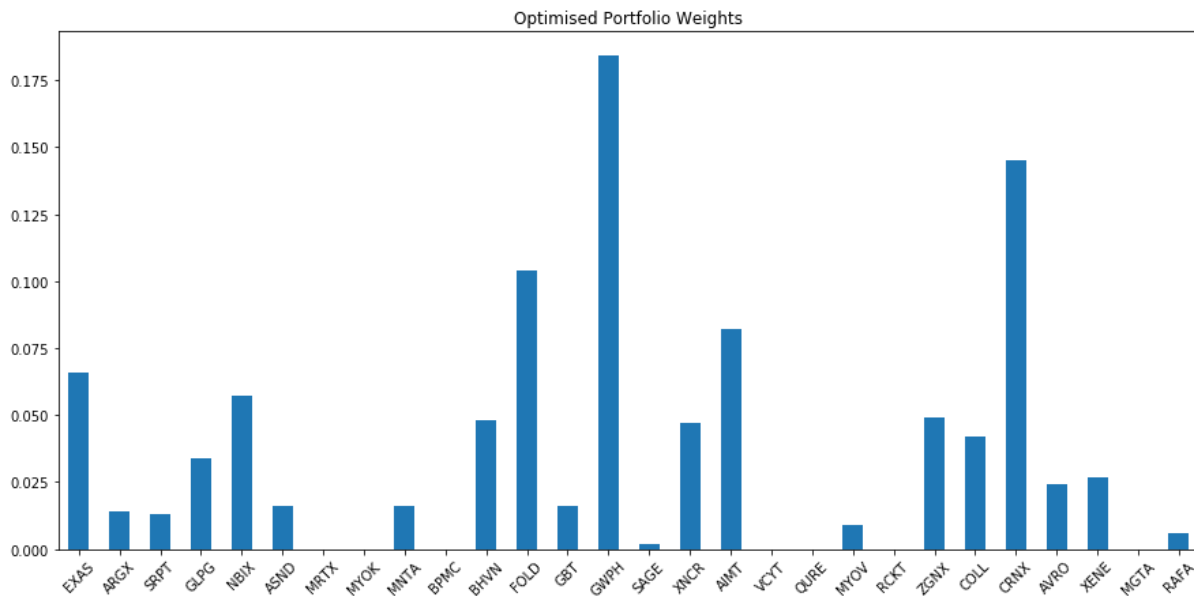
Portfolio	Ann. Return	Sharpe Ratio
ETIHX (best)	0.99	3.46
RYCFX (worst)	0.26	1.39
NBI (index)	0.22	1.12
Optimised	0.37	1.46

Portfolio Performance (2019)

Portfolio	1-day 5% VaR*	1-day 5% ES*
ETIHX (Best)	2.7%	3.8%
RYCFX (Worst)	1.9%	2.5%
NBI (Index)	2.0%	2.7%
Optimised	2.5%	3.4%

*values calculated using parametric approach

Portfolio Performance (2020)

Portfolio Monthly Returns
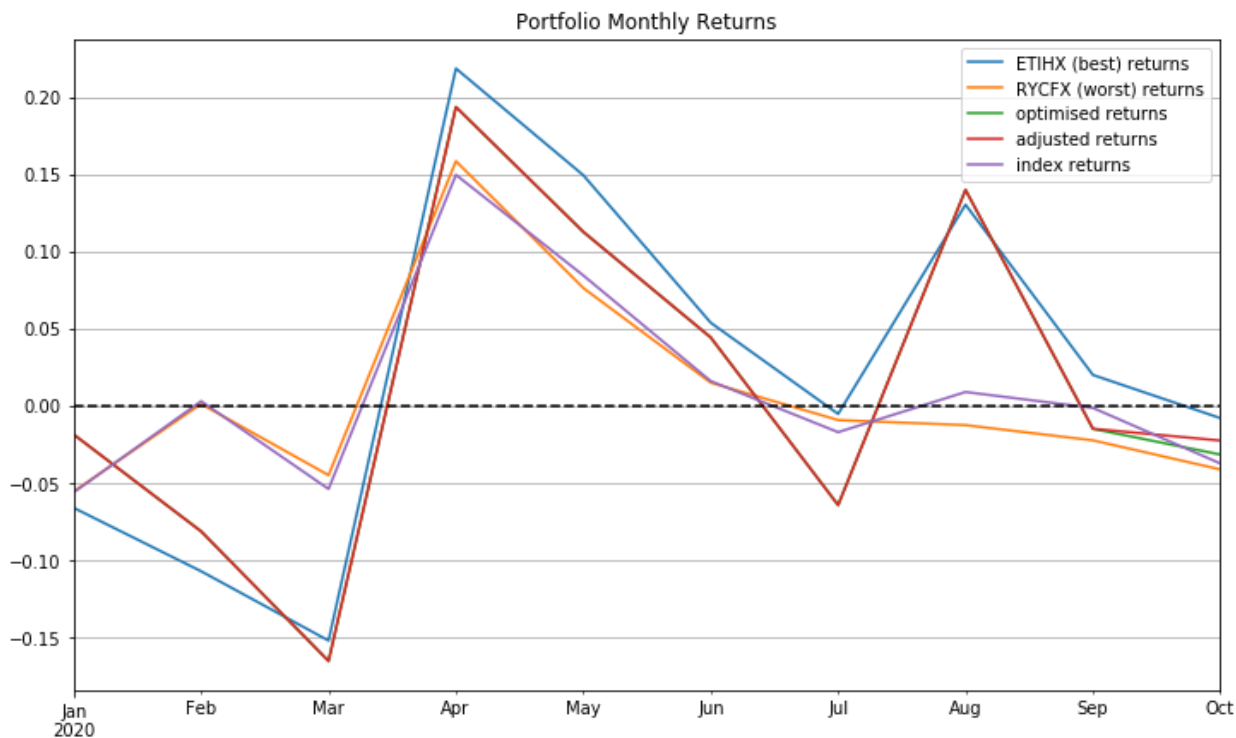
Portfolio	Total Return
ETIHX	18.8%
RYCFX	4.89%
Index	8.22%
Optimised	6.25%

Portfolio Performance (2020)

Observed vs Predicted Returns

Portfolio Performance (2020)

Portfolio Monthly Risk
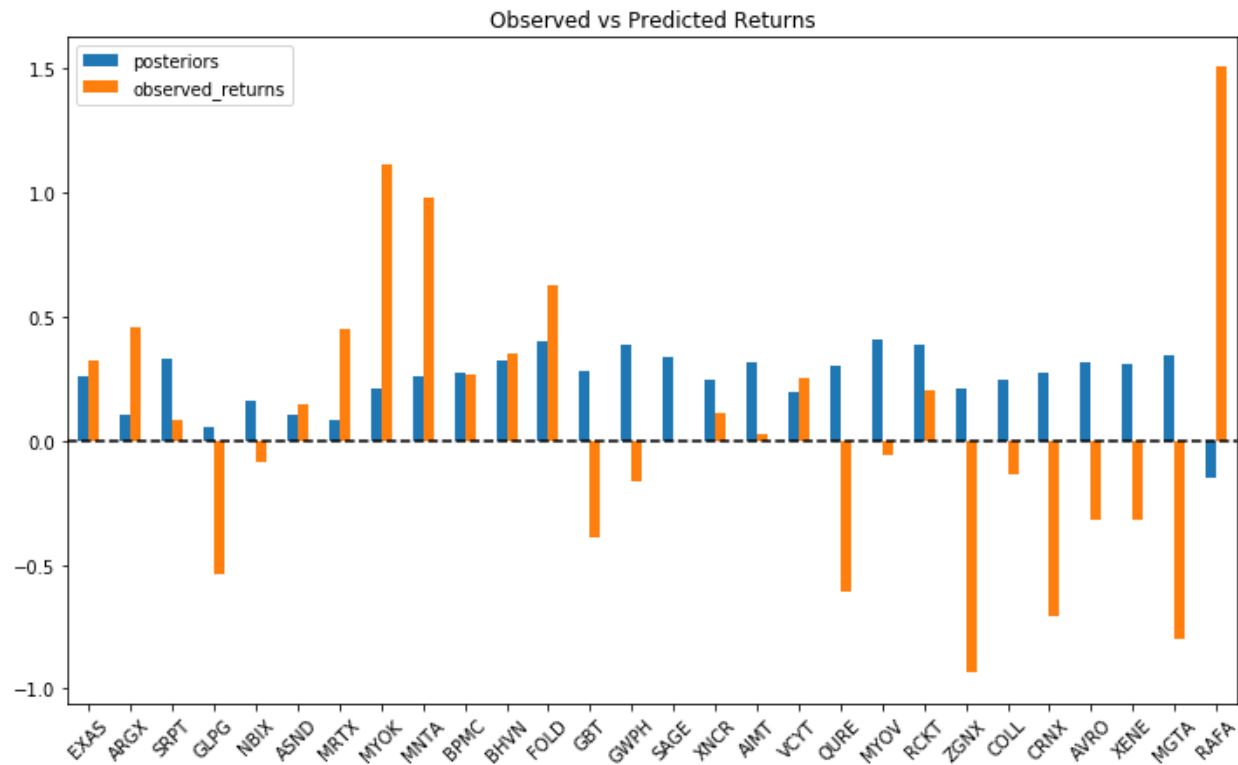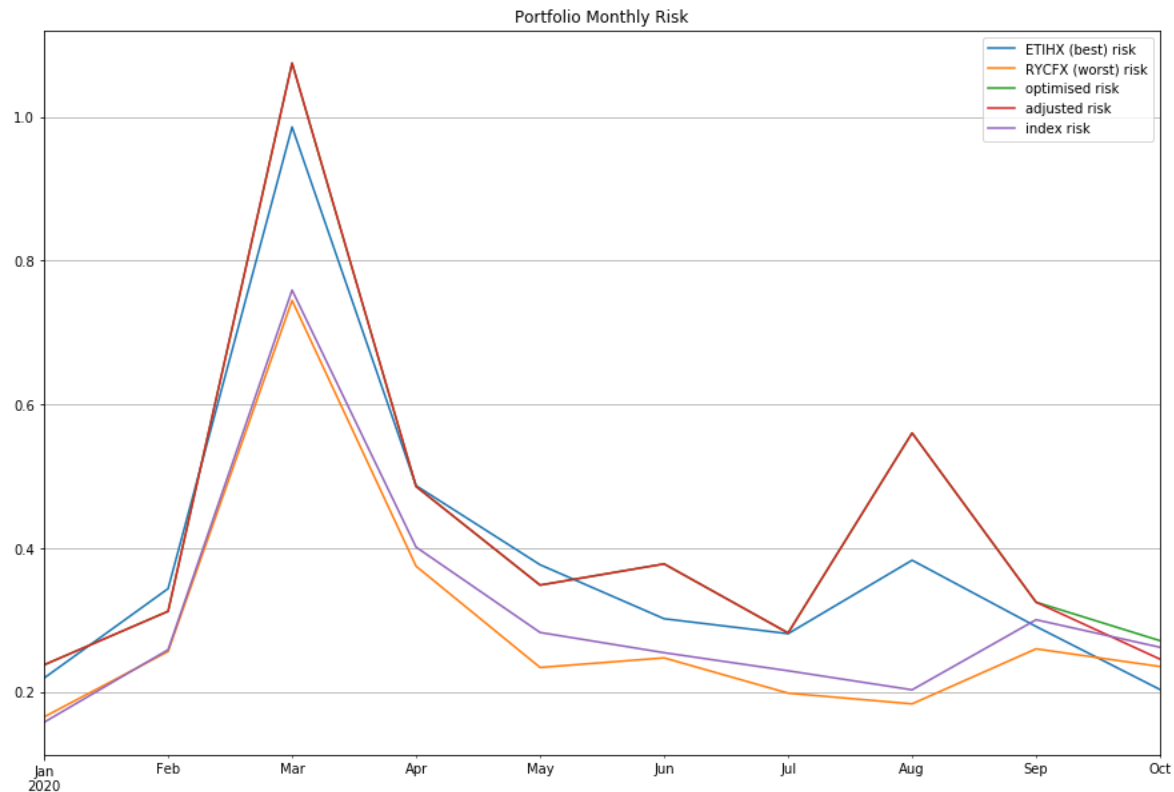
Portfolio Performance (2020)

Portfolio	1-day VaR (5% significance)	1-day ES (5% significance)
ETIHX (best)	3.29%	6.64%
RYCFX (worst)	2.87%	4.87%
Index	2.56%	5.02%
Optimised	3.86%	7.17%

Hedging

Selection of Options

Choose suitable index

- Healthcare indexes: **IXJ, IYH, FHLC**
- Market Index: **GSPC**
- Select based on R^2

Choose option expiry

- VaR analysis over 3/6/9 months
- Calibrate E(R) and Var(R) using CAPM approach

Choose strike price

- Based on investment attitude and risk tolerance
- Derive hypothetical price of index at level

Options Strategies

Protective Put

- Limits downside risk
- No upper bound on profits
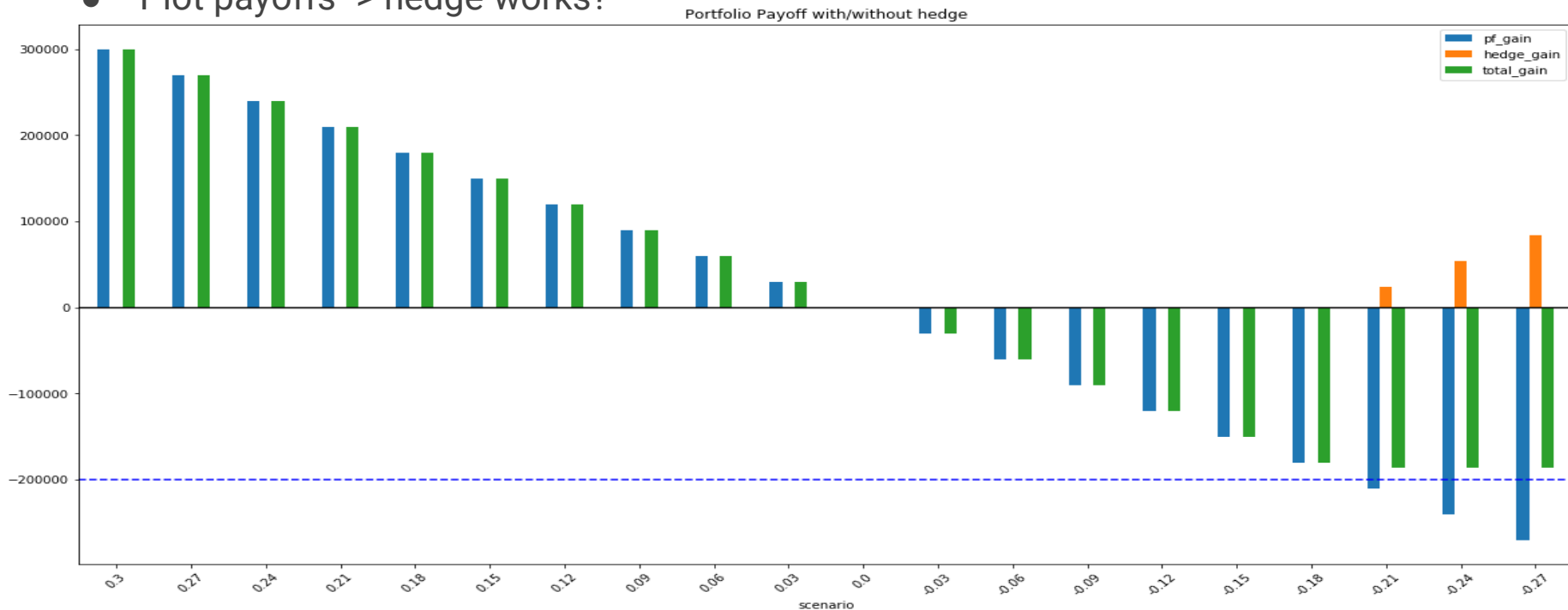- Might be expensive

Covered Call

- Generates income for purchase of assets
- Upper bound on profits
- Not applicable for risk management

Collar Strategy

- Finance purchase of puts with premium collected from writing calls
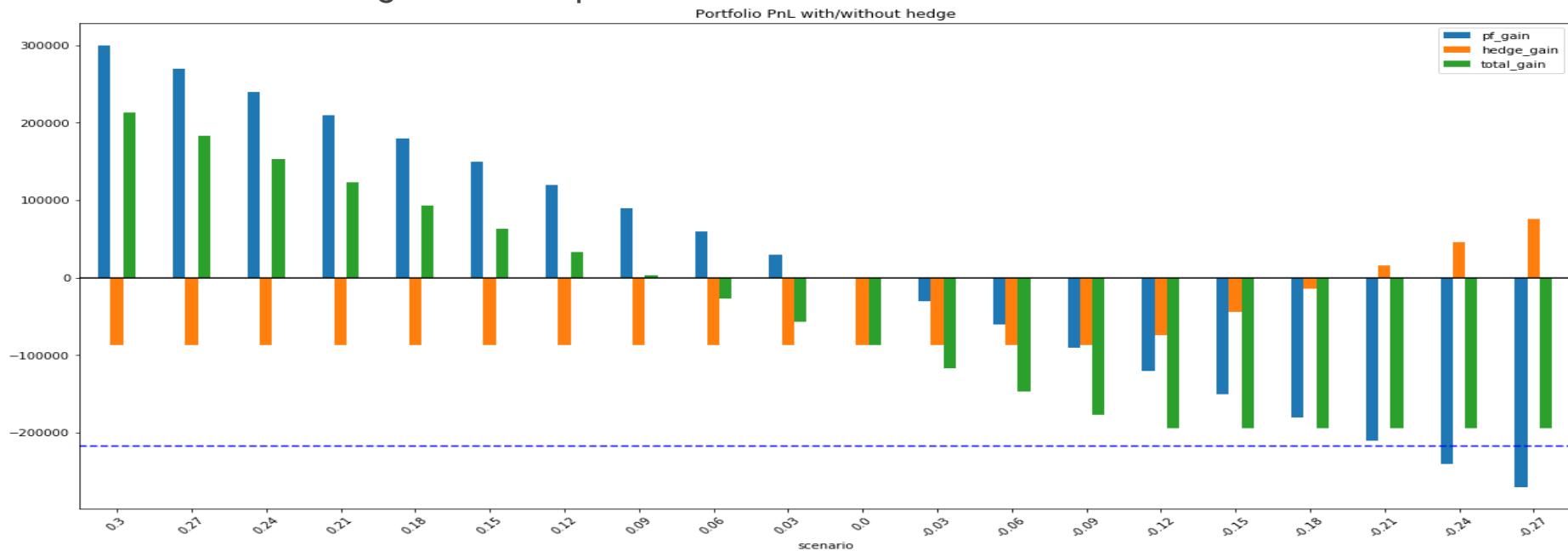- Limits downside risk
- Upper bound on profits

Payoff vs Profits

- Hedge at 20% loss
- Plot payoffs -> hedge works?

Portfolio Payoff with/without hedge

Payoff vs Profits

- Hedge at 20% loss
- Plot PnL -> hedge eats into profits
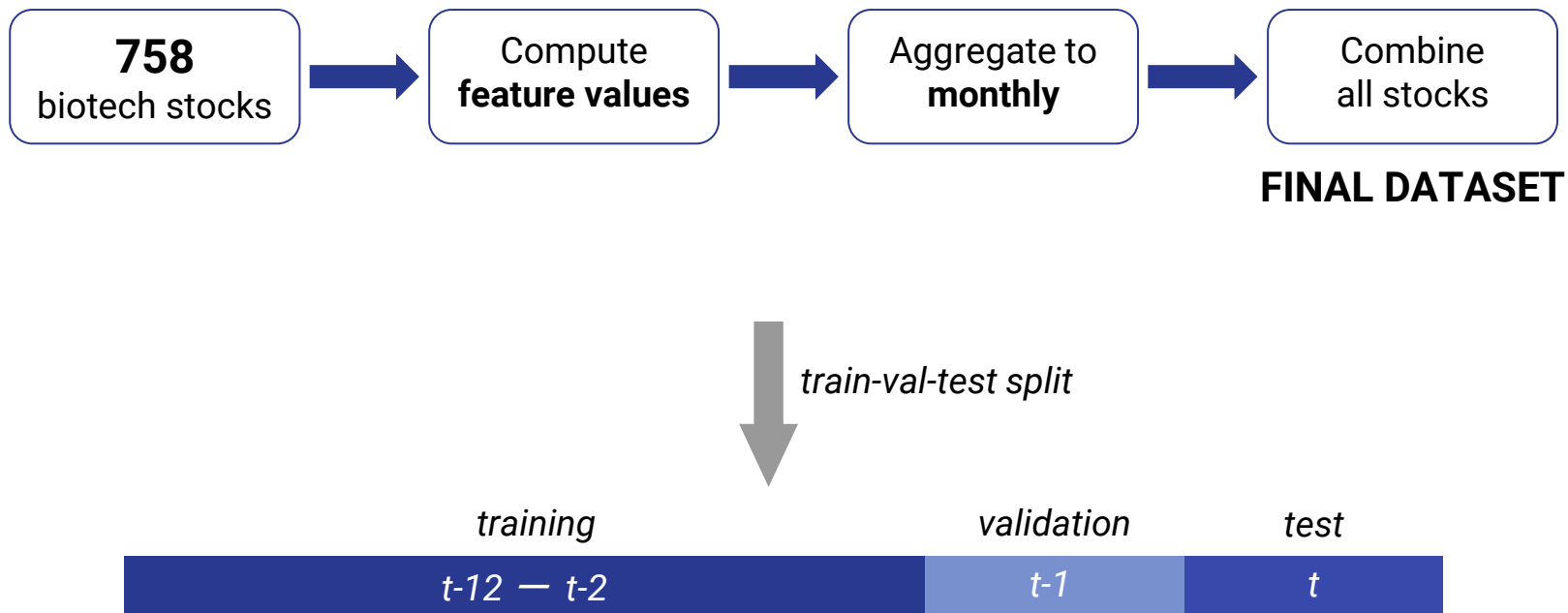

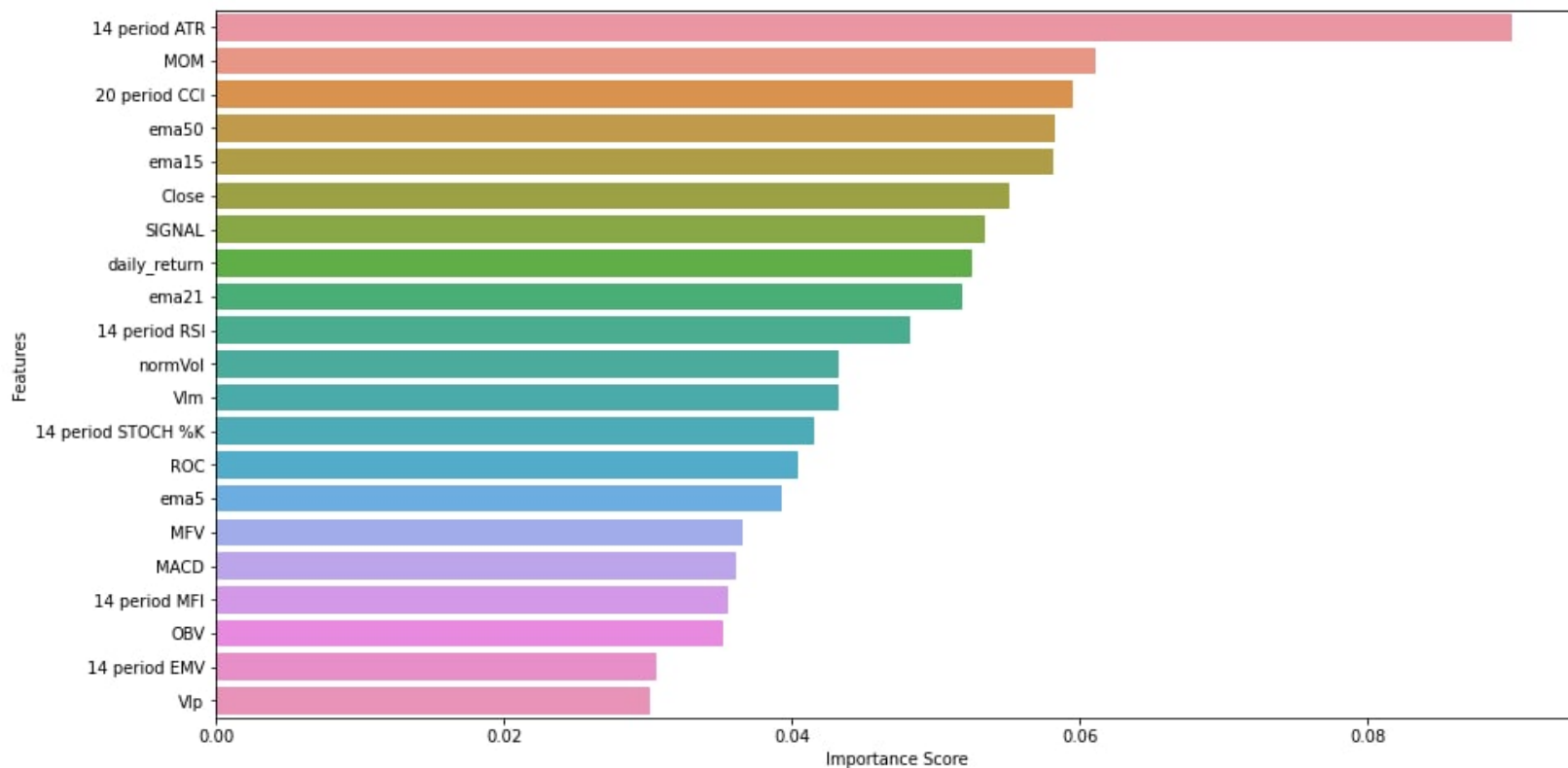Portfolio PnL with/without hedge

Alpha Forecasting

Features

- Closing Price
- Daily Returns
- Normalized Volume
- Technical Indicators, including:

  - Exponential Moving Average (EMA) — *describes the average price of the asset over the past window with more weightage given to more recent observations*

  - Moving Average Convergence Divergence (MACD) — *describes the relationship between the long term and short term relationship of the asset price*

  - Market Momentum (MOM) — *describes the 'ability' of the market to sustain the current trend of the price movements*

- **Dependent Variable: Monthly Alpha**

XGBoost

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│     758      │  →   │   Compute    │  →   │ Aggregate to │  →   │   Combine    │
│biotech stocks│      │feature values│      │   monthly    │      │  all stocks  │
└──────────────┘      └──────────────┘      └──────────────┘      └──────────────┘
```

FINAL DATASET

↓ *train-val-test split*

| *training*	*validation*	*test*
t-12 — t-2	*t-1*	*t*

XGBoost

Application to Portfolio Management

1. Estimate 1 year beta of the asset with the S&P 500 index

1. Estimate future returns of risky assets using predicted alpha and estimated beta → used as 'views' in BL model

1. Adjust confidence in BL model using model's performance on the validation set
   - performance evaluated as proportion of predictions that the model was able to predict "correctly"

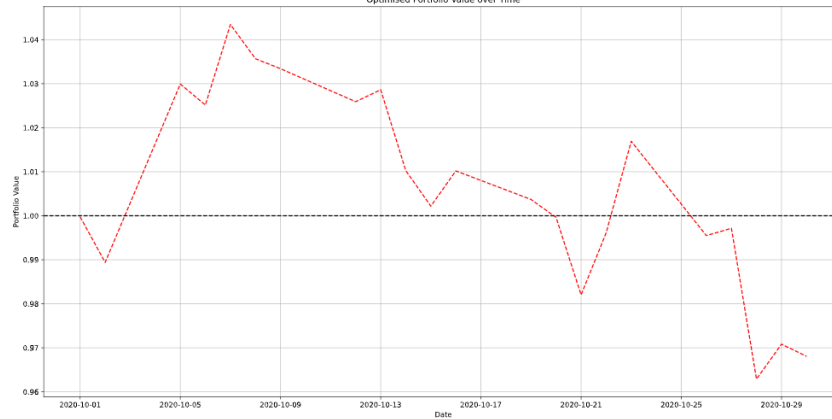1. Repeat optimization process to get the new weights

Results

XGBoost Views

Optimised Portfolio Value over Time
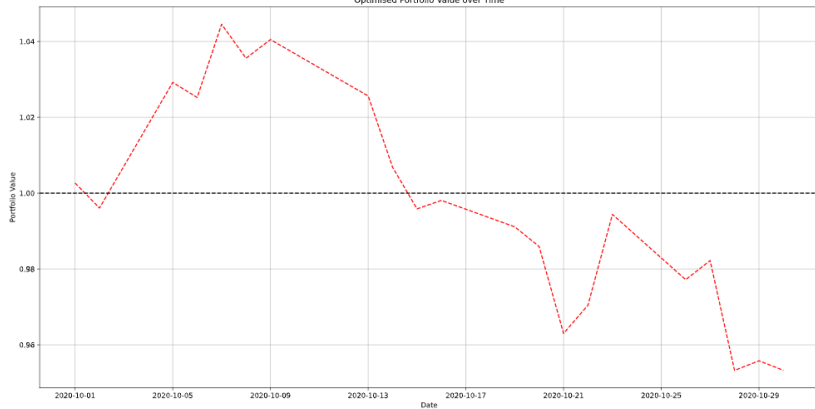
Analyst Views

Optimised Portfolio Value over Time

	Return	Standard Deviation	Sharpe Ratio
Index	-3.54%	2.62%	-1.35
Analyst Views	-3.12%	2.47%	-1.26
XGBoost Views	-4.23%	2.30%	-1.84

Future Improvements

Areas for Improvements

- Assumed Factors affecting returns
  - Assumed returns of our assets follow CAPM
  - Choice of S&P 500 as market proxy may not be the best
  - Explore use of other index as market proxies

- Selection of Instrument for Hedging
  - Limited choice of options
  - Large bid-ask spread
  - Explore use of other option contracts or financial instruments

- XGBoost
  - Assumed that all biotech stocks exhibit similar behaviours
  - Try training different models for each stock
  - Perform more hyperparameter tuning