

QFC Algorithmic Trading Case Competition



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Team Introduction

We are a team of finance enthusiasts who teamed up due to our diverse problem solving abilities. With strong fundamental knowledge of financial markets and robust technical abilities, we are confident in our ability to create an algorithm that outperforms the competition.

Ariel Khait: 4th year Financial economics specialist, math and computer science minors



Paolo Riverin: 4th year Rotman, Finance and Data science Focuses, Economics minor



Harrison Bell: 3rd year Rotman, Finance and Data science Focuses, Economics minor



Alec Maanavi: 2nd year Math major, Statistics and philosophy minors



Yiyi Xu: 2nd year Engineering Science; Math, Stats, Finance Major



Strategy Overview

Volatility

- Rolling volatility measure of last 20 days
- Allowed us to find potential breakouts in BFR
- Momentum confluence is used to guarantee volatility is upwards trending
- Although BFR has a higher expected return, we used this strategy to minimize risk

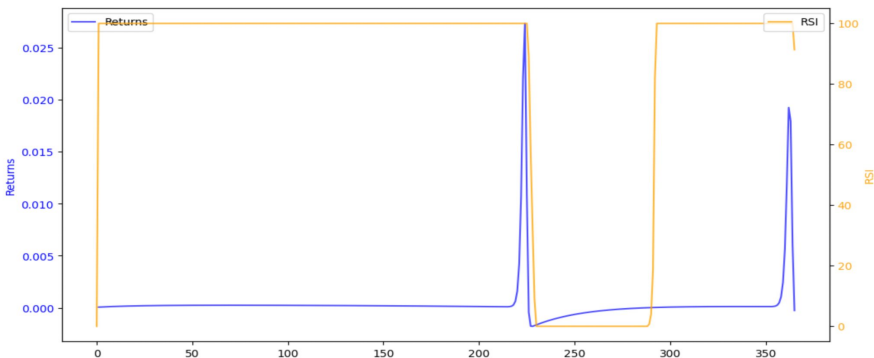
Momentum and Returns

- RSI used to measure stock's position in trading range
- We use reversals in RSI combined with exponential moving averages to determine when a run has concluded
- Upon conclusion, momentum of the base security is tested to see if we should re-enter immediately or hold cash

Our strategy is to allocate our portfolio completely to HC to capture consistent daily gains and use indicators to signal a volatility event in BFR, which gains value in short bursts.

Strategy

Returns and RSI



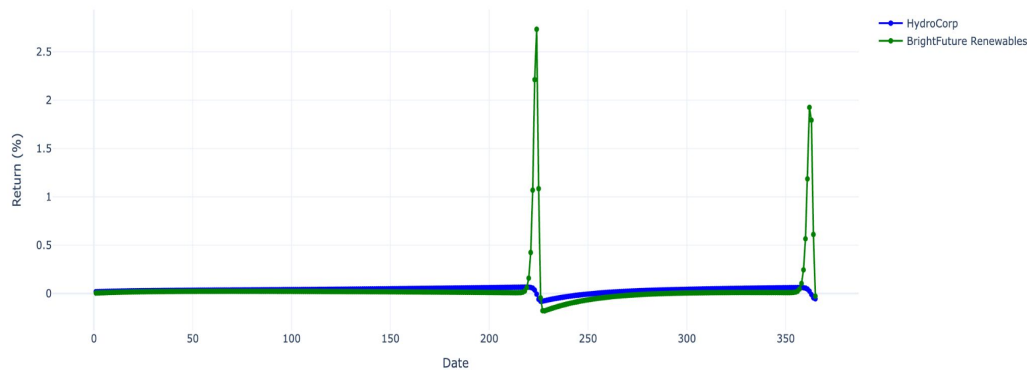
RSI as an Indicator:

When the first derivative of the price switches from positive to negative or vice versa, there are still several days of gains or losses that can be captured or avoided accordingly. While RSI is a lagging indicator, combining it with our volatility confluence enables us to adjust our positions effectively, even for small changes in RSI.

Volatility and Inverse Behaviors:

We are comfortable holding our entire position in one security at a time since we are confident our model will adjust to high volatility events. Furthermore, we see that HC's daily returns are almost always positive, whereas BFR's gains are concentrated on certain days (typically when HC is experiencing negative returns)

Daily Returns Comparison



Strategy Details

```
if Strat5:
    high_vol_event_bf = vol_bf.iloc[-1] >= vol_percentile_bf
    high_vol_event_h = vol_h.iloc[-1] >= vol_percentile_h
    neg_returns_bf = ema_bf_short <= 0
    neg_returns_h = ema_h_short <= 0
    full_vol_h = context.volatility(returns_h, len(context.price_history['HydroCorp']))
    high_vol_full_history = full_vol_h.quantile(0.95)
```

#HydroCorp Buy @ Day 1 as its the most consistent stock

```
if len(context.price_history['HydroCorp']) == 1:
    buy_h()
elif ema_h_short > 0 and curPortfolio.cash > 1:
    buy_h()
```

-> Start by buying HydroCorp as our base stock, if it's not the first day, and we have cash we buy HydroCorp as long its weighted returns are positive.

if you see high momentum, volatility and positive returns, buy

```
if rsi_bf > 80 and high_vol_event_bf and not neg_returns_bf:
    sell_h()
    buy_bf()
```

-> If RSI, Volatility, and non-negative returns, we consider it a positive shock and we sell off HydroCorp to buy into Bright Future Renewables

as soon as those returns become negative, sell

```
if neg_returns_bf:
    sell_bf()
```

-> We then exit Bright Future Renewables as soon as returns turn negative

```
if full_vol_h.iloc[-1] > high_vol_full_history and neg_returns_h:
    sell_h()
```

-> This check for large negative shocks to HydroCorp and considers switching to cash

Shocks Breakdown:

Shock: Bill to cut to environmental protections (day 415)

Likelihood: 30% chance the bill passes

Inferred Impact: HC benefits from reduced regulation and operational costs



Shock: Gulf of Mexico Oil Infrastructure Disruption (day 465)

Likelihood: 30% chance of off-season hurricane

Inferred Impact: Disastrous for HC; GoM generates 17.5% of domestic oil production. BFR stands to benefit from its decentralized battery storage solutions



Shock: Technological Improvement in Refinery (day 515)

Likelihood: 20% chance of successful R&D

Inferred Impact: Cleaner and stronger fuel sources directly benefits HC with its improved competitive edge



Shock: OPEC to reduce oil production in its region (day 615)

Likelihood: 20% chance of new restrictions

Inferred Impact: Benefits both companies; BFR has secured contract to develop wind farms in the region. HC has steady supply to meet international demand



Hedging with Respect to Shocks

Main Hedging Strategy

- We believe trading activity in the past few periods can provide hints to our program of the expected result of the shock
- Most of the given shocks would disproportionately benefit HC
- The robustness of our program and initial portfolio allocation means we do not need manual controls for these shocks

Evaluation

- If there is no high volatility event in BFR, we consider the option of either holding HydroCorp or selling for cash
- If there is a small negative shock to HC, we will hold to avoid incurring transaction fees totalling 1% of portfolio value
- If the negative shock has high enough magnitude, the program will exit HC and re enter at the next sign of gains

Thank You!

