

Intraday Bond ETF Trading

- Strategy identifies attractive intraday trading opportunities in illiquid corporate bond ETFs
- High frequency trading signals backed by research in ETF return predictability
- Intraday risk management with no overnight exposure and conservative cost estimation
- Backtest suggests outperformance against equally weighted credit ETF benchmark in 2020 of **5%**

Investment Universe

Ticker	Market Cap	Avg Daily Volume (shs)	Type
BKLN	\$5.4B	14M	Leveraged Loans
HYG	\$16.3B	44M	High Yield Corporate Bonds
JNK	\$7.6B	12M	High Yield Corporate Bonds
PFF	\$18.0B	6M	Preferred and Hybrid Securities
PGX	\$6.7B	5M	Preferred Securities
SPHY	\$600M	260K	High Yield Corporate Bonds
SRLN	\$10B	5M	Leveraged Loans
HYGH	\$160M	17K	Hedged HYG

- Fixed-Income ETFs experience larger/more frequent dislocations in market prices vs. Net Asset Values
 - May suggest more trading opportunities in this asset class
- Driven by ETF market dynamics and unique characteristics of underlying

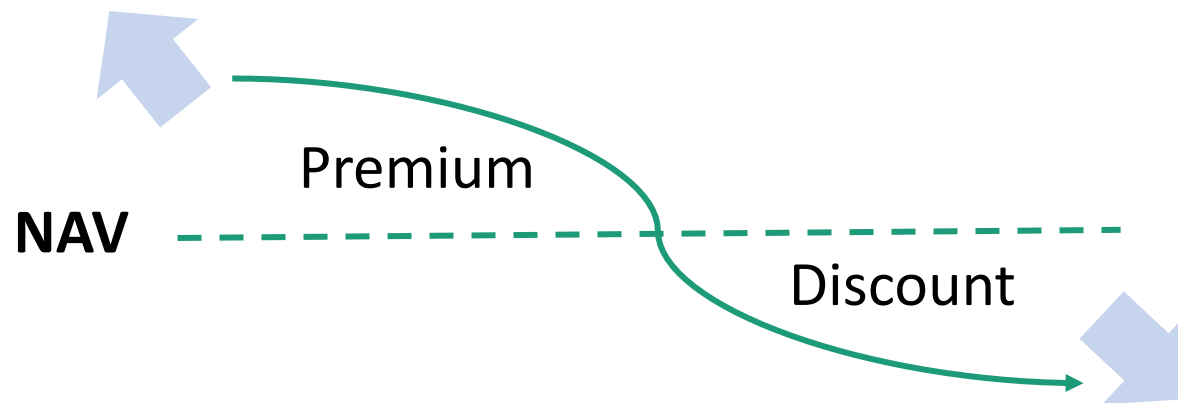
- Innovative, high frequency signals from quality sources
 - Nanosecond trade information from NYSE Trade and Quote (TAQ), largest dataset on WRDS
 - Minute level iNAV data from Bloomberg
- Robust feature selection and model training
 - Employ methodologies such as LASSO, exponentially-weighted regressions
 - Incorporating volatility during the 2020 pandemic

Economic Reasoning

When prices deviate significantly from NAV, Authorized Participants (APs) can use the Creation/Redemption mechanism to correct mispricing

Recognizing the “overpriced” ETF, the AP shorts, buys the underlying and closes position with a share creation in the primary market

An AP is a market maker, specialist or other large financial institution with rights to transact in the primary market for ETF shares.



Premium/Discount should disappear immediately in frictionless markets but APs experience real costs and risks

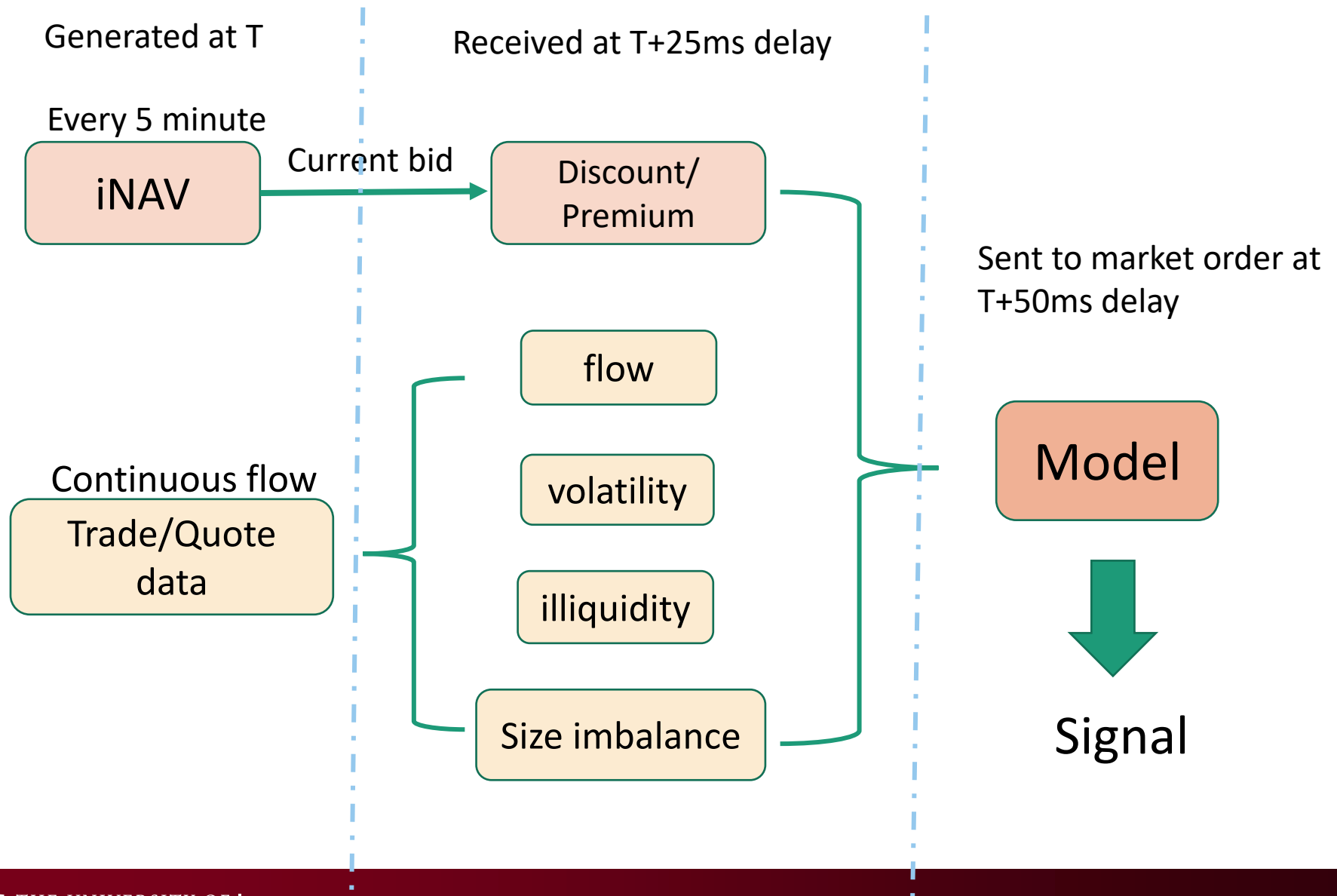
AP shorts the underlying, buys ETF at a discount and closes with a share redemption

- **Risks and Costs for APs**
 - Liquidity and volatility of the underlying
 - AP must transact at prices close to (or better) than NAV prices
 - Trade Flows and transaction costs
 - Creation/Redemption needed when ETF order book imbalanced
 - Price underlying transaction costs into ETF spreads
- **Corporate Bonds -> vola * (low liquidity + high trade costs)**
 - Corp. bonds are highly idiosyncratic and issues even among the same issuer trade differently (or not at all)
 - Trades occur OTC and in times of market stress:
 - Market makers widen spreads significantly
 - Quotes may not even be available

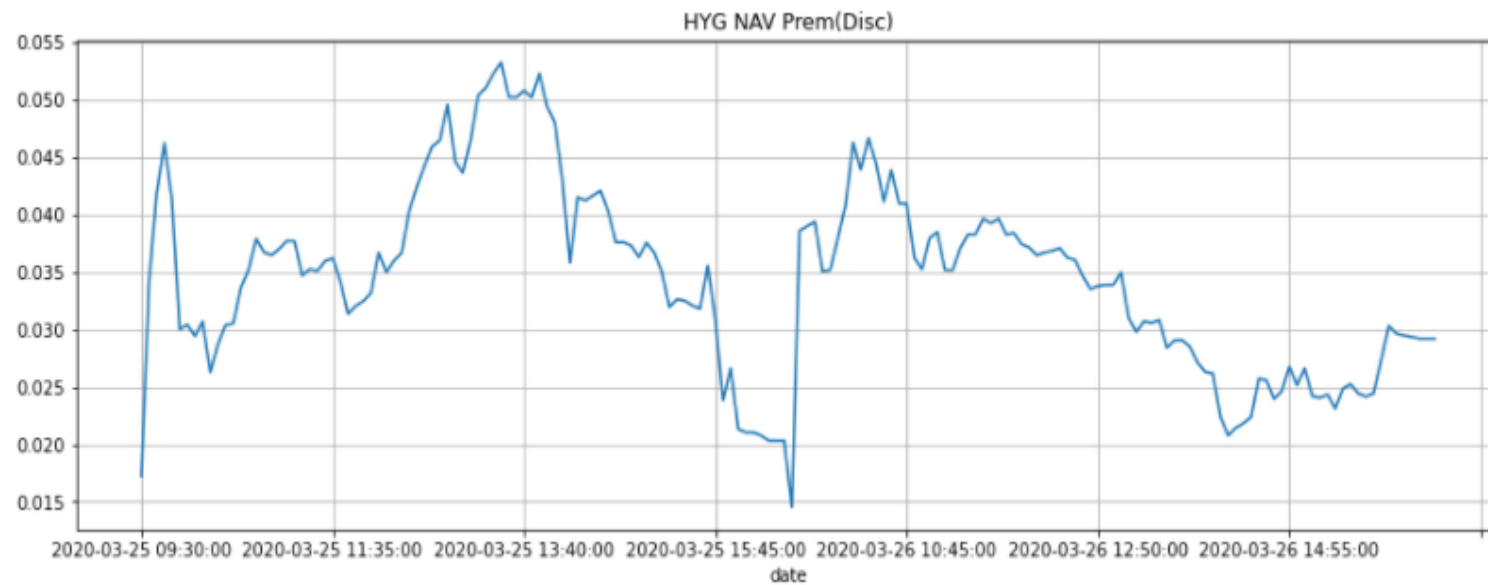
During market dislocations, exchange-traded bond ETFs serve as an enhanced liquidity and price discovery mechanism

- Use dynamics of ETF primary market to see what causes prices to (temporarily) deviate from NAV
 - Premiums/Discounts of ETF price vs. Net Asset Value reflect the cost of Authorized Participant (AP) arbitrage
- Construct factors proxying these effects at various intraday time intervals
 - Trade Flow and Size Imbalances
 - Volatility
 - iNAV Premium/Discount
- Use exponentially weighted regression techniques to predict short-term forward returns throughout the day

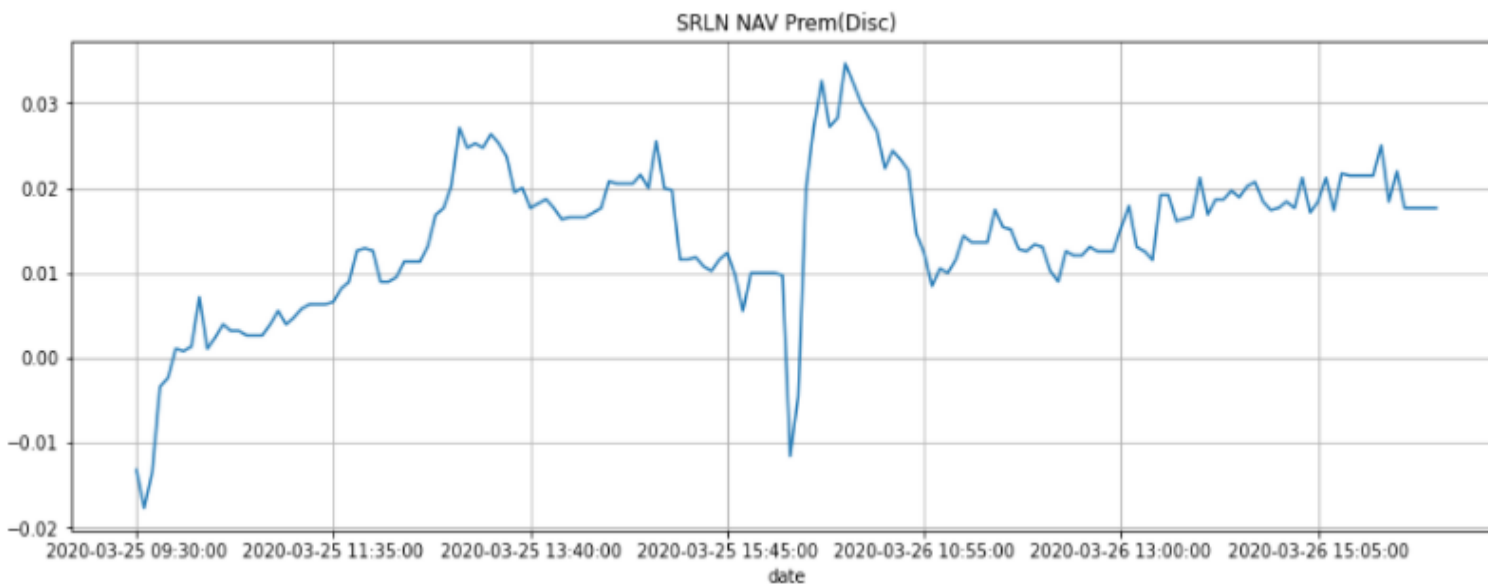
Model Framework



Empirical Exploration (NAV Prem/Disc)



- Prem/Disc varies by asset type and market state



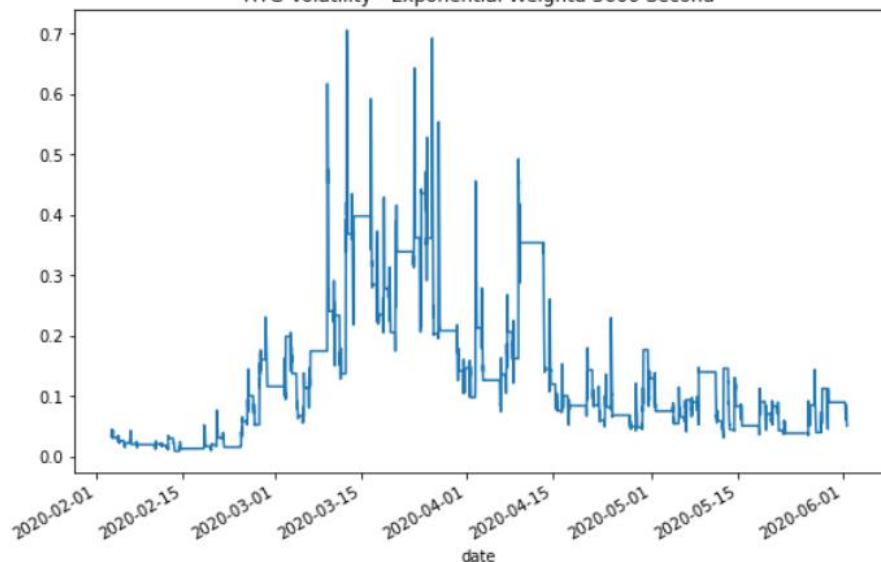
- High vola causes bigger/frequent dislocations

Empirical Exploration (Other Features)

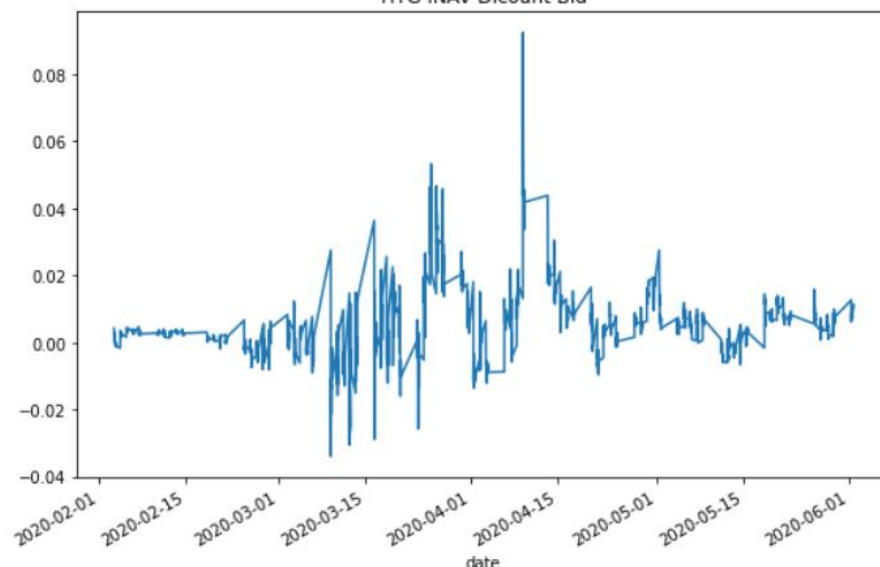
After performing feature selection using two different methods,

Out of 79 features, We decide to choose one feature from each category for regression and backtesting. When we look at the plot of the features across year 2020. Some features such as vol and flow captured the March spike quite well

HYG Volatility - Exponential Weighted 3600 Second



HYG iNAV Discount Bid



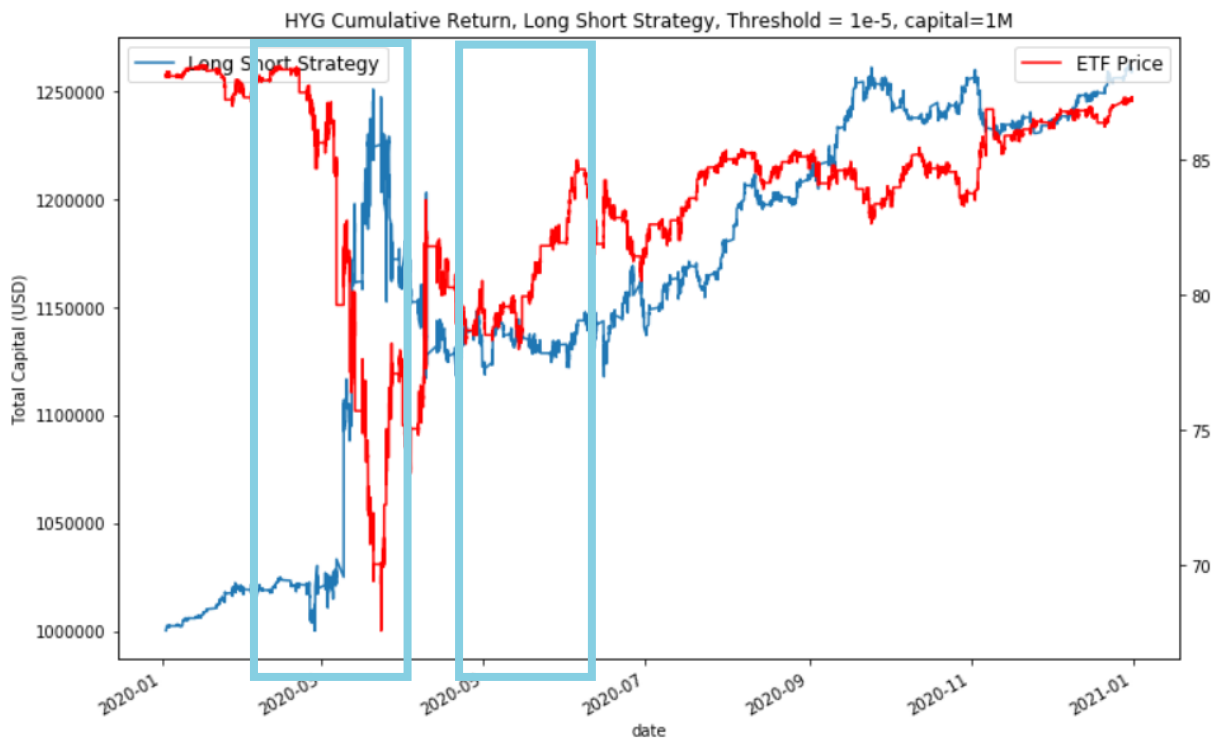
- Long-only and Long-short intraday ETF strategy
- Buy or continue to hold ETFs with positive 5 min return predictions (updated every 5 minutes)
 - Close positions with negative predicted returns
- Equal weight positions within the positive return subspace
- Flatten all positions by EOD
- Budget risk on intraday and cumulative basis

- No positions held for longer than a day
- Stop loss at 2% per day at a strategy level
 - Close positions and no more trading intraday
- Maximum strategy drawdown limited to 5%
- Concentration risk limited by scaling capital investment and equal weighting
- Transacting in highly liquid ETFs
 - Positions can be closed quickly intraday if market dynamics change
- (*Potential Improvement) monitor market news

- Period: 2020(market illiquidity)
- Trading costs
 - Observe prevailing B-A spread at the NBBO immediately prior to time of trade
 - Cross the spread at no more than 10% participation of the top-of-book depth
 - These ETF do not commission fees and financing costs
- Capacity:
 - No more than 10% of most recent best bid offer size
- Expose % of capital = % of universe in positive return subspace
 - i.e. If most recent signal predicts good returns for 50% of universe, use 50% of capital in making trades (then equal weight)

Backtesting Results

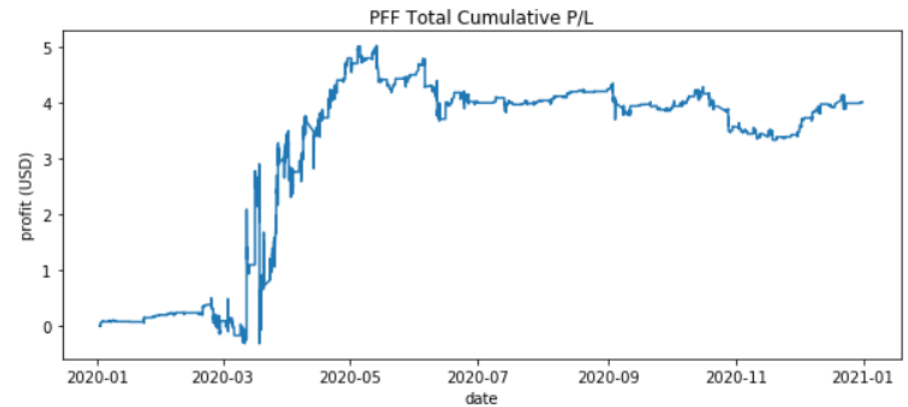
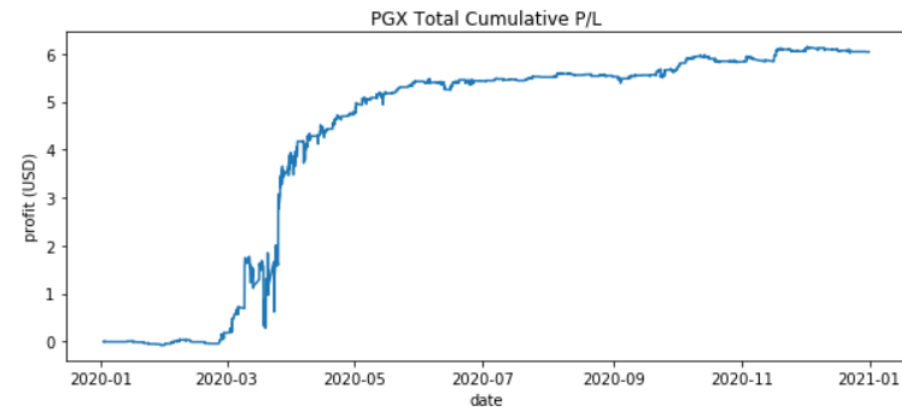
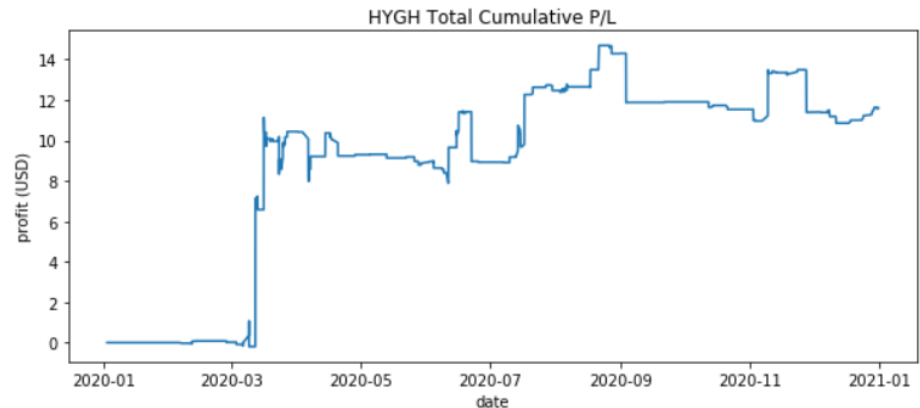
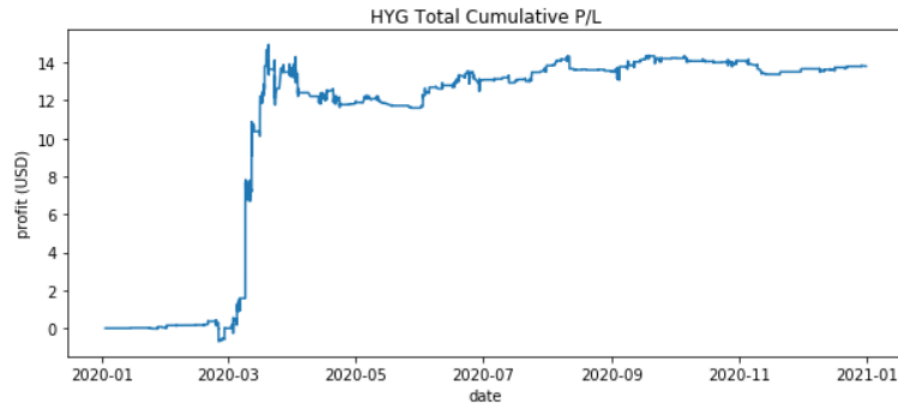
- Our strategy is able to adapt quite well to the March 2020 change as showed in the green area. It initially loses money at end February but picked up the market quite fast.
- On the other hand, when the market rallied, the model did not react to the shift until June. But overall the exponential weighted model adapts quickly.



Strategy picked up good profit in 2020 March!

Backtesting Results

Our long-only strategy works well across all selected ETF with steady PnL performance



Backtesting Results

Our strategy works well across all selected ETF with steady PnL performance.

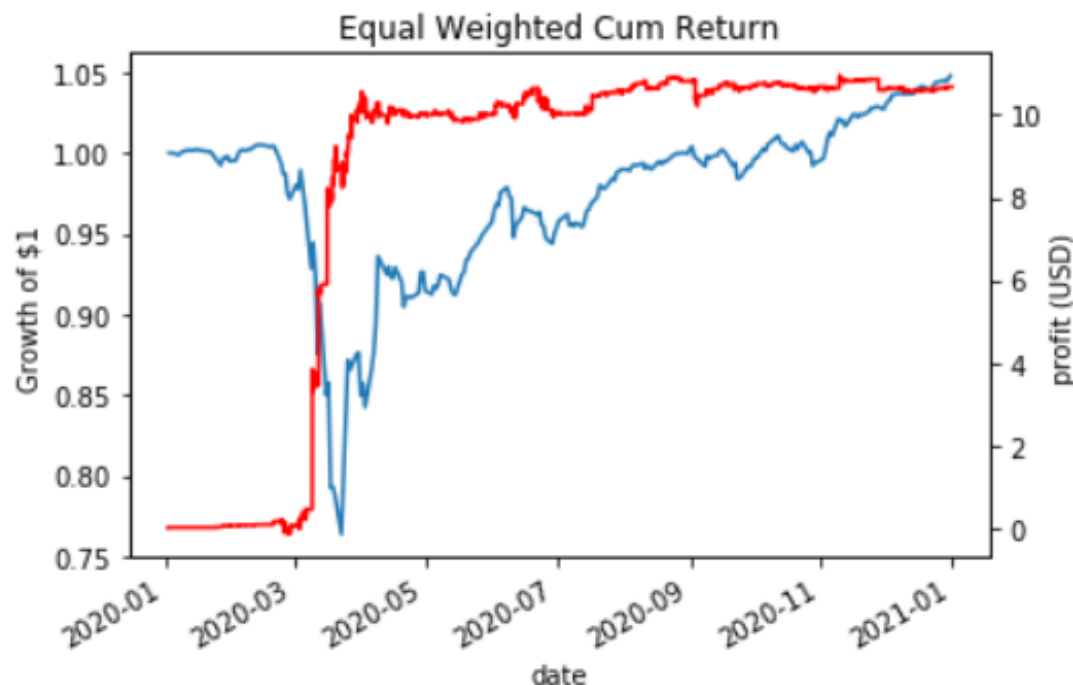
HYGH and SRLN strategy has the highest Sharpe ratio. HYG and JNK has the lowest maximum drawdown ratio.

	Sharpe	Vol	Min	Lower Quartile	Median	Mean	Upper Quartile	Max
BKLN	1.339026	0.208856	-0.055025	-0.000230	0.0	0.279664	0.000229	0.040385
HYG	0.959402	0.157857	-0.059153	-0.000232	0.0	0.151449	0.000234	0.058709
HYGH	4.732068	0.201305	-0.007903	0.000000	0.0	0.952591	0.000000	0.050144
JNK	1.318730	0.137080	-0.034324	-0.000195	0.0	0.180771	0.000202	0.032100
PFF	1.447666	0.238075	-0.084548	-0.000262	0.0	0.344653	0.000265	0.084793
PGX	1.573833	0.266957	-0.089172	-0.000334	0.0	0.420145	0.000334	0.099401
SPHY	2.442244	0.330594	-0.030854	-0.000161	0.0	0.807391	0.000004	0.064530
SRLN	3.103366	0.191491	-0.015769	-0.000226	0.0	0.594267	0.000227	0.034664

Asset Allocation Performance (benchmark)

Generally, our strategy is a high frequency timing strategy that does not involve portfolio construction and can work on a standalone basis.

However, just a simple equal weighted portfolio outperforms an equal weighted underlying ETF benchmark, suggesting our strategy is able to profit from the intraday trades.



Potential Risk of Strategy

- **Illiquidity Risk**(transaction cost):

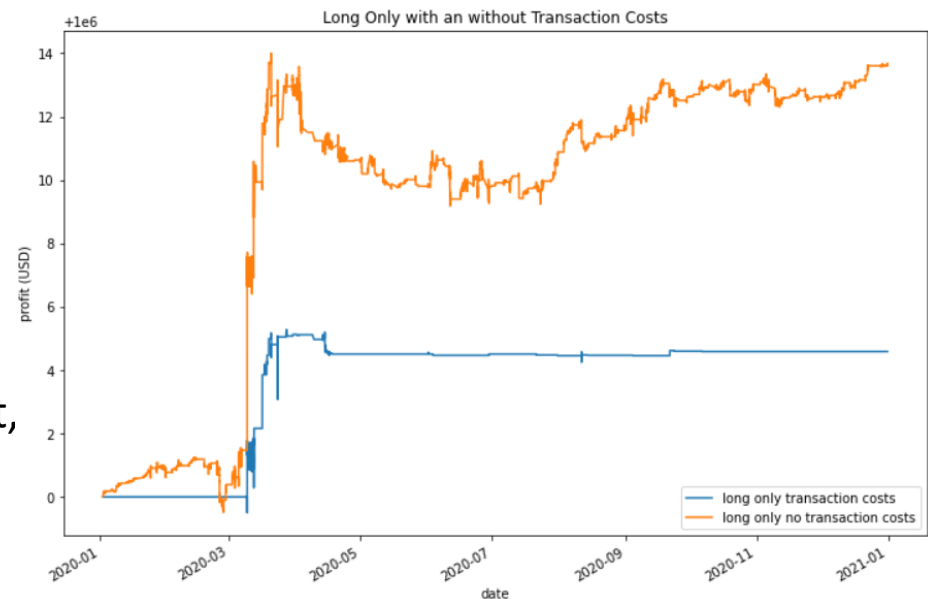
As showed from the right graph, transaction cost takes away half of the profit

- **Shorting capacity:**

During March when everyone wants to short, it is highly likely that makes shorting inaccessible.

- **Model Risk:**

when sudden market event happens, such as 2020 March, our model takes time to adapt to the new market condition. We may want to employ further risk control that monitor price and news to update model more frequently



References

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