Strategy Overview

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Strategy Description

- Mid-Frequency Equities Statistical Arbitrage
  - Top 3000 most liquid US Equities
  - Holding period between 1 and 2 days
- Completely Systematic
- US focused but can be deployed in any developed equity market
- Schonfeld External Portfolio Manager from 2018-2022

Risk

- Risk is measured relative to BARRA USFAST, with the option to use USE4S as well
  - The key difference between models is the inclusion of the one-day reversal factor which significantly increases turnover
- Idiosyncratic risk constrained to be at least 90% of total
- Dollar and β-neutral to all factors which include
  - Market and Industry Factors
  - Style Factors
- Realized daily risk was 9 basis points

Types of Signals

- Types of signals

Signal Type	Number of Signals	Number of Features
Technical	3	500
Cross-Asset	2	300
Sentiment	3	200
Fundamental	2	50

- Other signals were constructed but never deployed due to prohibitive data costs
  - Notable example: external Alpha Capture
- Data sets must have long depth of history and be cross-sectionally dense
- Industry-specific and event-driven strategies can be incorporated but historically have not been

Edge

- Combination of short and long term sources of alpha
  - For high-frequency, market microstructure is the main source of alpha
  - For low-frequency, fundamental sources and intrinsic value drive alpha
  - Both are relevant at the mid-frequency
- Forego classical Mean-Variance Markowitz approach in favor of a modern theoretical foundation
  - Stochastic Control
  - Reinforcement Learning
  - Transfer Learning

Track Record

- 3 years of trading at scale
- Alpha performance and portfolio construction were consistently strong
- Difficulty with monetization
  - Broker algo transaction costs much higher than expected
  - Expected: 1/4 spread
  - Actual: 1 spread
  - Notional-weighted spread: 12 basis points

Authorized GMV	100MM
Total Dollars Traded	15B
Lifetime PnL	-2MM
Alpha Size	18 bps
Alpha IC	3%

Table: Key Strategy Metrics

Alpha Performance

- One master signal that is fit against three horizons
- Consistent predictive power across all forecast horizons
- Negative correlation (reversal) between intraday and overnight alphas makes monetization more difficult

Horizon	**Name**	**Alpha Size** (bps)	**IC** (%)
9:30 - 10:30	fwd1	8	5
10:30 - 4:00	fwd2	4	1.5
Overnight	fwd3	6	2.5

Table: Key Alpha Metrics

Alpha Realization

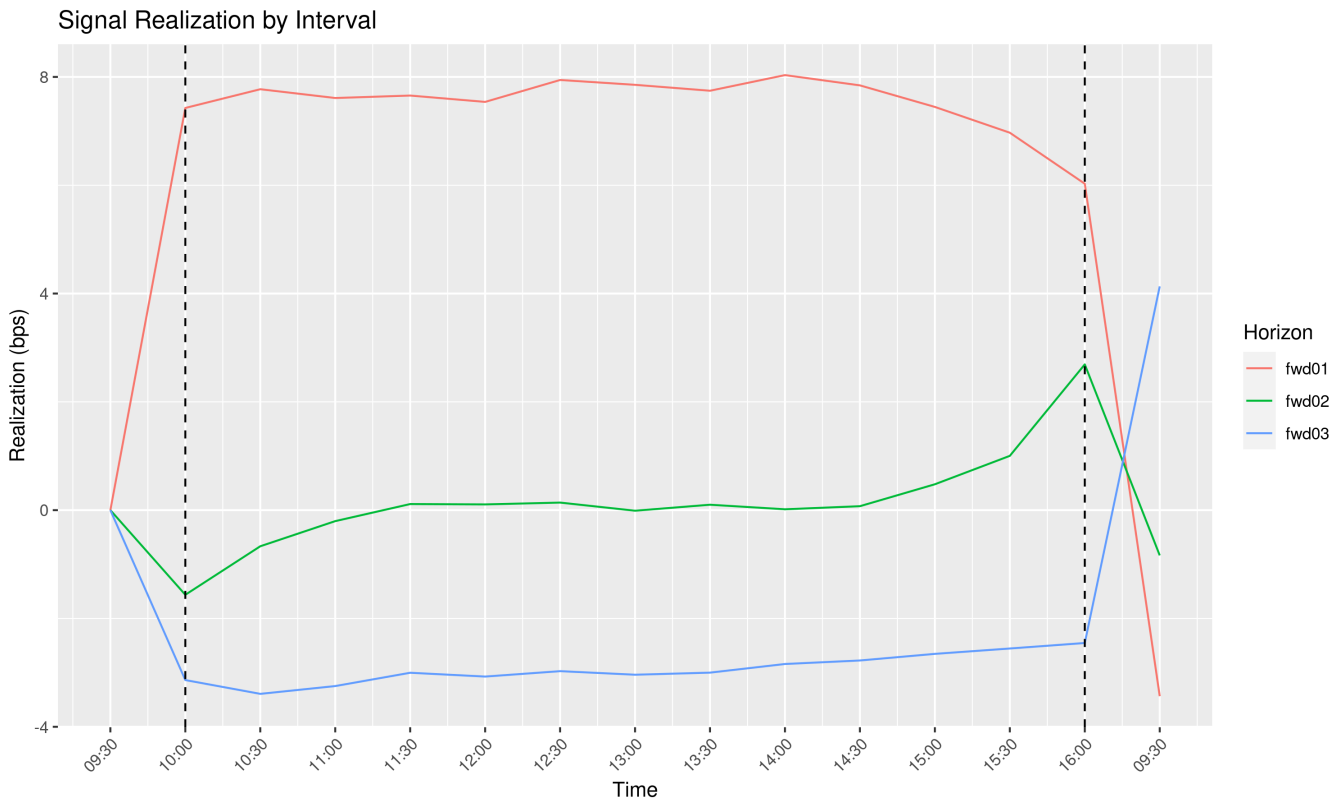


Figure: Alpha realization curve ($h_t' r_{t+1}$)

- Strong overnight reversal of alphas makes monetization more challenging

Alpha Realization by Year

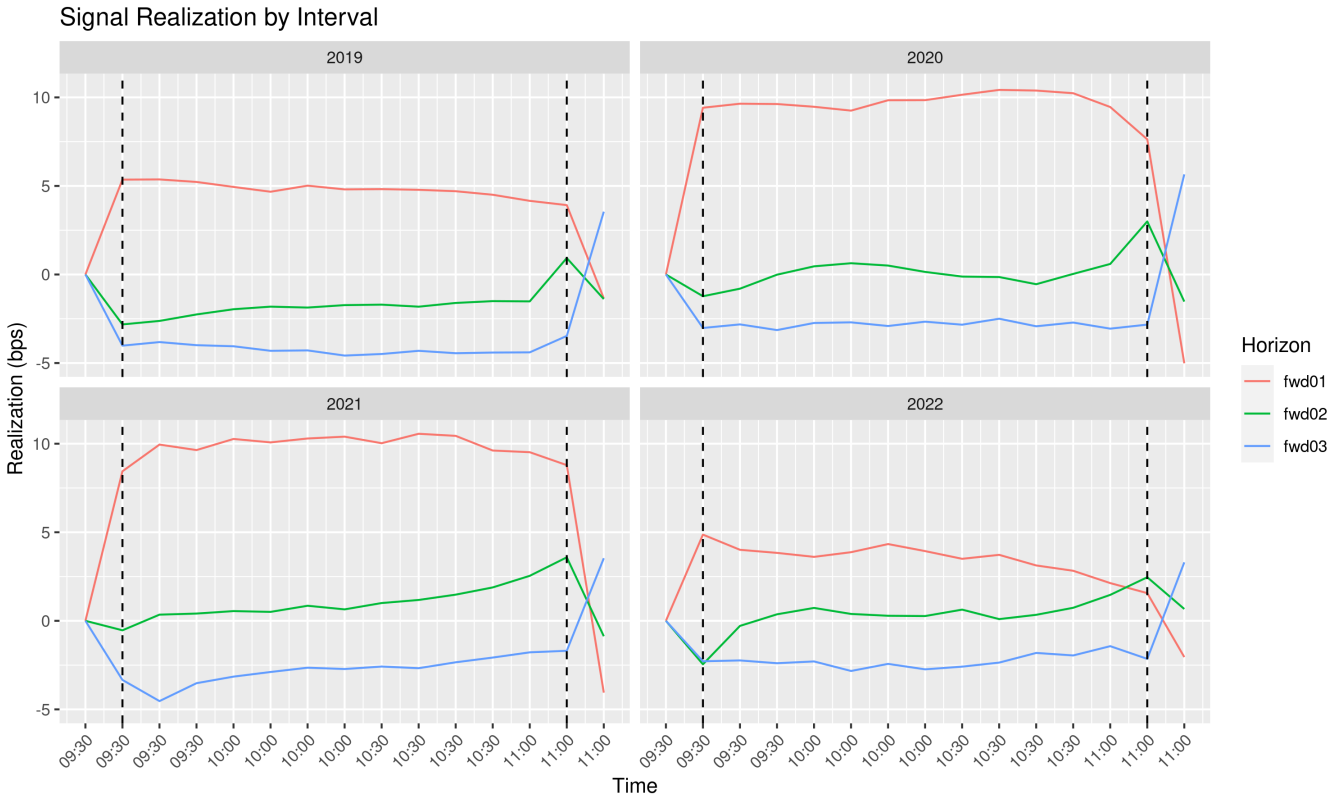


Figure: Yearly realization curves

Predictive Power

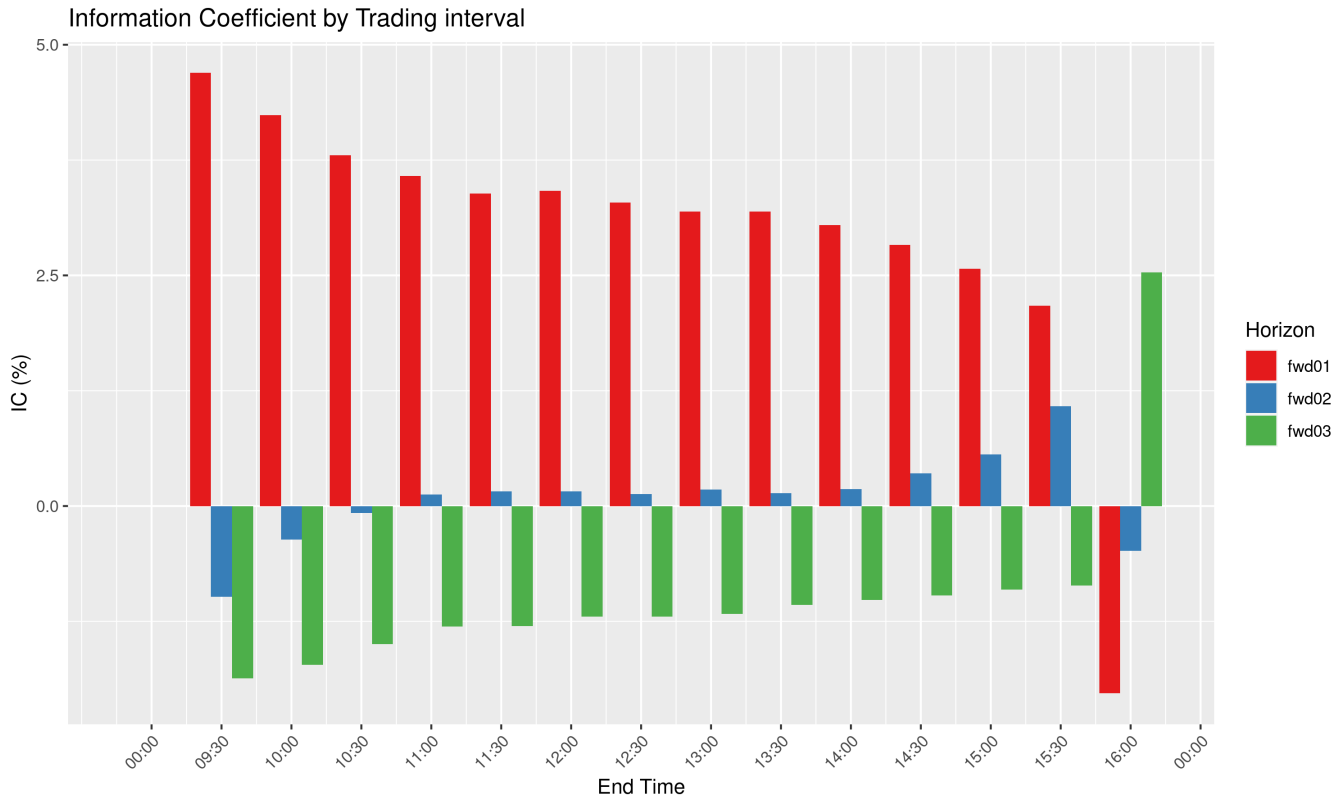


Figure: Information Coefficient ($\text{cor}(\alpha_t, r_{t+1})$) of alphas

- Predictive power is strongest in the morning
- Strong alpha at night, but difficult to position into

Predictive Power

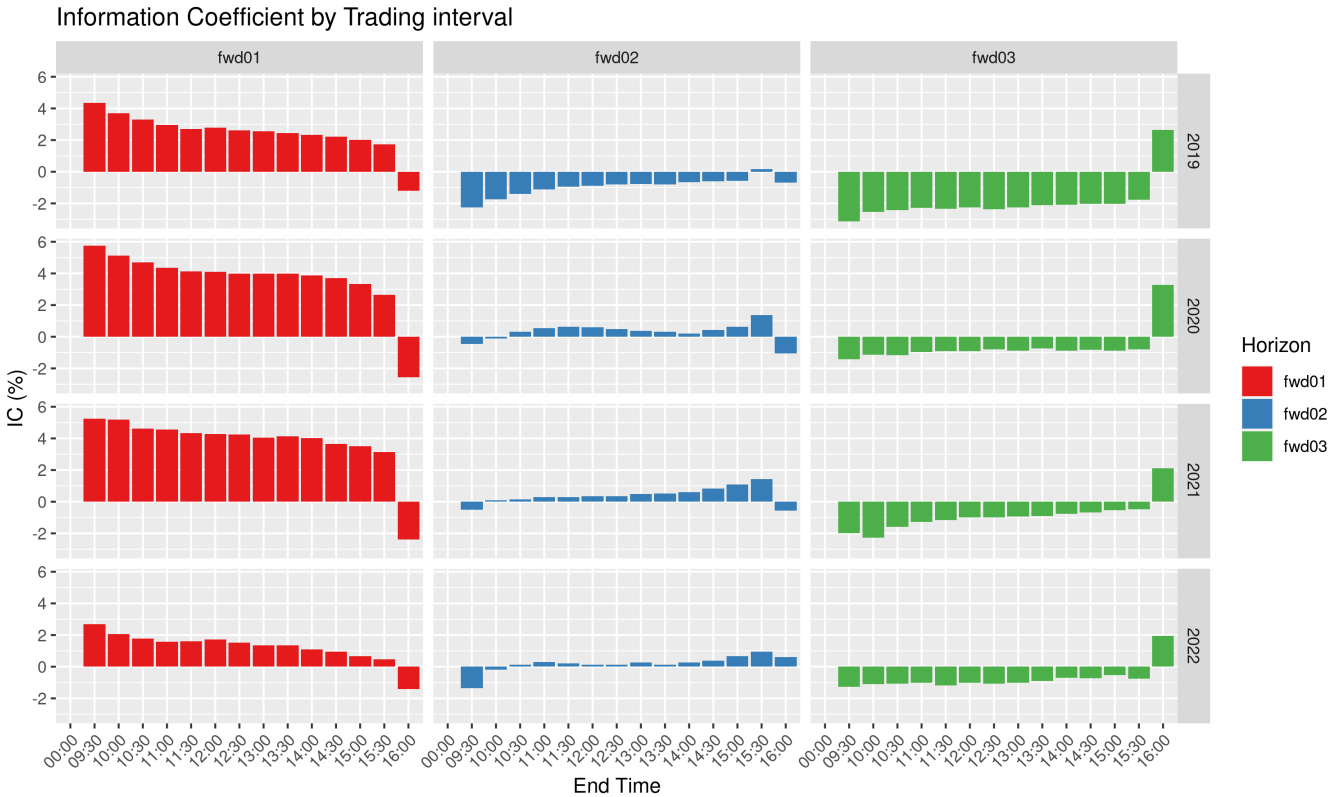


Figure: Information Coefficient by year

Realized Performance

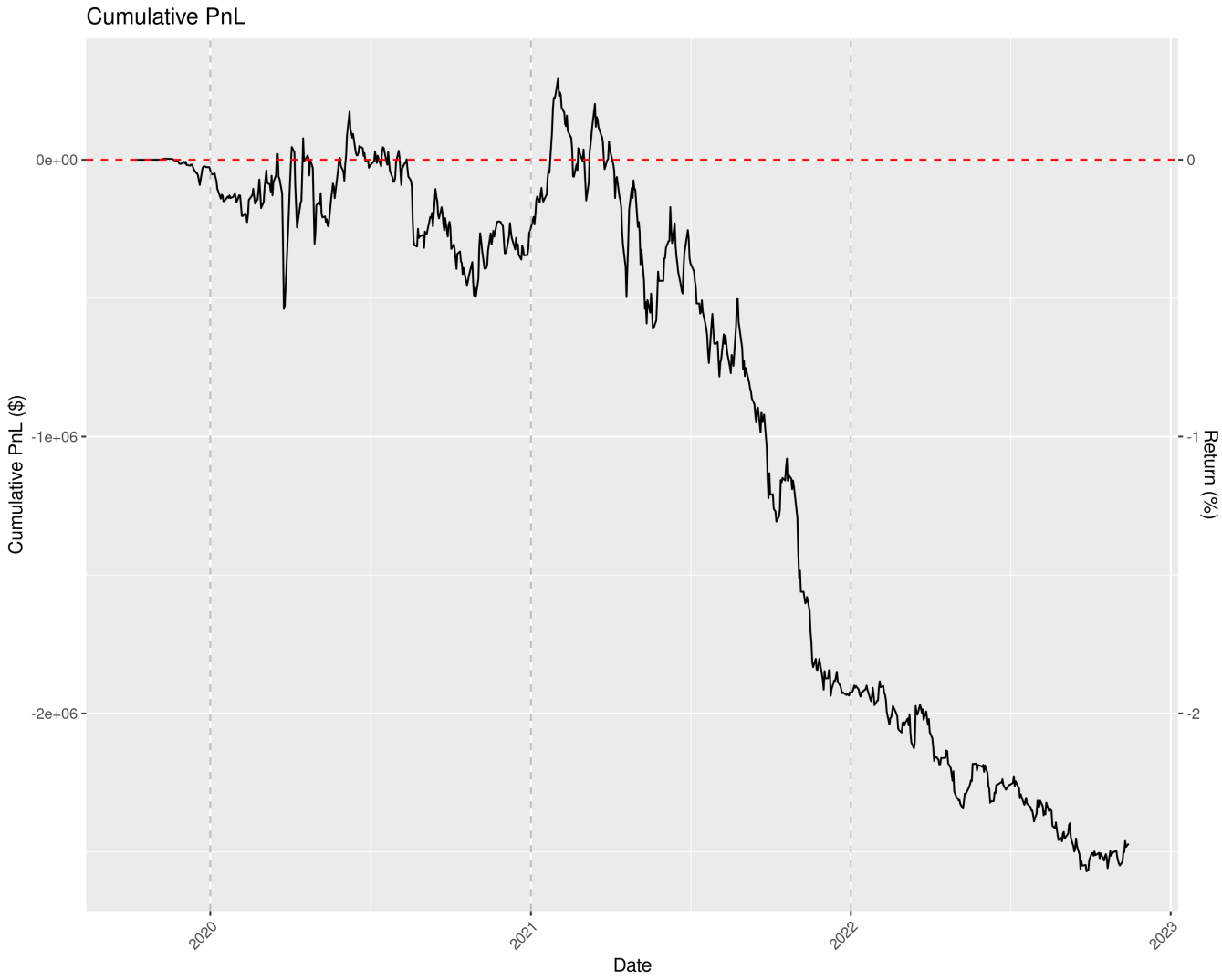


Figure: Live Performance

Execution Performance

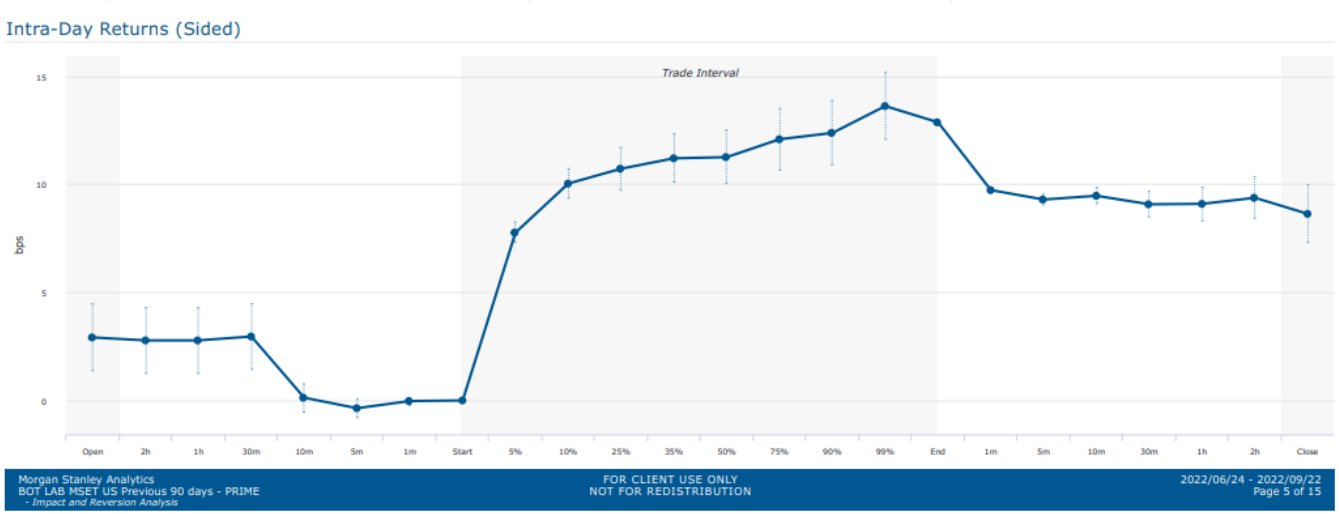


Figure: Signed Price action

- Price action realization of signal is 13 basis points from arrival
- Broker algos failed to achieve tenable prices
- Median trade was a slight loss due to reversal towards the end of the day

Realized Risk

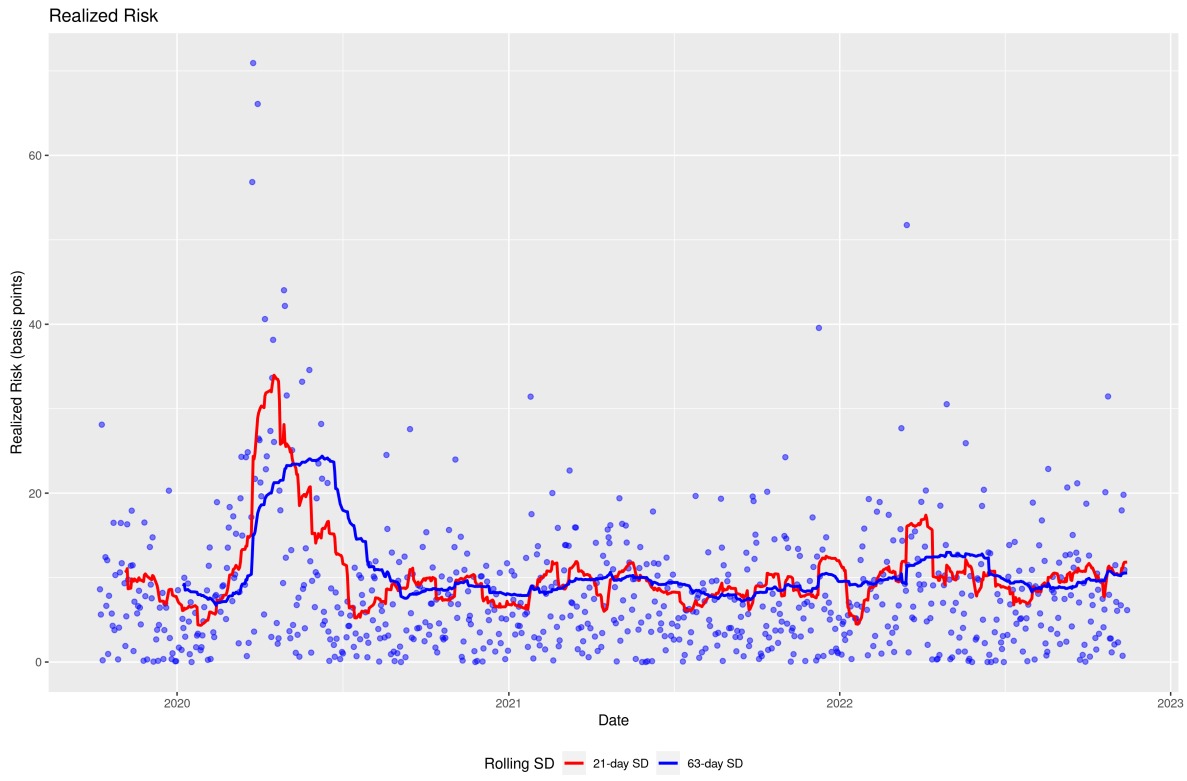


Figure: Realized Risk

- Historical average is 9 basis points
- It is lower when the pandemic period (Q1-2 2020) is removed

Realized Risk by Year

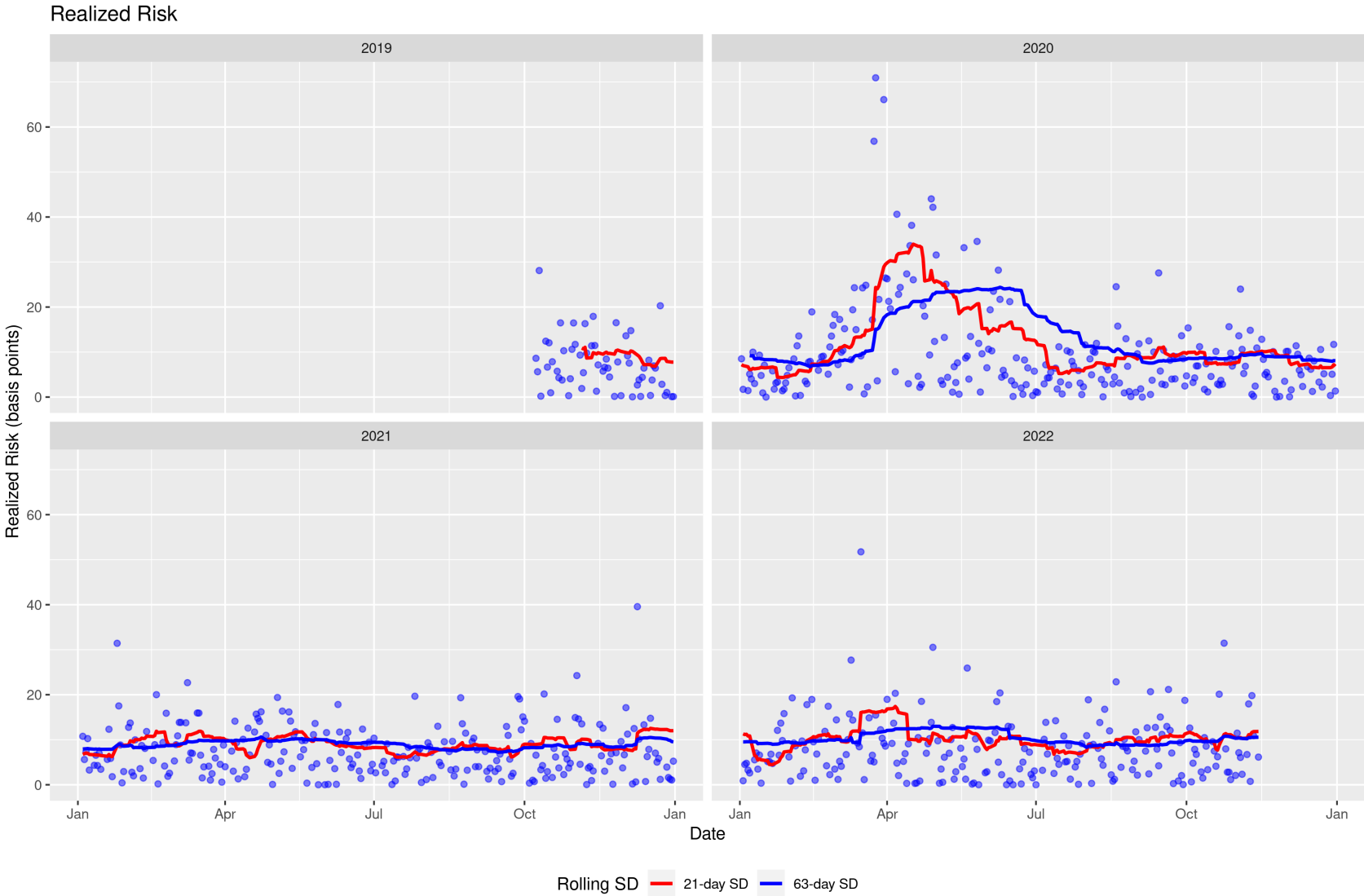


Figure: Realized risk by year

Position Concentration

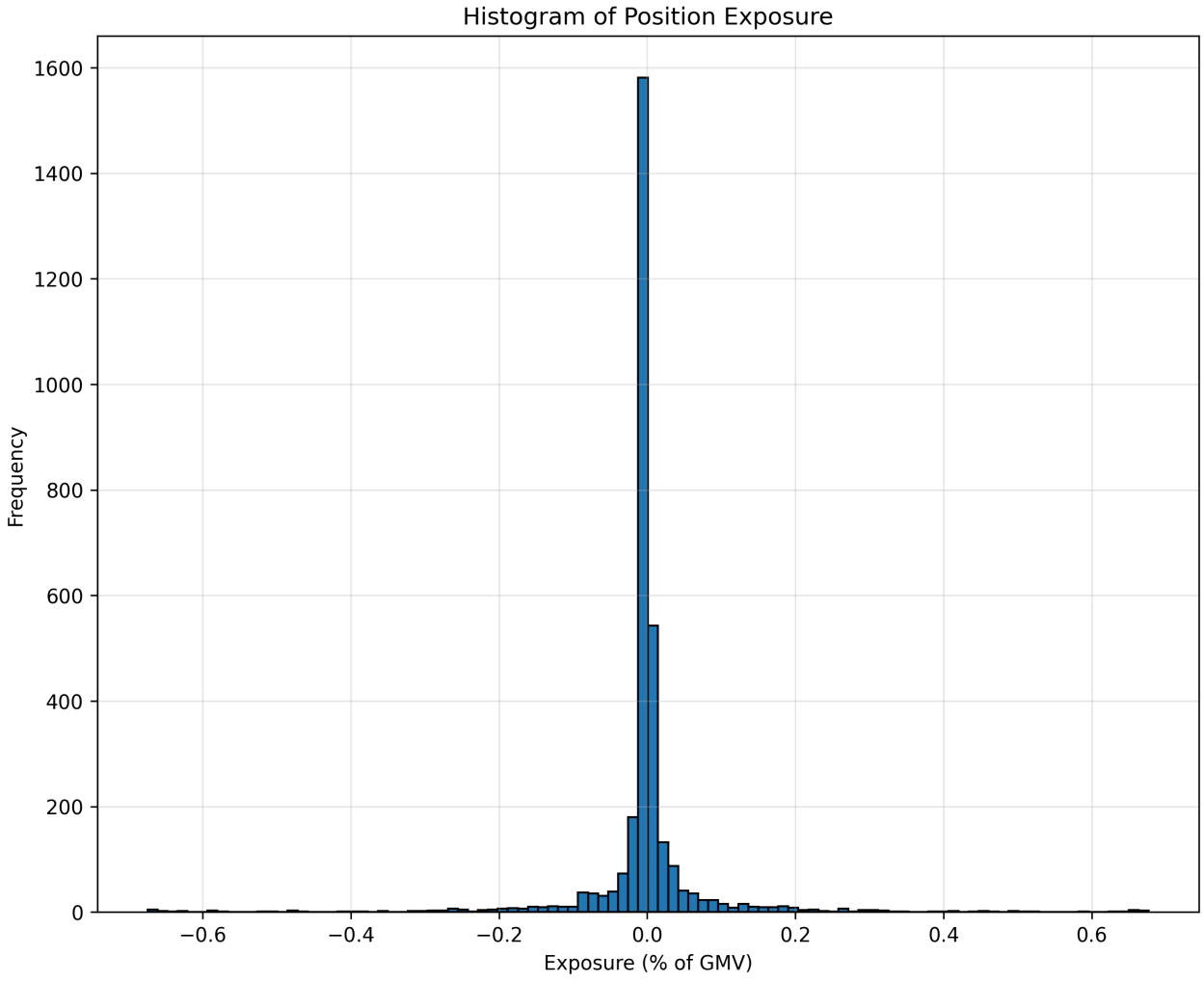


Figure: Sample portfolio position distribution

Track Record Verification

- Track record verifiable from raw SS&C GlobeOp files
- Also have our own logs
  - Alphas
  - Positions
  - Trades

Team Structure

- Historical team structure
  - Two Co-founders/Partners
  - One Quant Trader
  - One Quant Researcher
  - Two Quant Developers
- Would like to have smaller headcount until profitability is reached
- Founding team alone would suffice for development of minimum viable product

Historic Deal Structure

- Base deal was expenses and 20% of profits
- Additional performance fee depended on portfolio return and Sharpe ratio
- Schonfeld reserved exclusive investment rights for the first 5 years

Return \Sharpe	2	3	4	5
3%	0.00%	2.50%	5.00%	7.50%
4%	3.75%	6.25%	8.75%	11.25%
5%	7.50%	10.00%	12.5%	15.0%

Table: Additional Performance Fee Structure

IP

- We own all IP related to the strategy
- Strategy is not being traded elsewhere currently
- Intend to bring source code
- New Python-based implementation is in progress

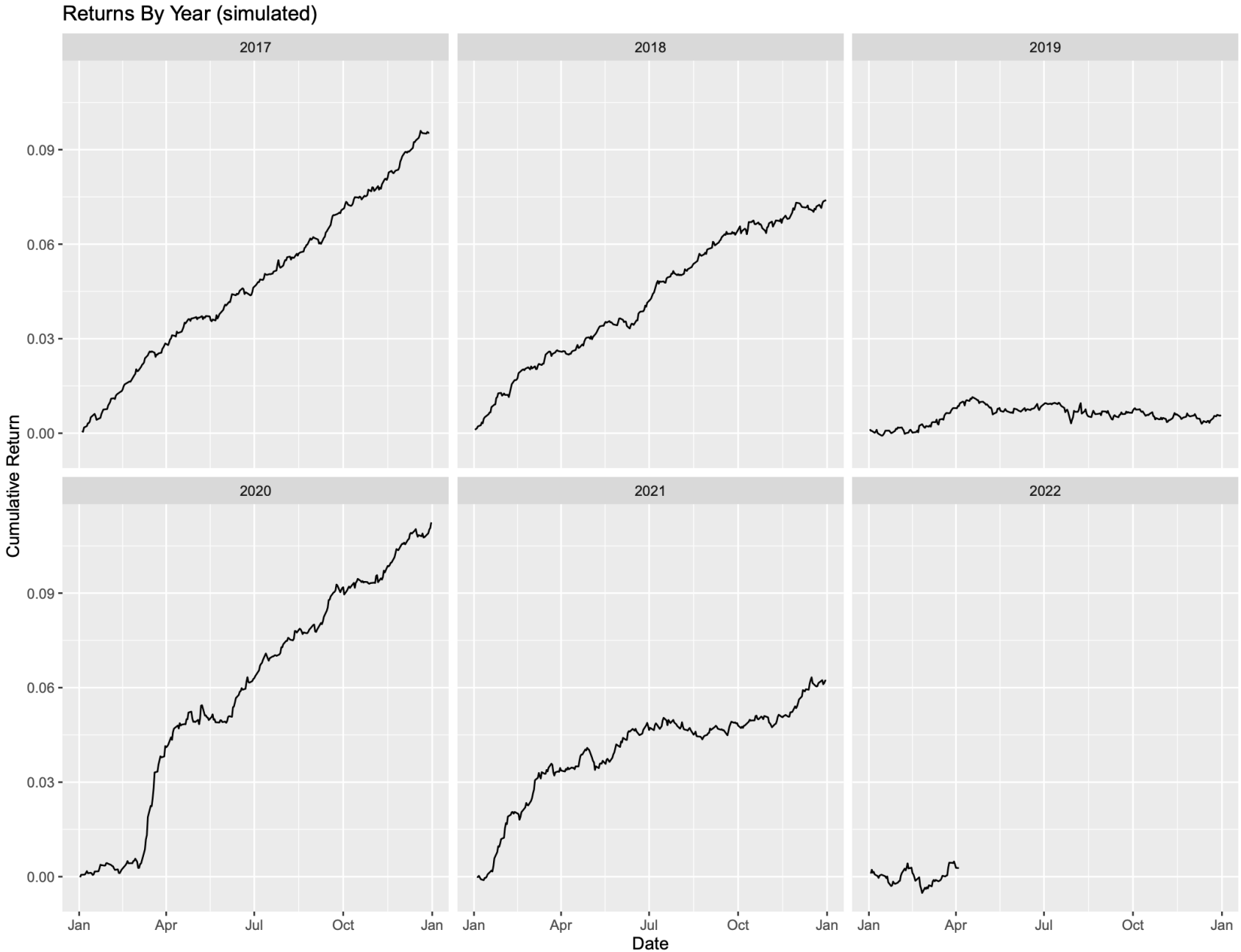
Future Direction

- Integrate proven alphas with revamped execution
- Cost saving of 2 basis points will suffice for profitability (1/6 of a notional weighted spread)
  - Integrate with institutional-grade execution system or central liquidity book
  - Internalize order flow if possible
  - Deploy proprietary monetization algorithms as needed

Proposed Strategy Overview

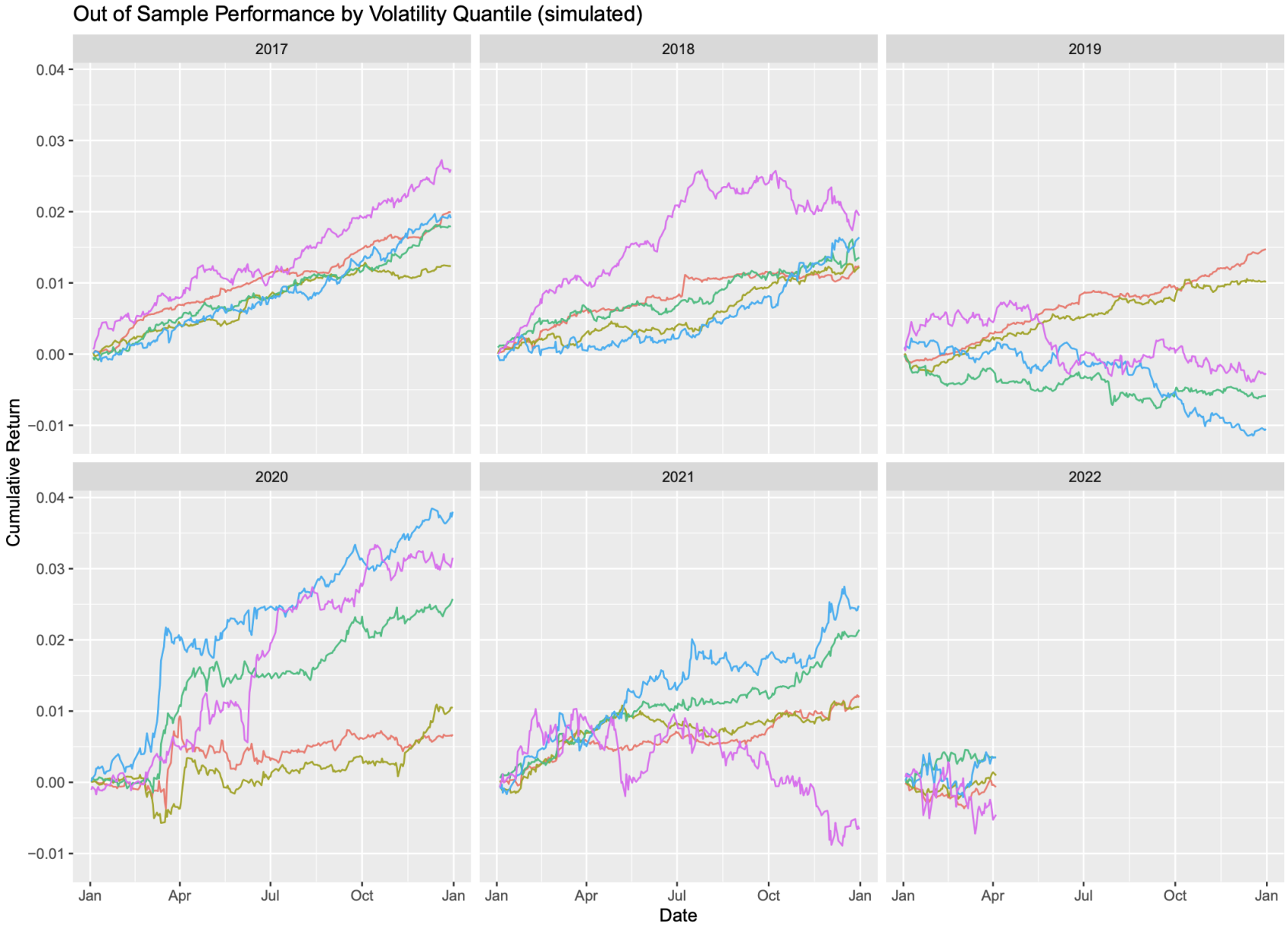
- Reconstruct alpha signals
- Target a 1-2 day holding period initially
  - Can be tuned to move faster or slower depending on execution capabilities or available data sets
- Begin in the US
  - Prioritize data sets that exist globally
  - EU and JP can be added once profitability is established
- Target Sharpe of 2 with return of about 5% per annum
  - Sharpe and risk profile can also be tuned depending on appetite
- GMV target is around 300MM US
  - Capacity of EUR and JP about 50% and 30% of US size, respectively
  - More sophisticated execution infrastructure required to scale far beyond these levels

Proposed Strategy Performance



Proposed Strategy Sharpe

Proposed Strategy Returns by Volatility Quantile



Contrasts with Previous Approach

- Substantially heavier focus on execution
  - **Before**: Complete reliance on fixed trade schedule and broker algorithms
  - **After**: Combination of broker algorithms and proprietary quoter, trade schedule is dependent on market conditions
- Integration between portfolio construction and execution
  - **Before**: Optimizer output is a target portfolio
  - **After**: Optimizer output is a list of quotes
- Alpha construction
  - **Before**: Alphas constructed in the morning, before open
  - **After**: Alphas constructed intraday, short-term forecasts added for use in quoter, more robust regression techniques

Execution Requirements

- Broker algorithms or some internalization mechanism could monetize alphas
- Prop algos could be developed using broker order router if simulation environment is robust
- If DMA is needed, quotes would be calculated minutely but would need fairly low latency to not have stale quotes

Execution Strategy	**Orders per Day**	**Latency**
Internal Cross	1×10^3	Daily
Broker Algo	1×10^4	Daily
Prop Algo	1×10^5	Minutely
DMA	1×10^6	Milliseconds

Data Sets

- Minimum set of data to get started is TAQ and some notion of Risk such as BARRA
  - Technical and statistical alphas can be constructed from derived data
  - Backtest and simulation infrastructure tools can be built
- All other datasets are "nice to haves" and we will likely begin with onboarding what is already available

Theme	**Information**	**Essential?**
Risk Model	BARRA	Yes
Microstructure	Trade and Quote	Yes
Fundamental	Analyst Estimates	No
Fundamental	Corporate Filings	No
Sentiment	News	No
Sentiment	Short Interest	No
Cross Asset	ETF Data	No
Cross Asset	Options	No

Table: Data Requirements

Setup Time

- Setup time will depend on what minimum viable product is
  - Likely less than one year
- Bot Lab, LP setup time was about 8 months
  - Had a total headcount of 5 during last build out (40 man-months time to launch)
  - Expect to be able to do a lot rapidly given that we have a reference implementation and prior experience
  - Implementation time will likely depend on dataset availability and technology infrastructure