Volatility Dispersion Strategy on DJIA

Group 3

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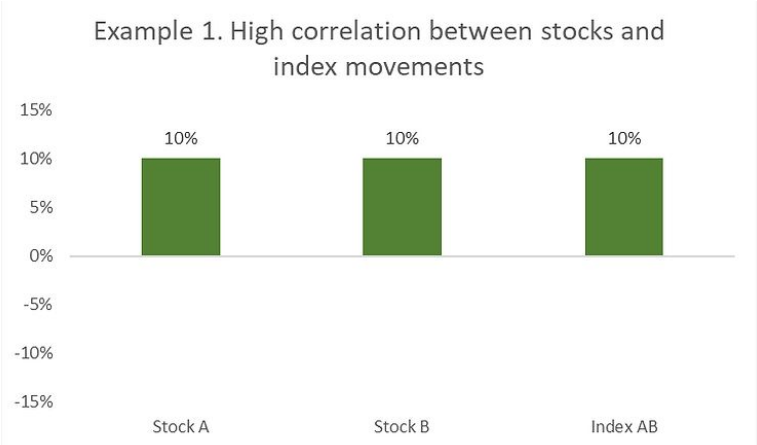
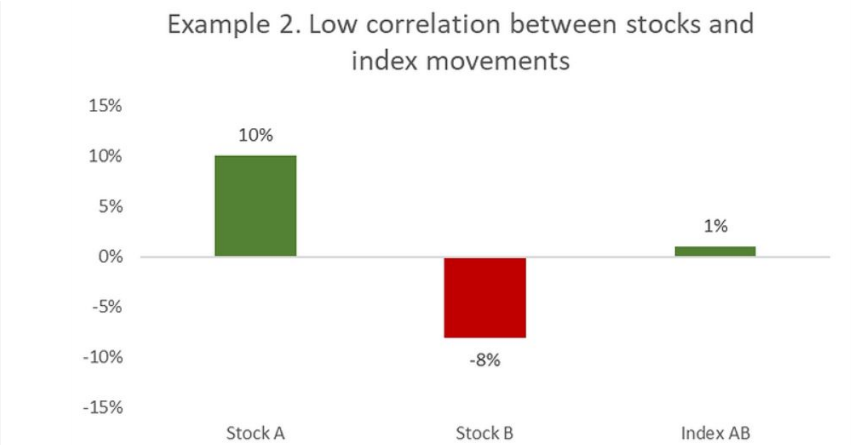
Economic Intuition

For ease of understanding, let's say we live in a world with three assets, A, B, and AB, where asset AB is an equal-weighted average of assets A and B.





In a dispersion trade, we might buy options on the constituents of the index (assets A and B) where large price movements are good, while selling options on the index (asset AB) where large price movements are bad.

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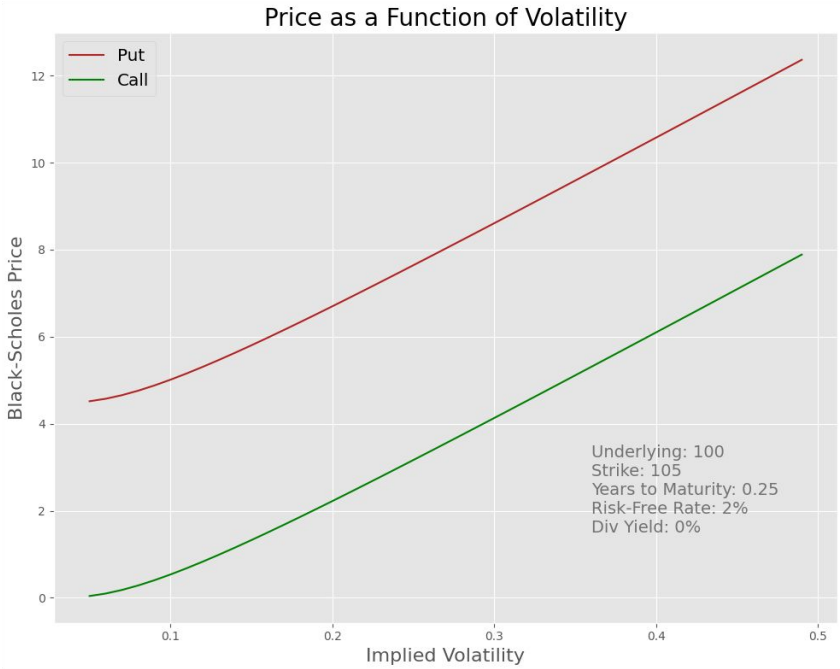
Economic Intuition

Both calls and puts increase in price as a function of implied volatility.

Referencing the previous example, a desirable dispersion trading outcome may look like:

- ➔ Asset A increases 10% (long volatility)
- ➔ Asset B decreases 8% (long volatility)
- ➔ Index AB increases 1% (short volatility)



Notably, this type of strategy is directionless and generally creates profit from unexpected news about earnings, mergers, or scandals. On the other hand, this strategy can lose money from unexpected macroeconomic events that similarly effect all constituents of the index.

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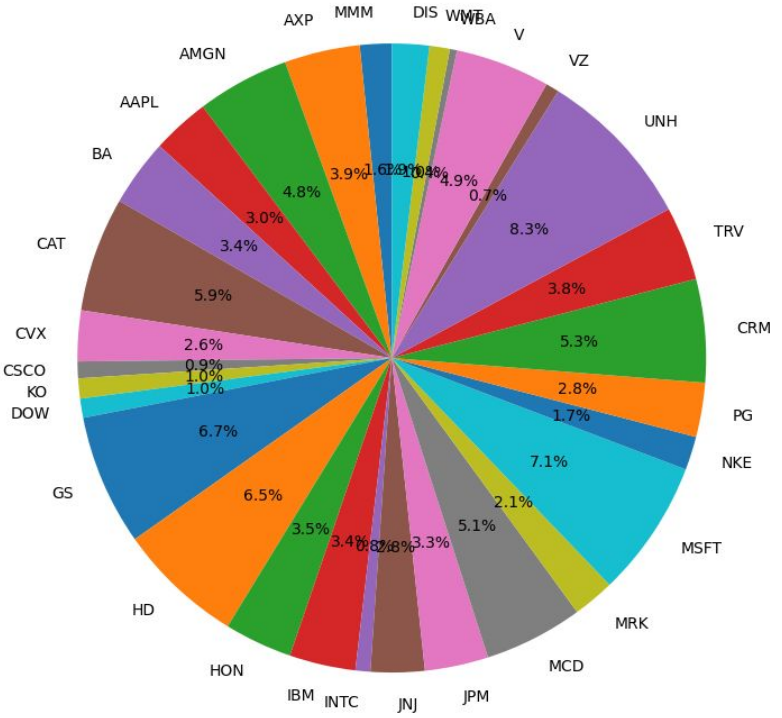
DJIA (Dow Jones Industrial Average)

DJIA, the second-oldest U.S. market index after the Dow Jones Transportation Average, is a stock market index of 30 prominent companies listed on the U.S stock exchanges.

Uncorrelated earnings between stocks within the index



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DJIA (Dow Jones Industrial Average)

Companies included in DJIA are price weighted, i,e. the index value are calculated by summing up the prices of each constituent companies and multiply by a constant factor.

Stocks with higher share prices are given greater weight in the index. A higher percentage move in a higher-priced component will have a greater impact on the final calculated value.

Selection/rebalance criteria
The weights of each company are rebalanced semi-annually

Key Notes from “Dispersion trading: Empirical evidence from U.S. options markets” by Cara M. Marshall

- “Because a dispersion trade can be in either direction, a violate of the LOP, and a trading opportunity, exists whenever MIV > (IOIV + transaction costs) or MIV < (IOIV - transaction costs)”
- They found that “the IOIV exceeded the MIV by 5.03% of the IOIV on average”

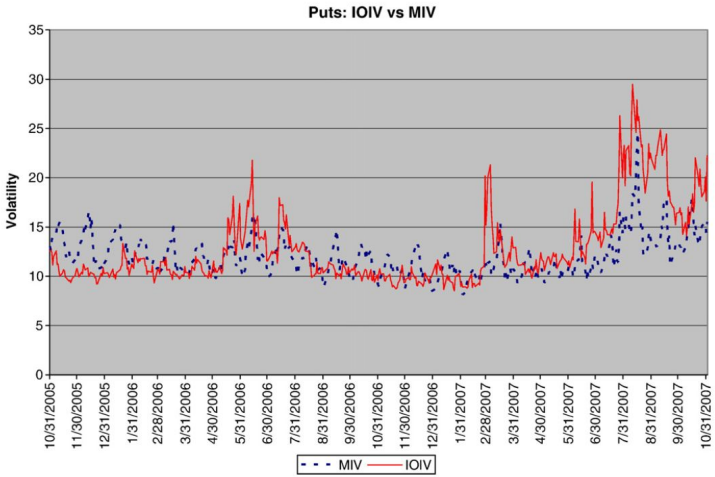


Fig. 3. Day-by-day IOIV versus MIV for puts.

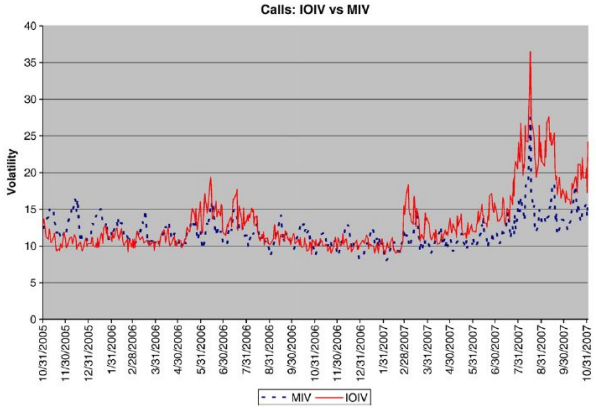


Fig. 2. Day-by-day IOIV versus MIV for calls.

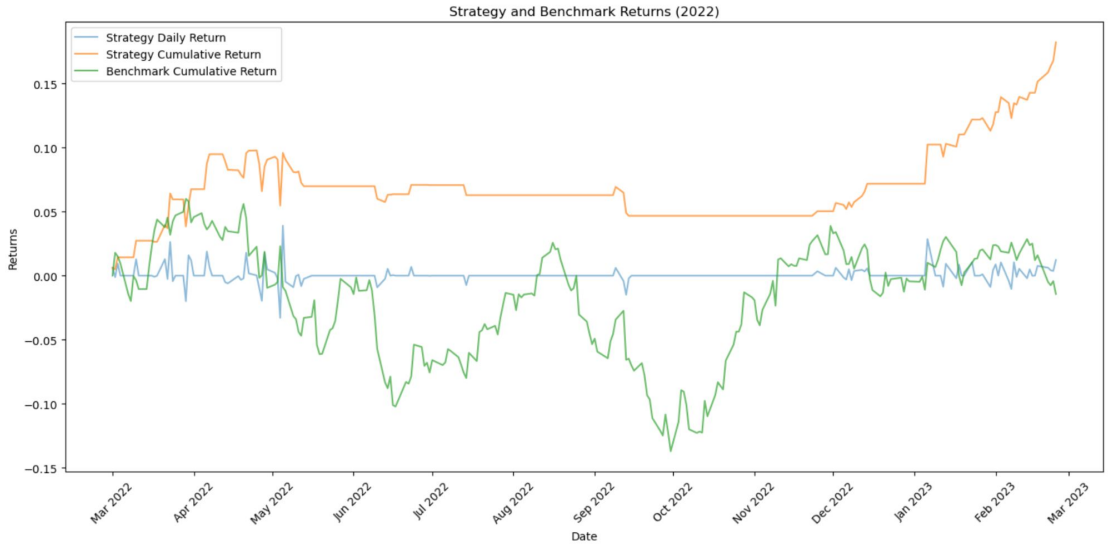
- They also found that the average difference between the IOIV and the MIV rejected the null hypothesis of being equal to zero at an “extraordinarily high level of significance (0.000001)”
- “Another… explanation for ongoing dispersion trading opportunities is the sheer complexity of the execution”

Strategy

1. Decide a valid index (DJIA)
2. Get the options data for the index and its constituents (the hardest part!)
3. We are taking long/short positions in straddles
4. We calculate daily p&l of straddles for both the index and the constituents
5. Calculate IV
6. Calculate dirty correlation(Index_IV / Constituents_IV)
7. Dirty correlation is mean reverting
8. If dirty_corr > 1, go long constituents and short index volatility and vice versa
9. Backtest for different regimes and out of sample!

Performance - Feb 28, 2022 to Feb 28, 2023

- Beats benchmark - Dow Jones Industrial Average
- Annual return: 18%
- Flat in the middle



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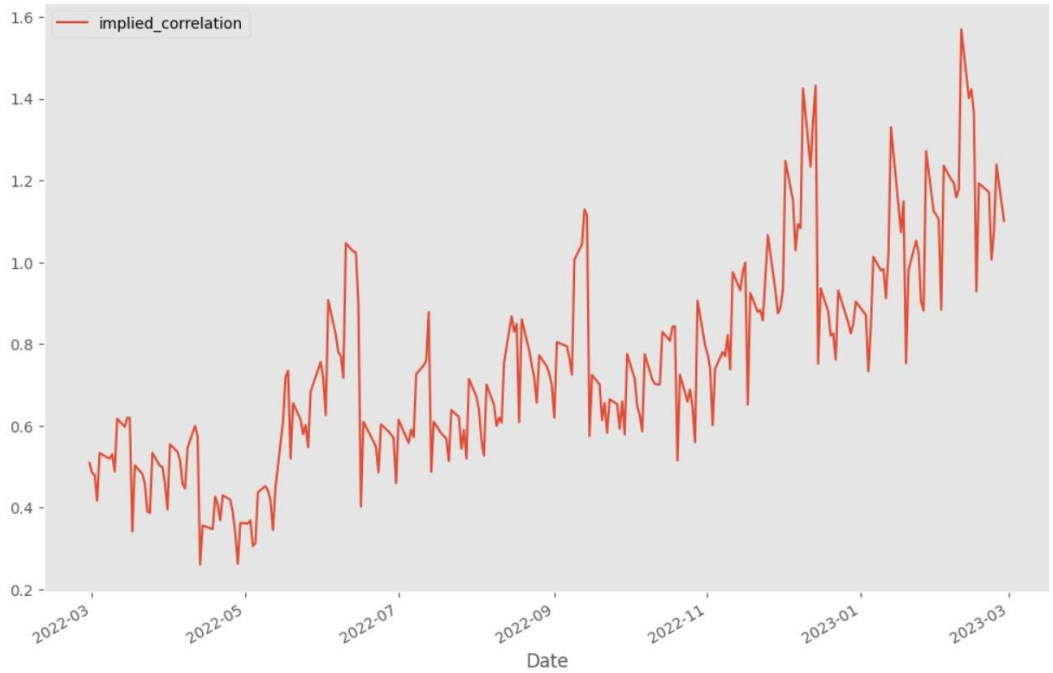
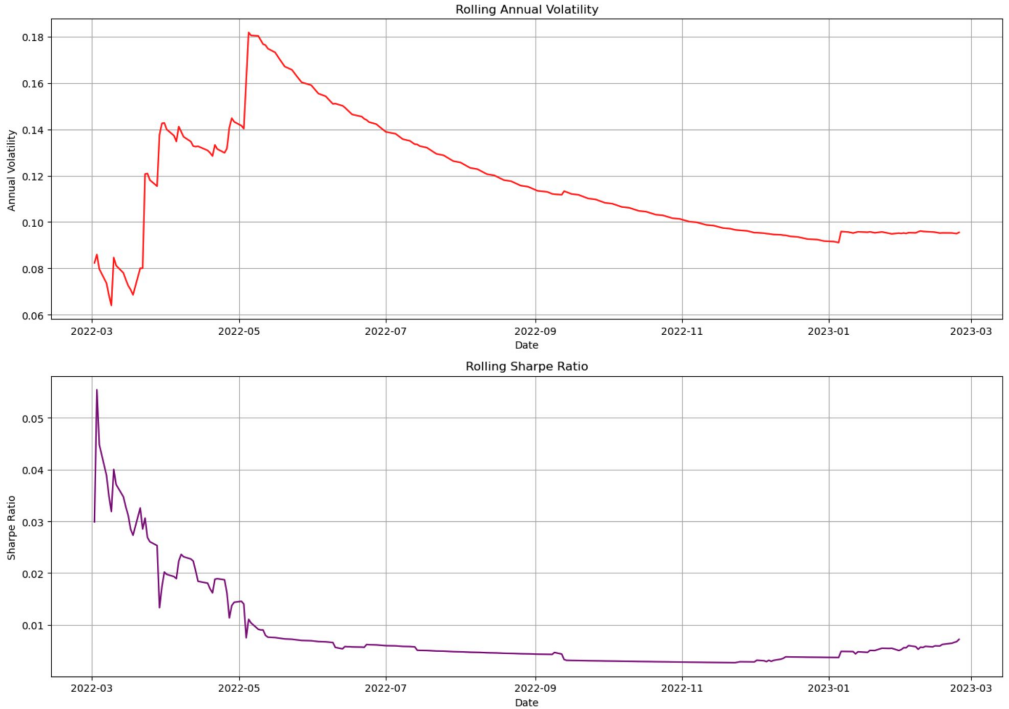
Performance - Feb 28, 2022 to Feb 28, 2023

- Implied correlation<0.5
- market movement < individual stock
- Implied correlation>1
- market movement > individual stock



Performance - Feb 28, 2022 to Feb 28, 2023

- Rolling Annual volatility (2022)
- Rolling Sharpe ratio (2022)
- Risk investment



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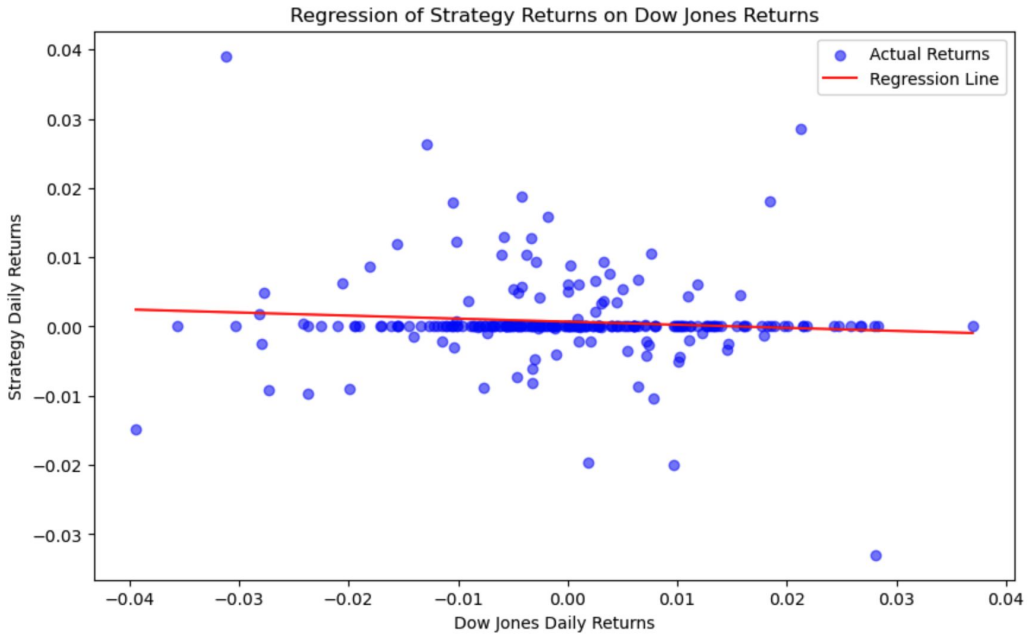
Performance - Feb 28, 2022 to Feb 28, 2023

- Regression daily return on daily return of Dow Jones
- Beta = -0.044
- Alpha = 0.0007 (0.18 annually)



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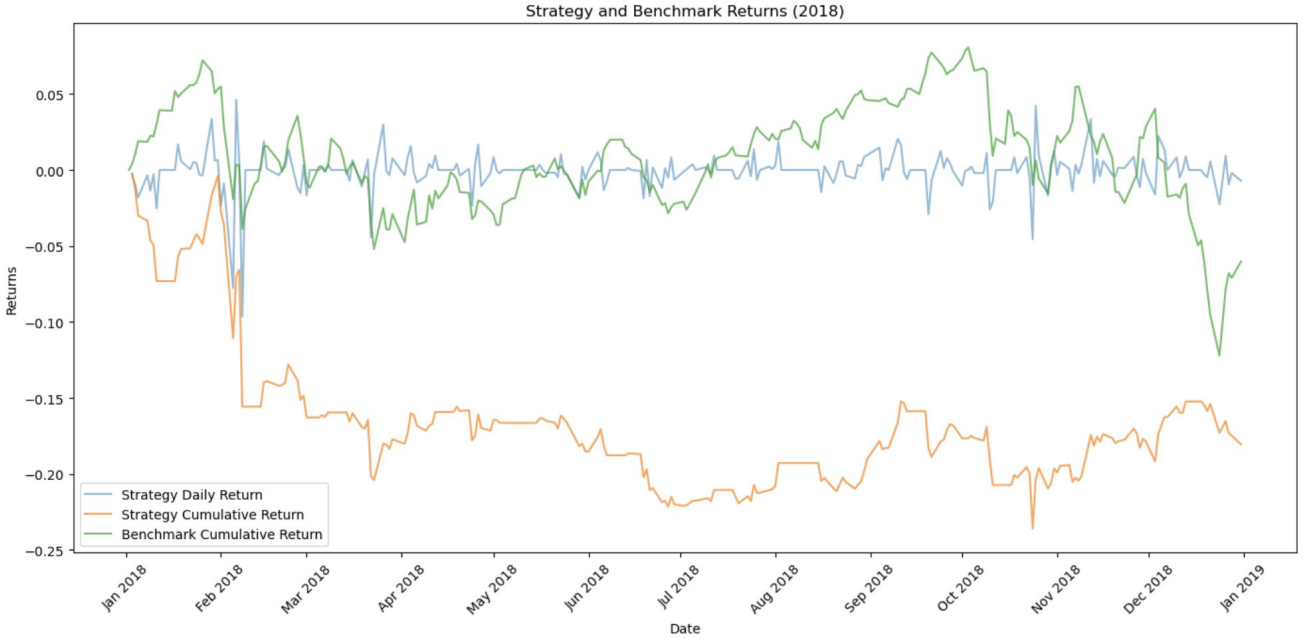
Performance - Year of 2018

- Outperformed benchmark at the beginning of 2018 where market incurred surging volatility
- Underperformed benchmark as rolling volatility decreases



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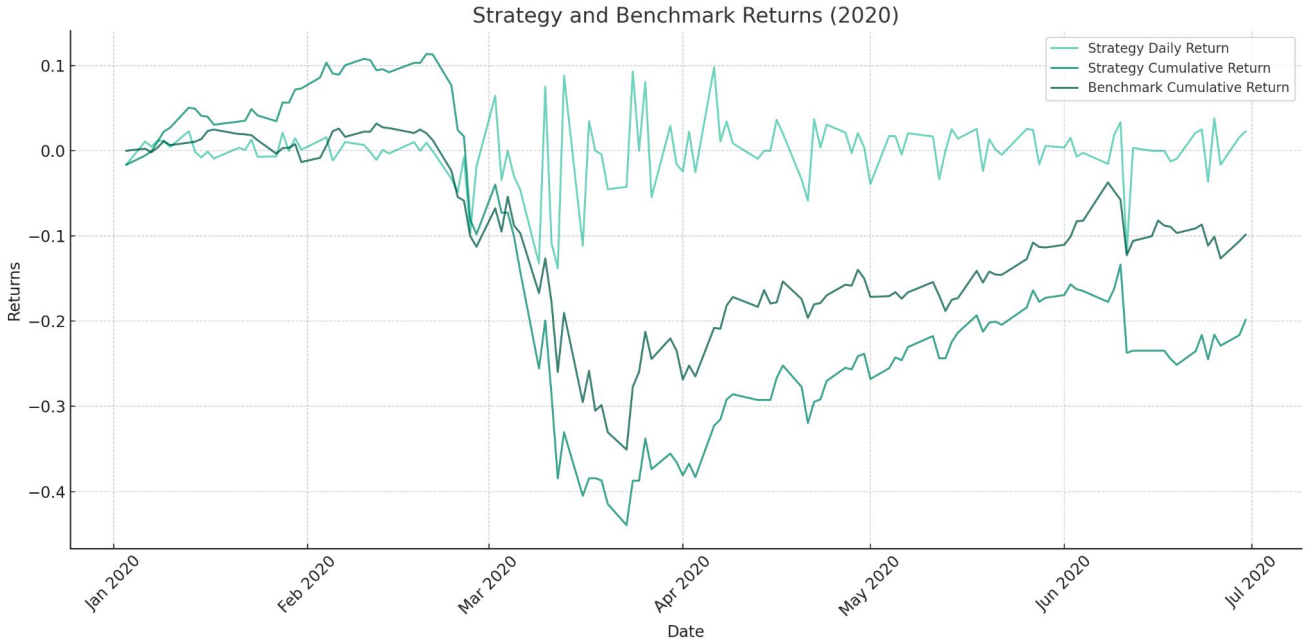
Performance - Year of 2020

- Underperformed benchmark
- Plunged from 10% to -43% in Feb, 2020 (Covid-19)
- Movement aligned with benchmark



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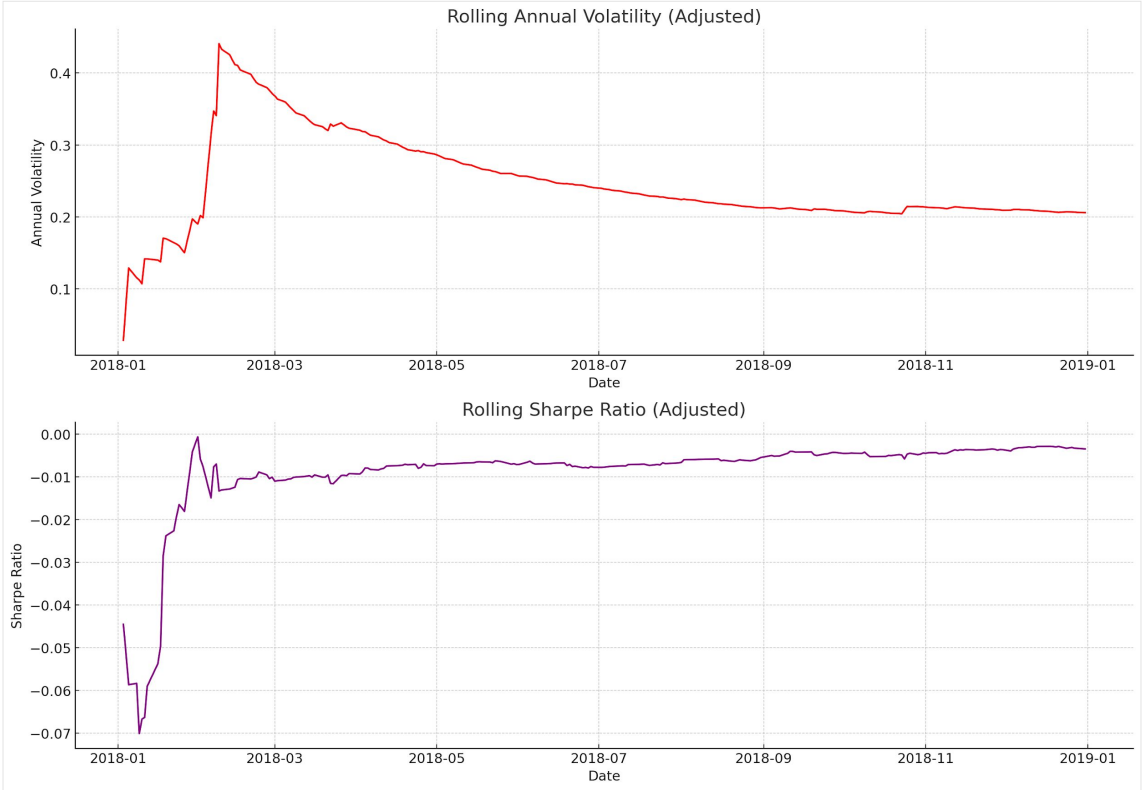
Performance - Year of 2018

- Rolling volatility (2018):

Rocketed to above 0.4 for the first 2 months, and decayed slowly over the year (approach to 0.2).

- Sharpe ratio (2018):

Started deep negative, bounced back quickly and maintained a stable (but still negative) level above -0.01 over the year.



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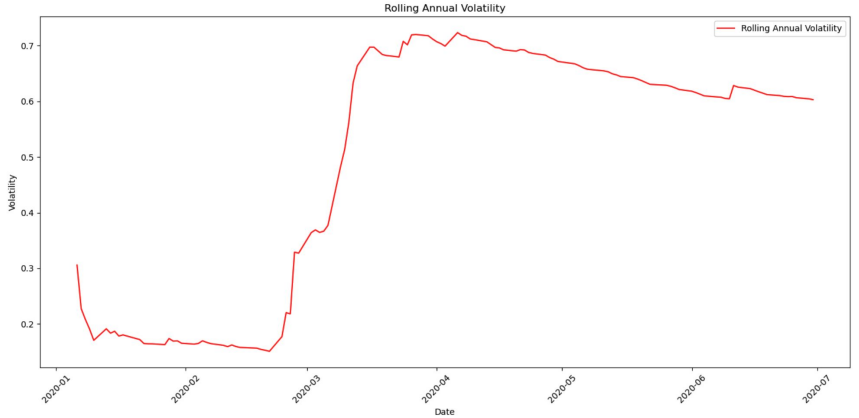
Performance - Year of 2020

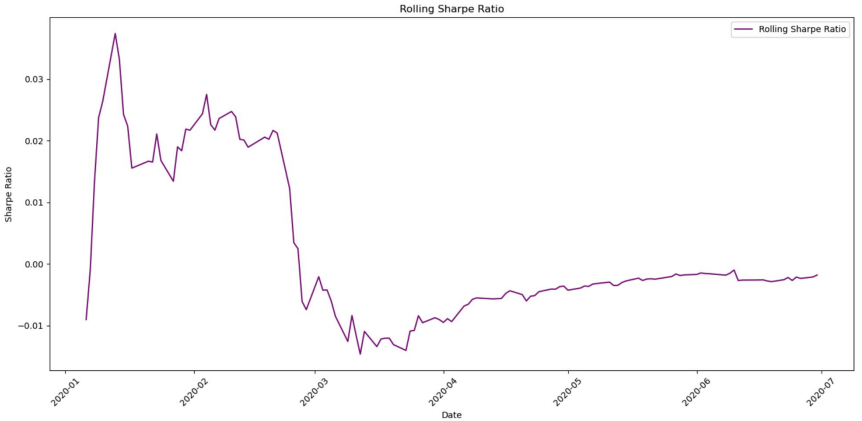
- Rolling volatility (2020)

Started low at around 0.2-0.3, quickly jumped to 0.7 in March, 2020 due to Covid-19. Then decayed slowly to 0.6 as market digests the impact of pandemic.

- Sharpe ratio (2020)

Maintained an average sharpe ratio of 0.02 pre-pandemic, then dropped to -0.01 right after outbreak of pandemic, rallied slowly to 0 in the latter half of 2020.





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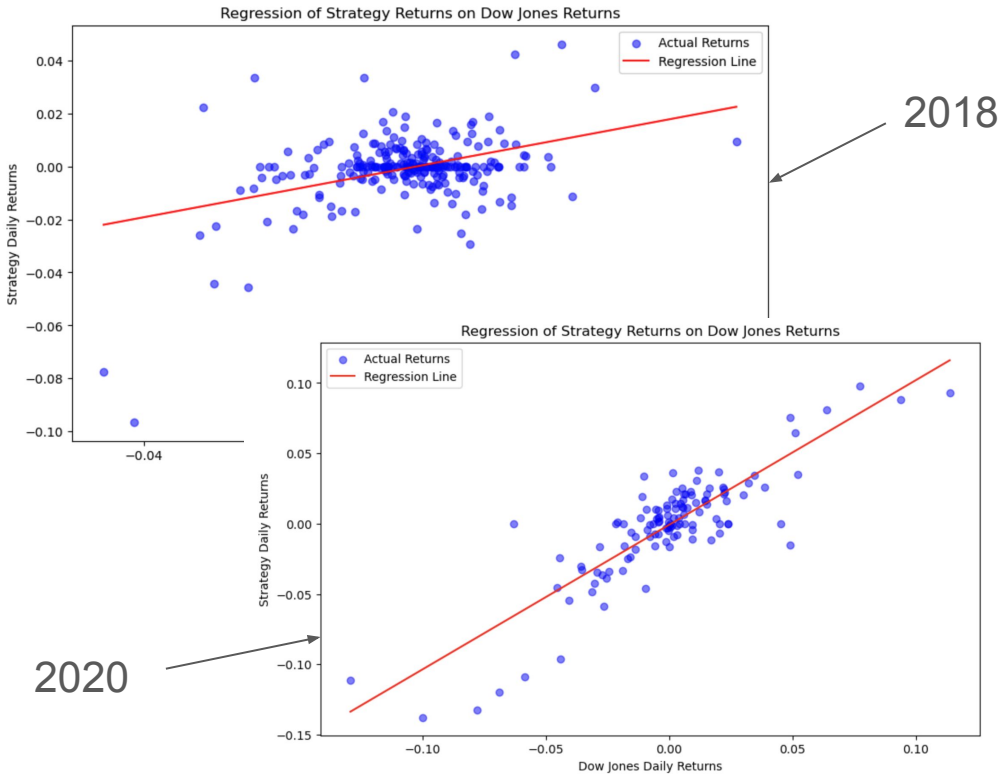
Performance - Year of 2018 & 2020

- Beta_2018 = 0.464
- Beta_2020 = 1.028

- Alpha_2018 = -0.183
- Alpha_2020 = -0.327



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Performance Summary - Year of 2018 & 2020

Market Environment: If the market as a whole experienced lower volatility while the selected stocks experienced higher individual volatility, the strategy may incur losses from being short on index volatility options.

Correlation Shifts: The strategy assumes that the index and its components move somewhat independently. If there's a shift towards higher correlation during a market stress period (like the COVID-19 pandemic in 2020), the expected dispersion might decrease, leading to underperformance with benchmark.

Costs: Transaction costs and bid-ask spreads also erode returns, especially in volatile markets where these costs can be higher.

Risk Considerations

- This strategy requires to manage options 5 dominating companies within DJIA and adjusts weights overtime - expensive transactional cost

- Trading options with low liquidity. - very expensive and orders may not execute immediately at a preferred price.

- Some of the companies within DJIA are not optionable. (very limited maturities to select)

Improvement

- Transaction Costs
- Construction of the portfolio
- Inclusion of more assets
- Calculate the missing implied volatility using R quantlab

	secid	date	symbol_x	symbol_flag	exdate	last_date	cp_flag	strike_price	best_bid	best_offer	...	div_convention	ex
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...	...	...	...	...	...	...	...	...	...	...	...	...	
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References

- Convex Asset Management, “Dispersion Trading Part 1”: https://www.convexam.com/post/dispersion-trading-part-1
- “Dispersion trading: Empirical evidence from U.S. options markets”, Cara M. Marshall, Global Finance Journal 20, 2009
- “Dispersion trading strategy in the Indian markets”, QuantInsti, Aug 03, 2023
- More to come