Vinter Quant Challenge

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October 10, 2022

Part A – Non-Technical

As DeFi continues to develop into a diverse financial market with a variety of assets listed on decentralized exchanges, Vinter aims to harness these opportunities into easily investable indices to allow investors to gain exposure to these innovative projects. The significant growth in staking has attracted many investors to this space. However, few understand how to value these tokenized digital assets and which projects to invest in.

In no more than a page, we would like you to propose a momentum-based investment strategy. The design should include

1. Definition of asset universe
2. Asset selection procedure
3. Choice of algorithm
4. Key metric to use for strategy evaluation

Part B – Technical

Based on your solution to part A. Please backtest your design. You should provide

1. The python scripts you used in your backtesting (Jupyter notebooks are not accepted as enough).
2. A report containing graphs and key metrics that you used to evaluate your strategy.
3. Conclusion about the strategy's performance and as well alternative design that could be evaluated going forward.

Solution: Part A – Non-Technical

Definition of asset universe

A universe of assets refers to the complete set of assets that share some common feature or features. The DeFi asset universe has to include projects from all blockchains (e.g. ETH, SOL, ZEN, BSC, and DOT) plus it needs to include projects from L1 and L2 networks. That means it includes staking platforms and liquidity providers such as Synthetix, AAVE, Compound, Panther Protocol, Osmosis, Alpaca Finance, or the older one as Curve, Convex Finance, and Uniswap. The joint features are: the project is in DeFi space (or interacts with other DeFi projects) and the project has its own (utility) token (the asset which will be used for investing) with a valuation (it exists on a DEX or CEX) and TVL can be calculated.

The projects such as automatic repaid loan (Alchemix), aggregators (Autofarm, Pancake Bunny), tools (APY Vision), yield optimizers (Beefy Finance), and others has to be included in the asset universe too.

Asset selection procedure

No constraints were mentioned in the Part A task. Thus I want to propose two methods of the asset selection procedure for the asset portfolio as follows:

1. an asset will be selected only if TVL of (utility) token $T_{TVL} > X$. Where X defines the threshold of project valuation from which it is considered a market-proven/solid/popular project. I propose to select the project with $T_{TVL} > \$10,000,000$. Based on CMC and current market conditions approximately 750 coins and tokens meet this threshold (but not all of them align with our asset universe definition which means the asset universe will be much smaller).

2. The first approach has the disadvantage that we will not be able to capitalise on new projects that have not reached the threshold value X. But its popularity rises fast (as a simple indicator can be used CMC rank, social media interaction, press releases, etc) and can be included in the set of selected assets. This approach involves more risk and could be used for constructing different asset groups using the same asset universe as defined above.

For the solution of the Part B task, only the first approach will be considered.

Choice of algorithm

The KDJ algorithm was chosen for this challenge (which is derived form of the Stochastic Oscillator Indicator). It has high accuracy in predicting trend reversals which are very useful in crypto-volatile markets. The parameters were set as follows: maximum price in last 14 days (from high prices) $P_{high} = \max(P_{high14})$ and minimum price in last 14 days (from low prices) $P_{low} = \min(P_{low14})$. Next, $rsv = \frac{P_{close} - P_{low}}{P_{high} - P_{low}}$. Finally, the K, D, and J lines are defined: $K = EMA(rsv, 3)$, $D = EMA(K, 3)$, and $J = 3K - 2D$. Where EMA stands for Exponential moving average.

Key metric to use for strategy evaluation

For strategy performance evaluation can be used standard metrics such as annualized return (the higher the better), Sharpe ratio S_a (targeting $2 < S_a$ for very good strategy), Sortino ratio S (targeting $2 < S$ for very good strategy), max drawdown (the lower the better), win/loss ratio (the higher the better), and profitability (the higher the better). Sometimes is performance stability of strategy required and then 6-month rolling Sharpe and Sortino ratios are analysed (the less volatility the better).

Solution: Part B – Technical

Python scripts

All classes and scripts are attached in a .zip file. The .zip file contains .html reports for the following tokens/coins which were picked for the initial strategy testing: UNI, AAVE, SNX, CRV, COMP, 1INCH, YFI, and ZEN.

The data are gathered from Binance API. You will need to create your own API key and secret and paste it into the .env file that you will need to create from the .env.example example file.

The code is divided into classes which allows easily extending of the current design by more strategies and data providers.

The main **main.py** file allows the execution from a terminal with parameters. You can use:

- **-tt** for **token tickers**: list of token tickers.
- **-us** for **used strategies** list of strategy names.
- **-dp** for **data provider** (only Binance is implemented).
- **-wg** for **with graphs** indicates if HTML files will be created.

Reports

The strategy report for UNI/USDT pair with all calculated metrics and graphs is attached at the end of this report.

All reports can be found in the attached .zip file in the **reports** folder.

Conclusion and Alternative Approaches

For the following evaluation of the KDJ strategy is used the attached report is with UNI/USDT pair. Other analysed pairs AAVE/USDT, SNX/USDT, CRV/USDT, COMP/USDT, 1INCH/USDT, YFI/USDT, and ZEN/USDT are presented in the attached .zip file in static HTML format.

The initial capital for the strategy for each pair was set to $100,000. Basic performance comparison of selected pairs is shown in Figure 1 showing that the proposed strategy generates positive returns.

```
2022-10-10 15:03:12,477 | INFO    | main.py:63 | Strategy name |   Pair    | Sharpe | Max DD |         Total returns          | Cash
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | uni/usdt  | 1.40   | -18.91% | ['-6.14%', '116.76%', '33.40%'] | $271411.81
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | aave/usdt | 1.33   | -19.94% | ['-6.12%', '57.82%', '56.45%'] | $231801.35
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | snx/usdt  | 1.02   | -26.53% | ['10.76%', '13.13%', '102.11%'] | $253240.81
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | crv/usdt  | 1.01   | -38.37% | ['41.24%', '24.63%', '51.92%'] | $267436.38
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | comp/usdt | 0.45   | -40.00% | ['9.83%', '10.31%', '3.70%'] | $125643.81
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | 1inch/usdt | 1.04  | -32.78% | ['0.00%', '32.61%', '29.42%'] | $171616.29
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | yfi/usdt  | 1.02   | -30.84% | ['40.24%', '86.78%', '-8.64%'] | $239302.82
2022-10-10 15:03:12,477 | INFO    | main.py:67 | Strategy KDJ  | zen/usdt  | 0.96   | -25.11% | ['0.73%', '68.53%', '6.36%'] | $180561.42
```

Figure 1: Basic performance comparison of selected pairs.

The attached UNI/USDT results with the KDP strategy can be interpreted as follows:

- Sharpe ratio 1.39 is good.
- Sortino ratio 3.21 is excellent (risk is low).
- Max drawdown -18.91% (for 54 days) is very good for the crypto-volatile market and the recent bear market.
- EOY returns -3.77%, 87.84%, and 31.06% for 2020, 2021, and 2022 years are in 2/3 cases positive with only one relatively small negative return in 2020.
- Cumulative return 171.41% outperforms Buy&Hold UNI strategy that would yield 111.54% cumulative return.

After inspecting and evaluating the reports can be stated that the chosen KDP strategy with selected parameters performed well in the dynamic DeFi market.

I want to propose three alternative designs that could be tested:

1. First, the current KDJ strategy has a lot of optional parameters: a period of K value, the moving average type of the indicator for the K value, a period for the smoothed K value, the moving average type of the indicator for the D value, a period for the D value, multipliers of K and D values for J value calculating, and much more. The first approach would be to fine-tune the KDJ strategy parameters and (back)test the strategy for the selected pairs in a portfolio.

2. Next, because Machine Learning can be applied to almost any data and even time-series as financial data. The second approach would be to use Random Forest (RF) for the prediction trend reversal point. The RF method is supervised training, and thus, labelled training data would need to be gathered. But based on recent research it could be an excellent way to test. See an example here.

3. The last proposal is to use the most recent research: Momentum Transformer for changepoint detection. Relevant links here and here.

A few technical improvements that can improve the current code are:

- Binance AsyncClient class can be used for downloading price data.
- The system is now using USDT - thus recalculating it into USD would be an enhancement.
- Get OHLCV data for a selected pair from multiple data providers and average it - the values can vary for each centralised/decentralised exchange.
- Add commission fees to get more accurate data.
- Fix Bokeh interactive HTML generator.

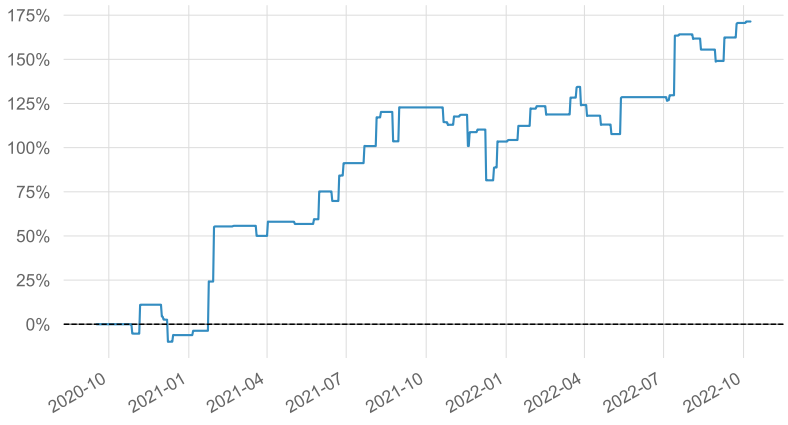
I hope you read it down here.

Lukas

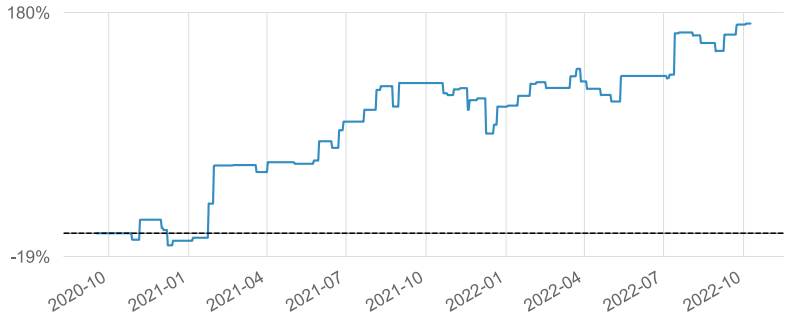
kdj 17 Sep, 2020 - 9 Oct, 2022

Generated by QuantStats (v. 0.0.59)

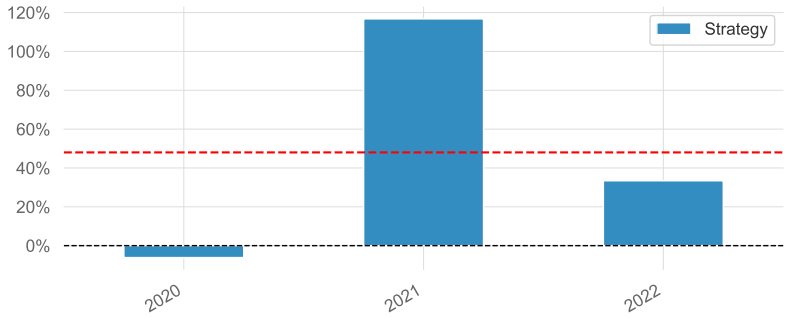
Cumulative Returns



Cumulative Returns (Log Scaled)



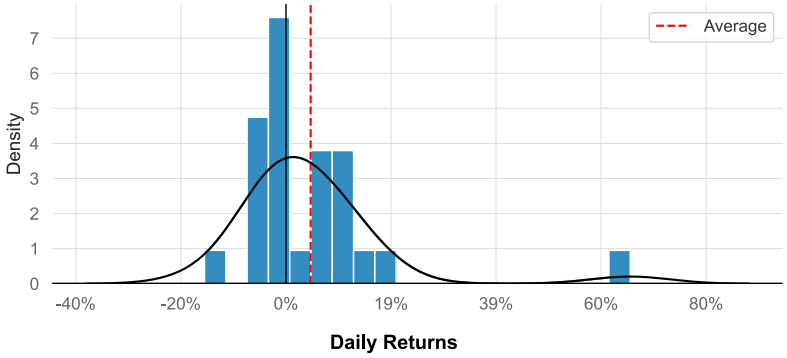
EOY Returns

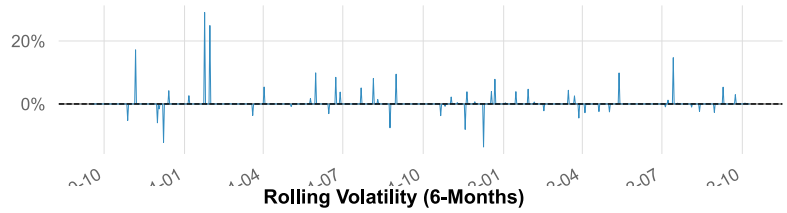


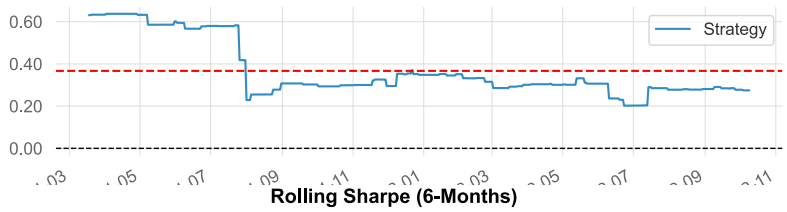
Distribution of Monthly Returns

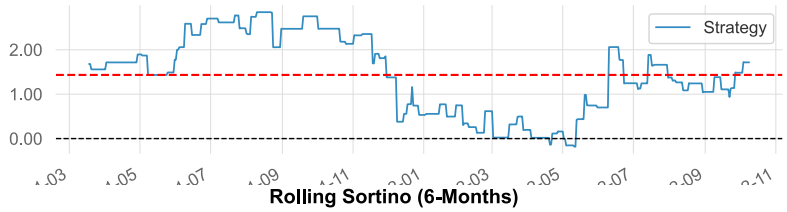
Key Performance Metrics

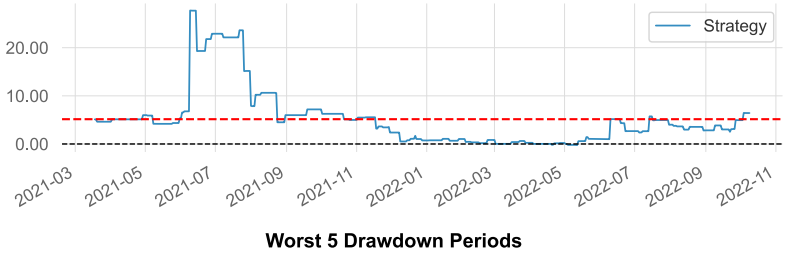
Metric	Strategy
Risk-Free Rate	0.0%
Time in Market	14.0%
Cumulative Return	171.41%
CAGR%	62.36%
Sharpe	1.39
Prob. Sharpe Ratio	99.42%
Smart Sharpe	1.39
Sortino	3.21
Smart Sortino	3.2
Sortino/√2	2.27
Smart Sortino/√2	2.26
Omega	2.3
Max Drawdown	-18.91%
Longest DD Days	157
Volatility (ann.)	40.03%
Calmar	3.3
Skew	6.68
Kurtosis	88.5
Expected Daily	0.13%
Expected Monthly	3.91%
Expected Yearly	39.49%
Kelly Criterion	34.6%
Risk of Ruin	0.0%
Daily Value-at-Risk	-3.29%
Expected Shortfall (cVaR)	-3.29%
Max Consecutive Wins	2
Max Consecutive Losses	4
Gain/Pain Ratio	1.3
Gain/Pain (1M)	2.61

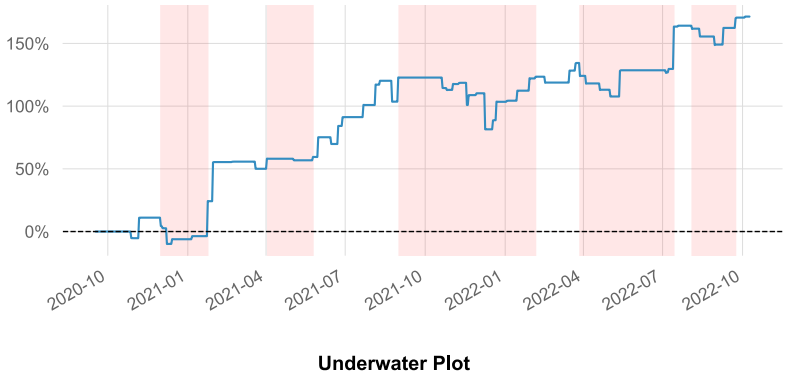




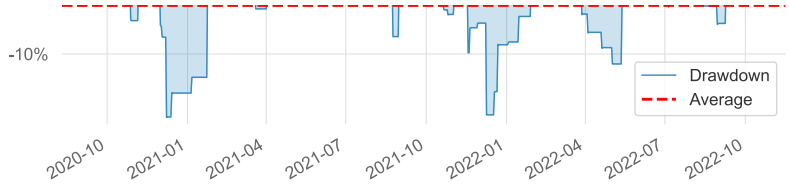


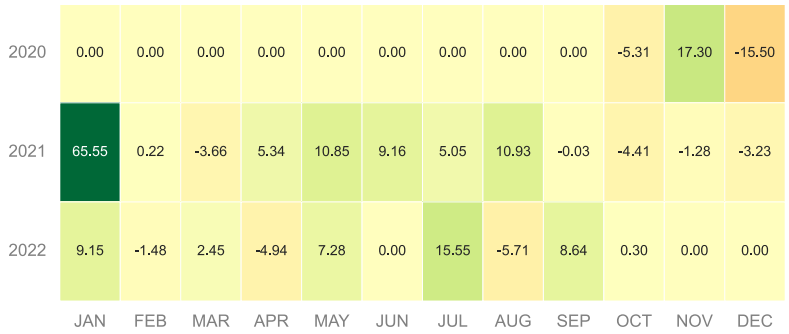


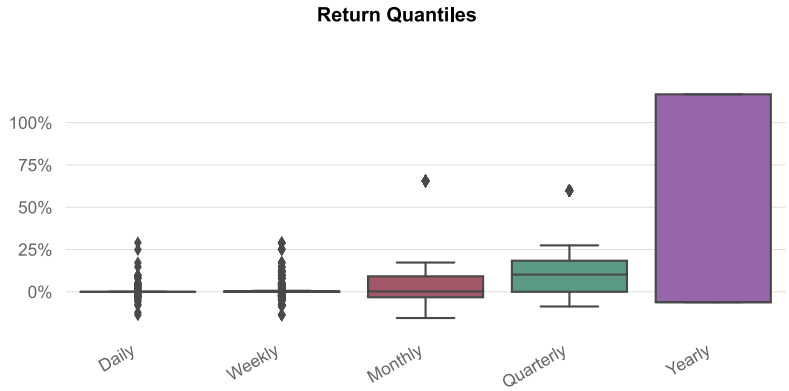




Metric	Strategy
Payoff Ratio	1.46
Profit Factor	2.3
Common Sense Ratio	40995688961096.66
CPC Index	2.05
Tail Ratio	17824655490074.13
Outlier Win Ratio	29.08
Outlier Loss Ratio	1.58
MTD	0.3%
3M	18.18%
6M	24.45%
YTD	33.4%
1Y	21.83%
3Y (ann.)	62.36%
5Y (ann.)	62.36%
10Y (ann.)	62.36%
All-time (ann.)	62.36%
Best Day	29.06%
Worst Day	-13.67%
Best Month	65.55%
Worst Month	-15.5%
Best Year	116.76%
Worst Year	-6.14%
Avg. Drawdown	-4.85%
Avg. Drawdown Days	33
Recovery Factor	9.06
Ulcer Index	0.06
Serenity Index	5.93
Avg. Up Month	11.98%
Avg. Down Month	-4.55%
Win Days	61.22%
Win Month	58.33%
Win Quarter	77.78%
Win Year	66.67%







EOY Returns

Year	Return	Cumulative
2020	-3.77%%	-6.14%
2021	87.84%%	116.76%
2022	31.06%%	33.4%

Worst 10 Drawdowns

Started	Recovered	Drawdown	Days
2020-12-01	2021-01-24	-18.91%	54
2021-09-01	2022-02-05	-18.55%	157
2022-03-28	2022-07-14	-11.40%	108
2021-08-24	2021-08-31	-7.57%	7
2022-08-04	2022-09-23	-5.86%	50
2020-10-28	2020-11-06	-5.31%	9
2021-03-20	2021-04-02	-3.66%	13
2021-06-15	2021-06-23	-3.08%	8
2022-02-16	2022-03-16	-2.18%	28
2021-04-03	2021-05-25	-0.85%	52