Digital Gold Digger

By Estrella Moreira, Dawa Lama, Zhi Li, Ali Salem

Introduction

Large-cap cryptocurrencies are generally considered to be safe crypto investments, these are companies with a market cap of more than $10 billion. The hypothesis of this project is that the prior view of crypto assets being decorrelated with traditional assets is no longer true; While this may be true for small and mid cap cryptos, large-cap cryptos are now being used by large institutional investors as a hedge on other assets. Yet, they are currently still view as "risk on" assets, this means that have significant correlation with high risk equities. The goal of this project is to use macro-indicator assests such as precious metals, stock indexes, interest rates and forex rates to anticipate crypto movements. With this in mind, we aim to trade large-cap cryptos based on traditional finance and macro indicators.

Market Universe

Instruments

For our universe, we choose five of the top large-cap cryptos. The instruments, along with their approximate market caps as of May 2022 are as follows:

- Bitcoin (BTC) - $563B
- Ethereum (ETH) - $239
- Binance Coin (BNB) - $53B
- USD_Coin (USDC-USD) - $53B
- Cardano (ADA) - $17B

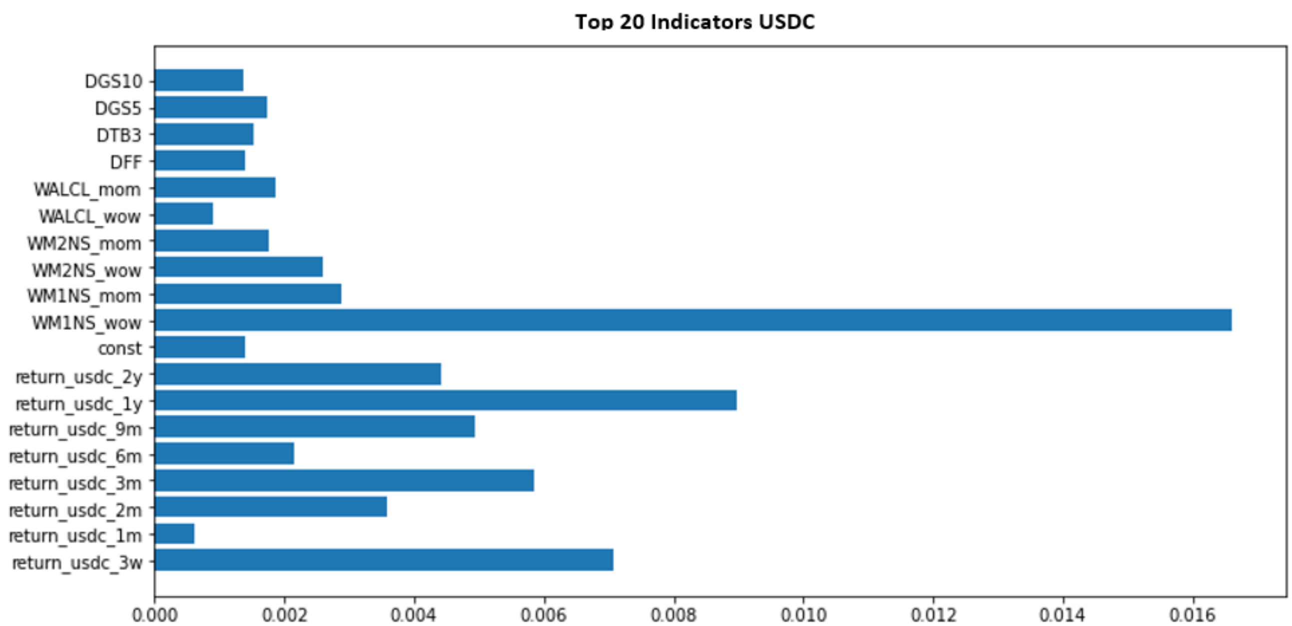
The datasets used for this project and the market caps values are from:

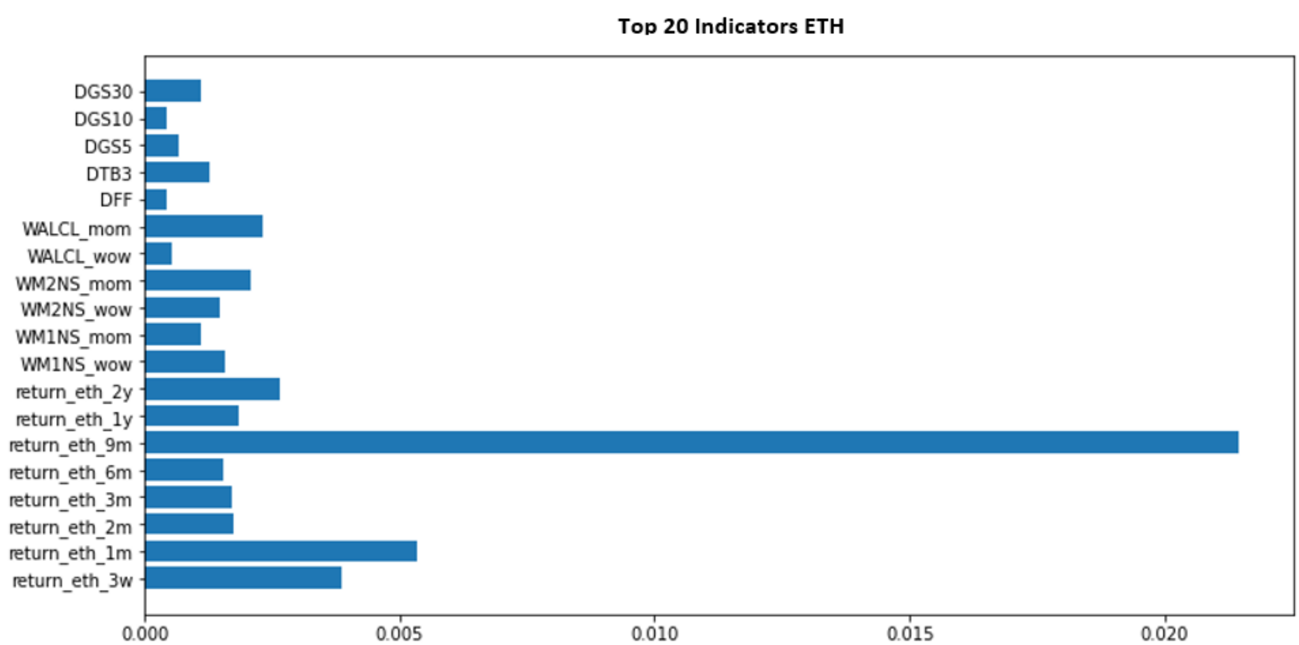
- https://www.yahoo.com
- https://coinmarketcap.com

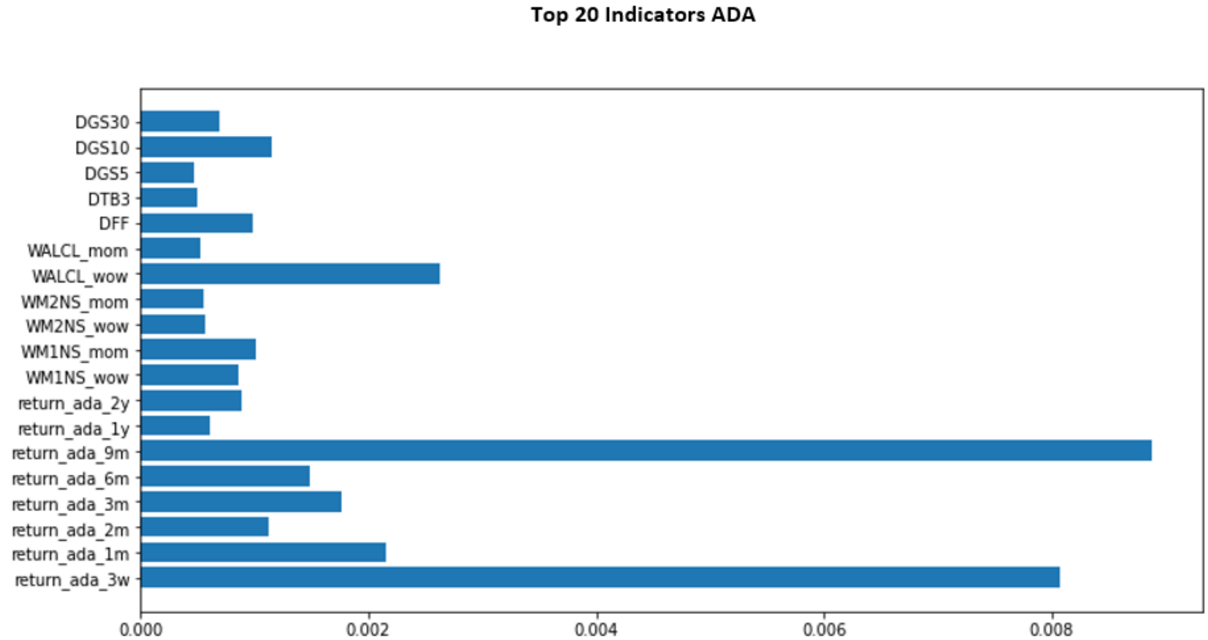
- https://fred.stlouisfed.org

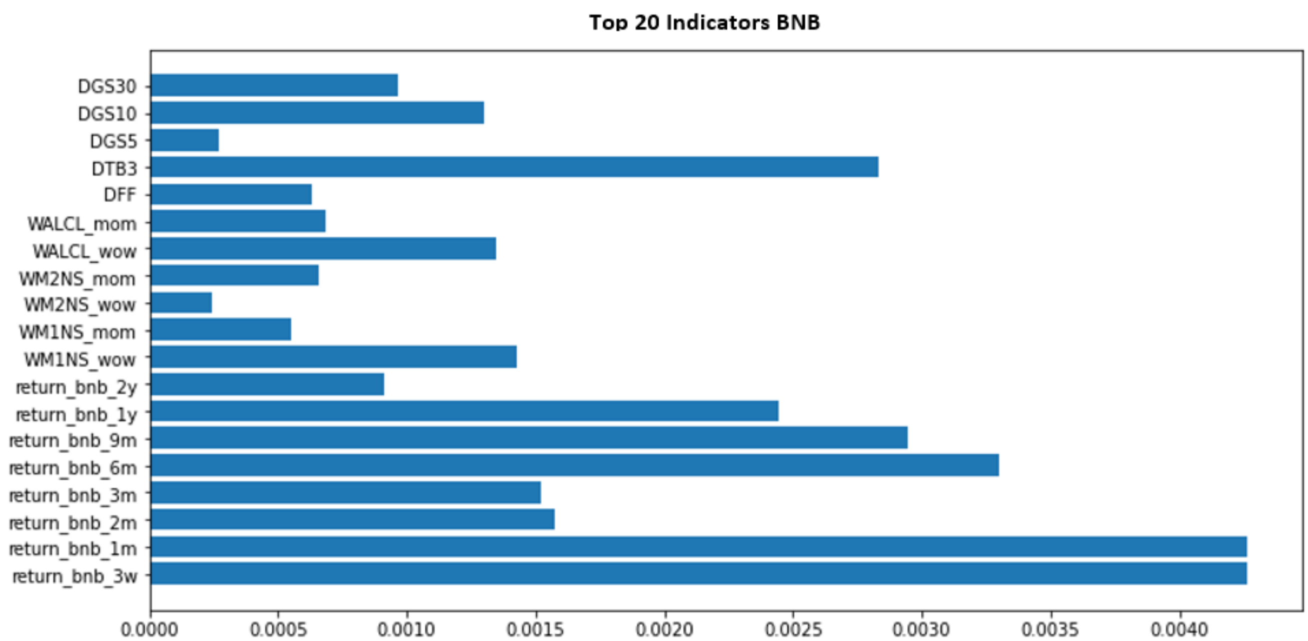
Macro Indicators

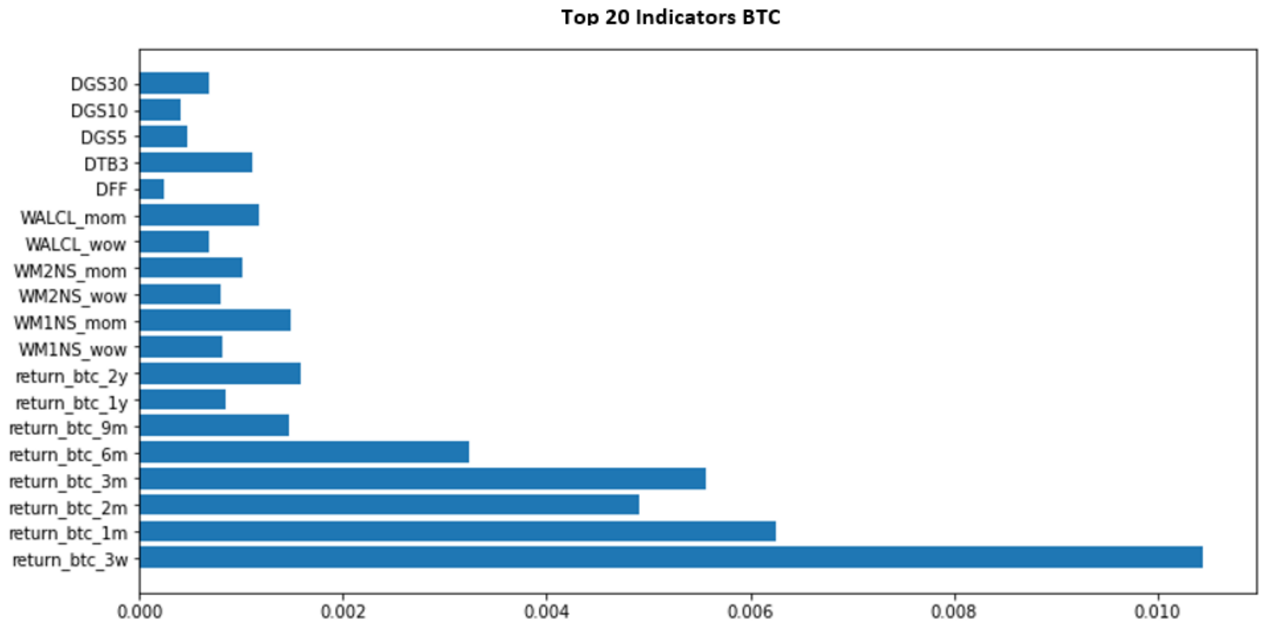
For our macro-indicators we used the top 20 Indicators having a direct effect on each coin from Fred and Yahoo Finance






Top 20 Indicators ADA
DGS30
DGS10
DGS5
DTB3
DFF
WALCL_mom
WALCL_wow
WM2NS_mom
WM2NS_wow
WM1NS_mom
WM1NS_wow
return_ada_2y
return_ada_1y
return_ada_9m
return_ada_6m
return_ada_3m
return_ada_2m
return_ada_1m
return_ada_3w
0.000
0.002
0.004
0.006
0.008


Top 20 Indicators BNB
DGS30
DGS10
DGS5
DTB3
DFF
WALCL_mom
WALCL_wow
WM2NS_mom
WM2NS_wow
WM1NS_mom
WM1NS_wow
return_bnb_2y
return_bnb_1y
return_bnb_9m
return_bnb_6m
return_bnb_3m
return_bnb_2m
return_bnb_1m
return_bnb_3w
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0.0030
0.0035
0.0040



Feature Engineering

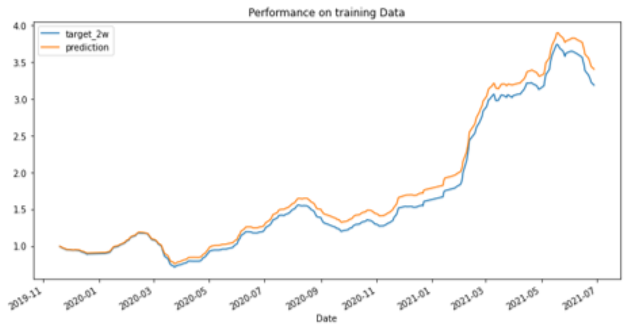
We used feature engineering to prepare all the macro-indcators and add additional features such as momentum, historical returns and calculate the factor betas.

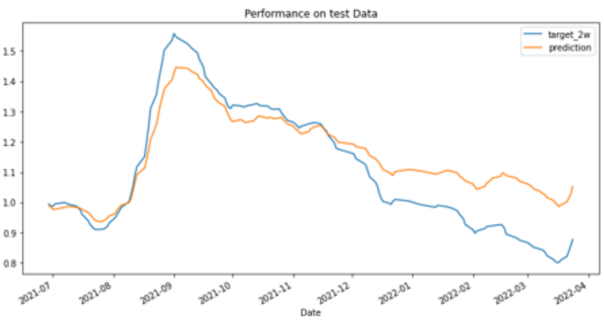
- Cryto Returns - these were the lags we used to calculate return (10 lags that capture short and long term past returns)
- Factor Betas - we calculated the factor betas for each stock to include them as features for our machine learning model
- Momentum - Traders and investors have long known about the effects of momentum and have found that these effects appear across a wide variety of markets and time frames. we added momentum factors to run these strategies on every singe single currency

Modeling

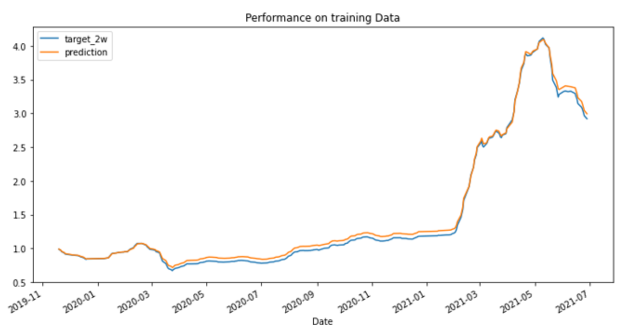
1. We used the Random Forest model which took all of the different factors and features to try to predict the next two weeks of return
2. We calculated the feature importance by extracting the most important variables (indicators) affecting each of the crypto currencies
3. We applied our model to test data in order to test the returns

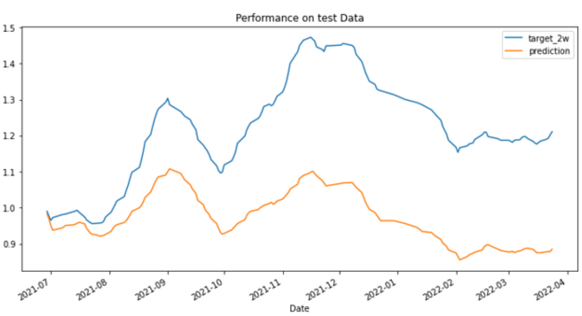
- ADA Performance



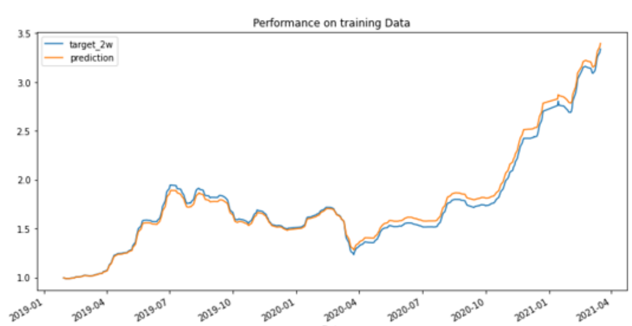


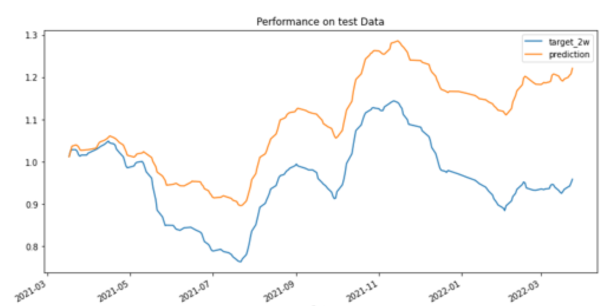
- BNB Performance



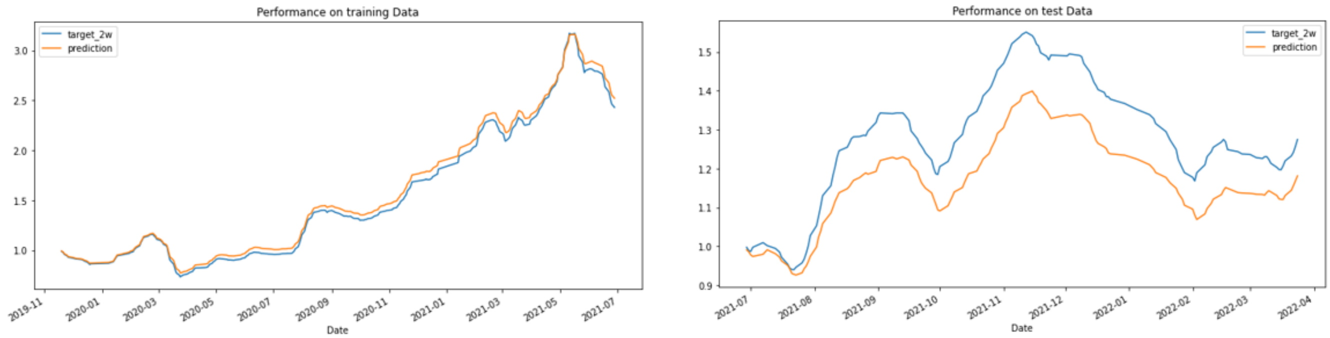


- BTC Performance

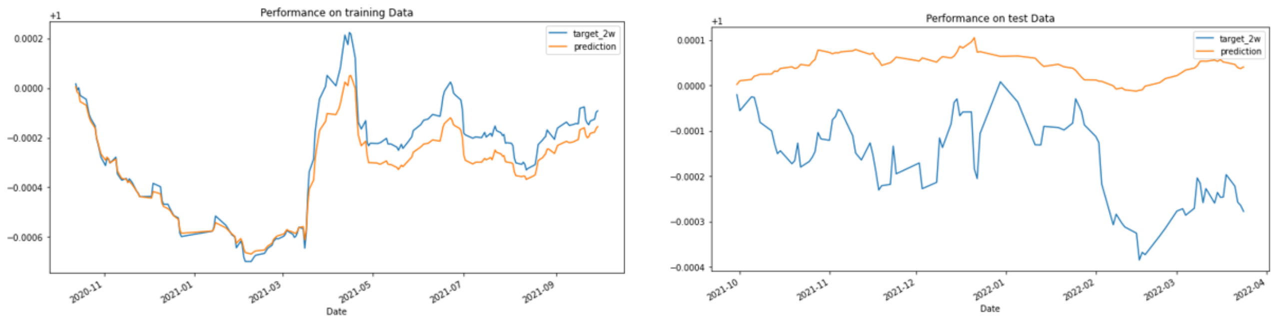




- ETH Performance



- USDC Performance

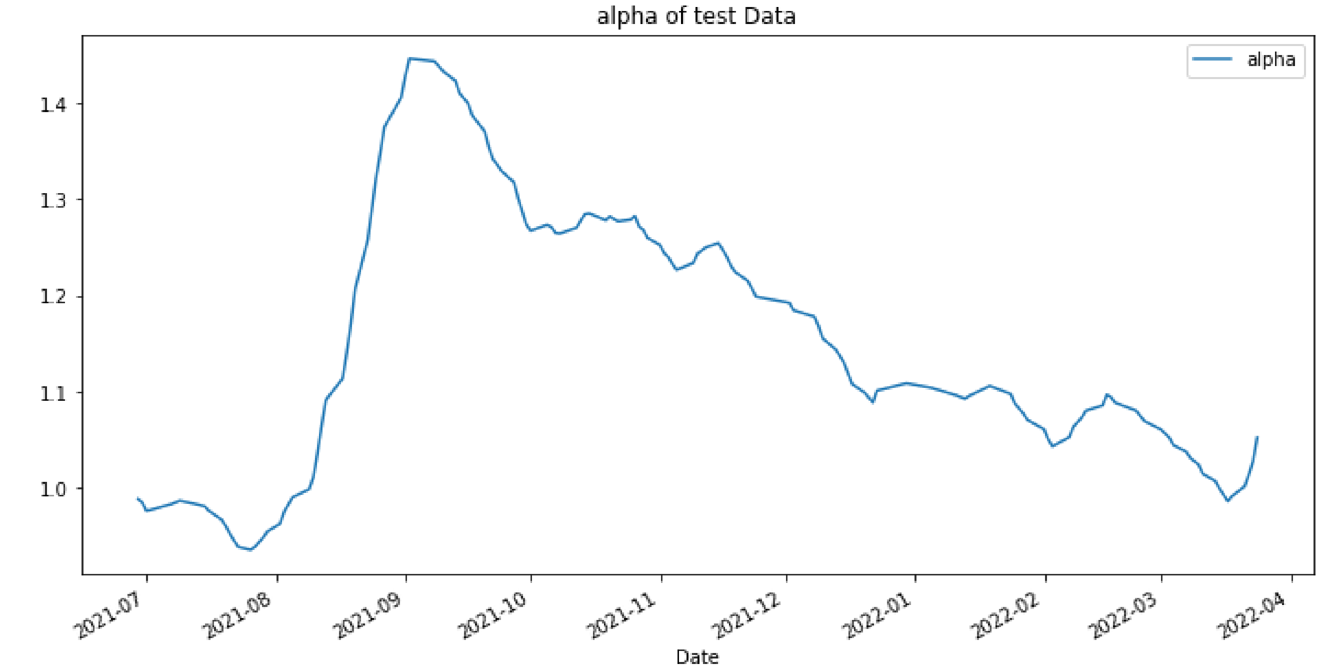


As a result, our model was capable of predicting the evolution of the target

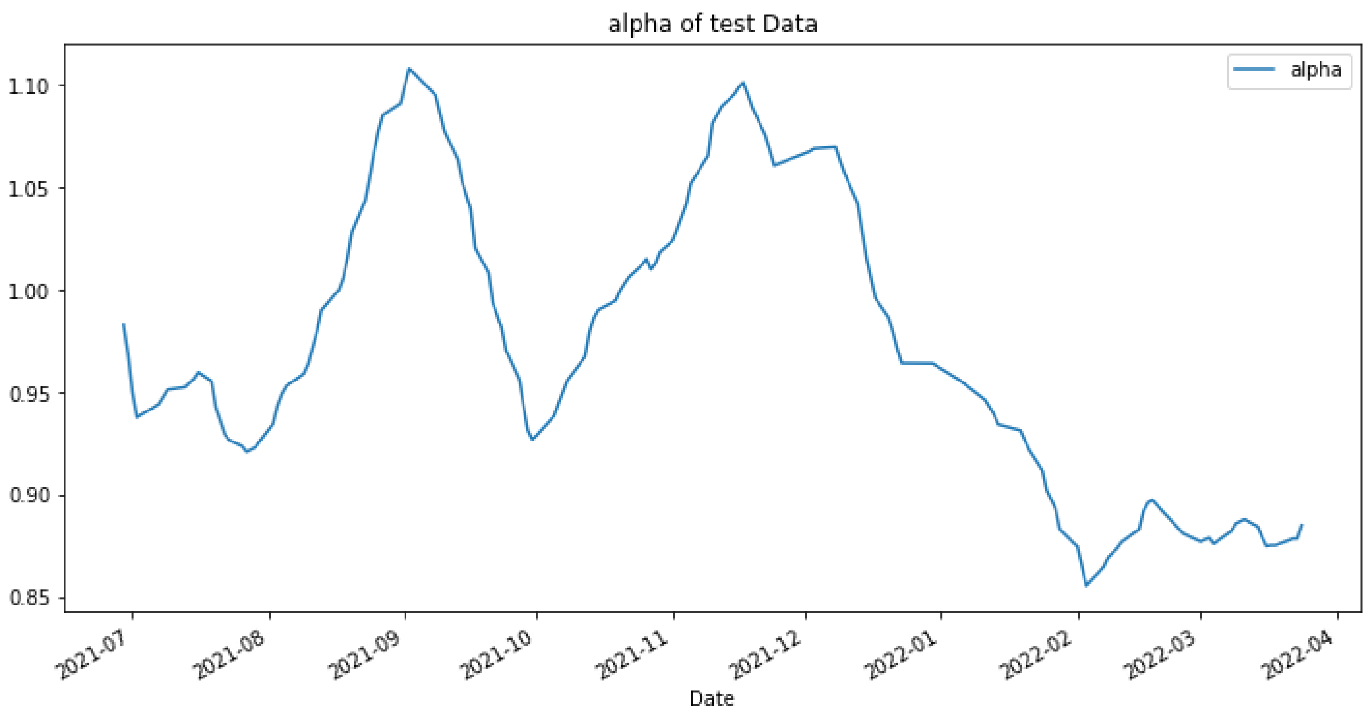
Generating the Alpha Signals

The Alpha signal is the net forward-looking estimate of an asset's future potential relative to other securities in a coverage universe. We used the Alpha input signals generated by our model as the numerator for the Mean Variance Optimization (MVO) for the predictions of each of the crypto currencies

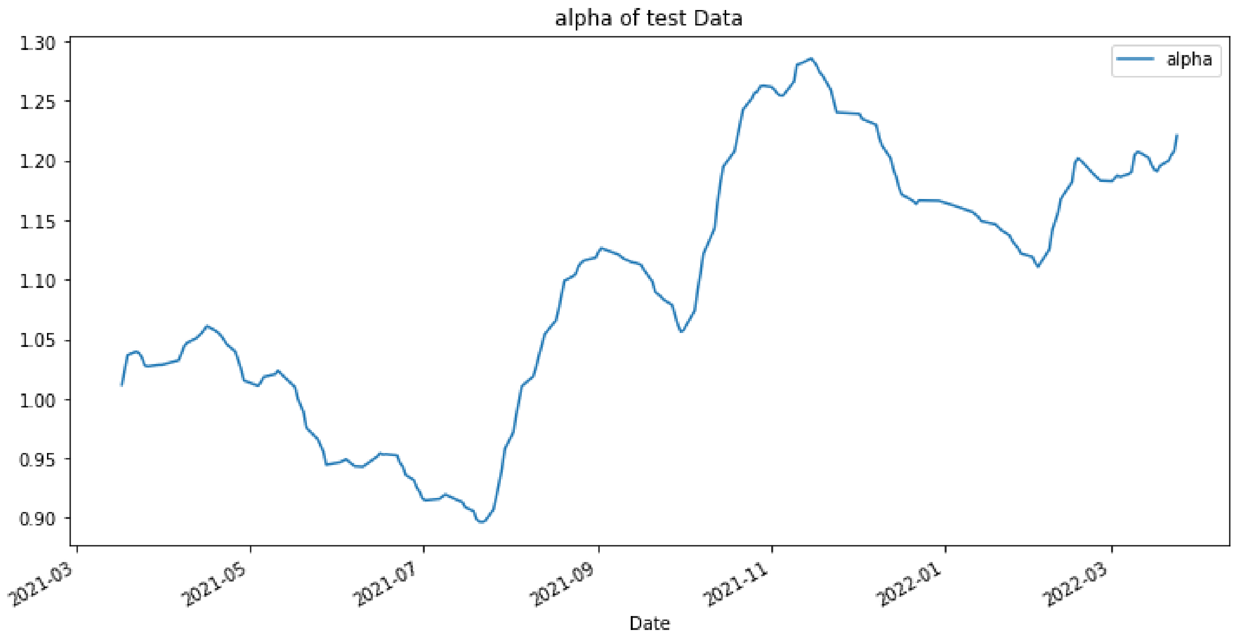
- ADA Alpha Signal



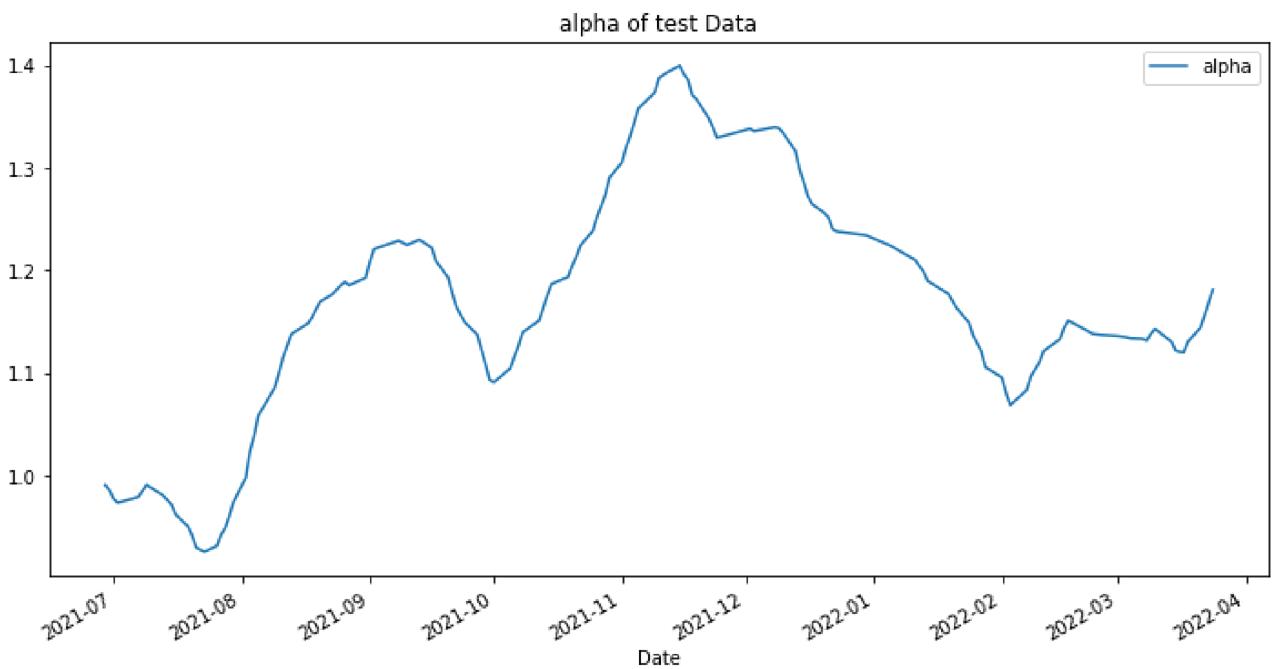
- BNB Apha Signal



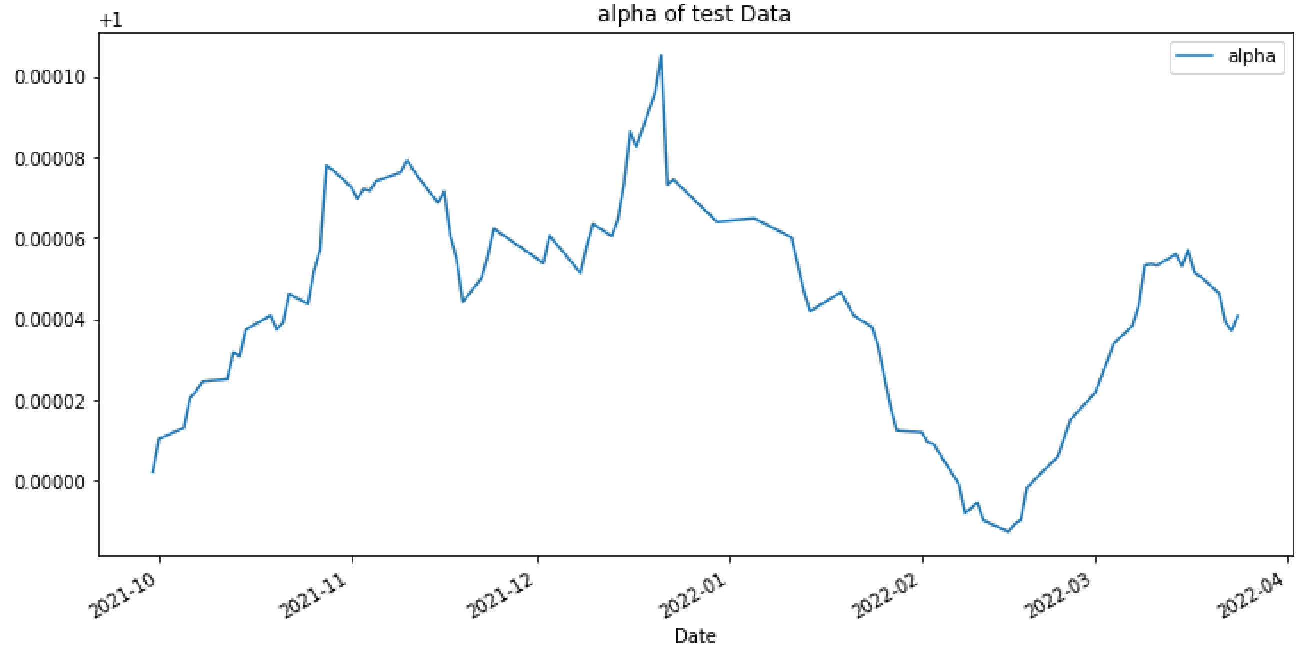
- BTC Alpha Signal



- ETH Alpha Signal



- USDC Alpha Signal



Strategy Definition

From the Alpha signals generated by the AI, we added SELL, BUY and HOLD signals. In this case, if the predicted returns are positive we decide to buy and if the predicted returns are negative we decide to sell. For trading and transaction cost purposes, we decided to use the Binance cryptocurrency exchange as all the cryptocurrencies we are using are availabe and transaction costs is 0.1%.

- ADA Strategy and Portfolio Evaluation

Strategy - adding sell, buy and hold signal from the alpha generated by the AI, including Transaction cost

Date	target_2w	alpha_AI	signal	buy	sell	Close	cost
2021-06-29	-0.004929	-0.011119	SELL	False	True	1.368437	0.1
2021-06-30	-0.007411	-0.003631	HOLD	False	False	1.383472	0.0
2021-07-01	-0.001067	-0.008814	SELL	False	True	1.335611	0.1
2021-07-02	0.008121	0.000886	HOLD	False	False	1.394397	0.0
2021-07-07	0.005113	0.006198	BUY	True	False	1.403118	0.1

Portfolio Evaluation

Date	value	cash	equity	transaction
2021-06-29	1000000.000000	1000000	0	Transaction.HOLD
2021-06-30	1000000.000000	1000000	0	Transaction.HOLD
2021-07-01	1000000.000000	1000000	0	Transaction.HOLD
2021-07-02	1000000.000000	1000000	0	Transaction.HOLD
2021-07-07	999999.900000	0	712698.361791	Transaction.BUY
...	...	...	...	...
2022-03-18	454182.514156	0	532182.976468	Transaction.BUY
2022-03-21	487895.773532	0	532182.976468	Transaction.HOLD
2022-03-22	519644.745542	0	532182.976468	Transaction.HOLD
2022-03-23	589383.067144	0	532182.976468	Transaction.HOLD
2022-03-24	601372.617421	0	532182.976468	Transaction.HOLD

144 rows × 4 columns

Date	value
2021-06-30	1.000000e+06
2021-07-31	8.575317e+05
2021-08-31	1.307172e+06
2021-09-30	1.527462e+06
2021-10-31	1.422548e+06
2021-11-30	1.136895e+06
2021-12-31	9.958083e+05
2022-01-31	7.246458e+05
2022-02-28	5.687208e+05
2022-03-31	4.766277e+05

- BNB Strategy and Portfolio Evaluation

Strategy - adding sell, buy and hold signal from the alpha generated by the AI, including Transaction cost

Date	target_2w	alpha_AI	signal	buy	sell	Close	cost
2021-06-29	-0.009576	-0.017038	SELL	False	True	300.211548	0.1
2021-06-30	-0.014326	-0.016593	SELL	False	True	303.295868	0.1
2021-07-01	-0.011262	-0.010358	SELL	False	True	288.218414	0.1
2021-07-02	0.007623	-0.012858	SELL	False	True	287.423096	0.1
2021-07-07	0.008371	0.005609	BUY	True	False	327.522461	0.1

Portfolio Evaluation

Date	value	cash	equity	transaction
2021-06-29	1000000.000000	1000000	0	Transaction.HOLD
2021-06-30	1000000.000000	1000000	0	Transaction.HOLD
2021-07-01	1000000.000000	1000000	0	Transaction.HOLD
2021-07-02	1000000.000000	1000000	0	Transaction.HOLD
2021-07-07	1000000.000000	0	3053.225714	Transaction.BUY
...	...	...	...	...
2022-03-18	973241.772503	973241.772503	0	Transaction.HOLD
2022-03-21	973241.772503	973241.772503	0	Transaction.HOLD
2022-03-22	973241.772503	973241.772503	0	Transaction.HOLD
2022-03-23	973241.772503	973241.772503	0	Transaction.HOLD
2022-03-24	973241.772503	0	2350.104702	Transaction.BUY

144 rows × 4 columns

Date	value
2021-06-30	1.000000e+06
2021-07-31	9.027273e+05
2021-08-31	1.065529e+06
2021-09-30	1.093724e+06
2021-10-31	1.131435e+06
2021-11-30	1.389465e+06
2021-12-31	1.175486e+06
2022-01-31	1.150318e+06
2022-02-28	1.093267e+06
2022-03-31	9.732418e+05

- BTC Strategy and Portfolio Evaluation

Strategy - adding sell, buy and hold signal from the alpha generated by the AI, including Transaction cost

Date	target_2w	alpha_AI	signal	buy	sell	Close	cost
2021-03-17	0.012592	0.011248	BUY	True	False	58870.894531	0.1
2021-03-18	0.012656	0.011498	BUY	True	False	57858.921875	0.1
2021-03-19	0.003059	0.012489	BUY	True	False	58346.652344	0.1
2021-03-22	-0.000111	0.002977	HOLD	False	False	54529.144531	0.0
2021-03-23	-0.004240	0.000535	HOLD	False	False	54738.945313	0.0

Portfolio Evaluation

Date	value	cash	equity	transaction
2021-03-17	1000000.000000	0	16.986322	Transaction.BUY
2021-03-18	982810.306110	0	16.986322	Transaction.HOLD
2021-03-19	991095.053147	0	16.986322	Transaction.HOLD
2021-03-22	926249.634313	0	16.986322	Transaction.HOLD
2021-03-23	929813.378055	0	16.986322	Transaction.HOLD
...	...	...	...	...
2022-03-18	560897.118574	0	13.41822	Transaction.BUY
2022-03-21	551193.596372	0	13.41822	Transaction.HOLD
2022-03-22	568379.820513	0	13.41822	Transaction.HOLD
2022-03-23	575547.141852	0	13.41822	Transaction.HOLD
2022-03-24	589877.486528	0	13.41822	Transaction.HOLD

Date	value
2021-03-31	931217.184801
2021-04-30	890003.408042
2021-05-31	793783.784921
2021-06-30	683985.184592
2021-07-31	626333.454387
2021-08-31	741433.310390
2021-09-30	758417.766862
2021-10-31	857492.463015
2021-11-30	871555.244335
2021-12-31	825383.287396
2022-01-31	711480.064336
2022-02-28	685548.913279
2022-03-31	568930.159260

- ETH Strategy and Portfolio Evaluation

Strategy - adding sell, buy and hold signal from the alpha generated by the AI, including Transaction cost

Date	target_2w	alpha_AI	signal	buy	sell	Close	cost
2021-06-29	-0.002862	-0.014064	SELL	False	True	2160.768311	0.1
2021-06-30	-0.008205	-0.003953	HOLD	False	False	2274.547607	0.0
2021-07-01	-0.002660	-0.009594	SELL	False	True	2113.605469	0.1
2021-07-02	0.010879	-0.002770	HOLD	False	False	2150.040283	0.0
2021-07-07	0.012132	0.008444	BUY	True	False	2315.161865	0.1

Portfolio Evaluation

Date	value	cash	equity	transaction
2021-06-29	1.000000e+06	1000000	0	Transaction.HOLD
2021-06-30	1.000000e+06	1000000	0	Transaction.HOLD
2021-07-01	1.000000e+06	1000000	0	Transaction.HOLD
2021-07-02	1.000000e+06	1000000	0	Transaction.HOLD
2021-07-07	1.000000e+06	0	431.935242	Transaction.BUY
...	...	...	...	...
2022-03-18	1.224012e+06	0	415.575255	Transaction.BUY
2022-03-21	1.204327e+06	0	415.575255	Transaction.HOLD
2022-03-22	1.235560e+06	0	415.575255	Transaction.HOLD
2022-03-23	1.259636e+06	0	415.575255	Transaction.HOLD
2022-03-24	1.291634e+06	0	415.575255	Transaction.HOLD

144 rows × 4 columns

Date	value
2021-06-30	1.000000e+06
2021-07-31	8.771804e+05
2021-08-31	1.123179e+06
2021-09-30	1.256954e+06
2021-10-31	1.360886e+06
2021-11-30	1.555086e+06
2021-12-31	1.484898e+06
2022-01-31	1.484898e+06
2022-02-28	1.412234e+06
2022-03-31	1.229606e+06

- USDC Strategy and Portfolio Evaluation

Strategy - adding sell, buy and hold signal from the alpha generated by the AI, including Transaction cost

Date	target_2w	alpha_AI	signal	buy	sell	Close	cost
2021-09-30	-0.000021	0.000007	HOLD	False	False	1.000140	0.0
2021-10-01	-0.000035	0.000007	HOLD	False	False	0.999545	0.0
2021-10-05	0.000031	0.000004	HOLD	False	False	0.999849	0.0
2021-10-06	-0.000001	0.000009	BUY	True	False	0.999990	0.1
2021-10-07	-0.000025	0.000004	HOLD	False	False	1.000023	0.0

Portfolio Evaluation

Date	value	cash	equity	transaction
2021-09-30	1.000000e+06	1000000	0	Transaction.HOLD
2021-10-01	1.000000e+06	1000000	0	Transaction.HOLD
2021-10-05	1.000000e+06	1000000	0	Transaction.HOLD
2021-10-06	1.000000e+06	0	1000010.0001	Transaction.BUY
2021-10-07	1.000033e+06	0	1000010.0001	Transaction.HOLD
...	...	...	...	...
2022-03-18	9.925457e+05	0	992696.588377	Transaction.BUY
2022-03-21	9.925258e+05	0	992696.588377	Transaction.HOLD
2022-03-22	9.926013e+05	0	992696.588377	Transaction.HOLD
2022-03-23	9.926499e+05	992649.931637	0	Transaction.SELL
2022-03-24	9.926499e+05	992649.931637	0	Transaction.HOLD

Date	value
2021-09-30	1000000.000000
2021-10-31	999847.054026
2021-11-30	999592.898573
2021-12-31	997925.193782
2022-01-31	995206.069013
2022-02-28	993317.955232
2022-03-31	992589.379022

Strategy annualized return

Running our machine learning model on each of the coins with each of the factors considered above, we were able to predict anualized return for each cryptocurrency

- ADA Annualized Strategy Return

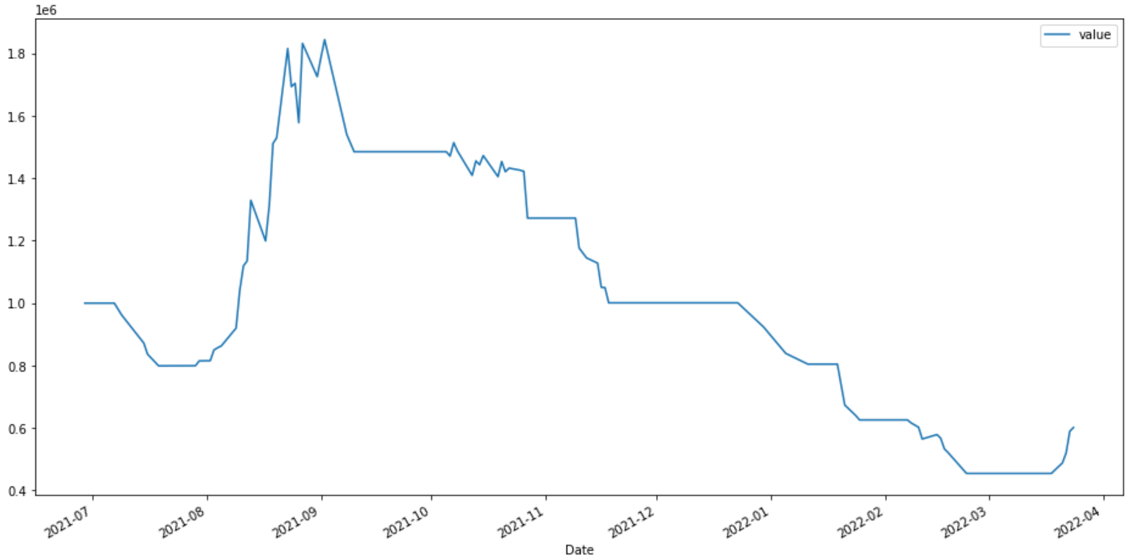
Strategy annualized return

In [71]:
```
gains = (portfolio["value"].values[-1] - portfolio["value"].values[0])/portfolio["value"].values[0]
print("gains: ", gains)

print("annualized return : ", (gains + 1)**(1/5) + 1)
```

```
gains:  -0.3986273825787373
annualized return :  1.9032931770894257
```

In [72]:
```
portfolio.plot(y="value", figsize=(16,8));
```



- BNB Annualized Strategy Return

Strategy annualized return

In [186…

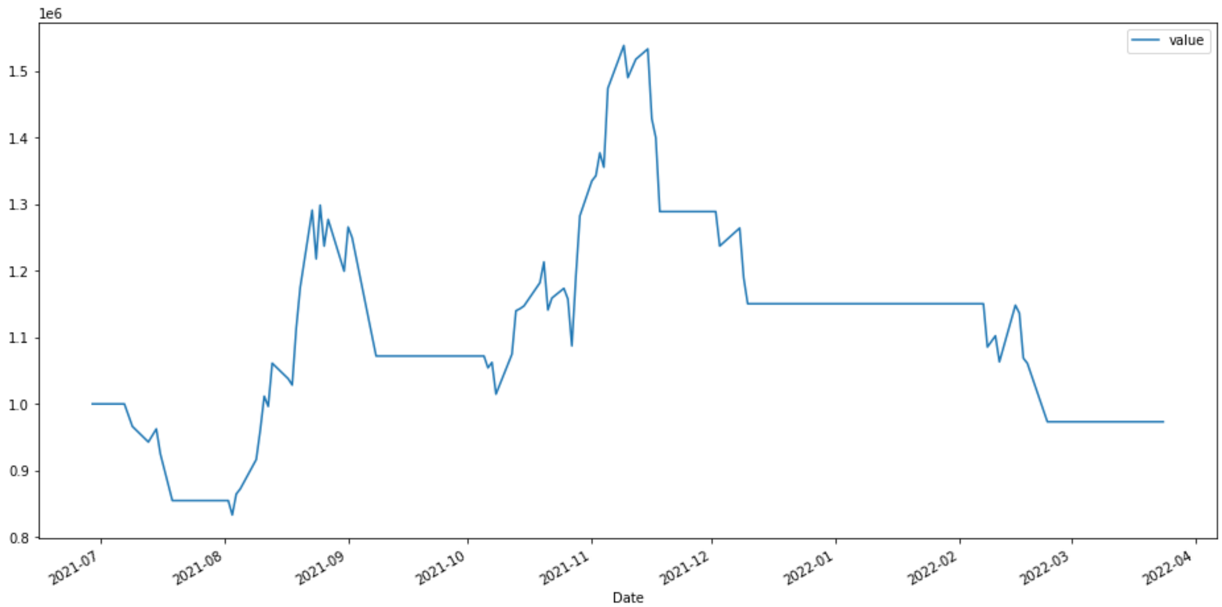
```
gains = (portfolio["value"].values[-1] - portfolio["value"].values[0])/portfolio["value"].values[0]
print("gains: ", gains)

print("annualized return : ", (gains + 1)**(1/5) + 1)
```

```
gains:  -0.02675822749746882
annualized return :  1.9945901370677797
```

In [187…

```
portfolio.plot(y="value", figsize=(16,8));
```



- BTC Annualized Strategy Return

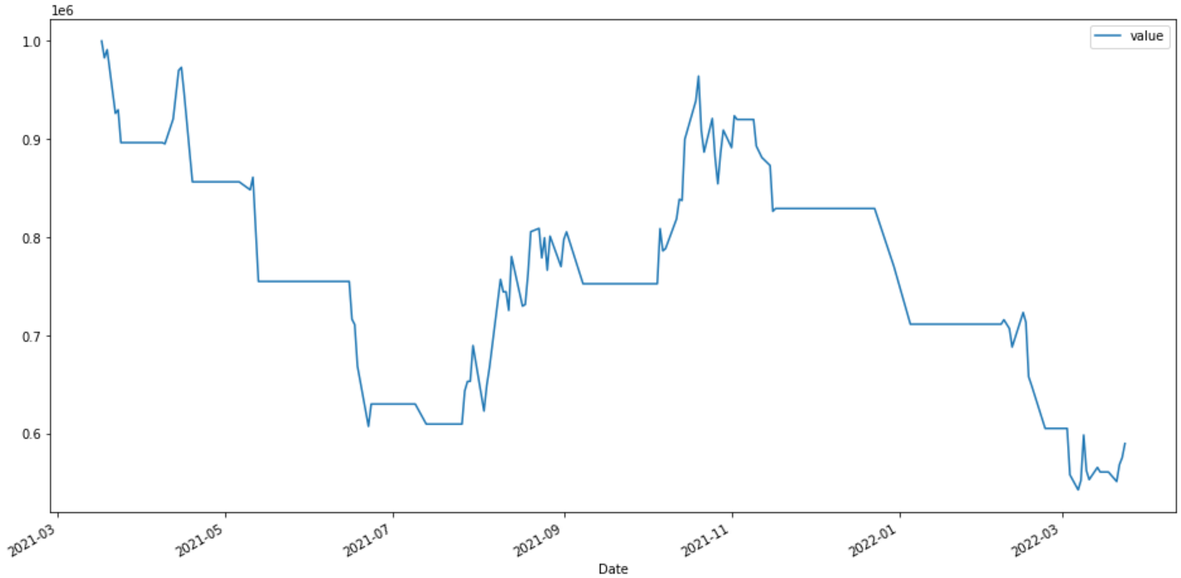
Strategy annualized return

In [65]:
```
gains = (portfolio["value"].values[-1] - portfolio["value"].values[0])/portfolio["value"].values[0]
print("gains: ", gains)

print("annualized return : ", (gains + 1)**(1/5) + 1)
```

```
gains:  -0.41012251347213946
annualized return :  1.899813209031011
```

In [66]:
```
portfolio.plot(y="value", figsize=(16,8));
```



- ETH Annualized Strategy Return

Strategy annualized return

In [205…

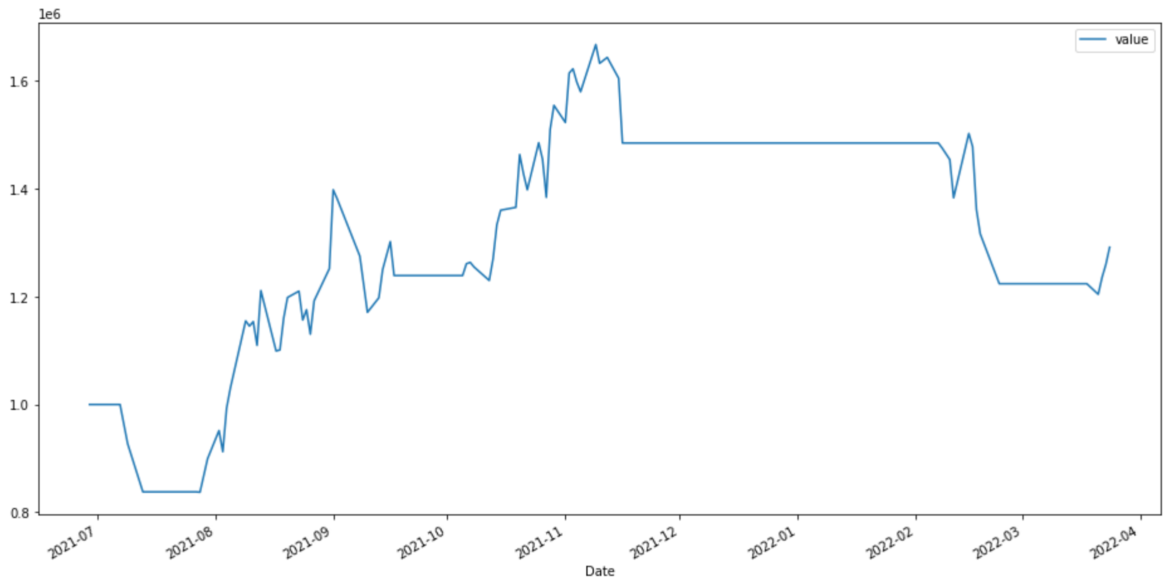
```
gains = (portfolio["value"].values[-1] - portfolio["value"].values[0])/portfolio["value"].values[0]
print("gains: ", gains)

print("annualized return : ", (gains + 1)**(1/5) + 1)
```

```
gains:  0.29163366263950546
annualized return :  2.0525139750686066
```

In [206…

```
portfolio.plot(y="value", figsize=(16,8));
```

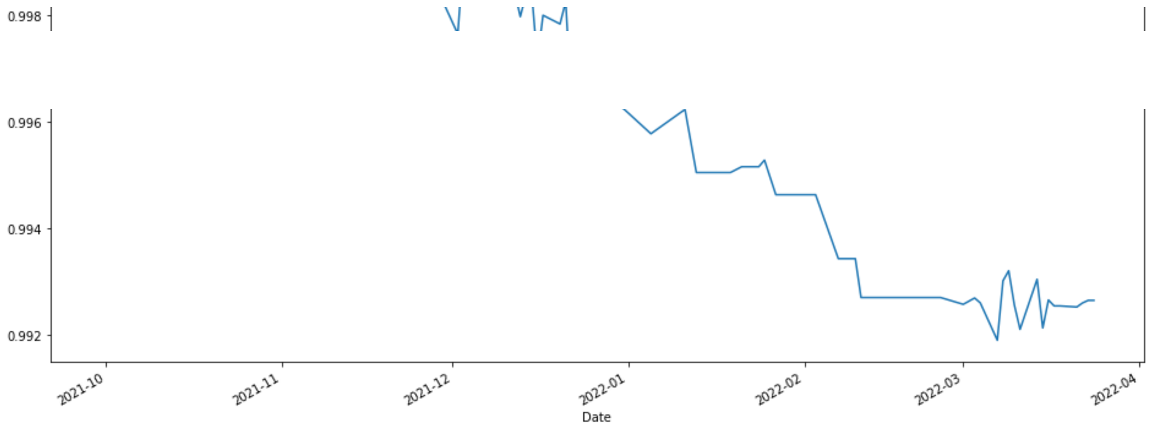


- BNB Annualized Strategy Return

Strategy annualized return

Conclusion

Large-cap cryptocurrencies are generally considered to be safe crypto investments. In conclusion, we were able to trade large-cap cryptocurrencies based on traditional finance and macro indicators. The Cryptocurrences used were: ADA, BNB, BTC, USDB and ETH. Our model was capable of predicting the evolution of each one of these cryptocurrencies against mutipe macro-Indicators and our model was able to give us sgnificant returns based on our different signals.



✓ 0s completed at 11:11 PM