backtest

September 25, 2023

[1]:
```python
import vectorbt as vbt

vbt.settings['plotting']['use_widgets'] = False
data_exchange = 'binanceusdm'
data_timeframe = '1h'
data_start = '2023-01-01'
data_end = '2023-08-31'
bband_sma = 20
bband_std = 2
bband_bandwidth_thr = 0.015 # max 0.22
```

[2]:
```python
btc_price = vbt.CCXTData.download_symbol('BTC/USDT', exchange=data_exchange,␣
 ↪timeframe=data_timeframe, start=data_start, end=data_end)
eth_price = vbt.CCXTData.download_symbol('ETH/USDT', exchange=data_exchange,␣
 ↪timeframe=data_timeframe, start=data_start, end=data_end)
```

```
0it [00:00, ?it/s]

0it [00:00, ?it/s]
```

[3]:
```python
btc_price['btc_eth'] = btc_price['Close'] / eth_price['Close']
bband = vbt.BBANDS.run(btc_price['btc_eth'], window=bband_sma, alpha=bband_std)
btc_price['bandwidth'] = bband.bandwidth
btc_price['bandwidth'].fillna(0.0, inplace=True)
bband.plot().show()
```

[4]:
```python
bband.bandwidth[bband.bandwidth > bband_bandwidth_thr]
bband.bandwidth.mean()
```

[4]:
```
0.01414273015840736
```

[5]:
```python
# long BTC short ETH, close at middle
btc_price['upper_crossed_above'] = bband.
 ↪upper_crossed_above(btc_price['btc_eth']) & (btc_price['bandwidth'] >␣
 ↪bband_bandwidth_thr)
btc_price['middle_crossed_below'] = bband.
 ↪middle_crossed_below(btc_price['btc_eth'])
```

[6]:
```python
entries = btc_price['upper_crossed_above']
exits = btc_price['middle_crossed_below']
pf = vbt.Portfolio.from_signals(btc_price['Close'], entries, exits, max_size=1,
 ↪init_cash=100000)
pf.plot().show()
```

[7]:
```python
pf.stats()
```

[7]:
```
Start                          2022-12-31 16:00:00+00:00
End                            2023-08-30 15:00:00+00:00
Period                                  242 days 00:00:00
Start Value                                      100000.0
End Value                                        106596.7
Total Return [%]                                   6.5967
Benchmark Return [%]                             63.84671
Max Gross Exposure [%]                          29.172944
Total Fees Paid                                       0.0
Max Drawdown [%]                                 2.482099
Max Drawdown Duration                   124 days 21:00:00
Total Trades                                           49
Total Closed Trades                                    49
Total Open Trades                                       0
Open Trade PnL                                        0.0
Win Rate [%]                                    59.183673
Best Trade [%]                                   10.14753
Worst Trade [%]                                 -4.172992
Avg Winning Trade [%]                            2.125024
Avg Losing Trade [%]                            -1.572093
Avg Winning Trade Duration   1 days 04:35:10.344827586
Avg Losing Trade Duration               0 days 18:57:00
Profit Factor                                    1.760891
Expectancy                                     134.626531
Sharpe Ratio                                     1.643291
Calmar Ratio                                     4.075021
Omega Ratio                                        1.1327
Sortino Ratio                                    2.427583
dtype: object
```

[8]:
```python
pf = vbt.Portfolio.from_signals(eth_price['Close'], short_entries=entries,
 ↪short_exits=exits, size=btc_price['btc_eth'], init_cash=100000)
pf.plot().show()
```

[9]:
```python
pf.stats()
```

[9]:
```
Start                          2022-12-31 16:00:00+00:00
End                            2023-08-30 15:00:00+00:00
Period                                  242 days 00:00:00
```

```
Start Value                                    100000.0
End Value                                  92938.777384
Total Return [%]                              -7.061223
Benchmark Return [%]                          41.613652
Max Gross Exposure [%]                              0.0
Total Fees Paid                                     0.0
Max Drawdown [%]                                8.86361
Max Drawdown Duration                 229 days 02:00:00
Total Trades                                         49
Total Closed Trades                                  49
Total Open Trades                                     0
Open Trade PnL                                      0.0
Win Rate [%]                                  40.816327
Best Trade [%]                                 6.822715
Worst Trade [%]                              -10.487001
Avg Winning Trade [%]                          1.760837
Avg Losing Trade [%]                           -2.26195
Avg Winning Trade Duration              0 days 21:57:00
Avg Losing Trade Duration   1 days 02:31:02.068965517
Profit Factor                                  0.576127
Expectancy                                  -144.106584
Sharpe Ratio                                   -1.55367
Calmar Ratio                                  -1.179745
Omega Ratio                                    0.888626
Sortino Ratio                                 -2.098598
dtype: object
```

[10]:

```
# long ETH short BTC, close at middle
btc_price['lower_crossed_below'] = bband.
 ↪lower_crossed_below(btc_price['btc_eth']) & (btc_price['bandwidth'] >␣
 ↪bband_bandwidth_thr)
btc_price['middle_crossed_above'] = bband.
 ↪middle_crossed_above(btc_price['btc_eth'])
```

[11]:

```
entries = btc_price['lower_crossed_below']
exits = btc_price['middle_crossed_above']
pf = vbt.Portfolio.from_signals(eth_price['Close'], entries, exits,␣
 ↪size=btc_price['btc_eth'], init_cash=100000)
pf.plot().show()
```

[12]:

```
pf.stats()
```

[12]:

```
Start                         2022-12-31 16:00:00+00:00
End                           2023-08-30 15:00:00+00:00
Period                                242 days 00:00:00
Start Value                                    100000.0
End Value                                 103114.675182
```

```
Total Return [%]                                3.114675
Benchmark Return [%]                           41.613652
Max Gross Exposure [%]                          31.03942
Total Fees Paid                                      0.0
Max Drawdown [%]                                3.968904
Max Drawdown Duration                  138 days 09:00:00
Total Trades                                          41
Total Closed Trades                                   41
Total Open Trades                                      0
Open Trade PnL                                       0.0
Win Rate [%]                                   46.341463
Best Trade [%]                                 12.235572
Worst Trade [%]                                -5.265773
Avg Winning Trade [%]                           3.359557
Avg Losing Trade [%]                           -2.046006
Avg Winning Trade Duration    1 days 10:03:09.473684210
Avg Losing Trade Duration     1 days 02:46:21.818181818
Profit Factor                                   1.255718
Expectancy                                     75.967687
Sharpe Ratio                                    0.797792
Calmar Ratio                                    1.192962
Omega Ratio                                      1.06282
Sortino Ratio                                   1.220586
dtype: object
```

[13]:
```
pf = vbt.Portfolio.from_signals(btc_price['Close'], short_entries=entries,␣
 ↪short_exits=exits, max_size=1, init_cash=100000)
pf.plot().show()
```

[14]:
```
pf.stats()
```

[14]:
```
Start                          2022-12-31 16:00:00+00:00
End                            2023-08-30 15:00:00+00:00
Period                                 242 days 00:00:00
Start Value                                     100000.0
End Value                                        95441.2
Total Return [%]                                 -4.5588
Benchmark Return [%]                            63.84671
Max Gross Exposure [%]                               0.0
Total Fees Paid                                      0.0
Max Drawdown [%]                                7.118069
Max Drawdown Duration                  230 days 01:00:00
Total Trades                                          41
Total Closed Trades                                   41
Total Open Trades                                      0
Open Trade PnL                                       0.0
Win Rate [%]                                   53.658537
```

```
Best Trade [%]                                4.904259
Worst Trade [%]                              -17.68695
Avg Winning Trade [%]                         1.652528
Avg Losing Trade [%]                         -3.321955
Avg Winning Trade Duration    1 days 01:54:32.727272727
Avg Losing Trade Duration     1 days 11:03:09.473684210
Profit Factor                                 0.682218
Expectancy                                 -111.190244
Sharpe Ratio                                 -1.131724
Calmar Ratio                                 -0.954699
Omega Ratio                                   0.914696
Sortino Ratio                                -1.523115
dtype: object
```