06_alphalens_signals_quality

September 29, 2021

1 Testing the signal quality with Alphalens

1.1 Imports & Settings

[1]:
```python
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```python
%matplotlib inline

from pathlib import Path
import pandas as pd
import seaborn as sns

from alphalens.tears import (create_summary_tear_sheet,
                             create_full_tear_sheet)

from alphalens.utils import get_clean_factor_and_forward_returns
```

[3]:
```python
sns.set_style('whitegrid')
```

[4]:
```python
idx = pd.IndexSlice
```

[5]:
```python
results_path = Path('results', 'return_predictions')
if not results_path.exists():
    results_path.mkdir(parents=True)
```

1.2 Evaluating the Cross-Validation Results

[6]:
```python
lookahead = 1
```

[7]:
```python
cv_store = Path(results_path / 'parameter_tuning.h5')
```

1.2.1 Get AlphaLens Input

[8]:
```python
DATA_DIR = Path('..', 'data')
```

Using next available prices.

[9]:

```
def get_trade_prices(tickers):
    store = DATA_DIR / 'assets.h5'
    prices = pd.read_hdf(store, 'stooq/jp/tse/stocks/prices')
    return (prices.loc[idx[tickers, '2014': '2019'], 'open']
            .unstack('ticker')
            .sort_index()
            .shift(-1)
            .dropna()
            .tz_localize('UTC'))
```

Reloading predictions.

[10]:

```
best_predictions = pd.read_hdf(results_path / 'predictions.h5', f'test/
 ↪{lookahead:02}')
best_predictions.info()
```

```
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 474264 entries, ('1332.JP', Timestamp('2019-11-29 00:00:00')) to
('9990.JP', Timestamp('2018-01-05 00:00:00'))
Data columns (total 11 columns):
 #   Column  Non-Null Count   Dtype
---  ------  --------------   -----
 0   y_test  474264 non-null  float64
 1   0       474264 non-null  float64
 2   1       474264 non-null  float64
 3   2       474264 non-null  float64
 4   3       474264 non-null  float64
 5   4       474264 non-null  float64
 6   5       474264 non-null  float64
 7   6       474264 non-null  float64
 8   7       474264 non-null  float64
 9   8       474264 non-null  float64
 10  9       474264 non-null  float64
dtypes: float64(11)
memory usage: 41.7+ MB
```

[11]:

```
test_tickers = best_predictions.index.get_level_values('ticker').unique()
```

[12]:

```
trade_prices = get_trade_prices(test_tickers)
trade_prices.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1464 entries, 2014-01-06 00:00:00+00:00 to 2019-12-27
00:00:00+00:00
Columns: 941 entries, 1332.JP to 9990.JP
dtypes: float64(941)
memory usage: 10.5 MB
```

[13]:

```
factor = (best_predictions
          .iloc[:, :3]
          .mean(1)
          .tz_localize('UTC', level='date')
          .swaplevel()
          .dropna()
          .reset_index()
          .drop_duplicates()
          .set_index(['date', 'ticker']))
```

[14]:

```
factor_data = get_clean_factor_and_forward_returns(factor=factor,
                                                   prices=trade_prices,
                                                   quantiles=5,
                                                   periods=(1, 5, 10, 21))
factor_data.sort_index().info()
```

```
Dropped 4.2% entries from factor data: 4.2% in forward returns computation and
0.0% in binning phase (set max_loss=0 to see potentially suppressed Exceptions).
max_loss is 35.0%, not exceeded: OK!
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 454503 entries, (Timestamp('2017-12-05 00:00:00+0000', tz='UTC',
freq='C'), '1332.JP') to (Timestamp('2019-11-28 00:00:00+0000', tz='UTC',
freq='C'), '9990.JP')
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype
---  ------           --------------   -----
 0   1D               454503 non-null  float64
 1   5D               454503 non-null  float64
 2   10D              454503 non-null  float64
 3   21D              454503 non-null  float64
 4   factor           454503 non-null  float64
 5   factor_quantile  454503 non-null  int64
dtypes: float64(5), int64(1)
memory usage: 22.6+ MB
```

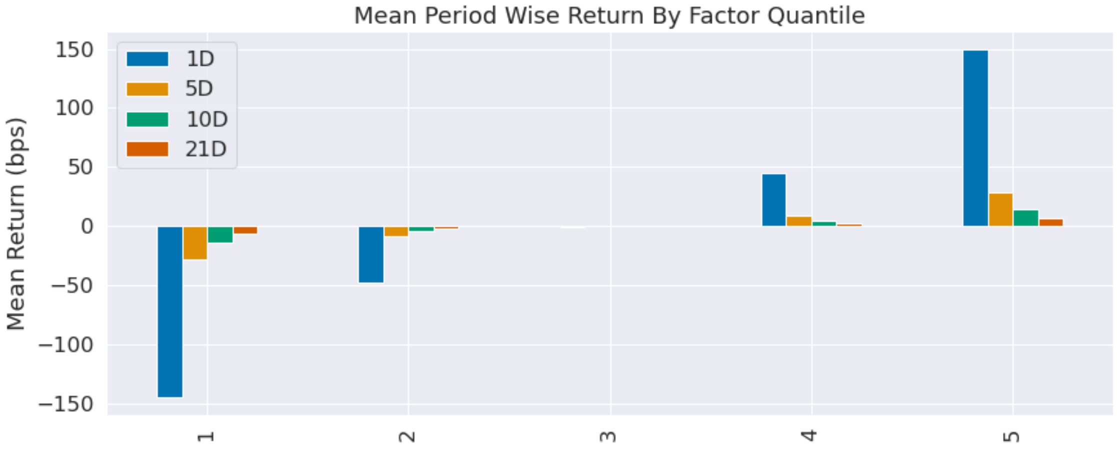
1.2.2 Summary Tearsheet

[15]:

```
create_summary_tear_sheet(factor_data)
```

```
Quantiles Statistics

                      min       max      mean       std  count    count %
factor_quantile
1               -0.091176  0.008467 -0.008580  0.007442  91287  20.085016
2               -0.028925  0.010390 -0.003716  0.005394  90804  19.978746
3               -0.025012  0.014643 -0.001439  0.005304  90804  19.978746
4               -0.022314  0.017857  0.000872  0.005353  90804  19.978746
5               -0.019701  0.116272  0.006104  0.007594  90804  19.978746
```

```
Returns Analysis

                                                 1D      5D      10D     21D
Ann. alpha                                   49.124   1.103    0.438   0.187
beta                                         -0.025  -0.034   -0.021  -0.010
Mean Period Wise Return Top Quantile (bps)  149.785  28.276   13.683   6.365
Mean Period Wise Return Bottom Quantile (bps) -145.333 -28.108 -13.826  -6.570
Mean Period Wise Spread (bps)               295.118  56.390   27.515  12.940

Information Analysis

                        1D      5D     10D     21D
IC Mean              0.662   0.276   0.192   0.130
IC Std.              0.092   0.117   0.120   0.118
Risk-Adjusted IC     7.160   2.350   1.606   1.102
t-stat(IC)         157.363  51.640  35.296  24.225
p-value(IC)          0.000   0.000   0.000   0.000
IC Skew             -1.413  -0.210  -0.175  -0.250
IC Kurtosis          5.265   0.610   0.517   0.684

Turnover Analysis

                               1D     5D    10D    21D
Quantile 1 Mean Turnover    0.767  0.788  0.792  0.785
Quantile 2 Mean Turnover    0.788  0.796  0.798  0.793
Quantile 3 Mean Turnover    0.780  0.788  0.793  0.791
Quantile 4 Mean Turnover    0.790  0.793  0.798  0.797
Quantile 5 Mean Turnover    0.772  0.788  0.790  0.785

                                       1D    5D    10D    21D
Mean Factor Rank Autocorrelation    0.005 -0.01 -0.013  0.005

<Figure size 432x288 with 0 Axes>
```



1.3 Evaluating the Out-of-sample predictions

1.3.1 Prepare Factor Data

[16]:

```
t = 1
predictions = pd.read_hdf(results_path / 'predictions.h5',
                          f'test/{t:02}').drop('y_test', axis=1)
```

[17]:

```
predictions.info()
```

```
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 474264 entries, ('1332.JP', Timestamp('2019-11-29 00:00:00')) to
('9990.JP', Timestamp('2018-01-05 00:00:00'))
Data columns (total 10 columns):
 #   Column  Non-Null Count   Dtype
---  ------  --------------   -----
 0   0       474264 non-null  float64
 1   1       474264 non-null  float64
 2   2       474264 non-null  float64
 3   3       474264 non-null  float64
 4   4       474264 non-null  float64
 5   5       474264 non-null  float64
 6   6       474264 non-null  float64
 7   7       474264 non-null  float64
 8   8       474264 non-null  float64
 9   9       474264 non-null  float64
dtypes: float64(10)
memory usage: 38.1+ MB
```

[18]:

```
factor = (predictions.iloc[:, :10]
                   .mean(1)
                   .sort_index().tz_localize('UTC', level='date').swaplevel().
 ↪dropna())
factor.head()
```

[18]:

```
date                       ticker
2017-12-05 00:00:00+00:00  1332.JP    0.000374
2017-12-06 00:00:00+00:00  1332.JP    0.003322
2017-12-07 00:00:00+00:00  1332.JP    0.000753
2017-12-08 00:00:00+00:00  1332.JP    0.000771
2017-12-11 00:00:00+00:00  1332.JP    0.003113
dtype: float64
```

1.3.2 Select next available trade prices

Using next available prices.

[19]:

```
tickers = factor.index.get_level_values('ticker').unique()
trade_prices = get_trade_prices(tickers)
trade_prices.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1464 entries, 2014-01-06 00:00:00+00:00 to 2019-12-27
00:00:00+00:00
Columns: 941 entries, 1332.JP to 9990.JP
dtypes: float64(941)
memory usage: 10.5 MB
```

1.3.3 Get AlphaLens Inputs

[20]:

```
factor_data = get_clean_factor_and_forward_returns(factor=factor,
                                                   prices=trade_prices,
                                                   quantiles=5,
                                                   periods=(1, 5, 10, 21))
factor_data.sort_index().info()
```

```
Dropped 4.2% entries from factor data: 4.2% in forward returns computation and
0.0% in binning phase (set max_loss=0 to see potentially suppressed Exceptions).
max_loss is 35.0%, not exceeded: OK!
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 454503 entries, (Timestamp('2017-12-05 00:00:00+0000', tz='UTC',
freq='C'), '1332.JP') to (Timestamp('2019-11-28 00:00:00+0000', tz='UTC',
freq='C'), '9990.JP')
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype
---  ------           --------------   -----
 0   1D               454503 non-null  float64
 1   5D               454503 non-null  float64
 2   10D              454503 non-null  float64
 3   21D              454503 non-null  float64
 4   factor           454503 non-null  float64
 5   factor_quantile  454503 non-null  int64
dtypes: float64(5), int64(1)
memory usage: 22.6+ MB
```

1.3.4 Summary Tearsheet

[21]:

```
create_summary_tear_sheet(factor_data)
```

```
Quantiles Statistics

                      min       max      mean       std  count    count %
factor_quantile
1               -0.029771  0.011669 -0.003807  0.005517  91290  20.085676
2               -0.026874  0.011995 -0.002648  0.005337  90826  19.983586
```

```
3                -0.026736  0.019500 -0.001916  0.005400  90781  19.973686
4                -0.026604  0.020725 -0.001161  0.005487  90803  19.978526
5                -0.026292  0.024385  0.000151  0.005752  90803  19.978526

Returns Analysis

                                                  1D     5D    10D    21D
Ann. alpha                                     0.050  0.006  0.003  0.017
beta                                           0.022  0.021  0.016  0.017
Mean Period Wise Return Top Quantile (bps)     2.873  0.712  0.323  0.962
Mean Period Wise Return Bottom Quantile (bps) -1.820 -0.054 -0.516 -1.006
Mean Period Wise Spread (bps)                  4.694  0.765  0.842  1.969

Information Analysis

                      1D     5D    10D    21D
IC Mean            0.010  0.003  0.004  0.017
IC Std.            0.109  0.112  0.109  0.106
Risk-Adjusted IC   0.088  0.027  0.041  0.159
t-stat(IC)         1.925  0.588  0.903  3.495
p-value(IC)        0.055  0.557  0.367  0.001
IC Skew           -0.007  0.162  0.183  0.342
IC Kurtosis        0.975  0.841  0.810  0.647

Turnover Analysis

                               1D     5D    10D    21D
Quantile 1 Mean Turnover    0.712  0.743  0.779  0.797
Quantile 2 Mean Turnover    0.777  0.784  0.792  0.800
Quantile 3 Mean Turnover    0.778  0.787  0.792  0.799
Quantile 4 Mean Turnover    0.774  0.785  0.795  0.800
Quantile 5 Mean Turnover    0.706  0.735  0.777  0.799

                                      1D     5D    10D    21D
Mean Factor Rank Autocorrelation   0.155  0.111  0.033 -0.006

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```

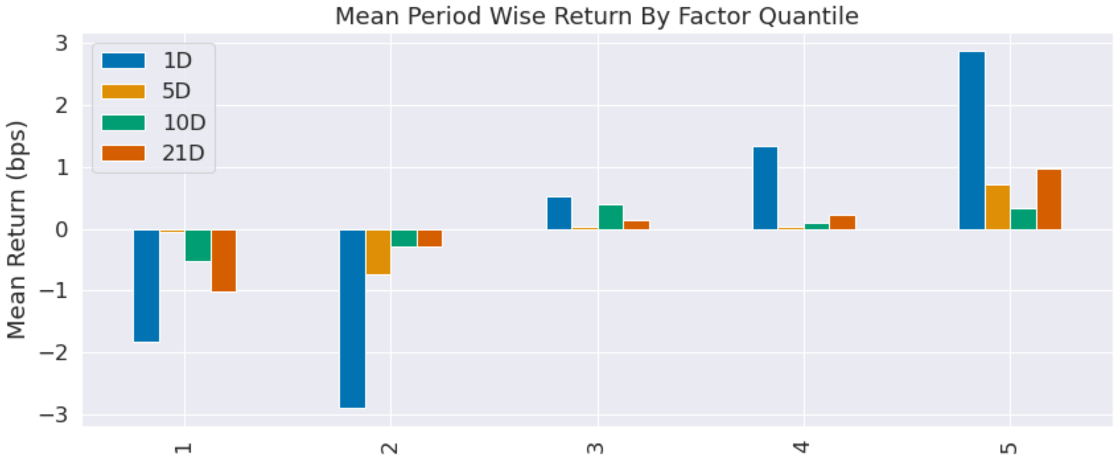
Mean Period Wise Return By Factor Quantile
Mean Return (bps)
1D
5D
10D
21D