06_alphalens_signals_quality

September 29, 2021

1 Testing the signal quality with Alphalens

1.1 Imports & Settings

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

[2]:
```
%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]:
```
sns.set_style('whitegrid')
```

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

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

1.2 Evaluating the Cross-Validation Results

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

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

1.2.1 Get AlphaLens Input

[8]:
```
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

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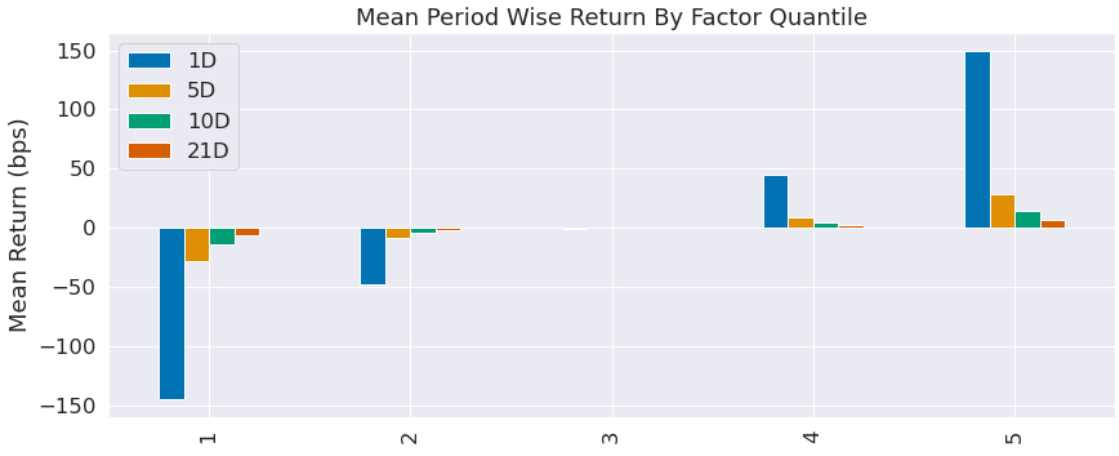

1.3 Evaluating the Out-of-sample predictions

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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