05_alphalens_analysis

September 29, 2021

1 Performance Analysis with Alphalens

1.1 Imports & Settings

[2]:
```
import warnings
warnings.filterwarnings('ignore')
```

[85]:
```
from pathlib import Path
from collections import defaultdict
from time import time

import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

from alphalens.tears import (create_returns_tear_sheet,
                             create_summary_tear_sheet,
                             create_full_tear_sheet)

from alphalens import plotting
from alphalens import performance as perf
from alphalens import utils
```

[3]:
```
sns.set_style('whitegrid')
np.random.seed(42)
idx = pd.IndexSlice
```

[12]:
```
DATA_STORE = Path('..', 'data', 'assets.h5')
```

1.2 Alphalens Analysis

1.2.1 Get trade prices

[53]:
```
def get_trade_prices(tickers):
    return (pd.read_hdf(DATA_STORE, 'quandl/wiki/prices')
              .loc[idx['2006':'2017', tickers], 'adj_open']
              .unstack('ticker')
```

```
            .sort_index()
           .shift(-1)
           .tz_localize('UTC'))
```

[54]:
```
trade_prices = get_trade_prices(tickers)
```

[55]:
```
trade_prices.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 3020 entries, 2006-01-03 to 2017-12-29
Columns: 500 entries, A to ZION
dtypes: float64(500)
memory usage: 11.5 MB
```

1.2.2 Load factors

[50]:
```
factors = (pd.concat([pd.read_hdf('data.h5', 'factors/common'),
                      pd.read_hdf('data.h5', 'factors/formulaic')
                      .rename(columns=lambda x: f'alpha_{int(x):03}')],
                     axis=1)
           .dropna(axis=1, thresh=100000)
           .sort_index())
```

[51]:
```
factors.info()
```

```
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 1255093 entries, (A, 2007-01-04 00:00:00) to (ZION, 2016-12-29
00:00:00)
Columns: 135 entries, sector to alpha_101
dtypes: float64(124), int64(11)
memory usage: 1.3+ GB
```

[52]:
```
tickers = factors.index.get_level_values('ticker').unique()
```

[71]:
```
alpha = 'alpha_054'
```

[72]:
```
factor = (factors[alpha]
          .unstack('ticker')
          .stack()
          .tz_localize('UTC', level='date')
          .sort_index())
```

1.2.3 Generate Alphalens input data

[74]:
```
factor_data = utils.get_clean_factor_and_forward_returns(factor=factor,
                                                         prices=trade_prices,
                                                         quantiles=5,
                                                         max_loss=0.35,
                                                         periods=(1, 5, 10)).
↪sort_index()
factor_data.info()
```

```
Dropped 0.5% entries from factor data: 0.0% in forward returns computation and
0.4% 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: 1249360 entries, (2007-01-04 00:00:00+00:00, A) to (2016-12-29
00:00:00+00:00, ZION)
Data columns (total 5 columns):
1D                 1249360 non-null float64
5D                 1249360 non-null float64
10D                1249360 non-null float64
factor             1249360 non-null float64
factor_quantile    1249360 non-null float64
dtypes: float64(5)
memory usage: 52.4+ MB
```

1.2.4 Compute Metrics

[98]:
```
mean_quant_ret_bydate, std_quant_daily = perf.mean_return_by_quantile(
    factor_data,
    by_date=True,
    by_group=False,
    demeaned=True,
    group_adjust=False,
)

mean_quant_rateret_bydate = mean_quant_ret_bydate.apply(
    rate_of_return,
    base_period=mean_quant_ret_bydate.columns[0],
)

compstd_quant_daily = std_quant_daily.apply(std_conversion,
                                            base_period=std_quant_daily.
↪columns[0])

alpha_beta = perf.factor_alpha_beta(factor_data,
                                    demeaned=True)
```

```
mean_ret_spread_quant, std_spread_quant = perf.compute_mean_returns_spread(
    mean_quant_rateret_bydate,
    factor_data["factor_quantile"].max(),
    factor_data["factor_quantile"].min(),
    std_err=compstd_quant_daily,
)
```

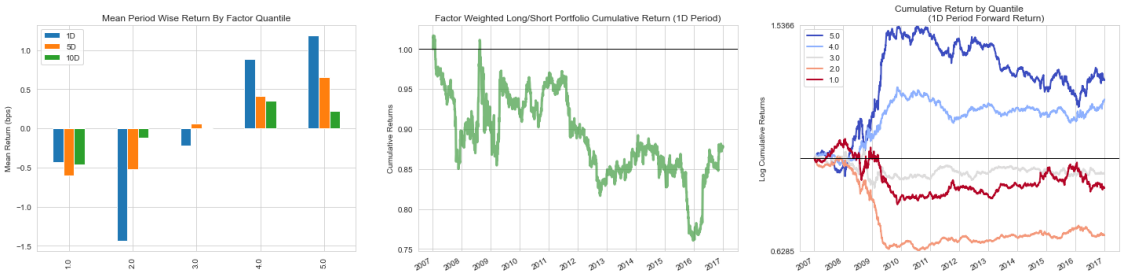
[100]:
```
mean_ret_spread_quant.mean().mul(10000).to_frame('Mean Period Wise Spread␣
↪(bps)').join(alpha_beta.T).T
```

[100]:

	1D	5D	10D
Mean Period Wise Spread (bps)	1.616562	1.239560	0.685174
Ann. alpha	-0.017286	0.011855	0.012242
beta	0.056012	0.053415	0.044731

1.2.5 Plot spread and cumulative returns

[95]:
```
fig, axes = plt.subplots(ncols=3, figsize=(20, 5))

mean_quant_ret, std_quantile = mean_return_by_quantile(factor_data,
                                                       by_group=False,
                                                       demeaned=True)

mean_quant_rateret = mean_quant_ret.apply(rate_of_return, axis=0,
                                          base_period=mean_quant_ret.columns[0])

plot_quantile_returns_bar(mean_quant_rateret, ax=axes[0])


factor_returns = perf.factor_returns(factor_data)

title = "Factor Weighted Long/Short Portfolio Cumulative Return (1D Period)"
plotting.plot_cumulative_returns(factor_returns['1D'],
                                 period='1D',
                                 freq=pd.tseries.offsets.BDay(),
                                 title=title,
                                 ax=axes[1])

plotting.plot_cumulative_returns_by_quantile(mean_quant_ret_bydate['1D'],
                                             freq=pd.tseries.offsets.BDay(),
                                             period='1D',
                                             ax=axes[2])
fig.tight_layout();
```



1.2.6 Create Tearsheet

[77]:
```
create_summary_tear_sheet(factor_data)
```

Quantiles Statistics

factor_quantile	min	max	mean	std	count	\
1.0	-564576.097386	-0.053881	-1558.250338	7272.525816	250286	
2.0	-84.567946	-0.029206	-2.659084	2.541298	249845	
3.0	-13.157136	-0.019221	-1.325346	1.035789	249408	
4.0	-5.569446	-0.001684	-0.749801	0.586770	249775	
5.0	-3.371885	12.567973	-0.323038	0.323306	250046	

factor_quantile	count %
1.0	20.033137
2.0	19.997839
3.0	19.962861
4.0	19.992236
5.0	20.013927

Returns Analysis

	1D	5D	10D
Ann. alpha	-0.017	0.012	0.012
beta	0.056	0.053	0.045
Mean Period Wise Return Top Quantile (bps)	1.187	0.651	0.224
Mean Period Wise Return Bottom Quantile (bps)	-0.429	-0.599	-0.465
Mean Period Wise Spread (bps)	1.617	1.240	0.685

Information Analysis

	1D	5D	10D
IC Mean	0.002	0.002	0.002
IC Std.	0.118	0.114	0.110
Risk-Adjusted IC	0.018	0.018	0.018
t-stat(IC)	0.911	0.894	0.915
p-value(IC)	0.362	0.372	0.360

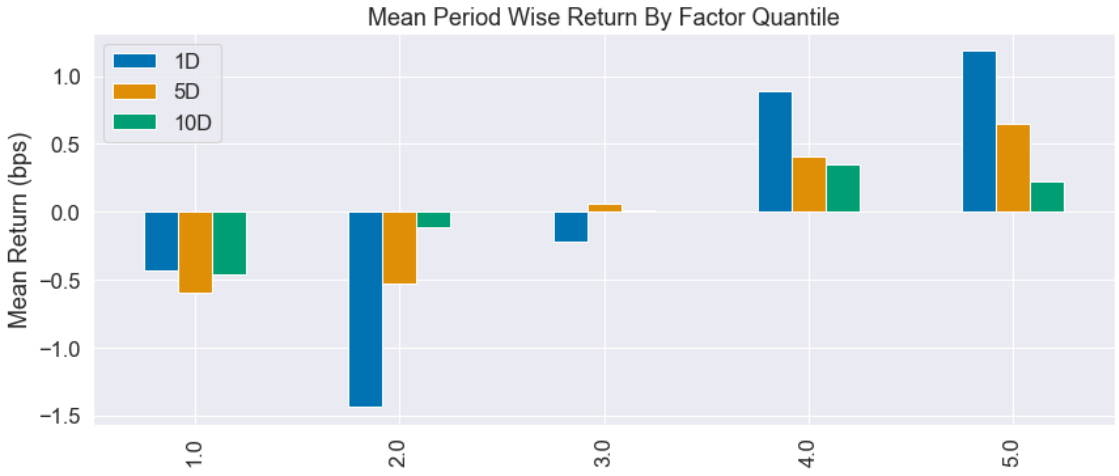
```
IC Skew           0.010  0.036  0.077
IC Kurtosis       0.446  0.559  0.684
```

```
Turnover Analysis
```

```
                            10D     1D     5D
Quantile 1 Mean Turnover   0.795  0.791  0.795
Quantile 2 Mean Turnover   0.798  0.798  0.797
Quantile 3 Mean Turnover   0.797  0.795  0.797
Quantile 4 Mean Turnover   0.800  0.797  0.798
Quantile 5 Mean Turnover   0.788  0.792  0.788
```

```
                                    1D    5D   10D
Mean Factor Rank Autocorrelation  0.006  0.01  0.01
```

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



[ ]: