

Lecture 12 Technical Signals

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1 Momentum

```
[20]: import pandas as pd
import numpy as np
import pandas_datareader as pdr

asset = pdr.get_data_famafrench('5_Industry_Portfolios', start='2000',
    →end='2020')
factor = pdr.get_data_famafrench('F-F_Research_Data_Factors', start='2000',
    →end='2020')
asset = asset[0]/100
factor = factor[0]/100

(1+asset).rolling(6).apply(np.prod).head(10)
```

```
[20]:
```

| | Cnsmr | Manuf | HiTec | Hlth | Other |
|---------|----------|----------|----------|----------|----------|
| Date | | | | | |
| 2000-01 | NaN | NaN | NaN | NaN | NaN |
| 2000-02 | NaN | NaN | NaN | NaN | NaN |
| 2000-03 | NaN | NaN | NaN | NaN | NaN |
| 2000-04 | NaN | NaN | NaN | NaN | NaN |
| 2000-05 | NaN | NaN | NaN | NaN | NaN |
| 2000-06 | 0.932043 | 0.981400 | 1.010403 | 1.277979 | 0.981895 |
| 2000-07 | 1.012135 | 1.023944 | 0.999395 | 1.115172 | 1.086771 |
| 2000-08 | 1.050747 | 1.164125 | 0.970725 | 1.189379 | 1.277143 |
| 2000-09 | 0.968508 | 1.073956 | 0.805582 | 1.229815 | 1.122314 |
| 2000-10 | 1.007956 | 1.067189 | 0.842872 | 1.198743 | 1.145715 |

2 Max

```
[2]: asset_d = pdr.get_data_famafrench('10_Industry_Portfolios_daily', start='2018',
    ↪end='2020')
    factor_d = pdr.get_data_famafrench('F-F_Research_Data_Factors_daily',
    ↪start='2018', end='2020')
    asset_d = asset_d[0]/100
    factor_d = factor_d[0]/100

    asset_d.resample("M").max().head()
```

```
[2]:
```

| | NoDur | Durbl | Manuf | Enrgy | HiTec | Telcm | Shops | Hlth | \ |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|---|
| Date | | | | | | | | | |
| 2018-01-31 | 0.0138 | 0.0185 | 0.0120 | 0.0208 | 0.0165 | 0.0153 | 0.0141 | 0.0233 | |
| 2018-02-28 | 0.0130 | 0.0299 | 0.0168 | 0.0231 | 0.0240 | 0.0149 | 0.0227 | 0.0162 | |
| 2018-03-31 | 0.0137 | 0.0231 | 0.0234 | 0.0284 | 0.0374 | 0.0137 | 0.0289 | 0.0197 | |
| 2018-04-30 | 0.0160 | 0.0267 | 0.0174 | 0.0337 | 0.0235 | 0.0154 | 0.0228 | 0.0185 | |
| 2018-05-31 | 0.0128 | 0.0177 | 0.0142 | 0.0323 | 0.0184 | 0.0176 | 0.0131 | 0.0152 | |

| | Utils | Other |
|------------|--------|--------|
| Date | | |
| 2018-01-31 | 0.0103 | 0.0094 |
| 2018-02-28 | 0.0251 | 0.0202 |
| 2018-03-31 | 0.0181 | 0.0285 |
| 2018-04-30 | 0.0148 | 0.0151 |
| 2018-05-31 | 0.0120 | 0.0157 |

3 IVol and ISkew

```
[3]: import time
import statsmodels.api as sm
from tqdm.notebook import tqdm

ER_d = asset_d.subtract(factor_d.RF, axis=0)
```

```
[4]: start_time = time.time()

IVol = pd.DataFrame(index=asset_d.resample("M").last().index, columns=asset_d.
    ↳columns)
ISkew = pd.DataFrame(index=asset_d.resample("M").last().index, columns=asset_d.
    ↳columns)

for ym in tqdm(factor_d.index.strftime('%Y-%m').unique()):

    X = factor_d.loc[ym, "Mkt-RF": "HML"]
    X.insert(0, 'Const', 1.0)
    for c in ER_d.columns:
        Y = ER_d.loc[ym, c]
        res = sm.OLS(Y, X).fit()
        IVol.loc[ym, c] = np.sqrt(res.mse_resid)
        ISkew.loc[ym, c] = res.resid.skew()

print("--- %s seconds ---" % (time.time() - start_time))
IVol.tail()
```

```
[4]:
```

| | NoDur | Durbl | Manuf | Enrgy | HiTec | Telcm \ |
|------------|----------|----------|----------|----------|----------|----------|
| Date | | | | | | |
| 2019-08-31 | 0.004581 | 0.004981 | 0.002009 | 0.005255 | 0.002568 | 0.004247 |
| 2019-09-30 | 0.004146 | 0.006403 | 0.002908 | 0.009819 | 0.002278 | 0.004058 |
| 2019-10-31 | 0.003945 | 0.007753 | 0.003556 | 0.007451 | 0.002635 | 0.004872 |
| 2019-11-30 | 0.002507 | 0.004507 | 0.002826 | 0.009915 | 0.001515 | 0.006182 |
| 2019-12-31 | 0.002685 | 0.006066 | 0.002797 | 0.006062 | 0.001429 | 0.002607 |

| | Shops | Hlth | Utils | Other |
|------------|----------|----------|----------|----------|
| Date | | | | |
| 2019-08-31 | 0.003151 | 0.003329 | 0.003393 | 0.001743 |
| 2019-09-30 | 0.003017 | 0.003601 | 0.00436 | 0.002034 |
| 2019-10-31 | 0.003145 | 0.003935 | 0.005947 | 0.001682 |
| 2019-11-30 | 0.003553 | 0.003956 | 0.004867 | 0.001744 |
| 2019-12-31 | 0.003237 | 0.002807 | 0.004589 | 0.000989 |

```
[5]: ISkew.tail()
```

```
[5]:
```

| | NoDur | Durbl | Manuf | Enrgy | HiTec | Telcm \ |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Date | | | | | | |
| 2019-08-31 | -0.189601 | 0.0909 | 0.920808 | 0.357438 | -0.875268 | -1.370331 |
| 2019-09-30 | -0.501131 | 0.147982 | -0.151804 | 1.687802 | 0.360004 | -0.410888 |
| 2019-10-31 | 0.575442 | 0.499235 | 0.247756 | -0.261178 | -0.352617 | -1.045111 |
| 2019-11-30 | -0.080936 | -0.458555 | 0.070123 | -0.287368 | -0.282737 | -0.002084 |
| 2019-12-31 | 0.121819 | 0.502792 | -0.326096 | 0.091468 | -0.256855 | -0.548939 |

| | Shops | Hlth | Utils | Other |
|------------|-----------|-----------|-----------|-----------|
| Date | | | | |
| 2019-08-31 | 0.149629 | 0.488632 | -0.957873 | -0.239642 |
| 2019-09-30 | -0.673692 | 0.236155 | 0.733967 | 1.155922 |
| 2019-10-31 | -0.027607 | 0.44157 | -0.628686 | -0.293493 |
| 2019-11-30 | -0.408933 | -0.234207 | 0.073662 | 0.058977 |
| 2019-12-31 | 1.208317 | -0.07132 | -0.81517 | 0.23533 |

4 Coskew

```
[6]: start_time = time.time()

Coskew = pd.DataFrame(index=asset.index, columns=asset.columns)

exog = factor[['Mkt-RF']]
exog.insert(0, 'Const', 1.0)
endog = asset.subtract(factor.RF, axis=0)

winsize = 60
for t in tqdm(range(winsize, len(exog)+1)):
    X = exog.iloc[t-winsize:t,:]
    Y = endog.iloc[t-winsize:t,:]
    eps_m = X['Mkt-RF'].subtract(X['Mkt-RF'].mean())

    for i in range(0, len(endog.columns)):
        res = sm.OLS(Y.iloc[:,i],X).fit()
        eps_i = res.resid
        Coskew.iloc[t-1,i] = np.mean(eps_i * (eps_m**2)) / (np.sqrt(np.
→mean(eps_i**2)) * np.mean(eps_m**2))

print("--- %s seconds ---" % (time.time() - start_time))

Coskew.tail()
```

```
[6]:
```

| | Cnsmr | Manuf | HiTec | Hlth | Other |
|---------|-----------|----------|----------|-----------|----------|
| Date | | | | | |
| 2019-09 | -0.176835 | 0.041361 | 0.190978 | -0.237318 | 0.006547 |
| 2019-10 | -0.163422 | 0.052327 | 0.180948 | -0.239758 | 0.005041 |
| 2019-11 | -0.150637 | 0.029775 | 0.184945 | -0.233446 | 0.006468 |
| 2019-12 | -0.147444 | 0.035983 | 0.167369 | -0.239895 | 0.024239 |
| 2020-01 | -0.154859 | 0.068083 | 0.139458 | -0.224085 | 0.029352 |

References

- [1] Andrew Ang, Robert Hodrick, Yuhang Xing, Xiaoyan Zhang (2006) "The Cross-Section of Volatility and Expected Returns", *The Journal of Finance*, 61(1): 259–299.
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- [3] Brian Boyer, Todd Mitton, Keith Vorkink (2010) "Expected Idiosyncratic Skewness", *The Review of Financial Studies*, 23(1): 169–202.
- [4] Eugene Fama and Kenneth French (1993) "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, 33(1): 3–56.
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