Factor_Analysis

September 29, 2021

1 Factor Analysis Portfolio

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import math

import warnings
warnings.filterwarnings("ignore")

# fix_yahoo_finance is used to fetch data
import fix_yahoo_finance as yf
yf.pdr_override()
```

[2]:
```
# input
symbols = ['AAPL','MSFT','AMD','NVDA']
start = '2012-01-01'
end = '2019-09-11'
```

[3]:
```
df = pd.DataFrame()
for s in symbols:
    df[s] = yf.download(s,start,end)['Adj Close']
```

```
[**********************100%**********************]  1 of 1 downloaded
[**********************100%**********************]  1 of 1 downloaded
[**********************100%**********************]  1 of 1 downloaded
[**********************100%**********************]  1 of 1 downloaded
```

[4]:
```
df.head()
```

[4]:

Date	AAPL	MSFT	AMD	NVDA
2012-01-03	51.269413	22.156071	5.48	12.939396
2012-01-04	51.544937	22.677486	5.46	13.086854
2012-01-05	52.117188	22.909233	5.46	13.556875
2012-01-06	52.662014	23.265116	5.43	13.400198

```
2012-01-09  52.578468  22.958887  5.59  13.400198
```

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

[5]:
```
                  AAPL        MSFT        AMD        NVDA
Date
2019-09-05  213.279999  140.050003  31.500000  179.740005
2019-09-06  213.259995  139.100006  30.559999  178.649994
2019-09-09  214.169998  137.520004  30.500000  180.500000
2019-09-10  216.699997  136.080002  30.230000  183.179993
2019-09-11  223.589996  136.119995  29.760000  184.330002
```

[6]:
```
from factor_analyzer import FactorAnalyzer
```

[7]:
```
fa = FactorAnalyzer(rotation=None)
```

[8]:
```
fa.fit(df)
```

[8]:
```
FactorAnalyzer(bounds=(0.005, 1), impute='median', is_corr_matrix=False,
        method='minres', n_factors=3, rotation=None, rotation_kwargs={},
        use_smc=True)
```

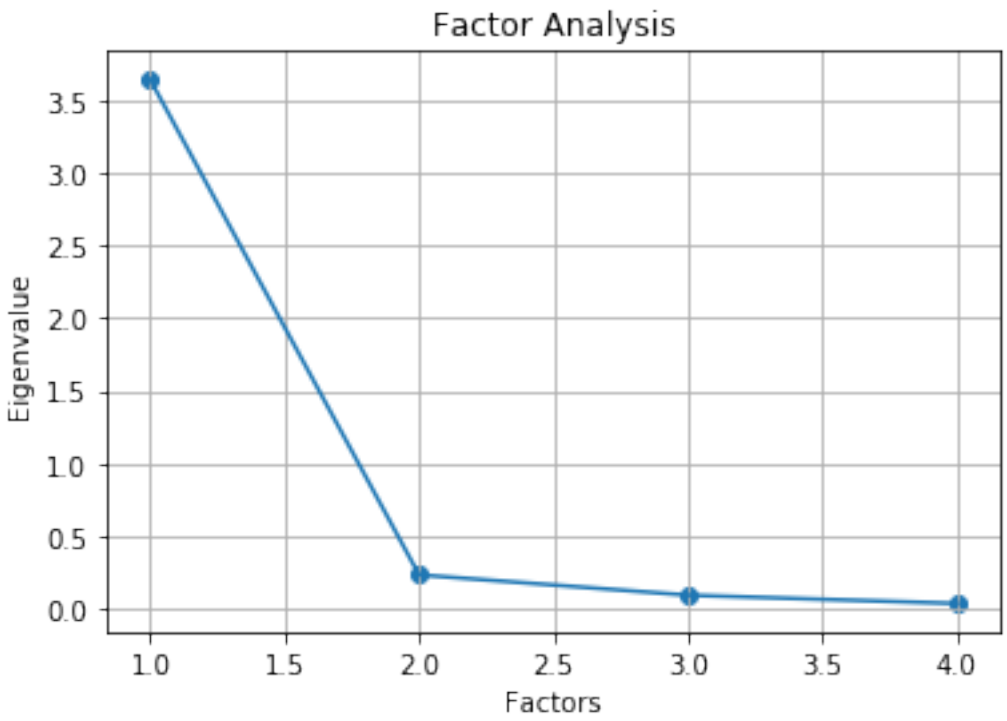
[9]:
```
fa.get_communalities()
```

[9]:
```
array([0.97268878, 0.99475467, 0.87073182, 0.86050823])
```

[20]:
```
ev, v = fa.get_eigenvalues()
ev
```

[20]:
```
array([3.64585553, 0.23044865, 0.09047303, 0.03322279])
```

[21]:
```
plt.scatter(range(1,df.shape[1]+1),ev)
plt.plot(range(1,df.shape[1]+1),ev)
plt.title('Factor Analysis')
plt.xlabel('Factors')
plt.ylabel('Eigenvalue')
plt.grid()
plt.show()
```



[10]:
```
from factor_analyzer.factor_analyzer import calculate_bartlett_sphericity
chi_square_value,p_value=calculate_bartlett_sphericity(df)
chi_square_value, p_value
```

[10]: (11558.982758095883, 0.0)

[11]:
```
from factor_analyzer.factor_analyzer import calculate_kmo
kmo_all,kmo_model=calculate_kmo(df)
```

[12]:
```
kmo_model
```

[12]: 0.7960086410757489

[13]:
```
from factor_analyzer import (ConfirmatoryFactorAnalyzer,
↪ModelSpecificationParser)
```

[14]:
```
model_spec = ModelSpecificationParser.parse_model_specification_from_dict(df)
```

[15]:
```
cfa = ConfirmatoryFactorAnalyzer(model_spec, disp=False)
```

[16]:
```
cfa.fit(df.values)
```

[16]:
```
ConfirmatoryFactorAnalyzer(bounds=None, disp=False, impute='median',
                is_cov_matrix=False, max_iter=200, n_obs=1935,
specification=<factor_analyzer.confirmatory_factor_analyzer.ModelSpecification
object at 0x0000018224B65278>,
                tol=None)
```

[17]:
```
cfa.loadings_
```

[17]:
```
array([[1.46526724, 1.46526736, 1.46526718, 1.4652684 ],
       [0.88884701, 0.8888463 , 0.88884723, 0.88884605],
       [0.09607419, 0.0960753 , 0.09607442, 0.09607403],
       [2.36864499, 2.36864292, 2.36864517, 2.36864525]])
```

[18]:
```
cfa.factor_varcovs_
```

[18]:
```
array([[1.        , 6.91758045, 6.91758839, 6.91752822],
       [6.91758045, 1.        , 6.91775377, 6.91769158],
       [6.91758839, 6.91775377, 1.        , 6.91771481],
       [6.91752822, 6.91769158, 6.91771481, 1.        ]])
```

[19]:
```
cfa.transform(df.values)
```

[19]:
```
array([[  3717151.62284127,  -5538394.40105194,   3989013.91270873,
         -2167807.78566406],
       [  3751308.29182493,  -5503202.49454121,   4067244.67896649,
         -2315386.93769271],
       [  3701409.57386969,  -5455250.20980751,   4000948.68926051,
         -2247144.2377661 ],
       …,
       [ -4851642.58724023,  19844473.81027293,    886569.48048959,
        -15879331.92596557],
       [ -5337722.68804131,  19714846.10185819,    -47453.6896819 ,
        -14329600.22115603],
       [ -6654899.711953  ,  20658818.77332188,  -1952900.25663411,
        -12050947.44646332]])
```