Protective_Mask_Maker_Portfolio

September 29, 2021

1 Protective Mask Maker Portfolio Risk and Returns (Coronavirus)

[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 yfinance as yf
yf.pdr_override()
```

[2]:
```
# input
# Protective Mask Maker Stocks
symbols = ['APT','LAKE','MMM','ETSY','HON','GPS','RL','HBI']
start = '2019-12-01'
end = '2020-05-13'
```

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

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

[4]:
```
from datetime import datetime
from dateutil import relativedelta
```

```
d1 = datetime.strptime(start, "%Y-%m-%d")
d2 = datetime.strptime(end, "%Y-%m-%d")
delta = relativedelta.relativedelta(d2,d1)
print('How many years of investing?')
print('%s years' % delta.years)
```

```
How many years of investing?
0 years
```

[5]:
```
number_of_years = delta.years
```

[6]:
```
days = (df.index[-1] - df.index[0]).days
days
```

[6]:
```
162
```

[7]:
```
df.head()
```

[7]:

Date	APT	LAKE	MMM	ETSY	HON	GPS	RL	HBI
2019-12-02	3.31	10.19	166.759888	43.119999	173.381561	15.386941	105.164062	15.031661
2019-12-03	3.30	10.36	163.687698	42.630001	171.621094	14.921246	103.913742	14.447811
2019-12-04	3.20	10.33	165.640030	42.139999	172.277542	15.253883	107.005074	14.566561
2019-12-05	3.30	10.10	162.894882	41.070000	173.073227	15.491484	110.322823	14.705100
2019-12-06	3.27	10.08	169.931168	41.230000	174.515427	15.462973	109.938873	14.813954

[8]:
```
df.tail()
```

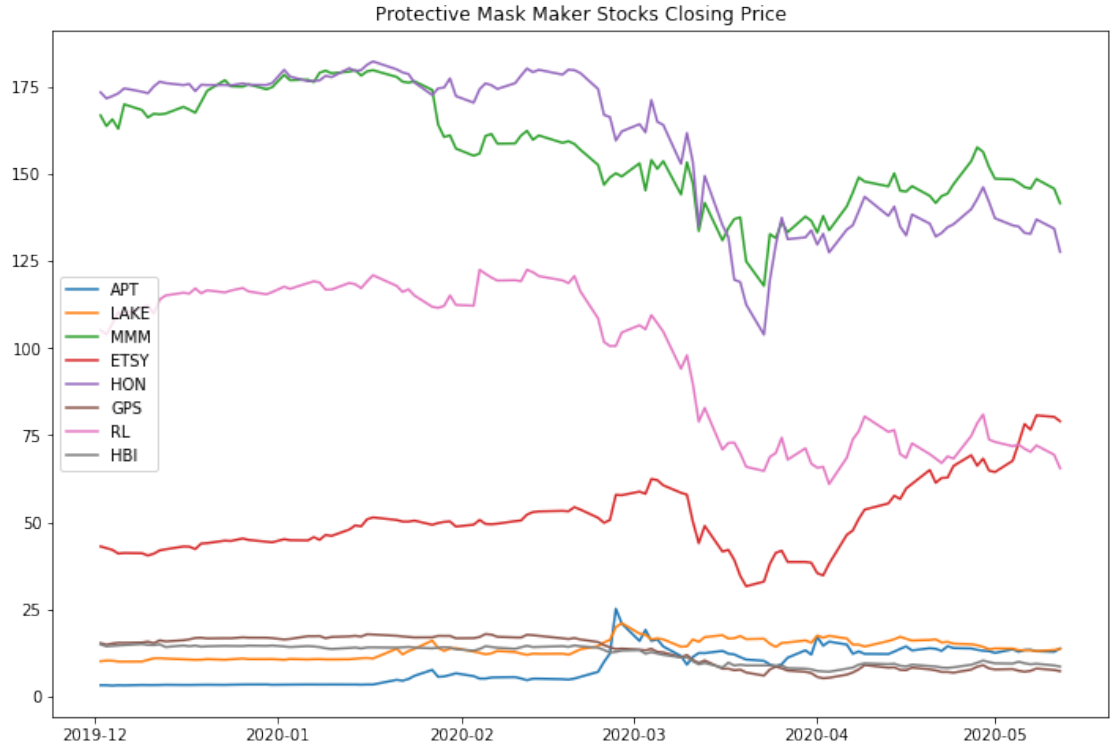
[8]:

Date	APT	LAKE	MMM	ETSY	HON	GPS	RL	HBI
2020-05-06	13.42	13.36	146.199997	78.239998	133.039993	7.17	71.129997	
2020-05-07	13.50	13.31	145.740005	76.589996	132.789993	7.42	70.230003	
2020-05-08	13.05	13.11	148.509995	80.709999	136.910004	8.10	72.080002	
2020-05-11	12.88	13.41	145.729996	80.279999	134.279999	7.67	69.410004	
2020-05-12	13.84	13.76	141.520004	79.019997	127.589996	7.32	65.529999	

```
2020-05-06  9.60
2020-05-07  9.31
2020-05-08  9.47
2020-05-11  8.97
2020-05-12  8.65
```

[9]:
```
plt.figure(figsize=(12,8))
plt.plot(df)
plt.title('Protective Mask Maker Stocks Closing Price')
plt.legend(labels=df.columns)
```

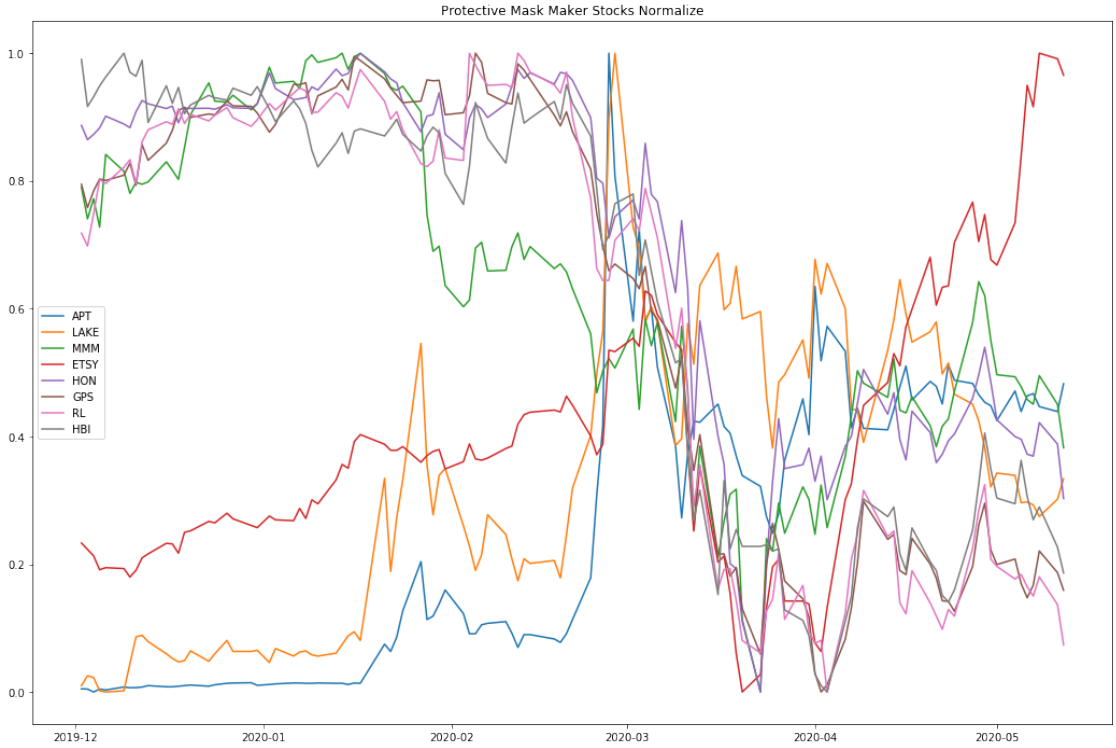
[9]: <matplotlib.legend.Legend at 0x27196d75128>



[10]:
```
# Normalize the data
normalize = (df - df.min())/ (df.max() - df.min())
```

[11]:
```
plt.figure(figsize=(18,12))
plt.plot(normalize)
plt.title('Protective Mask Maker Stocks Normalize')
plt.legend(labels=normalize.columns)
```

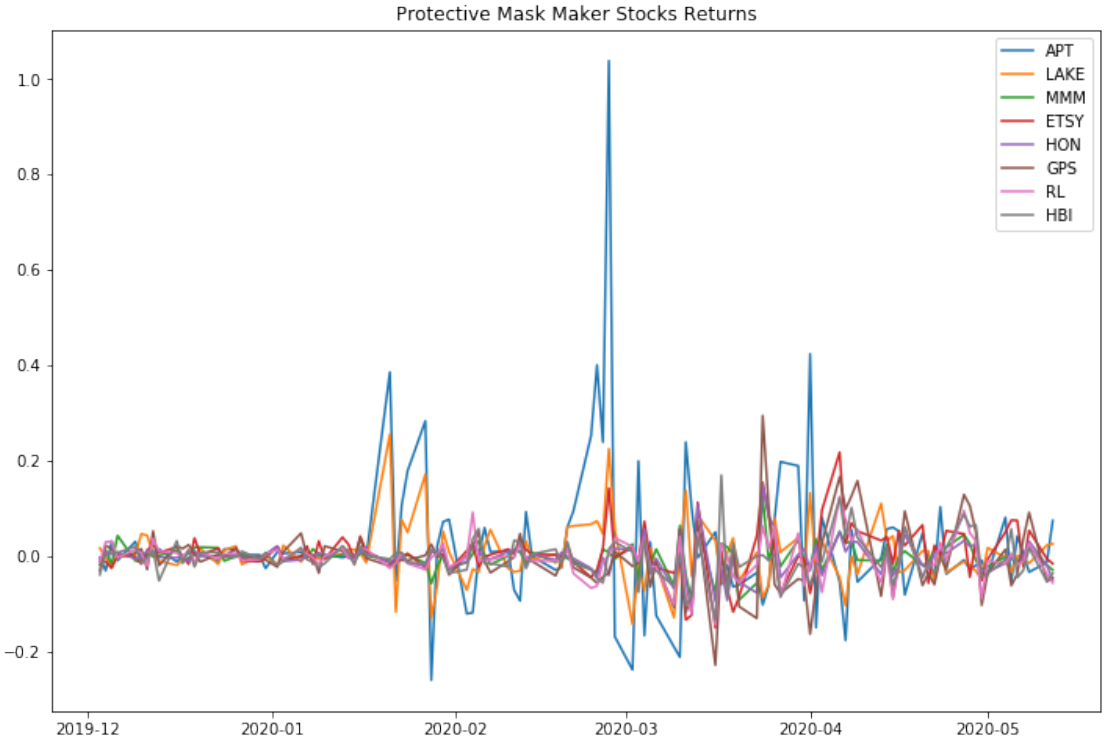
[11]: <matplotlib.legend.Legend at 0x27196dd17b8>



[12]:
```
stock_rets = df.pct_change().dropna()
```

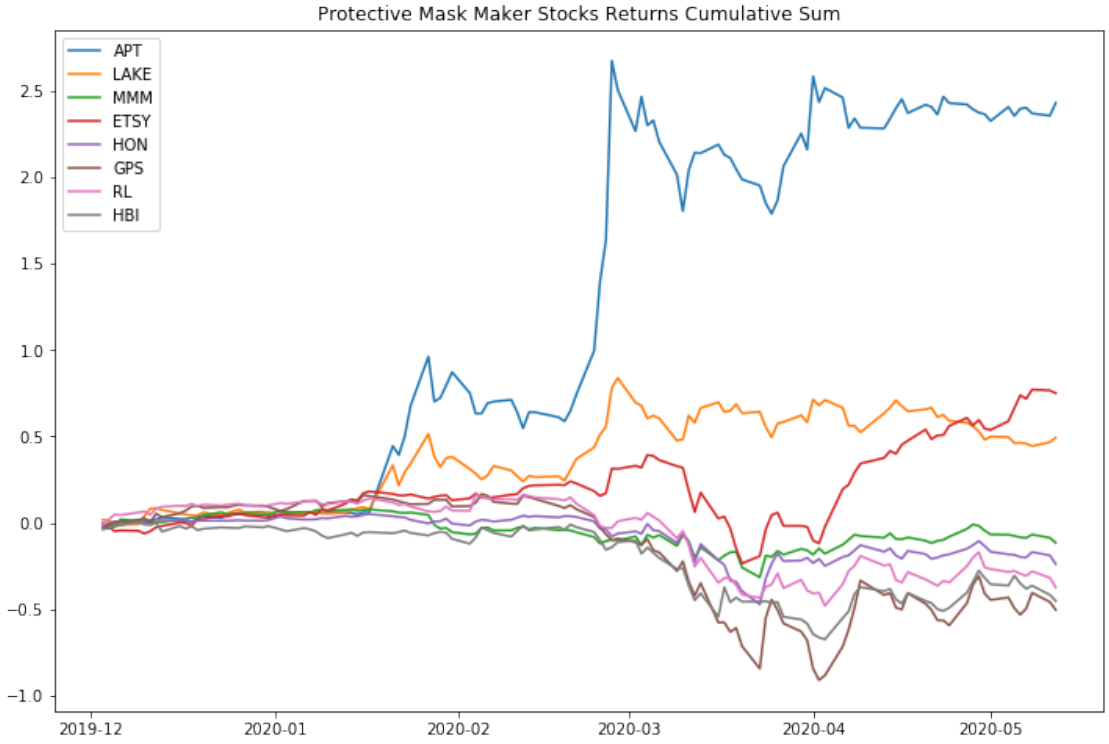
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Protective Mask Maker Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x27196e318d0>

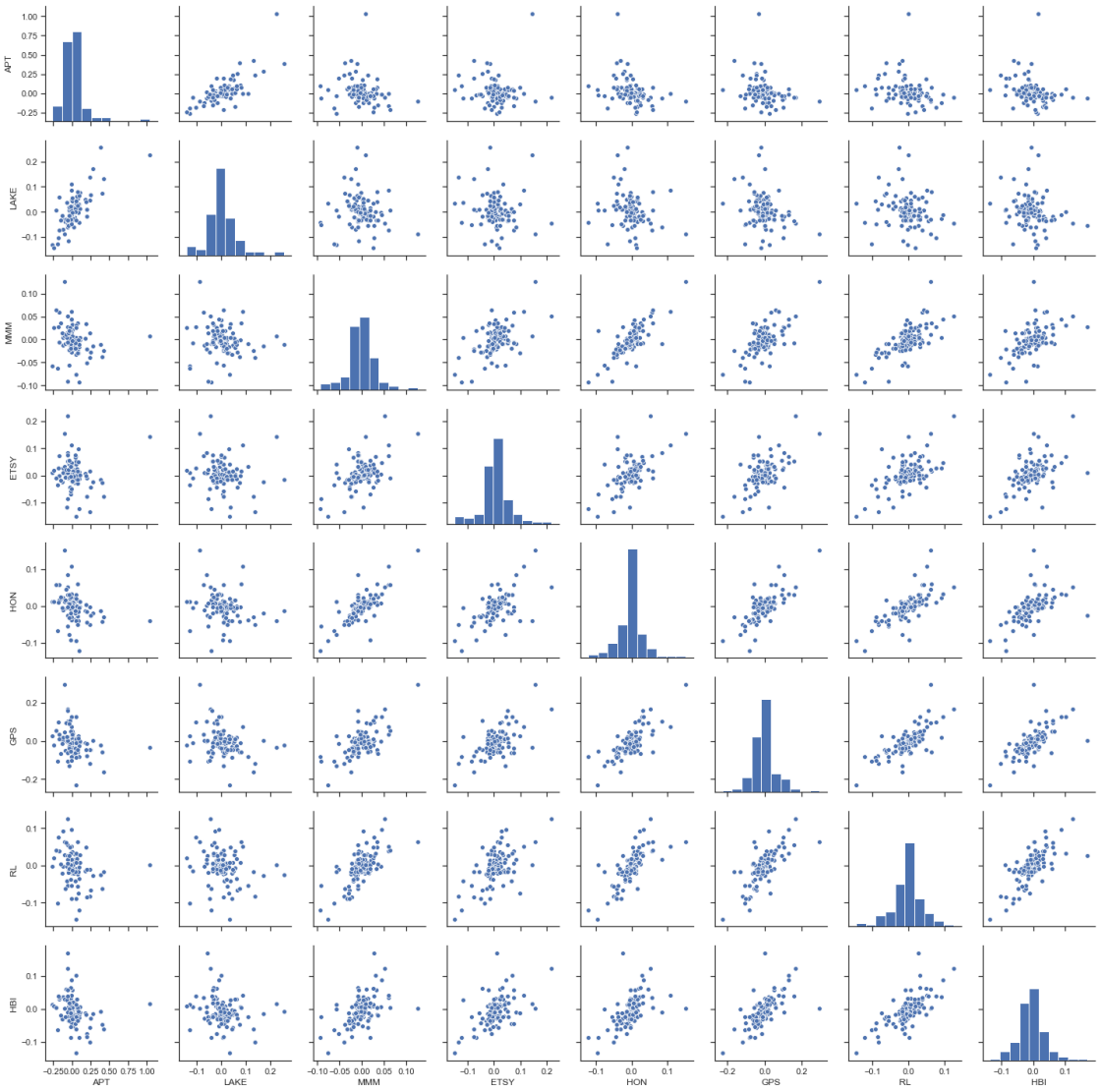


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Protective Mask Maker Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

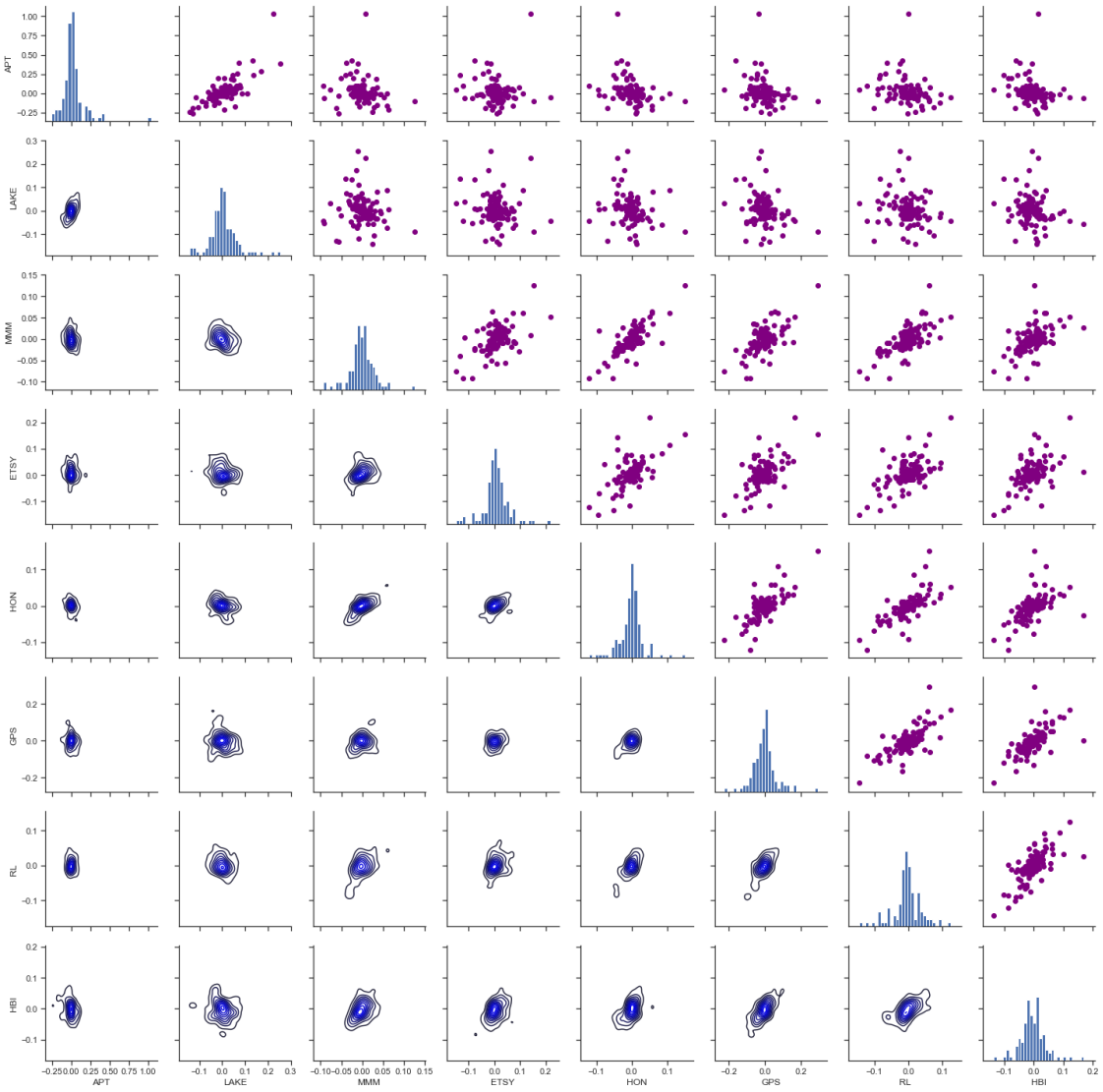
[14]: <matplotlib.legend.Legend at 0x27196e90940>



[15]:
```
sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

nplot = len(stock_rets.columns)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```

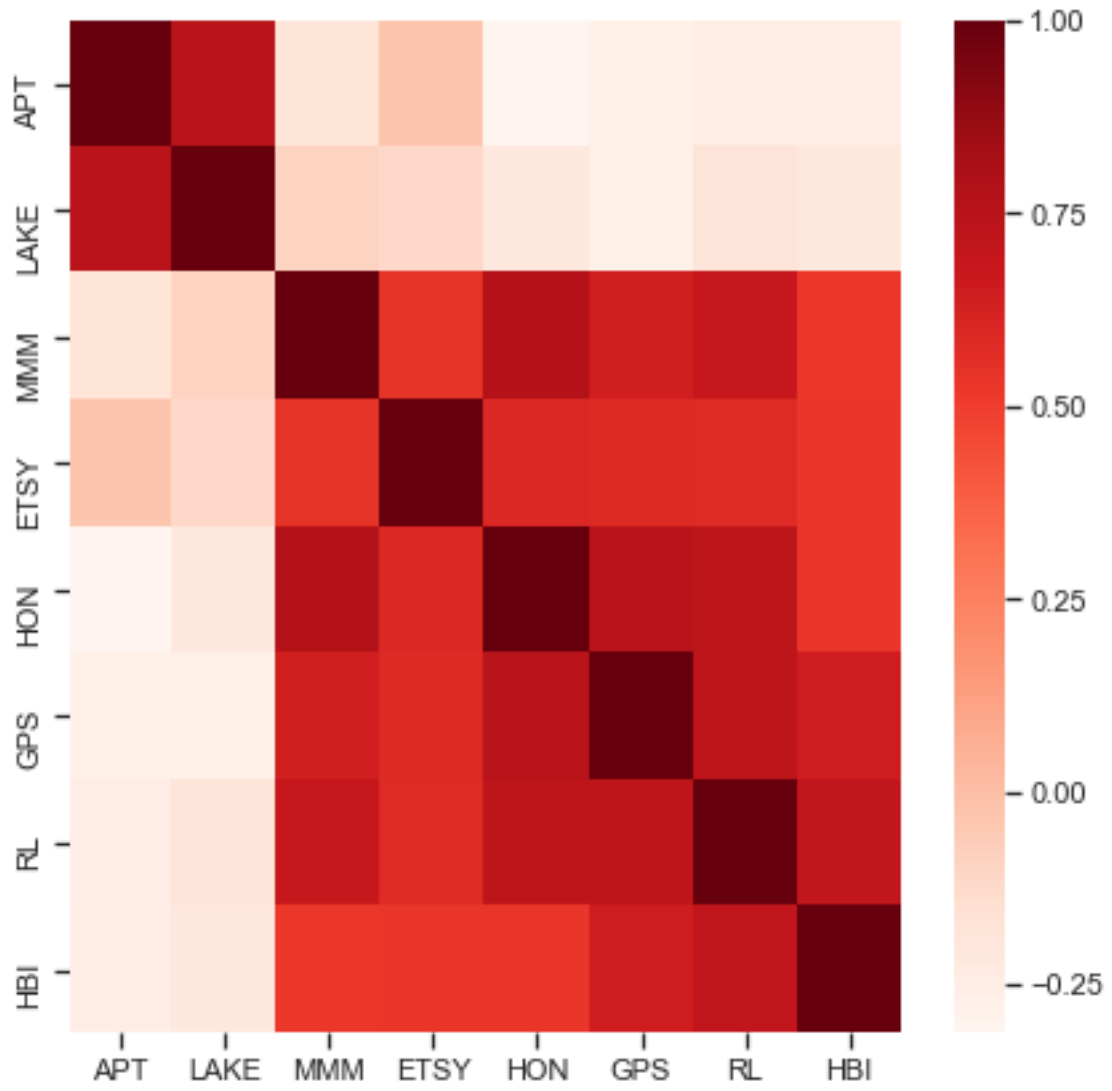


[16]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



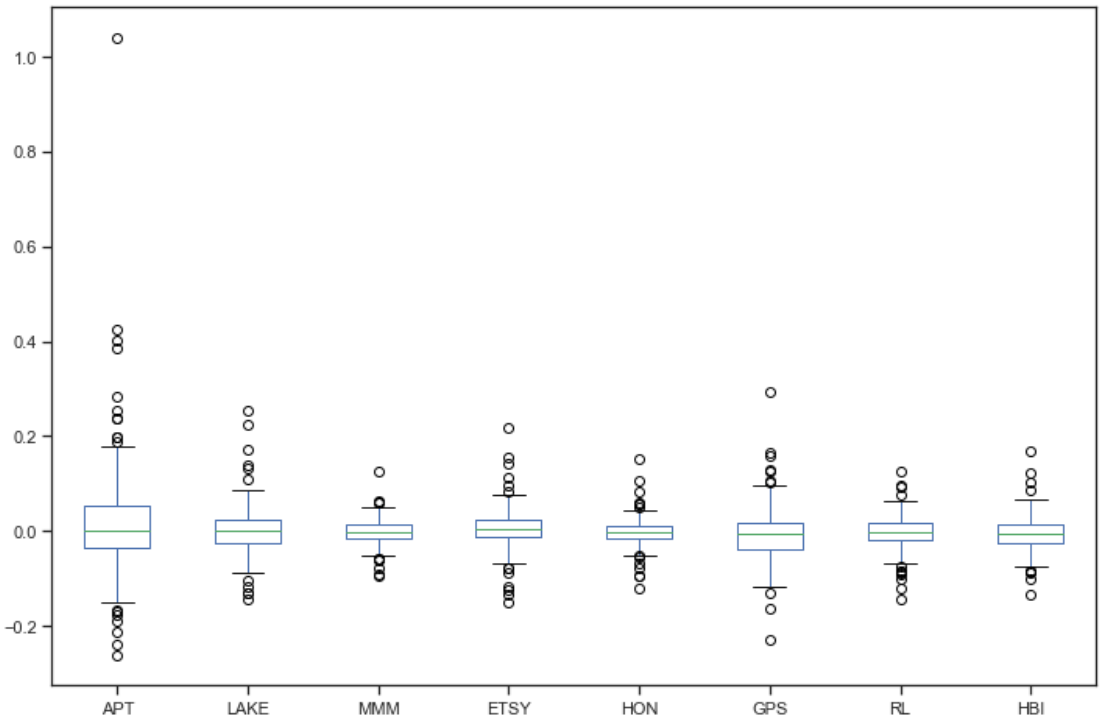
[17]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

# plot the heatmap
sns.heatmap(corr,
        xticklabels=corr.columns,
        yticklabels=corr.columns,
            cmap="Reds")
```

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x2719d7edac8>

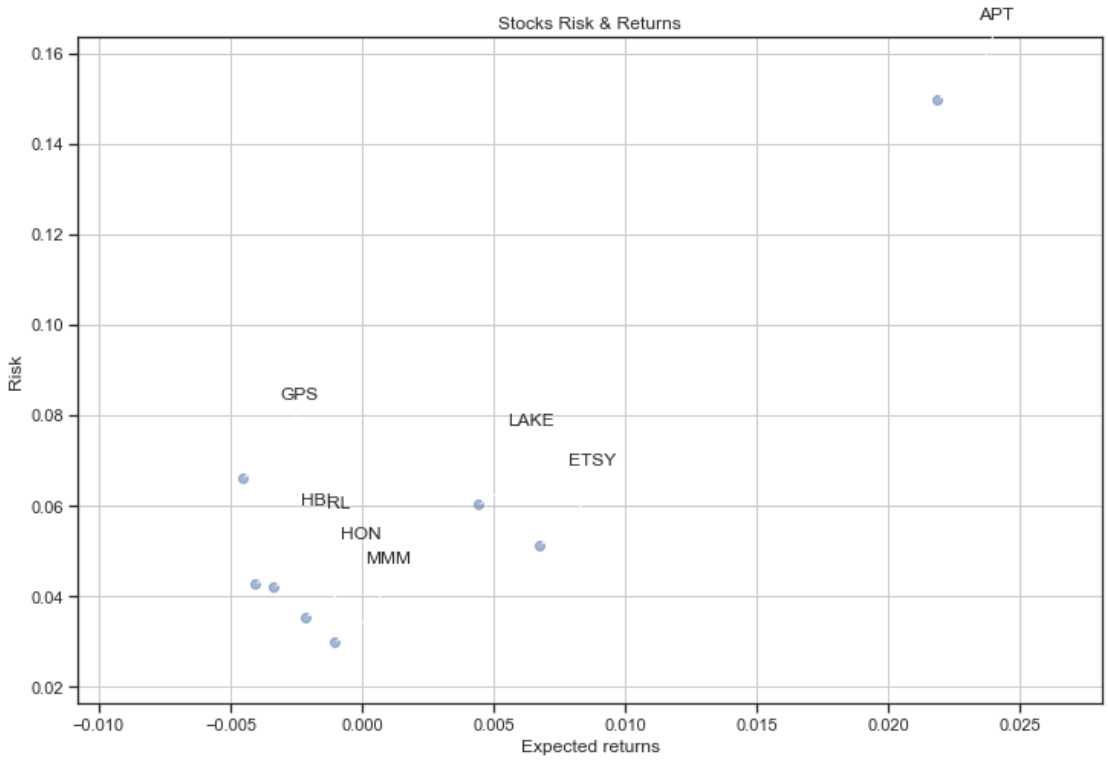


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

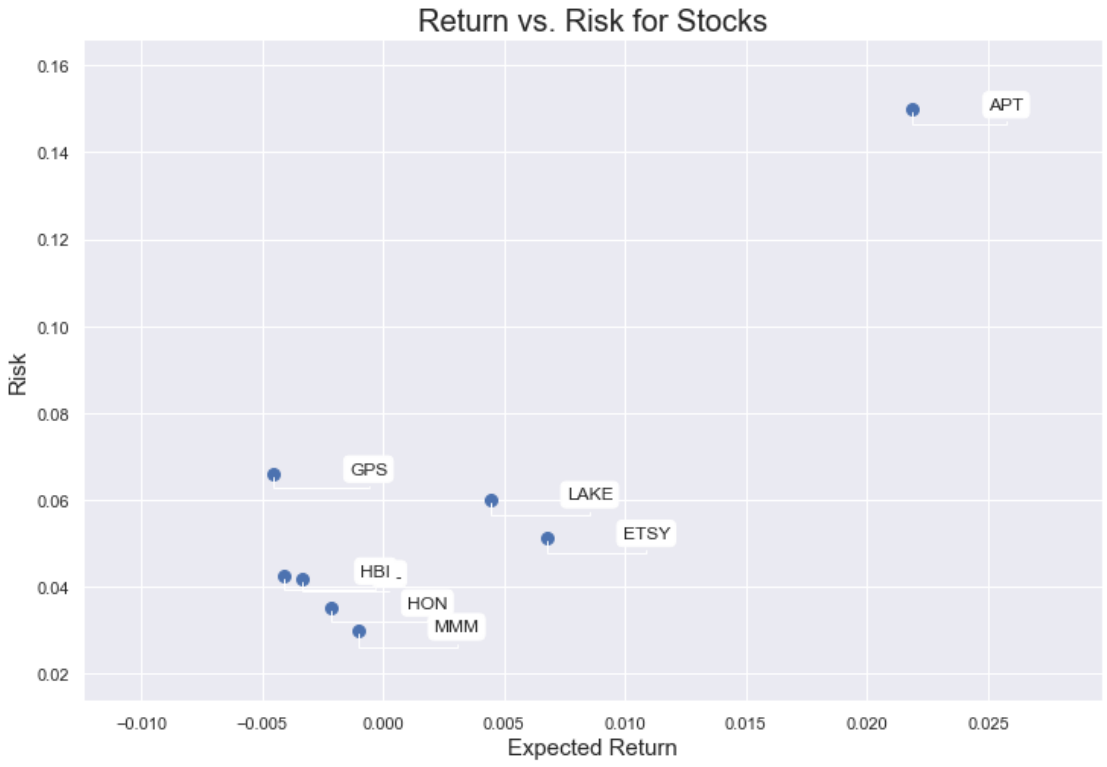
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x2719e85b0b8>



[19]:
```
rets = stock_rets.dropna()

plt.figure(figsize=(12,8))
plt.scatter(rets.mean(), rets.std(),alpha = 0.5)

plt.title('Stocks Risk & Returns')
plt.xlabel('Expected returns')
plt.ylabel('Risk')
plt.grid(which='major')

for label, x, y in zip(rets.columns, rets.mean(), rets.std()):
    plt.annotate(
        label,
        xy = (x, y), xytext = (50, 50),
        textcoords = 'offset points', ha = 'right', va = 'bottom',
        arrowprops = dict(arrowstyle = '-', connectionstyle = 'arc3,rad=-0.3'))
```



[20]:
```
rets = stock_rets.dropna()
area = np.pi*20.0

sns.set(style='darkgrid')
plt.figure(figsize=(12,8))
plt.scatter(rets.mean(), rets.std(), s=area)
plt.xlabel("Expected Return", fontsize=15)
plt.ylabel("Risk", fontsize=15)
plt.title("Return vs. Risk for Stocks", fontsize=20)

for label, x, y in zip(rets.columns, rets.mean(), rets.std()) :
    plt.annotate(label, xy=(x,y), xytext=(50, 0), textcoords='offset points',
                 arrowprops=dict(arrowstyle='-',␣
 ↪connectionstyle='bar,angle=180,fraction=-0.2'),
                 bbox=dict(boxstyle="round", fc="w"))
```



[21]:
```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[21]:
```
HBI   HBI     1.000000
RL    RL      1.000000
LAKE  LAKE    1.000000
MMM   MMM     1.000000
ETSY  ETSY    1.000000
HON   HON     1.000000
GPS   GPS     1.000000
APT   APT     1.000000
MMM   HON     0.770922
HON   MMM     0.770922
APT   LAKE    0.749293
LAKE  APT     0.749293
HON   GPS     0.749202
GPS   HON     0.749202
HON   RL      0.726732
RL    HON     0.726732
GPS   RL      0.725325
RL    GPS     0.725325
HBI   RL      0.715286
```

```
RL    HBI     0.715286
      MMM     0.693012
MMM   RL      0.693012
GPS   HBI     0.651394
HBI   GPS     0.651394
GPS   MMM     0.644062
MMM   GPS     0.644062
HON   ETSY    0.595569
ETSY  HON     0.595569
GPS   ETSY    0.589055
ETSY  GPS     0.589055
                …
HON   HBI     0.533165
HBI   HON     0.533165
      ETSY    0.529419
ETSY  HBI     0.529419
HBI   MMM     0.525431
MMM   HBI     0.525431
APT   HON     0.313058
HON   APT     0.313058
GPS   LAKE    0.269636
LAKE  GPS     0.269636
GPS   APT     0.268285
APT   GPS     0.268285
      HBI     0.246891
HBI   APT     0.246891
RL    APT     0.241436
APT   RL      0.241436
LAKE  HBI     0.204813
HBI   LAKE    0.204813
LAKE  HON     0.202682
HON   LAKE    0.202682
MMM   APT     0.182894
APT   MMM     0.182894
LAKE  RL      0.178233
RL    LAKE    0.178233
ETSY  LAKE    0.114804
LAKE  ETSY    0.114804
      MMM     0.092825
MMM   LAKE    0.092825
ETSY  APT     0.027554
APT   ETSY    0.027554
Length: 64, dtype: float64
```

[22]:
```
# Normalized Returns Data
Normalized_Value = ((rets[:] - rets[:].min()) /(rets[:].max() - rets[:].min()))
Normalized_Value.head()
```

[22]:
```
                 APT      LAKE       MMM      ETSY       HON       GPS  \
Date
2019-12-03  0.197830  0.400348  0.339874  0.377203  0.407711  0.378962
2019-12-04  0.176807  0.351133  0.478611  0.376848  0.459188  0.479441
2019-12-05  0.224240  0.302445  0.348330  0.339083  0.462110  0.466601
2019-12-06  0.193153  0.353435  0.621544  0.418669  0.475788  0.433304
2019-12-09  0.223724  0.363400  0.380368  0.403469  0.424744  0.449747

                  RL       HBI
Date
2019-12-03  0.492354  0.314261
2019-12-04  0.647231  0.469193
2019-12-05  0.651904  0.473445
2019-12-06  0.523632  0.466504
2019-12-09  0.589204  0.508110
```

[23]:
```
Normalized_Value.corr()
```

[23]:
```
            APT      LAKE       MMM      ETSY       HON       GPS        RL  \
APT    1.000000  0.749293 -0.182894 -0.027554 -0.313058 -0.268285 -0.241436
LAKE   0.749293  1.000000 -0.092825 -0.114804 -0.202682 -0.269636 -0.178233
MMM   -0.182894 -0.092825  1.000000  0.543935  0.770922  0.644062  0.693012
ETSY  -0.027554 -0.114804  0.543935  1.000000  0.595569  0.589055  0.580980
HON   -0.313058 -0.202682  0.770922  0.595569  1.000000  0.749202  0.726732
GPS   -0.268285 -0.269636  0.644062  0.589055  0.749202  1.000000  0.725325
RL    -0.241436 -0.178233  0.693012  0.580980  0.726732  0.725325  1.000000
HBI   -0.246891 -0.204813  0.525431  0.529419  0.533165  0.651394  0.715286

            HBI
APT   -0.246891
LAKE  -0.204813
MMM    0.525431
ETSY   0.529419
HON    0.533165
GPS    0.651394
RL     0.715286
HBI    1.000000
```

[24]:
```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[24]:
```
HBI   HBI     1.000000
RL    RL      1.000000
LAKE  LAKE    1.000000
MMM   MMM     1.000000
ETSY  ETSY    1.000000
```

```
HON   HON     1.000000
GPS   GPS     1.000000
APT   APT     1.000000
MMM   HON     0.770922
HON   MMM     0.770922
APT   LAKE    0.749293
LAKE  APT     0.749293
HON   GPS     0.749202
GPS   HON     0.749202
HON   RL      0.726732
RL    HON     0.726732
GPS   RL      0.725325
RL    GPS     0.725325
HBI   RL      0.715286
RL    HBI     0.715286
      MMM     0.693012
MMM   RL      0.693012
GPS   HBI     0.651394
HBI   GPS     0.651394
GPS   MMM     0.644062
MMM   GPS     0.644062
HON   ETSY    0.595569
ETSY  HON     0.595569
GPS   ETSY    0.589055
ETSY  GPS     0.589055
                …
HON   HBI     0.533165
HBI   HON     0.533165
      ETSY    0.529419
ETSY  HBI     0.529419
HBI   MMM     0.525431
MMM   HBI     0.525431
APT   HON     0.313058
HON   APT     0.313058
GPS   LAKE    0.269636
LAKE  GPS     0.269636
GPS   APT     0.268285
APT   GPS     0.268285
      HBI     0.246891
HBI   APT     0.246891
RL    APT     0.241436
APT   RL      0.241436
LAKE  HBI     0.204813
HBI   LAKE    0.204813
LAKE  HON     0.202682
HON   LAKE    0.202682
MMM   APT     0.182894
```

```
APT   MMM     0.182894
LAKE  RL      0.178233
RL    LAKE    0.178233
ETSY  LAKE    0.114804
LAKE  ETSY    0.114804
      MMM     0.092825
MMM   LAKE    0.092825
ETSY  APT     0.027554
APT   ETSY    0.027554
Length: 64, dtype: float64
```

[25]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
APT     0.021891
LAKE    0.004438
MMM    -0.001039
ETSY    0.006758
HON    -0.002145
GPS    -0.004537
RL     -0.003366
HBI    -0.004074
dtype: float64
--------------------------------------------------
Stock risks:
APT     0.149892
LAKE    0.060156
MMM     0.029736
ETSY    0.051245
HON     0.035252
GPS     0.066058
RL      0.041942
HBI     0.042571
dtype: float64
```

[26]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[26]:

	Returns	Risk
GPS	-0.004537	0.066058
HBI	-0.004074	0.042571

```
RL   -0.003366  0.041942
HON  -0.002145  0.035252
MMM  -0.001039  0.029736
LAKE  0.004438  0.060156
ETSY  0.006758  0.051245
APT   0.021891  0.149892
```

[27]:
```
table.sort_values(by='Risk')
```

[27]:
```
       Returns      Risk
MMM  -0.001039  0.029736
HON  -0.002145  0.035252
RL   -0.003366  0.041942
HBI  -0.004074  0.042571
ETSY  0.006758  0.051245
LAKE  0.004438  0.060156
GPS  -0.004537  0.066058
APT   0.021891  0.149892
```

[28]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[28]:
```
       Returns      Risk  Sharpe Ratio
APT   0.021891  0.149892      0.079332
LAKE  0.004438  0.060156     -0.092455
MMM  -0.001039  0.029736     -0.371252
ETSY  0.006758  0.051245     -0.063269
HON  -0.002145  0.035252     -0.344521
GPS  -0.004537  0.066058     -0.220059
RL   -0.003366  0.041942     -0.318673
HBI  -0.004074  0.042571     -0.330604
```

[29]:
```
table['Max Returns'] = rets.max()
```

[30]:
```
table['Min Returns'] = rets.min()
```

[31]:
```
table['Median Returns'] = rets.median()
```

[32]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[32]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
APT   0.021891  0.149892      0.079332     1.037934    -0.259740
LAKE  0.004438  0.060156     -0.092455     0.255242    -0.142586
MMM  -0.001039  0.029736     -0.371252     0.125986    -0.092774
```

```
ETSY  0.006758  0.051245     -0.063269     0.217824    -0.150173
HON  -0.002145  0.035252     -0.344521     0.150684    -0.120868
GPS  -0.004537  0.066058     -0.220059     0.294586    -0.228492
RL   -0.003366  0.041942     -0.318673     0.124590    -0.144257
HBI  -0.004074  0.042571     -0.330604     0.169451    -0.134298

      Median Returns  Total Return
APT         0.000000      7.453416
LAKE        0.001855      2.609995
MMM        -0.001346     -2.888898
ETSY        0.003010     -1.569509
HON        -0.000885     -4.982129
GPS        -0.005577     -4.563232
RL         -0.002743     -5.589979
HBI        -0.006285     -3.567454
```

[33]:
```
table['Average Return Days'] = (1 + total_return)**(1 / days) - 1
table
```

[33]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
APT   0.021891  0.149892      0.079332     1.037934    -0.259740
LAKE  0.004438  0.060156     -0.092455     0.255242    -0.142586
MMM  -0.001039  0.029736     -0.371252     0.125986    -0.092774
ETSY  0.006758  0.051245     -0.063269     0.217824    -0.150173
HON  -0.002145  0.035252     -0.344521     0.150684    -0.120868
GPS  -0.004537  0.066058     -0.220059     0.294586    -0.228492
RL   -0.003366  0.041942     -0.318673     0.124590    -0.144257
HBI  -0.004074  0.042571     -0.330604     0.169451    -0.134298

      Median Returns  Total Return  Average Return Days
APT         0.000000      7.453416             0.000444
LAKE        0.001855      2.609995             0.000159
MMM        -0.001346     -2.888898            -0.000181
ETSY        0.003010     -1.569509            -0.000098
HON        -0.000885     -4.982129            -0.000315
GPS        -0.005577     -4.563232            -0.000288
RL         -0.002743     -5.589979            -0.000355
HBI        -0.006285     -3.567454            -0.000224
```

[34]:
```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[34]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
APT   0.021891  0.149892      0.079332     1.037934    -0.259740
LAKE  0.004438  0.060156     -0.092455     0.255242    -0.142586
```

```
MMM  -0.001039  0.029736     -0.371252     0.125986    -0.092774
ETSY  0.006758  0.051245     -0.063269     0.217824    -0.150173
HON  -0.002145  0.035252     -0.344521     0.150684    -0.120868
GPS  -0.004537  0.066058     -0.220059     0.294586    -0.228492
RL   -0.003366  0.041942     -0.318673     0.124590    -0.144257
HBI  -0.004074  0.042571     -0.330604     0.169451    -0.134298

      Median Returns  Total Return  Average Return Days      CAGR
APT         0.000000      7.453416              0.000444  8.257192
LAKE        0.001855      2.609995              0.000159  0.595561
MMM        -0.001346     -2.888898             -0.000181 -0.225307
ETSY        0.003010     -1.569509             -0.000098  1.565676
HON        -0.000885     -4.982129             -0.000315 -0.379386
GPS        -0.005577     -4.563232             -0.000288 -0.685143
RL         -0.002743     -5.589979             -0.000355 -0.520877
HBI        -0.006285     -3.567454             -0.000224 -0.576668
```

[35]:
```
table.sort_values(by='Average Return Days')
```

[35]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
RL   -0.003366  0.041942     -0.318673     0.124590    -0.144257
HON  -0.002145  0.035252     -0.344521     0.150684    -0.120868
GPS  -0.004537  0.066058     -0.220059     0.294586    -0.228492
HBI  -0.004074  0.042571     -0.330604     0.169451    -0.134298
MMM  -0.001039  0.029736     -0.371252     0.125986    -0.092774
ETSY  0.006758  0.051245     -0.063269     0.217824    -0.150173
LAKE  0.004438  0.060156     -0.092455     0.255242    -0.142586
APT   0.021891  0.149892      0.079332     1.037934    -0.259740

      Median Returns  Total Return  Average Return Days      CAGR
RL         -0.002743     -5.589979             -0.000355 -0.520877
HON        -0.000885     -4.982129             -0.000315 -0.379386
GPS        -0.005577     -4.563232             -0.000288 -0.685143
HBI        -0.006285     -3.567454             -0.000224 -0.576668
MMM        -0.001346     -2.888898             -0.000181 -0.225307
ETSY        0.003010     -1.569509             -0.000098  1.565676
LAKE        0.001855      2.609995              0.000159  0.595561
APT         0.000000      7.453416              0.000444  8.257192
```