Investment_Risk_Analysis

September 29, 2021

1 Investment Risk Analysis

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import pyfolio as pf
import math
from sklearn.linear_model import LinearRegression

import warnings
warnings.filterwarnings("ignore")

# yahoo finance is used to fetch data
import yfinance as yf
yf.pdr_override()
```

```
C:\Users\Tin Hang\Anaconda3\lib\site-packages\pyfolio\pos.py:28: UserWarning:
Module "zipline.assets" not found; mutltipliers will not be applied to position
notionals.
  ' to position notionals.'
```

[2]:
```
# input
# Water Stock
title = 'Stock'
symbols = ['AMD','SPY']
start = '2021-01-01'
end = '2021-06-18'
```

[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
```

[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]:
```
months = (d2.year - d1.year) * 12 + (d2.month - d1.month)
months
```

[6]:
```
5
```

[7]:
```
days = (df.index[-1] - df.index[0]).days
days
```

[7]:
```
164
```

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

[8]:

Date	AMD	SPY
2021-01-04	92.300003	367.586090
2021-01-05	92.769997	370.117767
2021-01-06	90.330002	372.330505
2021-01-07	95.160004	377.862427
2021-01-08	94.580002	380.015381

[9]:
```
df.tail()
```

[9]:

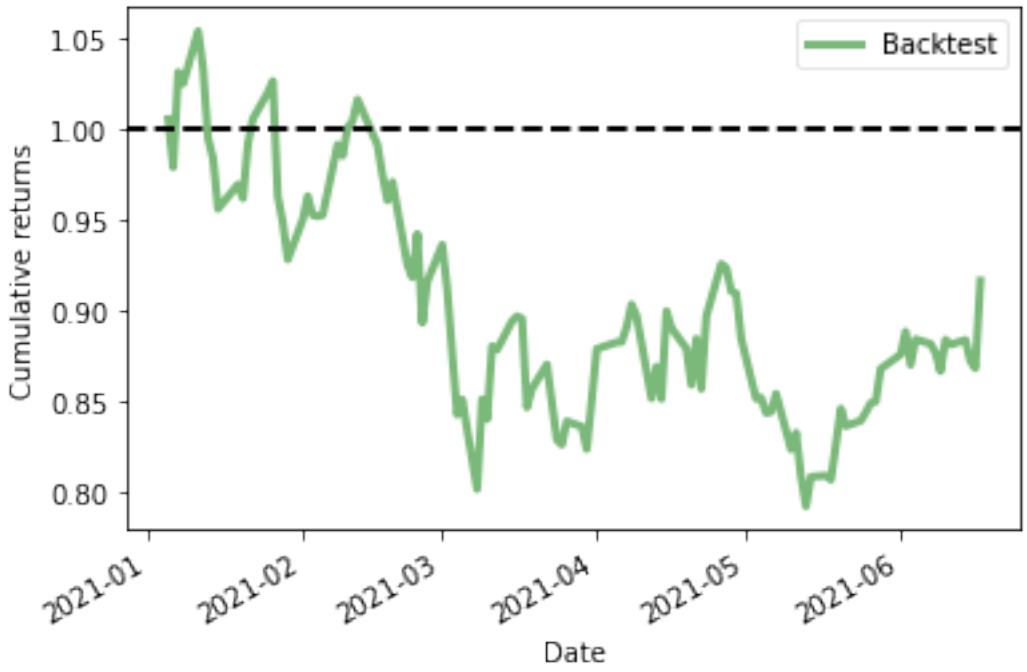
Date	AMD	SPY
2021-06-11	81.309998	424.309998
2021-06-14	81.550003	425.260010
2021-06-15	80.470001	424.480011
2021-06-16	80.110001	422.109985
2021-06-17	84.559998	421.970001

[10]:
```
amd = df["AMD"].pct_change()[1:]
spy = df["SPY"].pct_change()[1:]
```

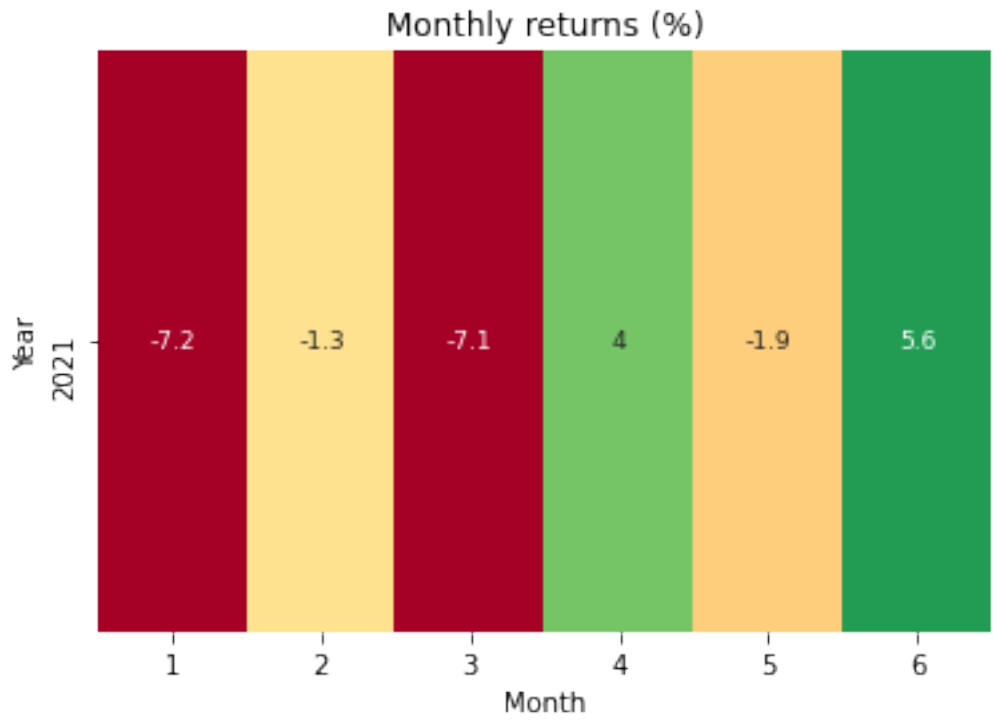
[11]:
```
pf.show_perf_stats(amd, spy)
```

```
<IPython.core.display.HTML object>
```

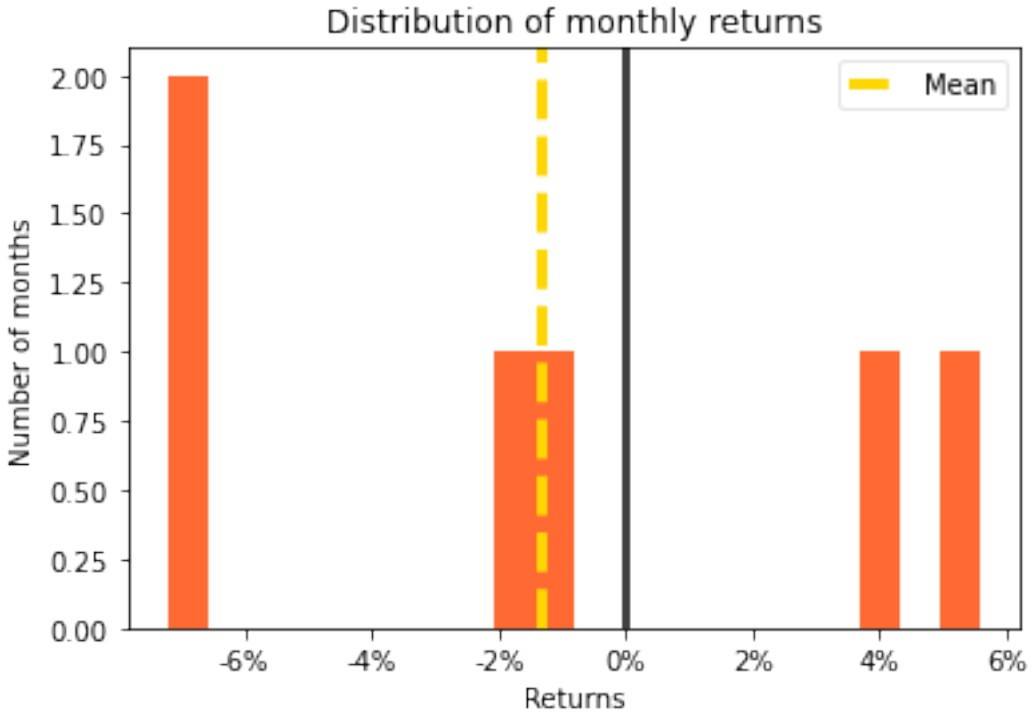
[12]:
```
pf.plot_rolling_returns(amd)
plt.show()
```



[13]:
```
pf.plot_monthly_returns_heatmap(amd)
plt.show()
```

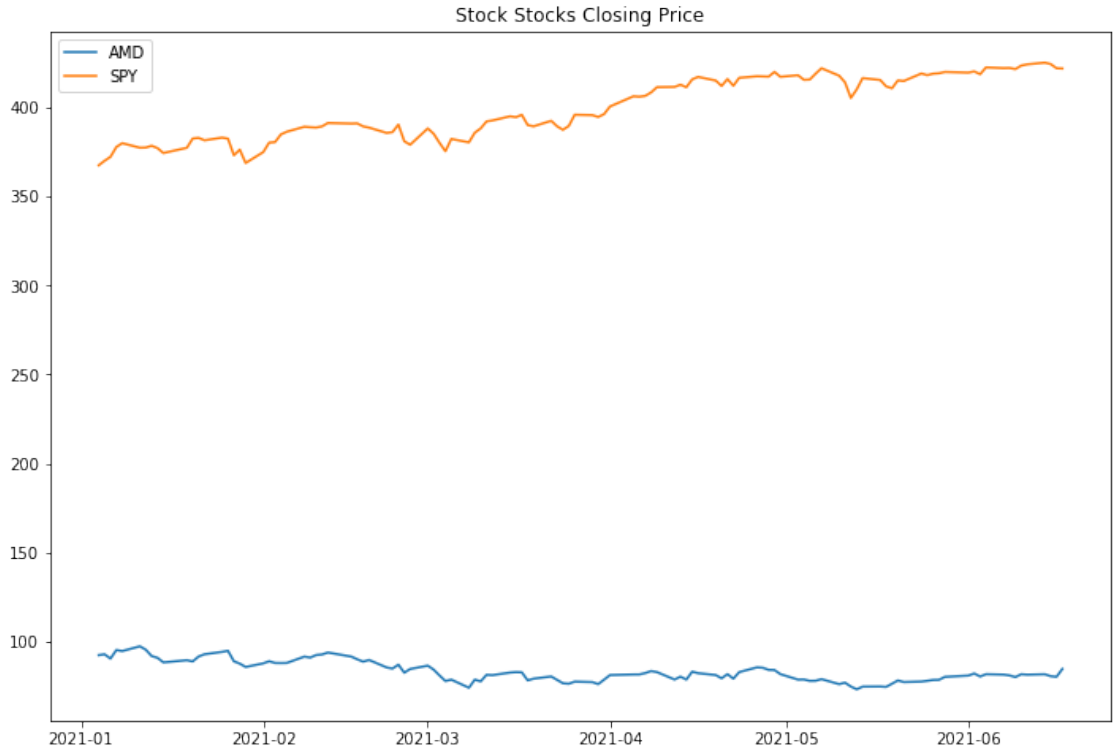


[14]:
```
pf.plot_monthly_returns_dist(amd)
plt.show()
```



[15]:
```
plt.figure(figsize=(12,8))
plt.plot(df)
plt.title(title + ' Stocks Closing Price')
plt.legend(labels=df.columns)
```

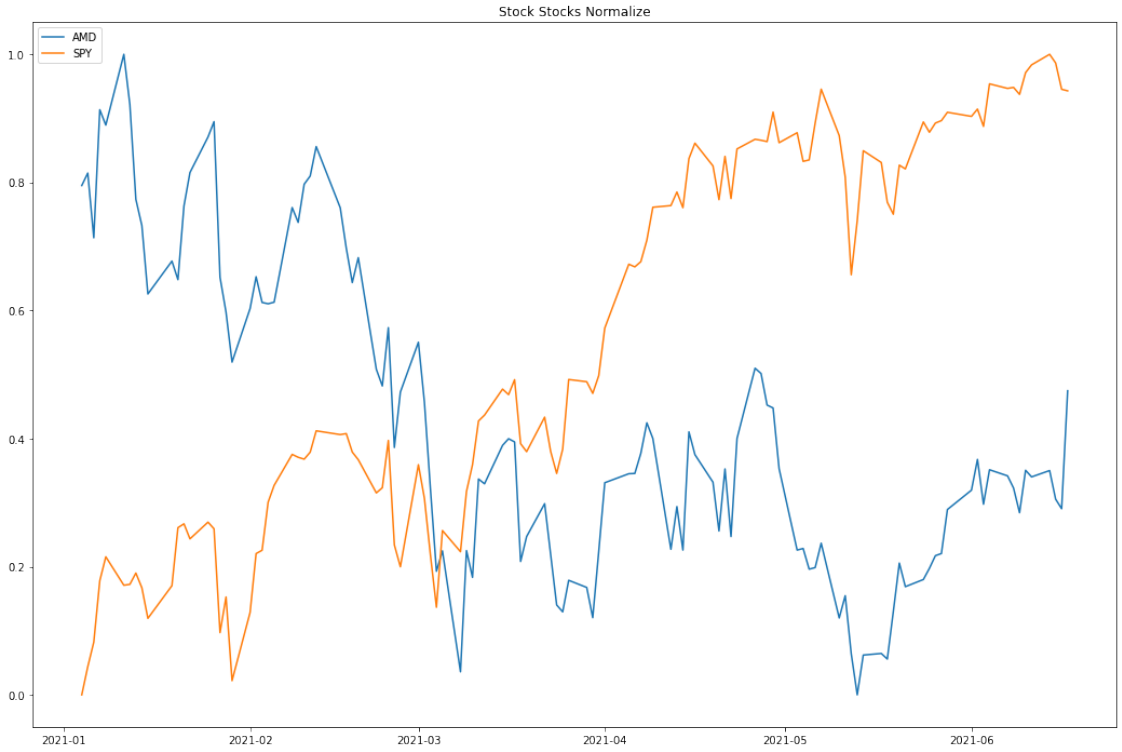
[15]:
```
<matplotlib.legend.Legend at 0x1c76018d4e0>
```



[16]:
```
# Normalize the data
normalize = (df - df.min())/ (df.max() - df.min())
```

[17]:
```
plt.figure(figsize=(18,12))
plt.plot(normalize)
plt.title(title + ' Stocks Normalize')
plt.legend(labels=normalize.columns)
```

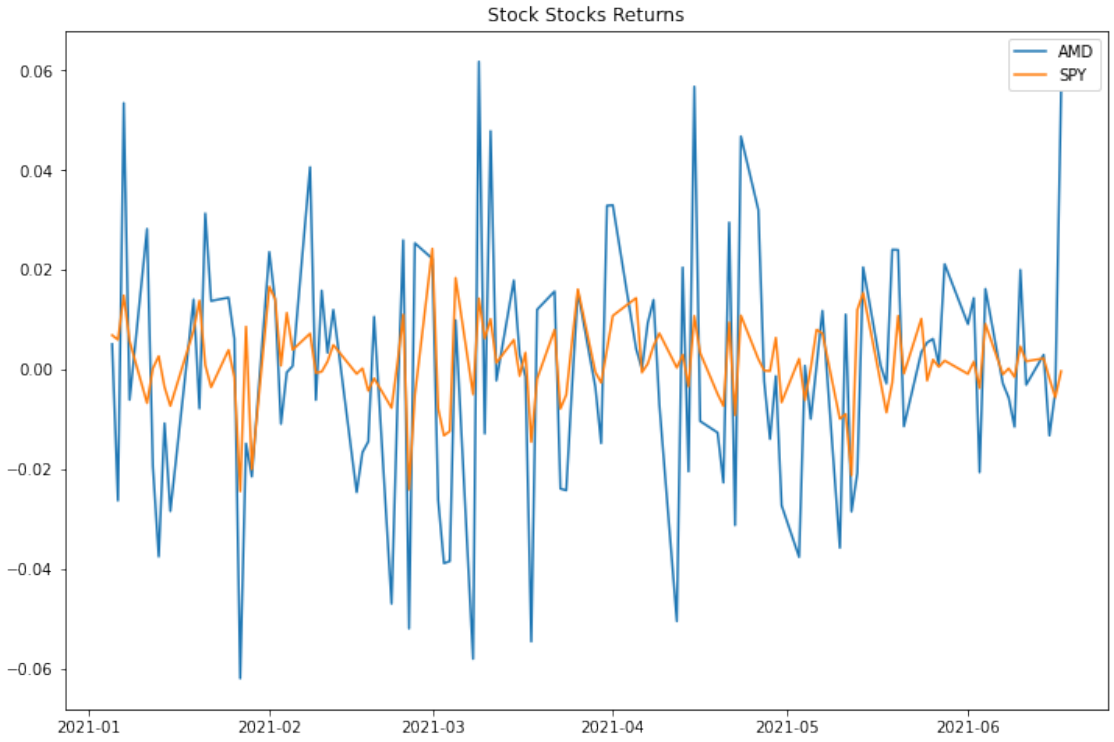
[17]:
```
<matplotlib.legend.Legend at 0x1c7601cb0b8>
```



[18]:
```
stock_rets = df.pct_change().dropna()
```

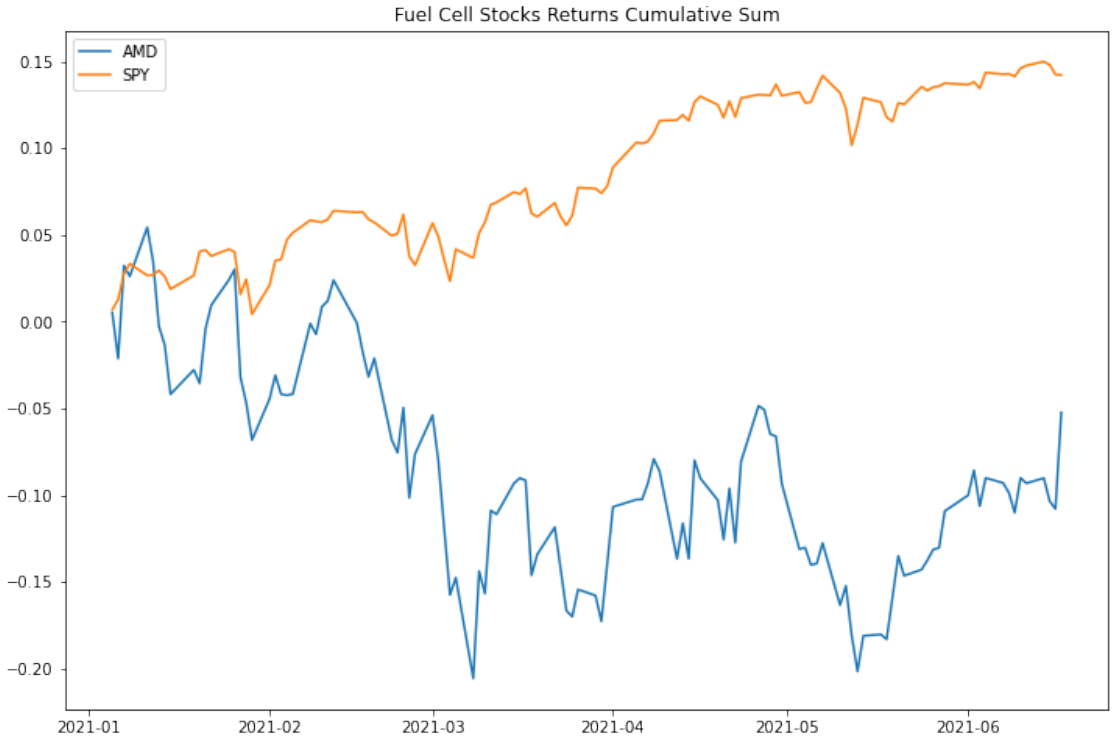
[19]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title(title +' Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[19]: <matplotlib.legend.Legend at 0x1c760237d68>

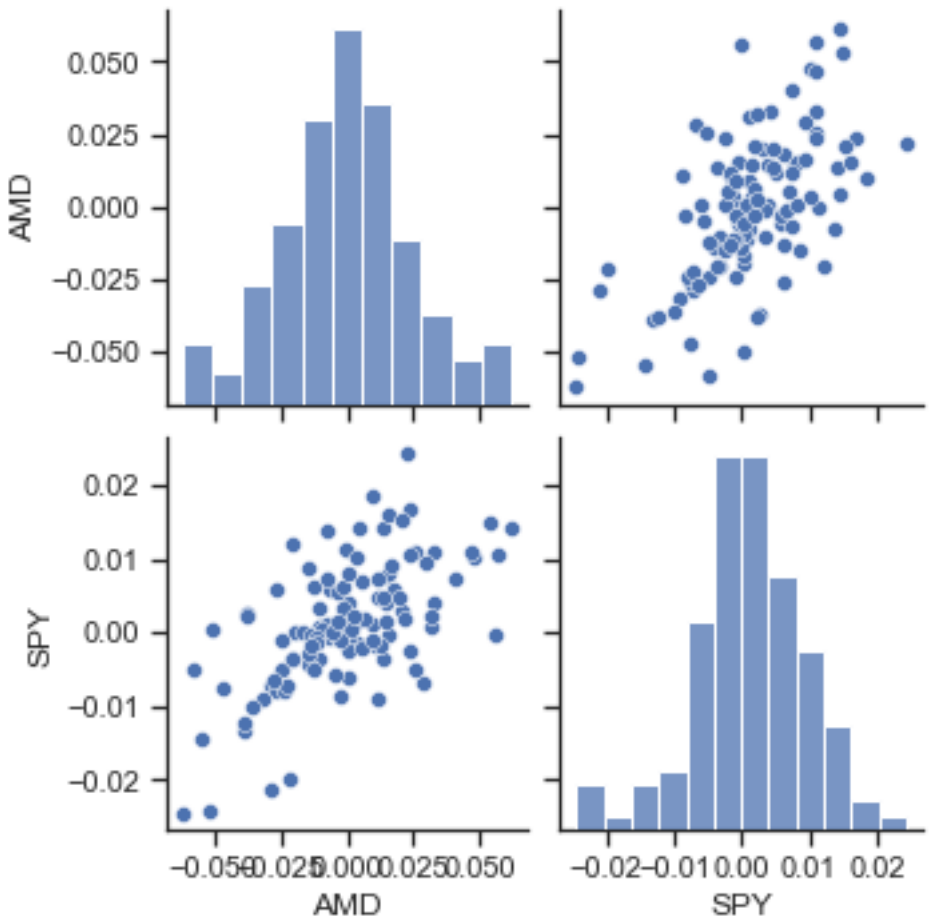


[20]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Fuel Cell Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

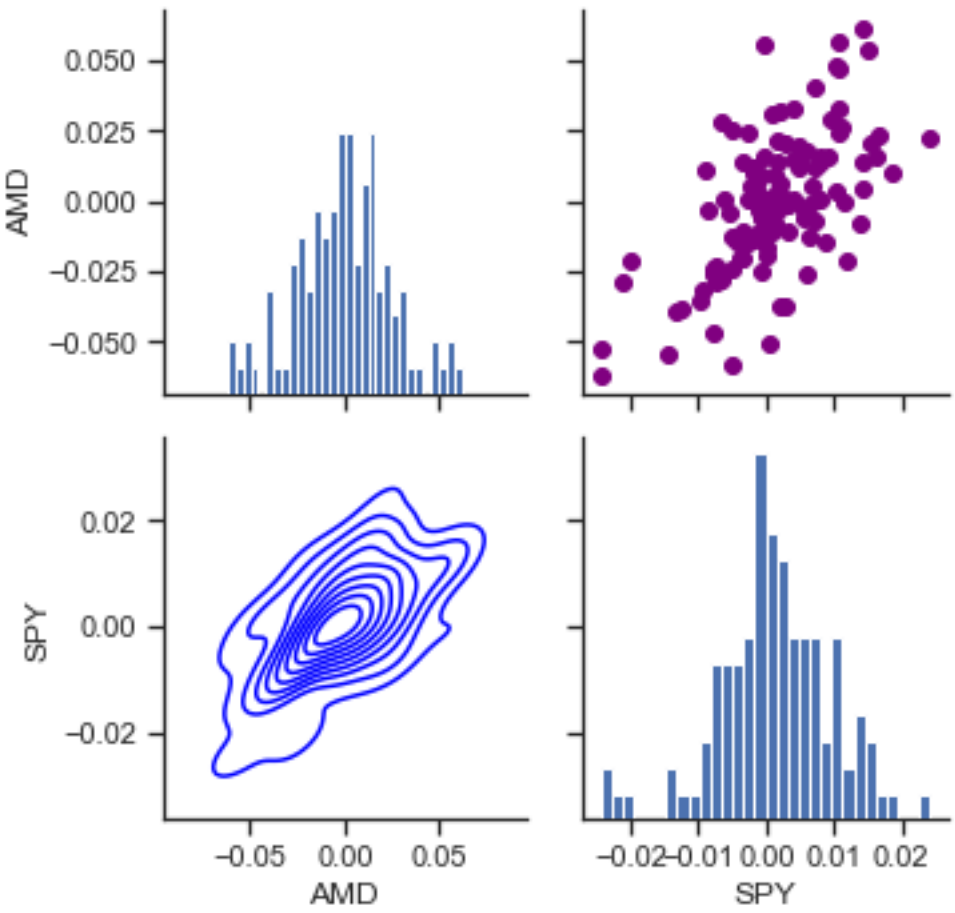
[20]: <matplotlib.legend.Legend at 0x1c76025f0b8>



[21]:
```
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)
```

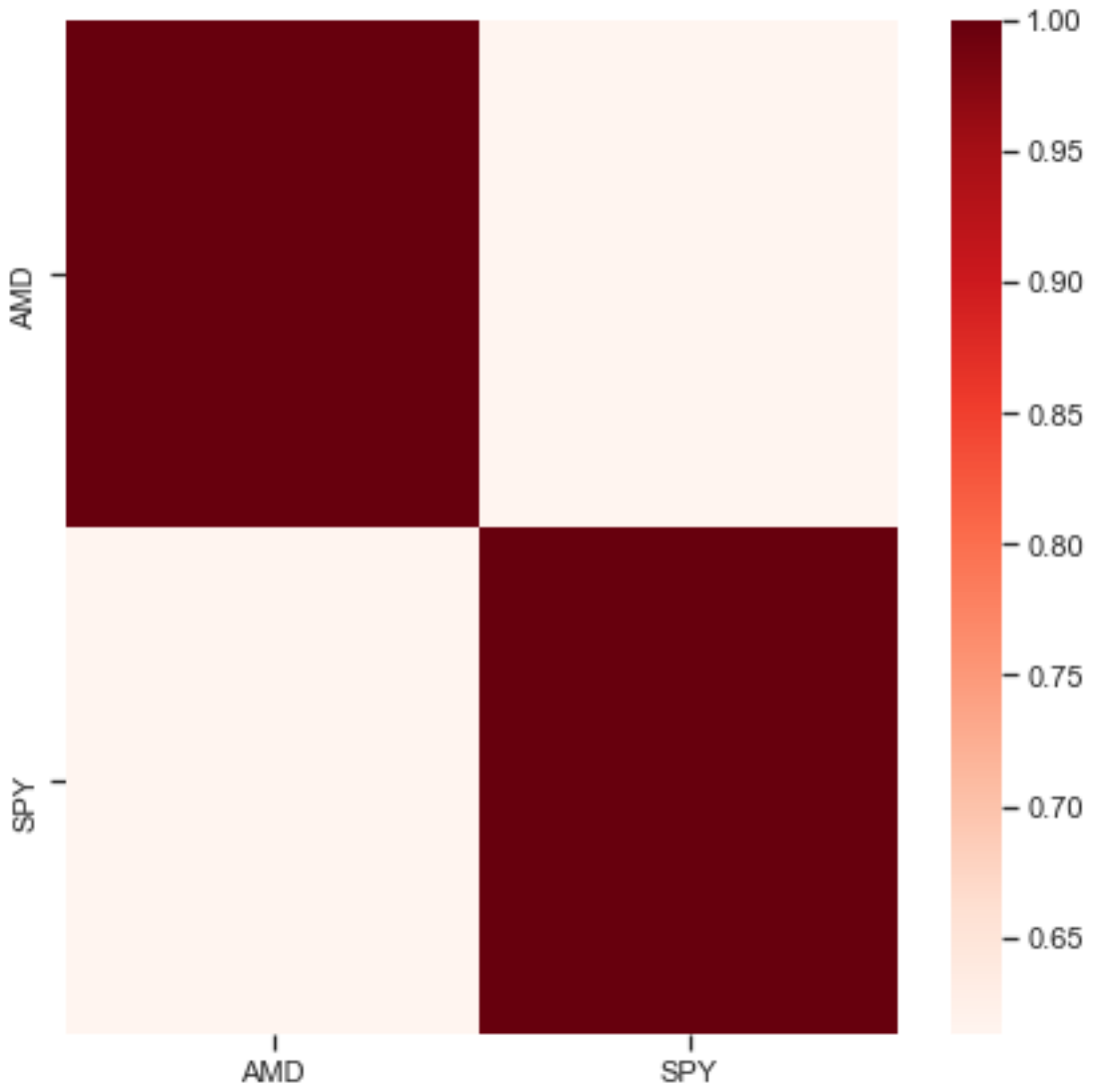


[22]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



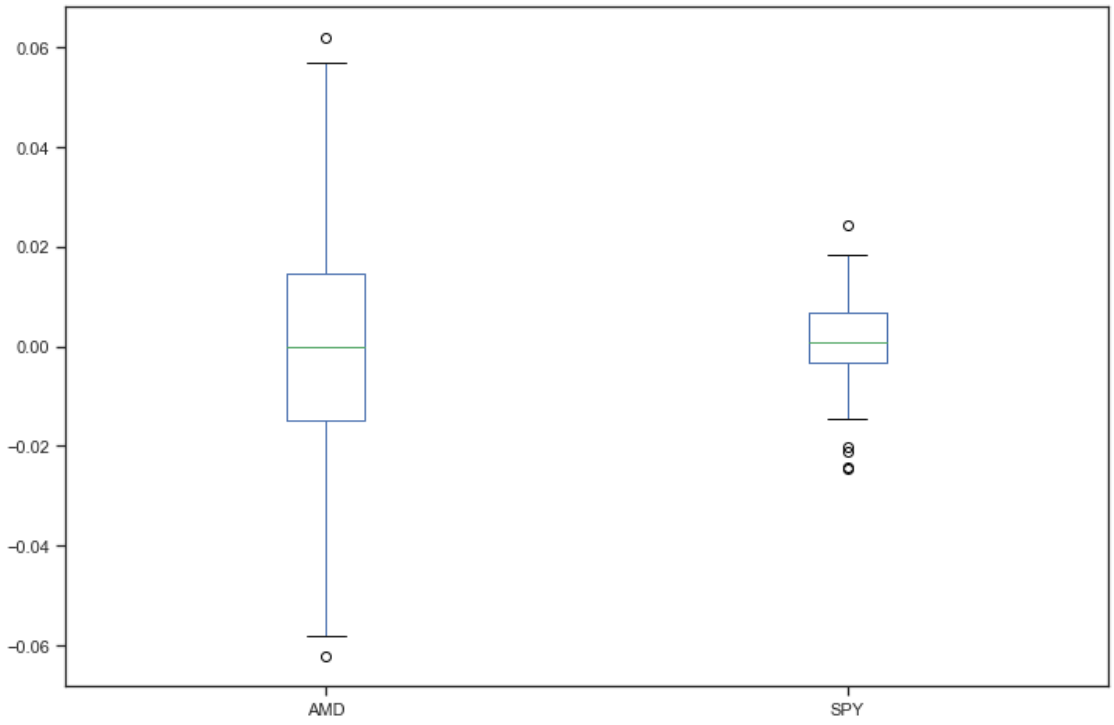
[23]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

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

[23]: <AxesSubplot:>

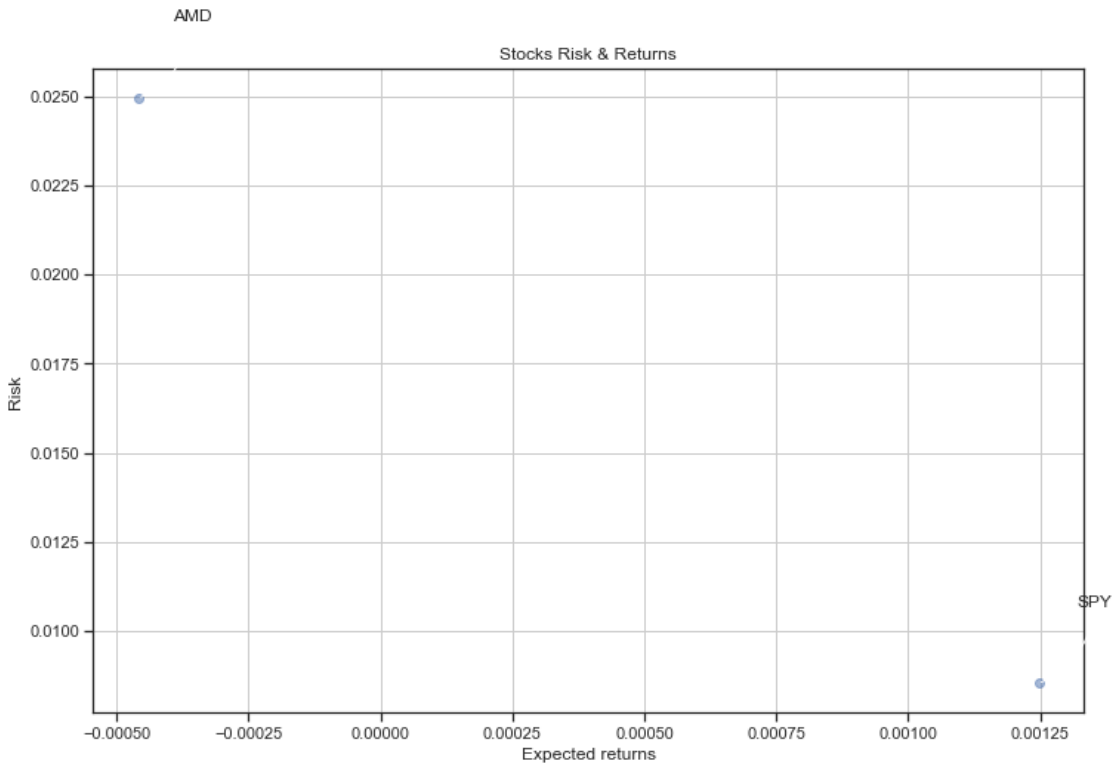


[24]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

[24]: <AxesSubplot:>



[25]:
```
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'))
```



[26]:
```
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"))
```

[27]:
```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[27]:
```
SPY  SPY    1.000000
AMD  AMD    1.000000
SPY  AMD    0.612799
AMD  SPY    0.612799
dtype: float64
```

[28]:
```
# Normalized Returns Data
Normalized_Value = ((rets[:] - rets[:].min()) /(rets[:].max() - rets[:].min()))
Normalized_Value.head()
```

[28]:

Date	AMD	SPY
2021-01-05	0.541903	0.643536
2021-01-06	0.288256	0.624867
2021-01-07	0.932782	0.807261
2021-01-08	0.451517	0.619100
2021-01-11	0.728849	0.363587

[29]:
```
Normalized_Value.corr()
```

[29]:
```
           AMD       SPY
AMD   1.000000  0.612799
SPY   0.612799  1.000000
```

[30]:
```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[30]:
```
SPY  SPY    1.000000
AMD  AMD    1.000000
SPY  AMD    0.612799
AMD  SPY    0.612799
dtype: float64
```

[31]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
AMD   -0.000459
SPY    0.001247
dtype: float64
--------------------------------------------------
Stock risks:
AMD    0.024947
SPY    0.008532
dtype: float64
```

[32]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[32]:
```
       Returns      Risk
AMD -0.000459  0.024947
SPY  0.001247  0.008532
```

[33]:
```
table.sort_values(by='Risk')
```

[33]:
```
       Returns      Risk
SPY  0.001247  0.008532
AMD -0.000459  0.024947
```

[34]:
```
rf = 0.001
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
```

```
table
```

[34]:
```
      Returns      Risk  Sharpe Ratio
AMD -0.000459  0.024947     -0.058487
SPY  0.001247  0.008532      0.028970
```

[35]:
```
table['Max Returns'] = rets.max()
```

[36]:
```
table['Min Returns'] = rets.min()
```

[37]:
```
table['Median Returns'] = rets.median()
```

[38]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[38]:
```
      Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AMD -0.000459  0.024947     -0.058487      0.06179    -0.061979
SPY  0.001247  0.008532      0.028970      0.02424    -0.024440

     Median Returns  Total Return
AMD       -0.000223      5.554858
SPY        0.000849     -0.033163
```

[39]:
```
table['Average Return Days'] = (1 + total_return)**(1 / days) - 1
table
```

[39]:
```
      Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AMD -0.000459  0.024947     -0.058487      0.06179    -0.061979
SPY  0.001247  0.008532      0.028970      0.02424    -0.024440

     Median Returns  Total Return  Average Return Days
AMD       -0.000223      5.554858             0.000330
SPY        0.000849     -0.033163            -0.000002
```

[40]:
```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[40]:
```
      Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AMD -0.000459  0.024947     -0.058487      0.06179    -0.061979
SPY  0.001247  0.008532      0.028970      0.02424    -0.024440

     Median Returns  Total Return  Average Return Days      CAGR
AMD       -0.000223      5.554858             0.000330 -0.125916
SPY        0.000849     -0.033163            -0.000002  0.236164
```

[41]:
```
table.sort_values(by='Average Return Days')
```

[41]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
SPY   0.001247  0.008532      0.028970      0.02424    -0.024440
AMD  -0.000459  0.024947     -0.058487      0.06179    -0.061979

     Median Returns  Total Return  Average Return Days      CAGR
SPY        0.000849     -0.033163            -0.000002  0.236164
AMD       -0.000223      5.554858             0.000330 -0.125916
```

[42]:
```
table['var_99'] = round((rets).quantile(0.01), 3)
table['var_95'] = round((rets).quantile(0.05), 3)
```

[43]:
```
table.sort_values(by='Returns')
```

[43]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AMD  -0.000459  0.024947     -0.058487      0.06179    -0.061979
SPY   0.001247  0.008532      0.028970      0.02424    -0.024440

     Median Returns  Total Return  Average Return Days      CAGR  var_99  \
AMD       -0.000223      5.554858             0.000330 -0.125916  -0.058
SPY        0.000849     -0.033163            -0.000002  0.236164  -0.024

     var_95
AMD  -0.042
SPY  -0.013
```

[44]:
```
# Pure Profit Score
df = df.dropna()
t = np.arange(0, df.shape[0]).reshape(-1, 1)
regression = LinearRegression().fit(t, df)
r_squared = regression.score(t, df)
table['PPS'] = table['CAGR'] * r_squared
```

[45]:
```
table
```

[45]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AMD  -0.000459  0.024947     -0.058487      0.06179    -0.061979
SPY   0.001247  0.008532      0.028970      0.02424    -0.024440

     Median Returns  Total Return  Average Return Days      CAGR  var_99  \
AMD       -0.000223      5.554858             0.000330 -0.125916  -0.058
SPY        0.000849     -0.033163            -0.000002  0.236164  -0.024

     var_95       PPS
AMD  -0.042 -0.091019
SPY  -0.013  0.170712
```