Aerospace_Defense_Portfolio

September 29, 2021

1 Aerospace and Defense Portfolio Risk and Returns

[1]:

```python
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]:

```python
# input
# Aerospace and Defense
symbols = ['LMT','NOC','RTN']
start = '2019-01-01'
end = '2020-04-24'
```

[3]:

```python
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
```

[4]:

```python
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?
1 years
```

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

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

[6]: 477

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

[7]:

	LMT	NOC	RTN
Date			
2019-01-02	256.459991	241.629272	151.138794
2019-01-03	250.017685	235.303391	146.873474
2019-01-04	256.760315	243.129852	150.746597
2019-01-07	259.705292	245.022720	152.335037
2019-01-08	261.439392	246.130981	154.149033

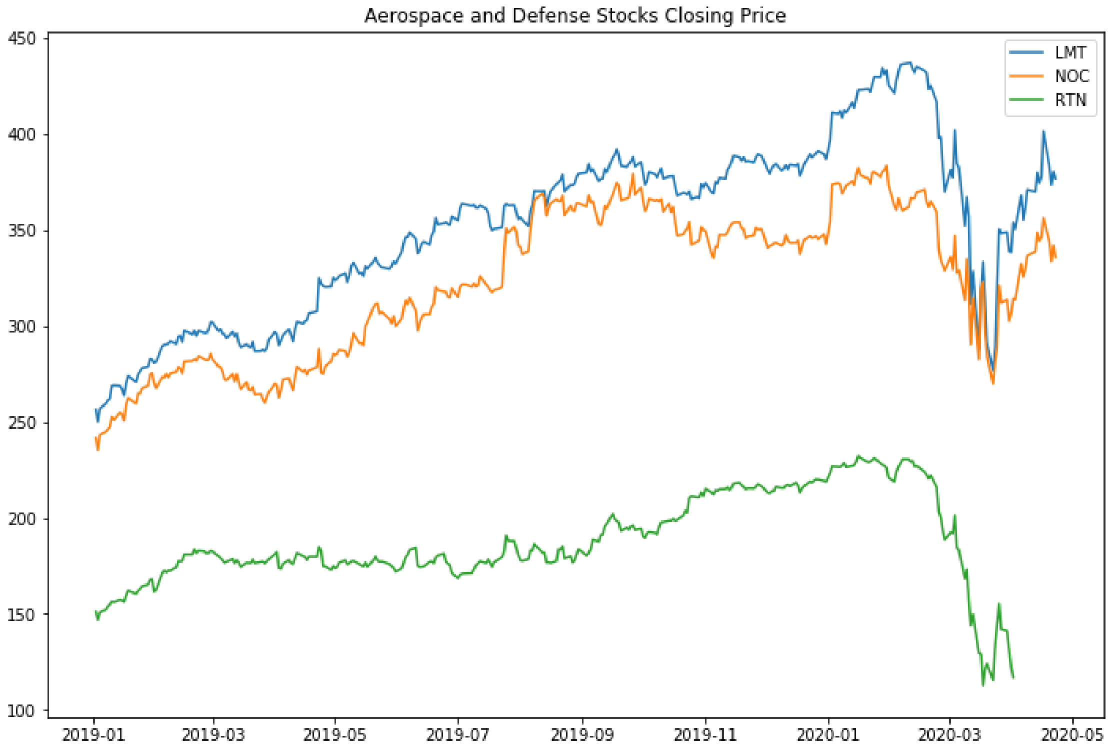
[8]:
```
df.tail()
```

[8]:

	LMT	NOC	RTN
Date			
2020-04-17	401.510010	356.299988	NaN
2020-04-20	383.209991	343.910004	NaN
2020-04-21	373.440002	333.679993	NaN
2020-04-22	380.399994	342.010010	NaN
2020-04-23	376.730011	335.829987	NaN

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

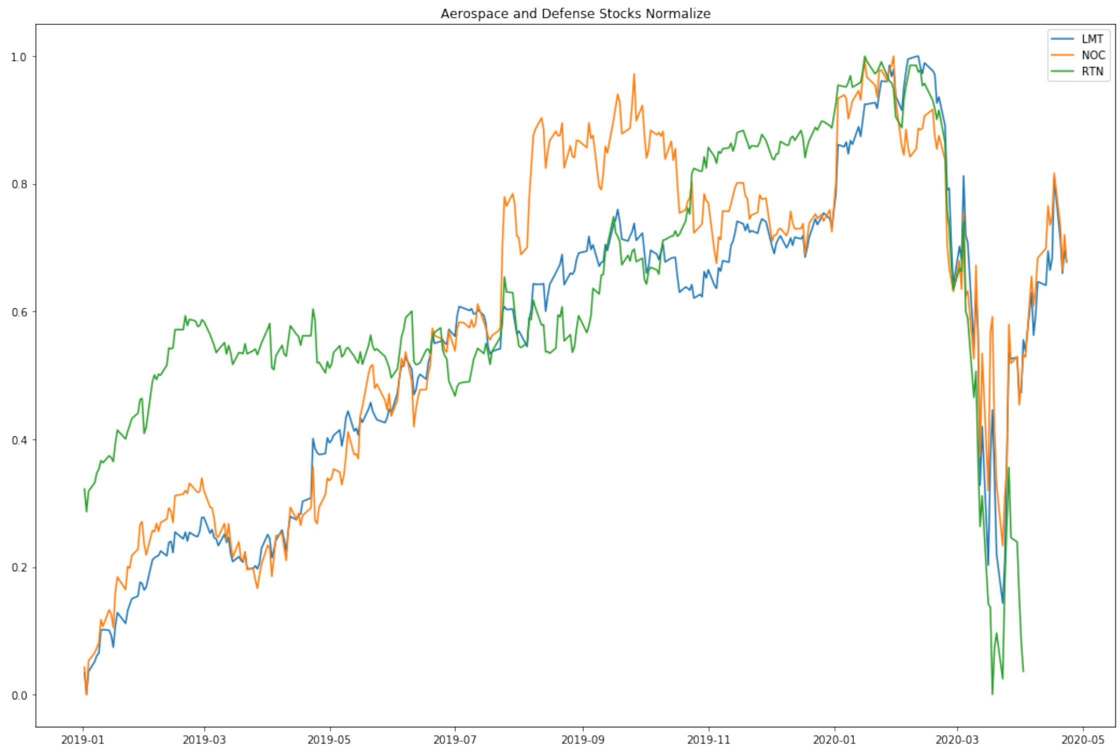
[9]: <matplotlib.legend.Legend at 0x2653725e898>



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

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

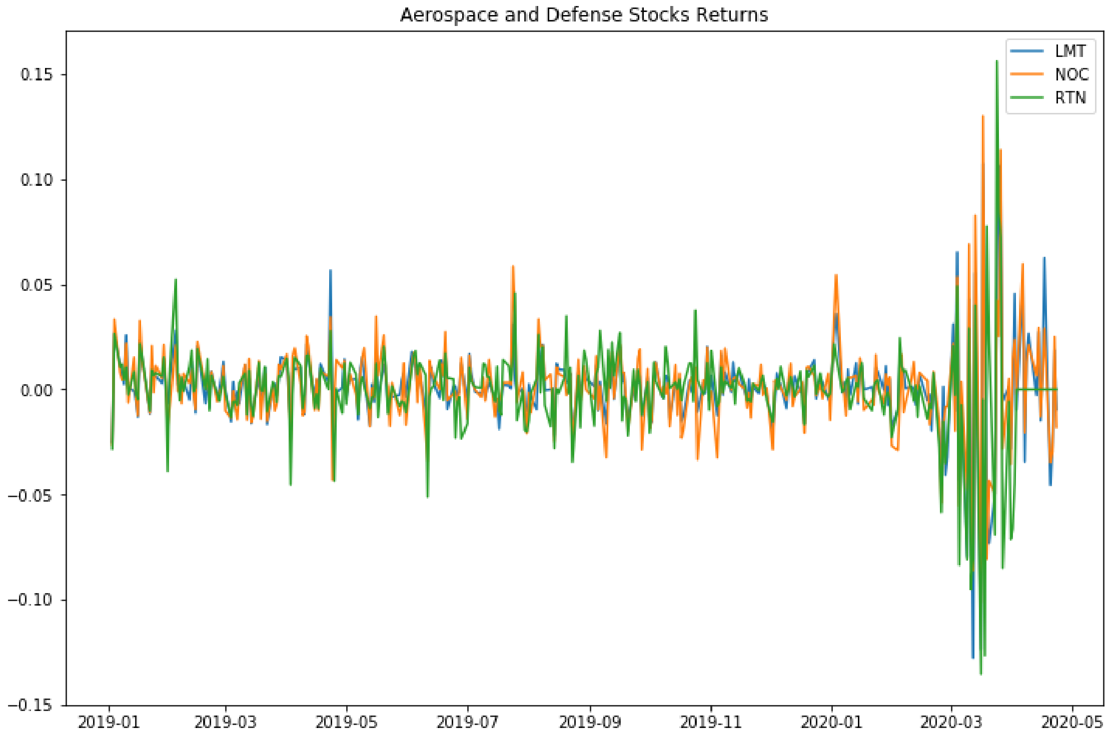
[11]: <matplotlib.legend.Legend at 0x265384b67b8>



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

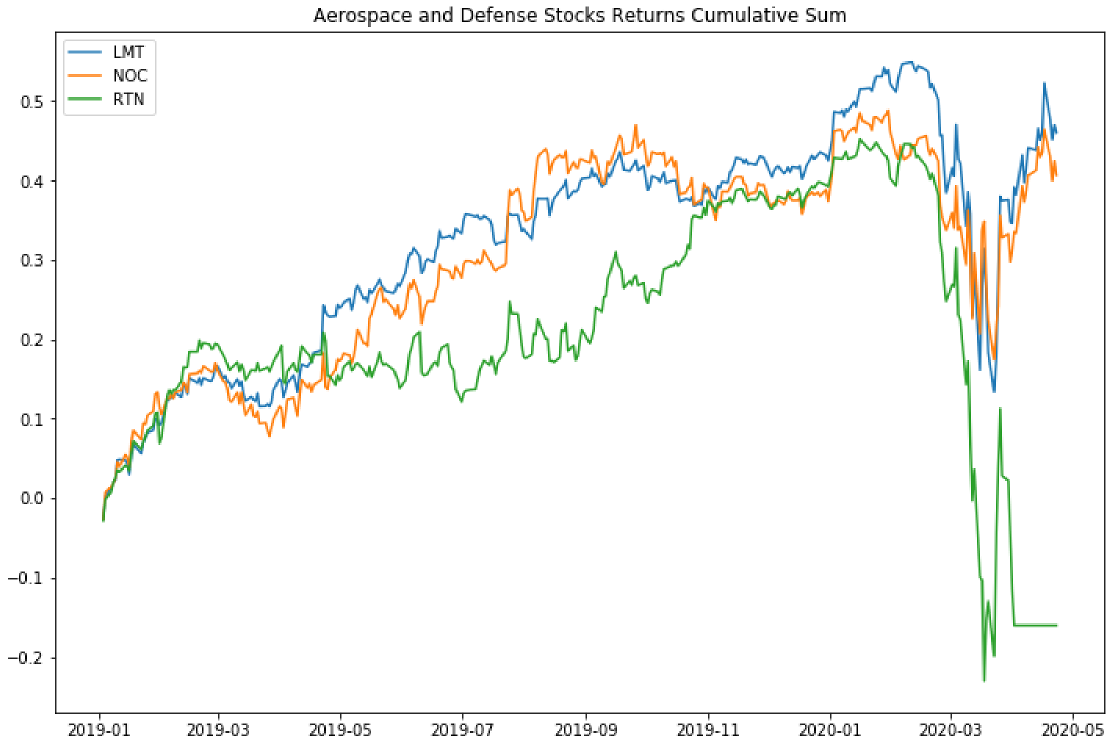
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Aerospace and Defense Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x265372c6f60>

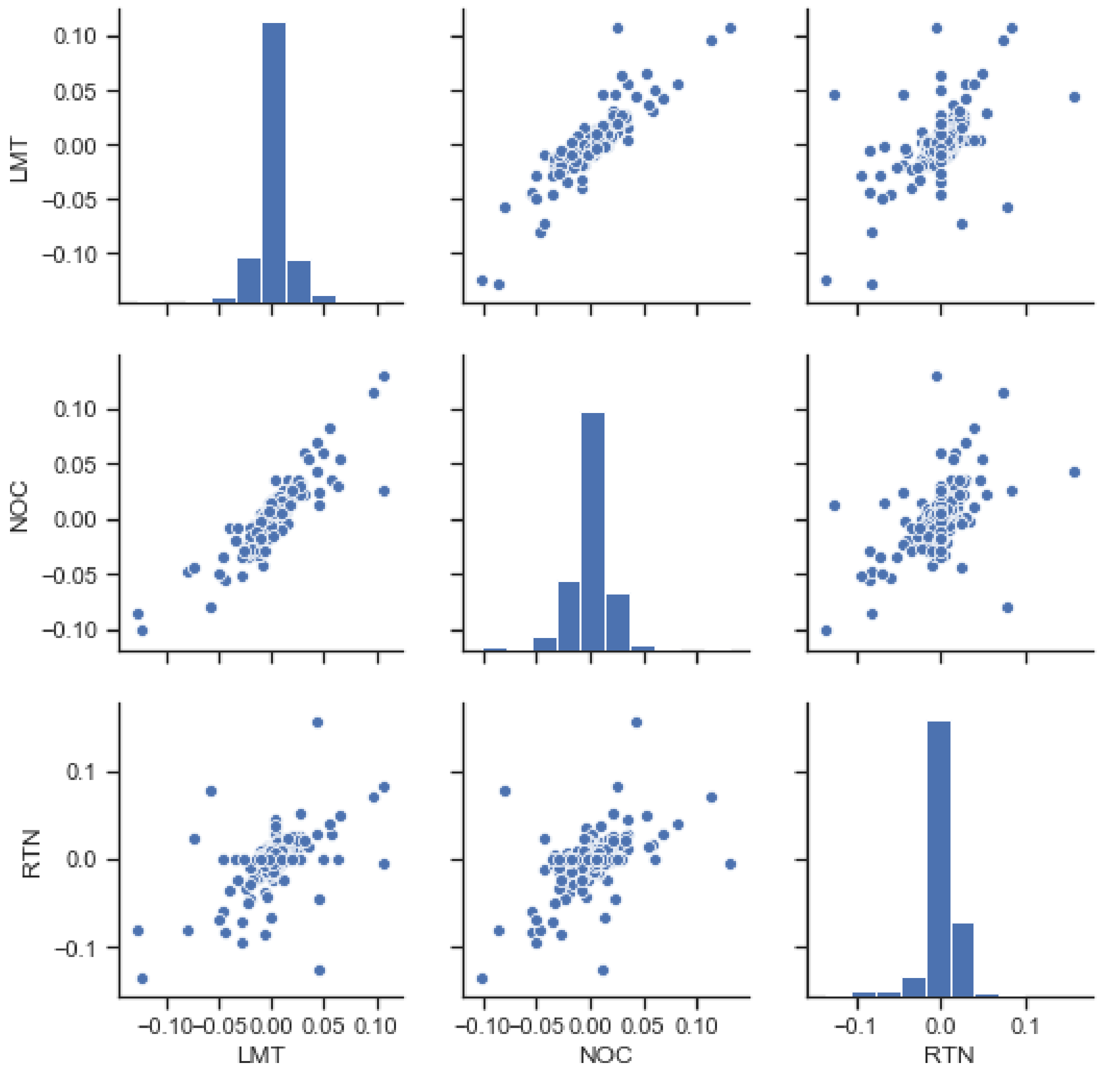


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Aerospace and Defense Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

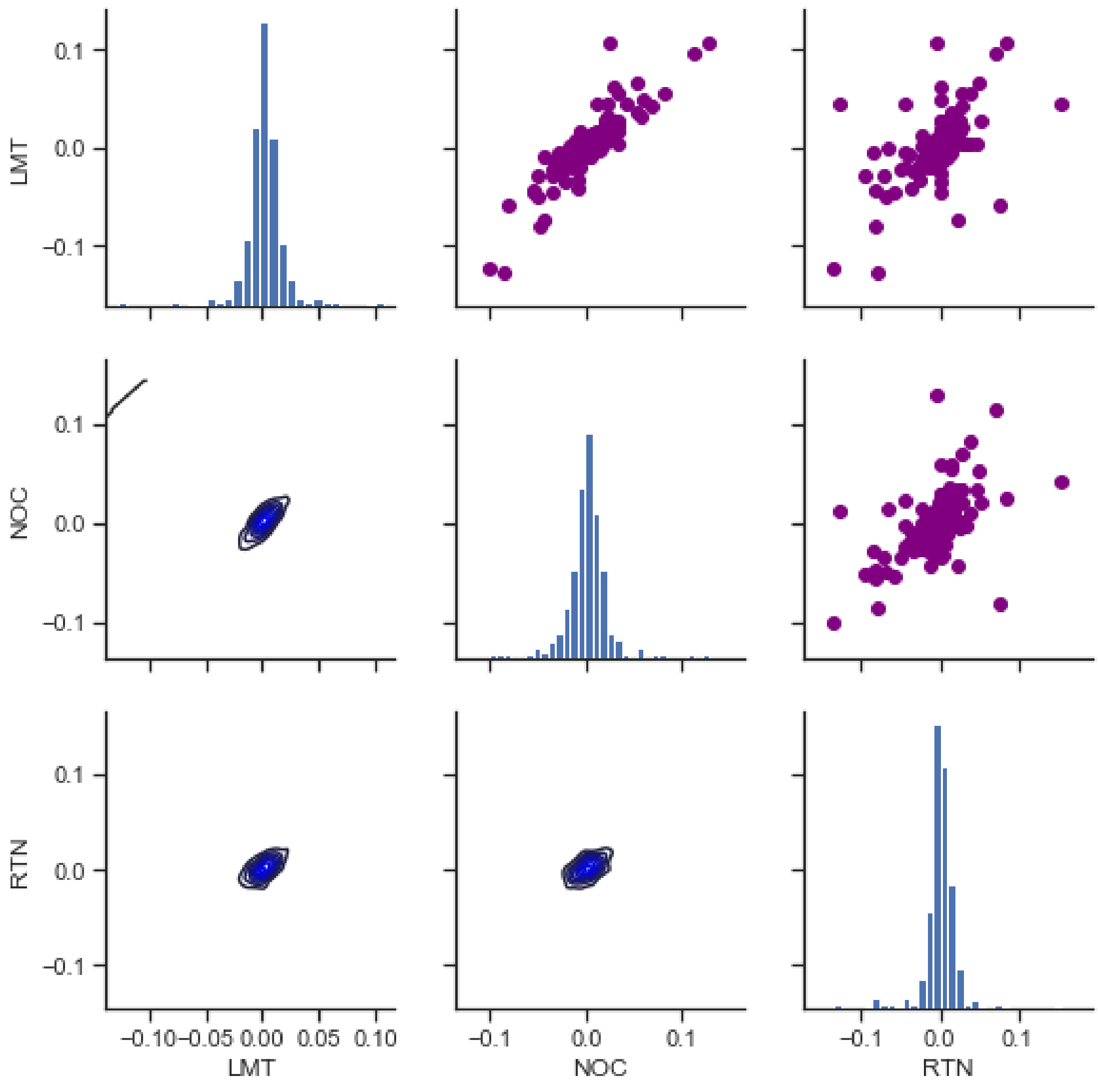
[14]: <matplotlib.legend.Legend at 0x2653730fb00>



[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)
```

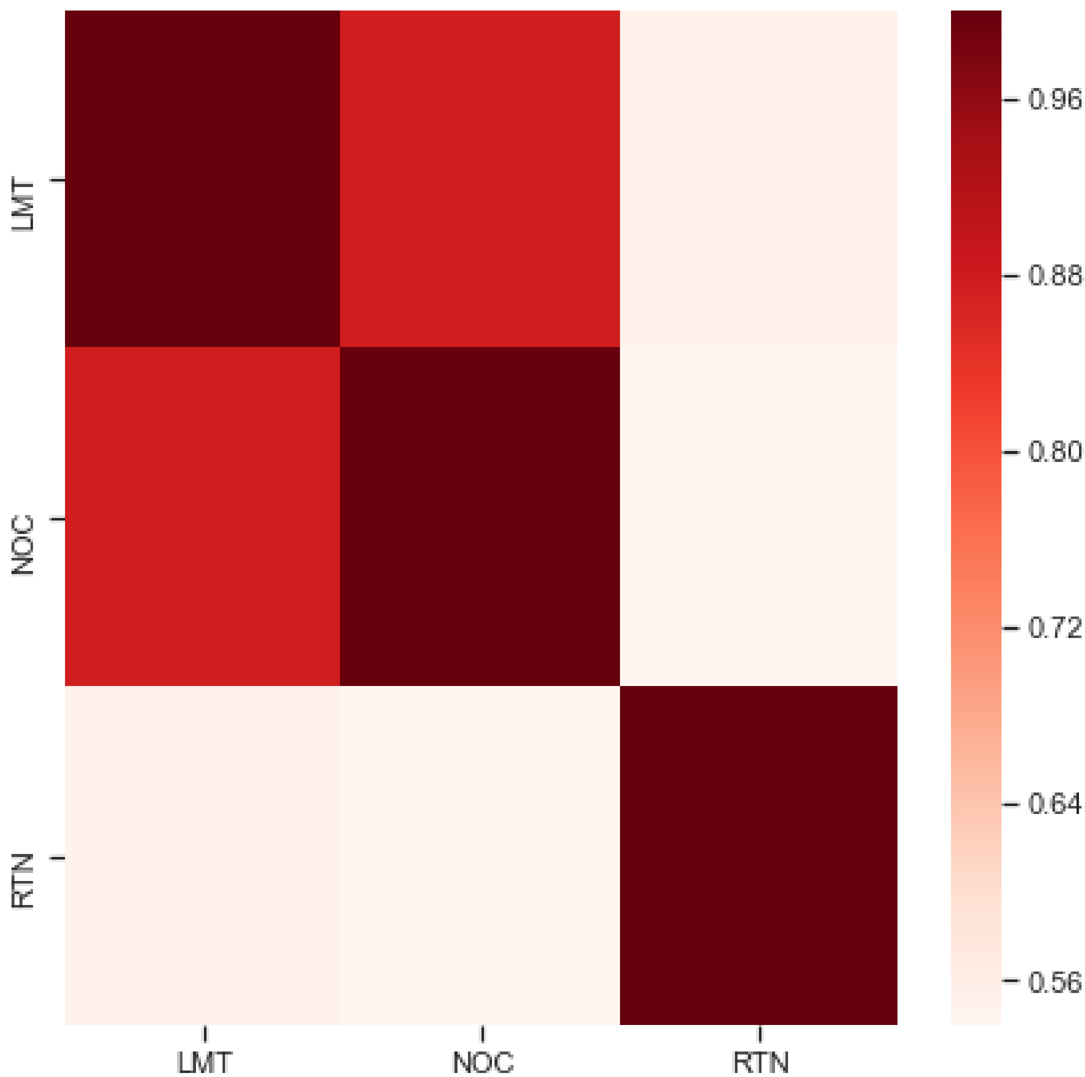



```
[16]: ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



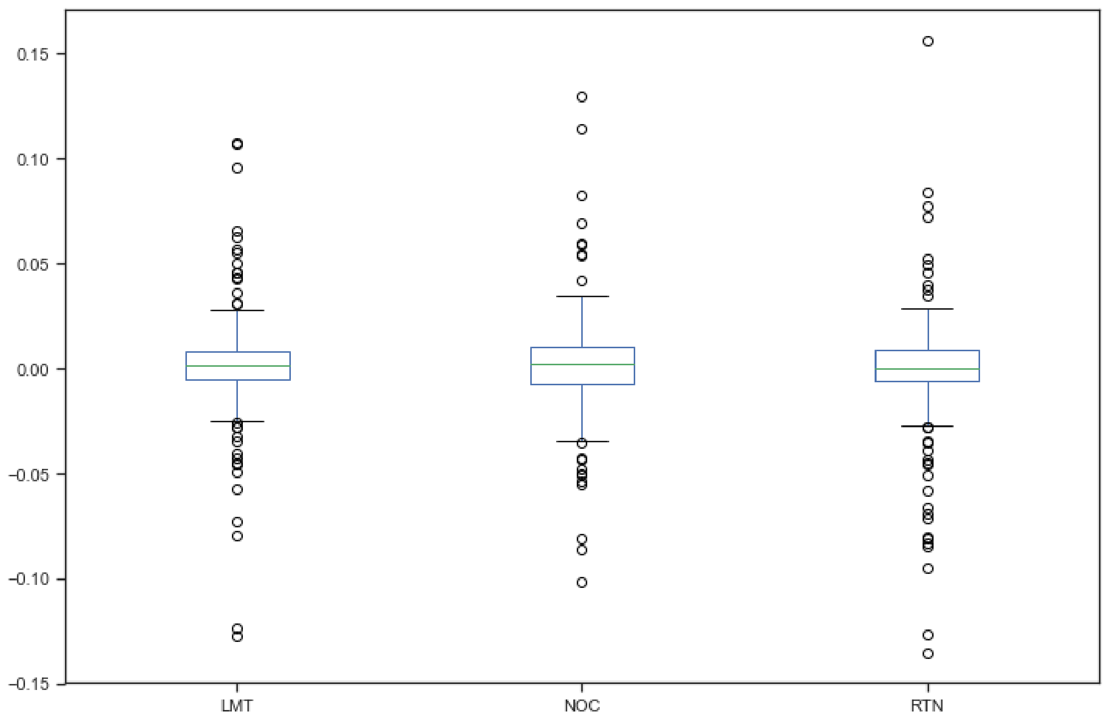

```
[17]: plt.figure(figsize=(7,7))
      corr = stock_rets.corr()

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

```
[17]: <matplotlib.axes._subplots.AxesSubplot at 0x26538a10ba8>
```

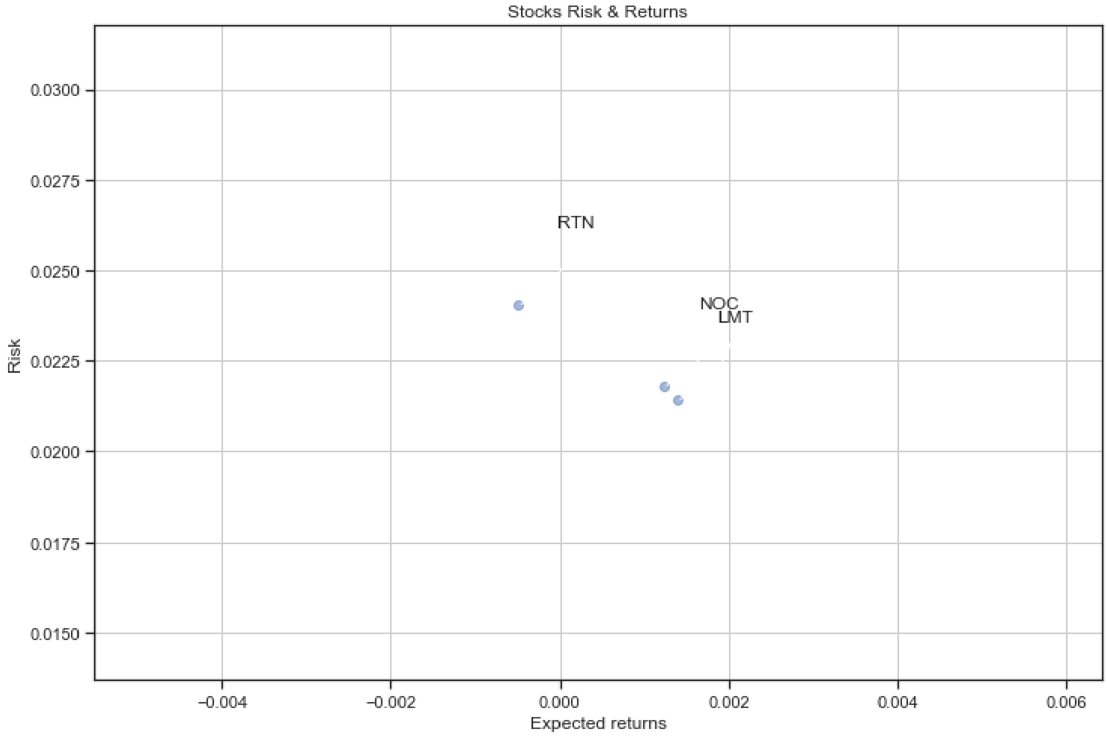


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

[18]: <matplotlib.axes._subplots.AxesSubplot at 0x265394e0ac8>



[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]:
```
RTN  RTN    1.000000
NOC  NOC    1.000000
LMT  LMT    1.000000
NOC  LMT    0.874089
LMT  NOC    0.874089
RTN  LMT    0.549722
LMT  RTN    0.549722
RTN  NOC    0.539163
NOC  RTN    0.539163
dtype: float64
```

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

[22]:
```
                 LMT       NOC       RTN
Date
2019-01-03  0.436347  0.325231  0.367458
2019-01-04  0.658100  0.582025  0.554853
```

```
2019-01-07  0.592118  0.471966  0.500503
2019-01-08  0.571715  0.457873  0.505208
2019-01-09  0.553858  0.458817  0.480053
```

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

[23]:
```
          LMT       NOC       RTN
LMT  1.000000  0.874089  0.549722
NOC  0.874089  1.000000  0.539163
RTN  0.549722  0.539163  1.000000
```

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

[24]:
```
RTN  RTN    1.000000
NOC  NOC    1.000000
LMT  LMT    1.000000
NOC  LMT    0.874089
LMT  NOC    0.874089
RTN  LMT    0.549722
LMT  RTN    0.549722
RTN  NOC    0.539163
NOC  RTN    0.539163
dtype: float64
```

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

```
Stock returns:
LMT    0.001400
NOC    0.001236
RTN   -0.000486
dtype: float64
--------------------------------------------------
Stock risks:
LMT    0.021418
NOC    0.021795
RTN    0.024030
dtype: float64
```

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

```
table.sort_values(by='Returns')
```

[26]:

```
      Returns      Risk
RTN -0.000486  0.024030
NOC  0.001236  0.021795
LMT  0.001400  0.021418
```

[27]:

```
table.sort_values(by='Risk')
```

[27]:

```
      Returns      Risk
LMT  0.001400  0.021418
NOC  0.001236  0.021795
RTN -0.000486  0.024030
```

[28]:

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

[28]:

```
      Returns      Risk  Sharpe Ratio
LMT  0.001400  0.021418     -0.401526
NOC  0.001236  0.021795     -0.402099
RTN -0.000486  0.024030     -0.436384
```

[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  \
LMT  0.001400  0.021418     -0.401526     0.107279    -0.127616
NOC  0.001236  0.021795     -0.402099     0.130012    -0.101463
RTN -0.000486  0.024030     -0.436384     0.156050    -0.135269

     Median Returns  Total Return
LMT        0.001419     -0.964769
NOC        0.001847     -1.806971
RTN        0.000336      0.000000
```

[33]:

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

[33]:
```
      Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
LMT  0.001400  0.021418     -0.401526     0.107279    -0.127616
NOC  0.001236  0.021795     -0.402099     0.130012    -0.101463
RTN -0.000486  0.024030     -0.436384     0.156050    -0.135269

     Median Returns  Total Return  Average Return Days
LMT        0.001419     -0.964769            -0.000020
NOC        0.001847     -1.806971            -0.000038
RTN        0.000336      0.000000             0.000000
```

[34]:
```python
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  \
LMT  0.001400  0.021418     -0.401526     0.107279    -0.127616
NOC  0.001236  0.021795     -0.402099     0.130012    -0.101463
RTN -0.000486  0.024030     -0.436384     0.156050    -0.135269

     Median Returns  Total Return  Average Return Days      CAGR
LMT        0.001419     -0.964769            -0.000020  0.225271
NOC        0.001847     -1.806971            -0.000038  0.189957
RTN        0.000336      0.000000             0.000000       NaN
```

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

[35]:
```
      Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
NOC  0.001236  0.021795     -0.402099     0.130012    -0.101463
LMT  0.001400  0.021418     -0.401526     0.107279    -0.127616
RTN -0.000486  0.024030     -0.436384     0.156050    -0.135269

     Median Returns  Total Return  Average Return Days      CAGR
NOC        0.001847     -1.806971            -0.000038  0.189957
LMT        0.001419     -0.964769            -0.000020  0.225271
RTN        0.000336      0.000000             0.000000       NaN
```