Warren_Buffet_Vaccine_Portfolio

September 29, 2021

1 Warren Buffet Vaccine 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")

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

[2]:
```
# input
# 4 Companies Vaccine
symbols = ['ABBV','MRK','PFE','BMY']
start = '2020-01-01'
end = '2020-11-27'
```

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

```
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[*********************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]: 328

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

[7]:

Date	ABBV	MRK	PFE	BMY
2020-01-02	84.852608	89.912033	35.677311	61.879055
2020-01-03	84.047203	89.140297	35.485886	61.331974
2020-01-06	84.710480	89.521278	35.440315	61.527363
2020-01-07	84.227234	87.137688	35.321815	62.455448
2020-01-08	84.824188	86.551559	35.604385	62.387066

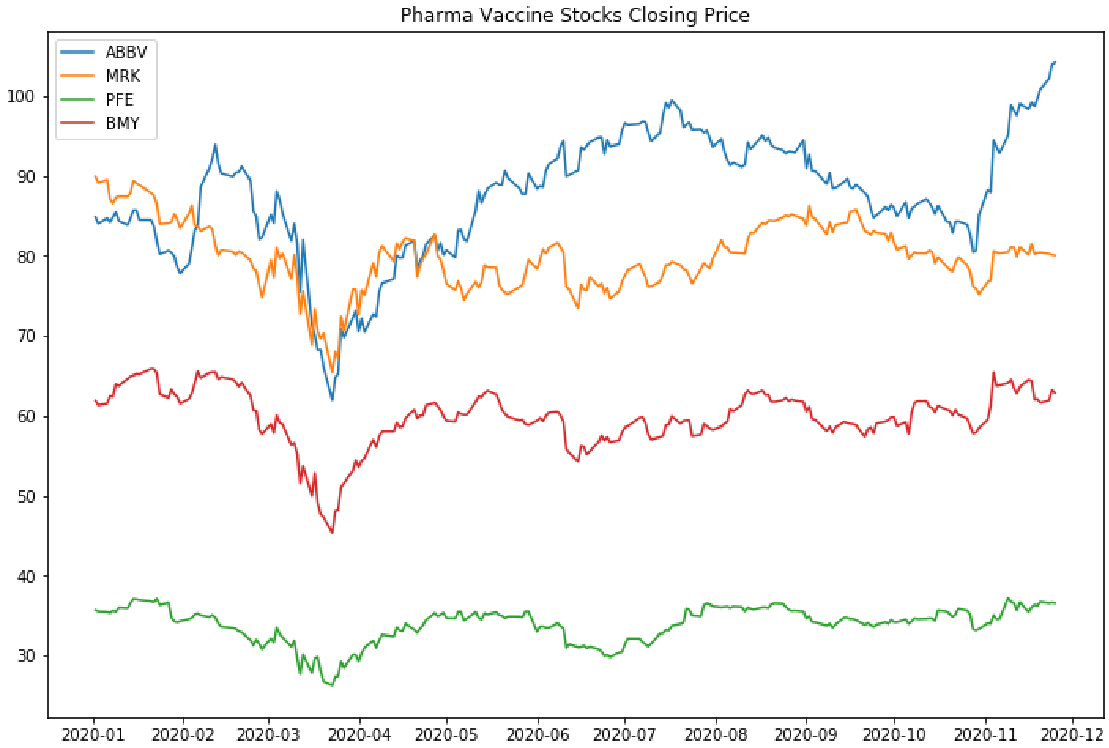
[8]:
```
df.tail()
```

[8]:

Date	ABBV	MRK	PFE	BMY
2020-11-19	99.669998	80.389999	36.189999	62.090000
2020-11-20	100.839996	80.449997	36.700001	61.610001
2020-11-23	102.180000	80.279999	36.520000	61.919998
2020-11-24	103.959999	80.139999	36.599998	63.220001
2020-11-25	104.199997	80.059998	36.529999	62.840000

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

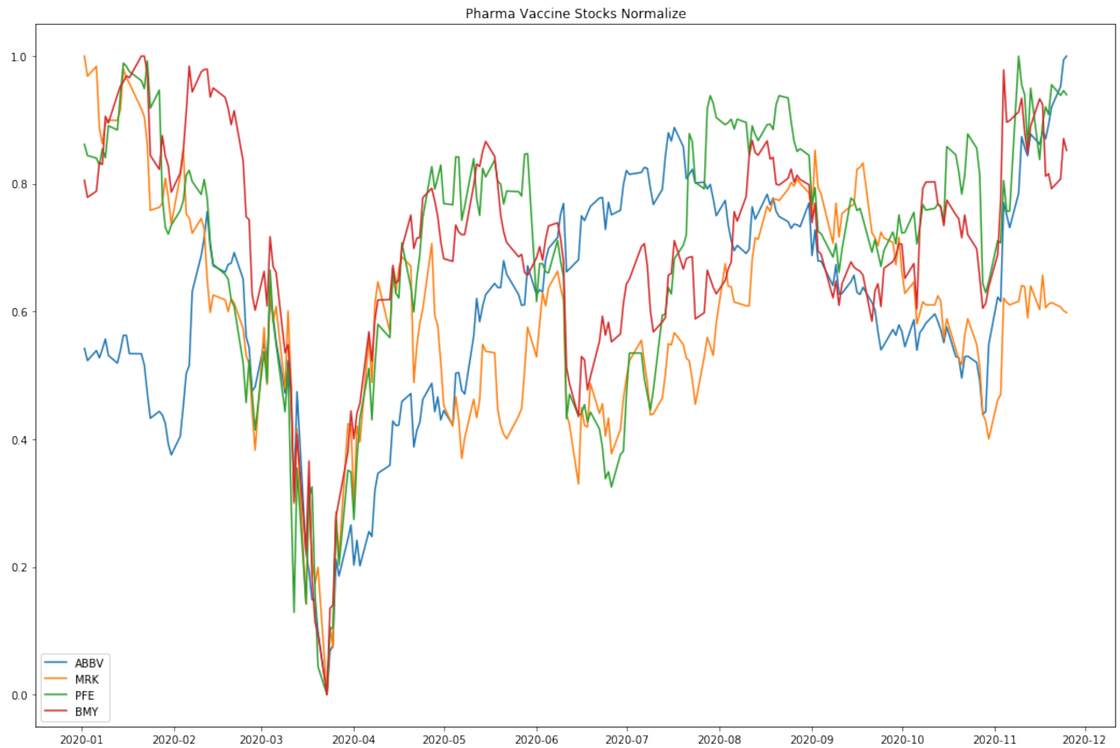
[9]: <matplotlib.legend.Legend at 0x2521b8897b8>



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

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

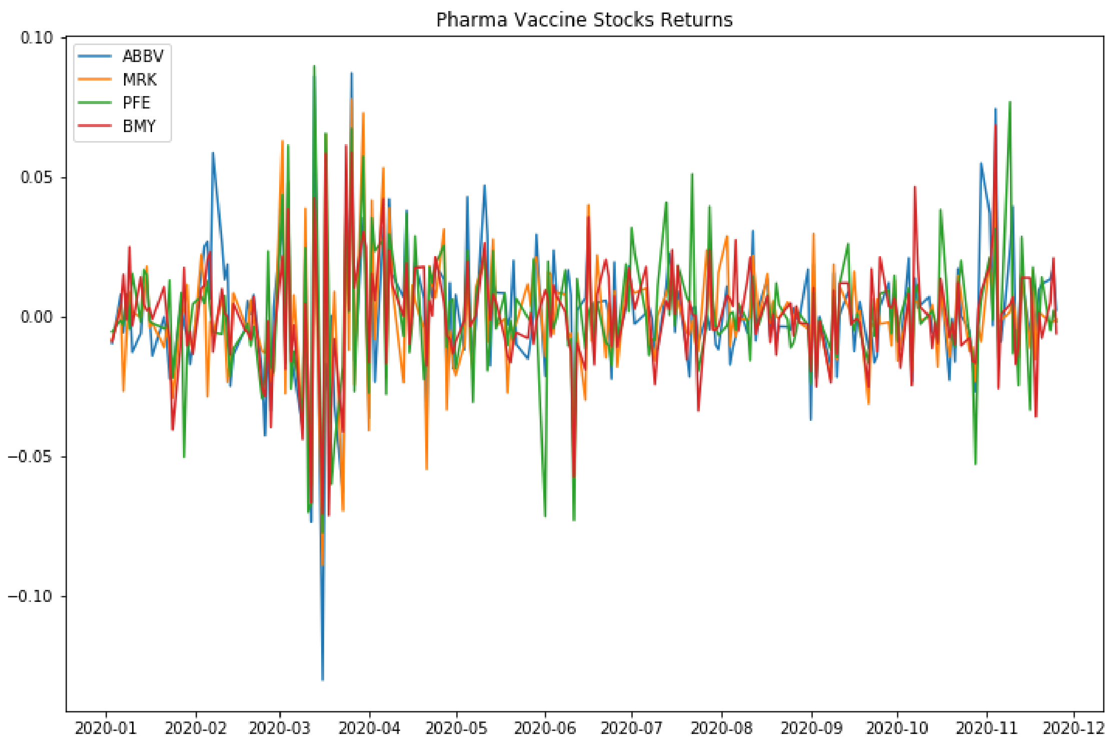
[11]: <matplotlib.legend.Legend at 0x2521bcf2f28>



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

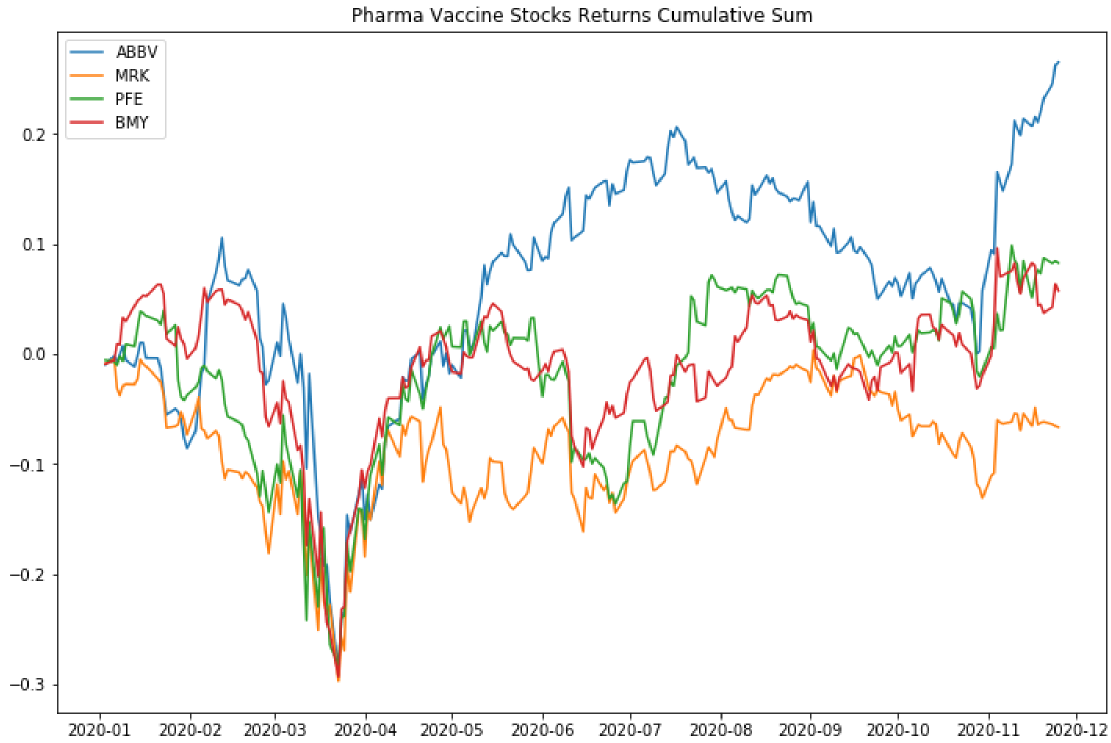
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Pharma Vaccine Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x2521ba9b7b8>

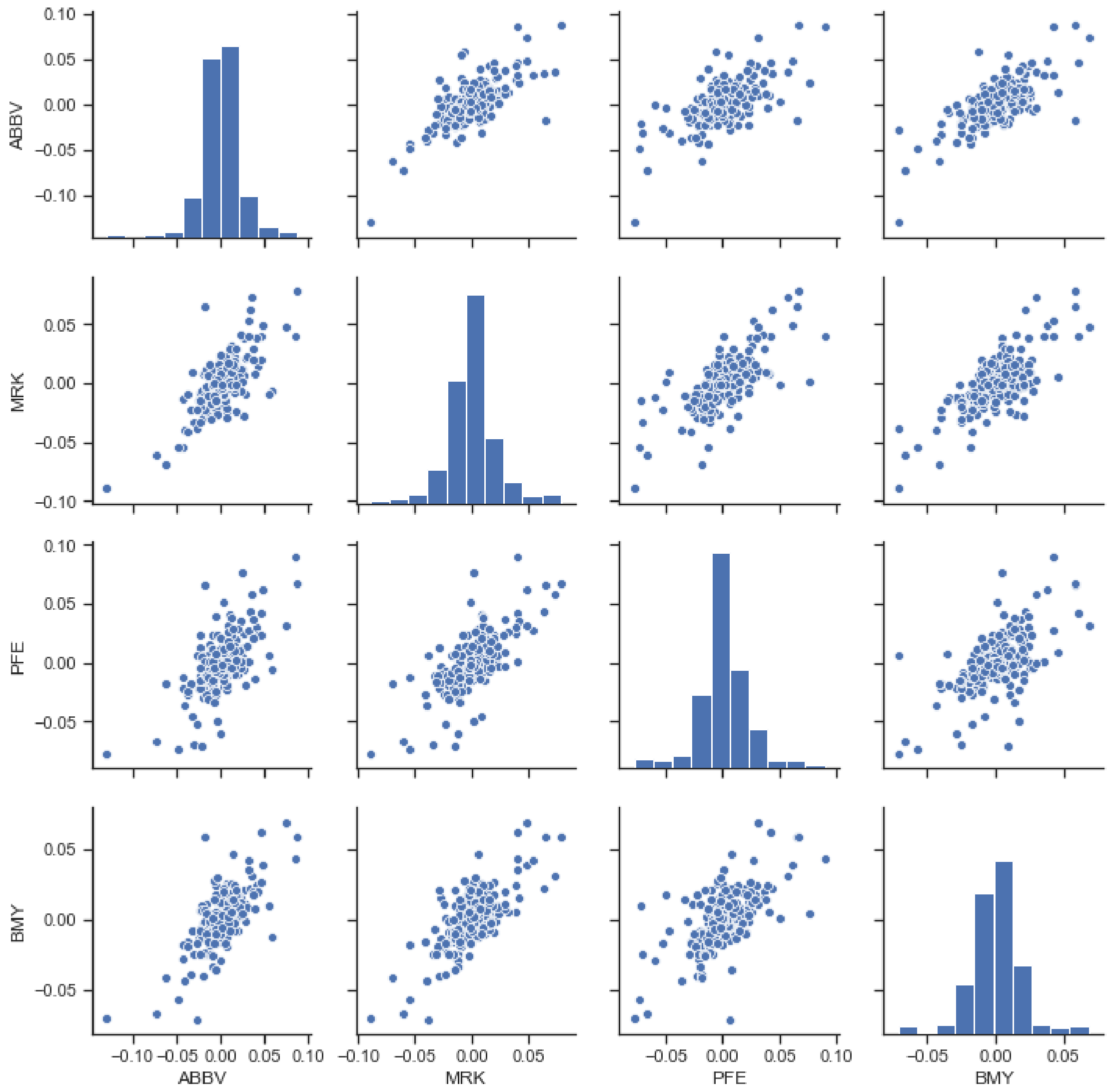


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Pharma Vaccine Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

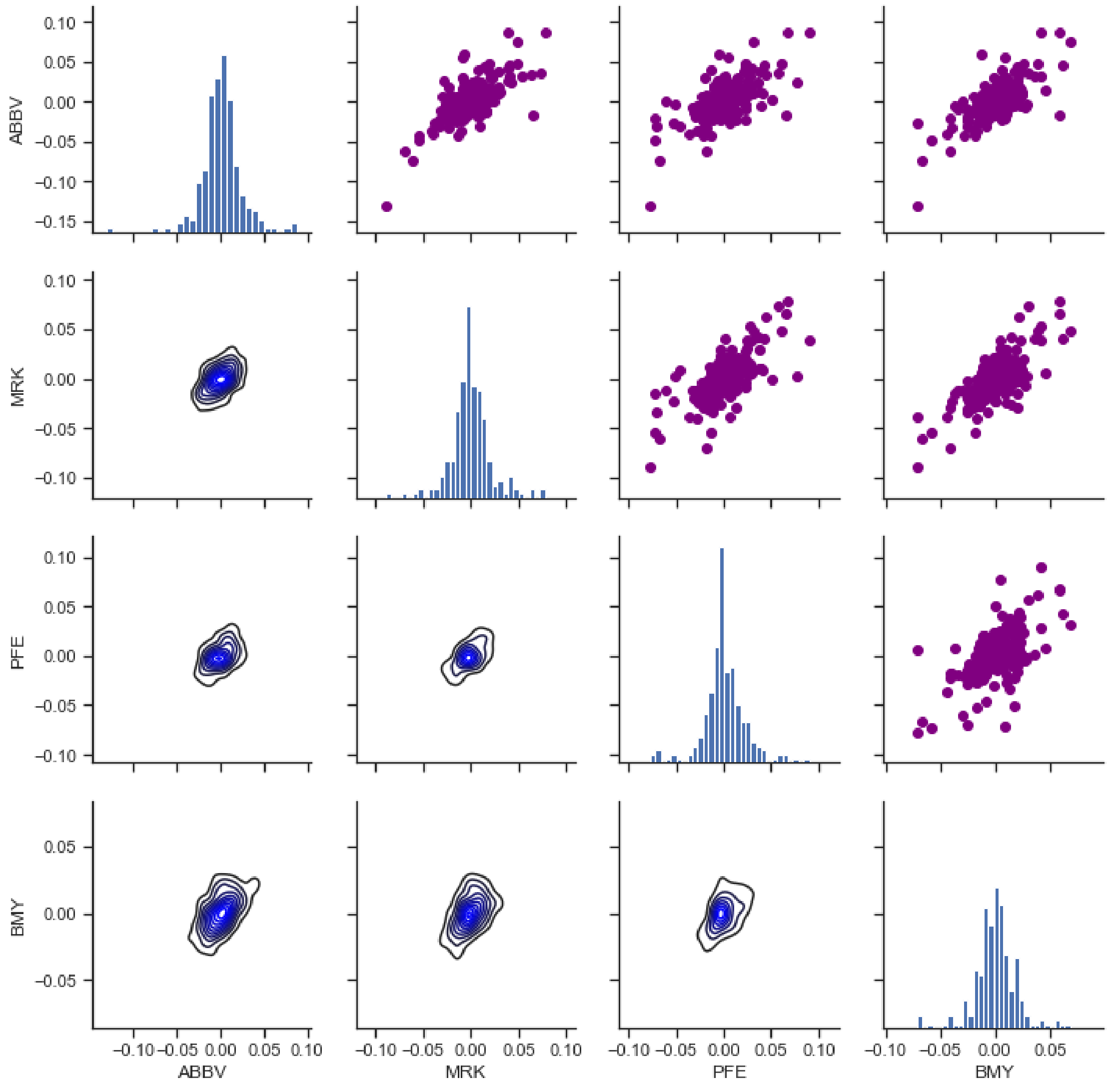
[14]: <matplotlib.legend.Legend at 0x2521baabf28>



[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)
```

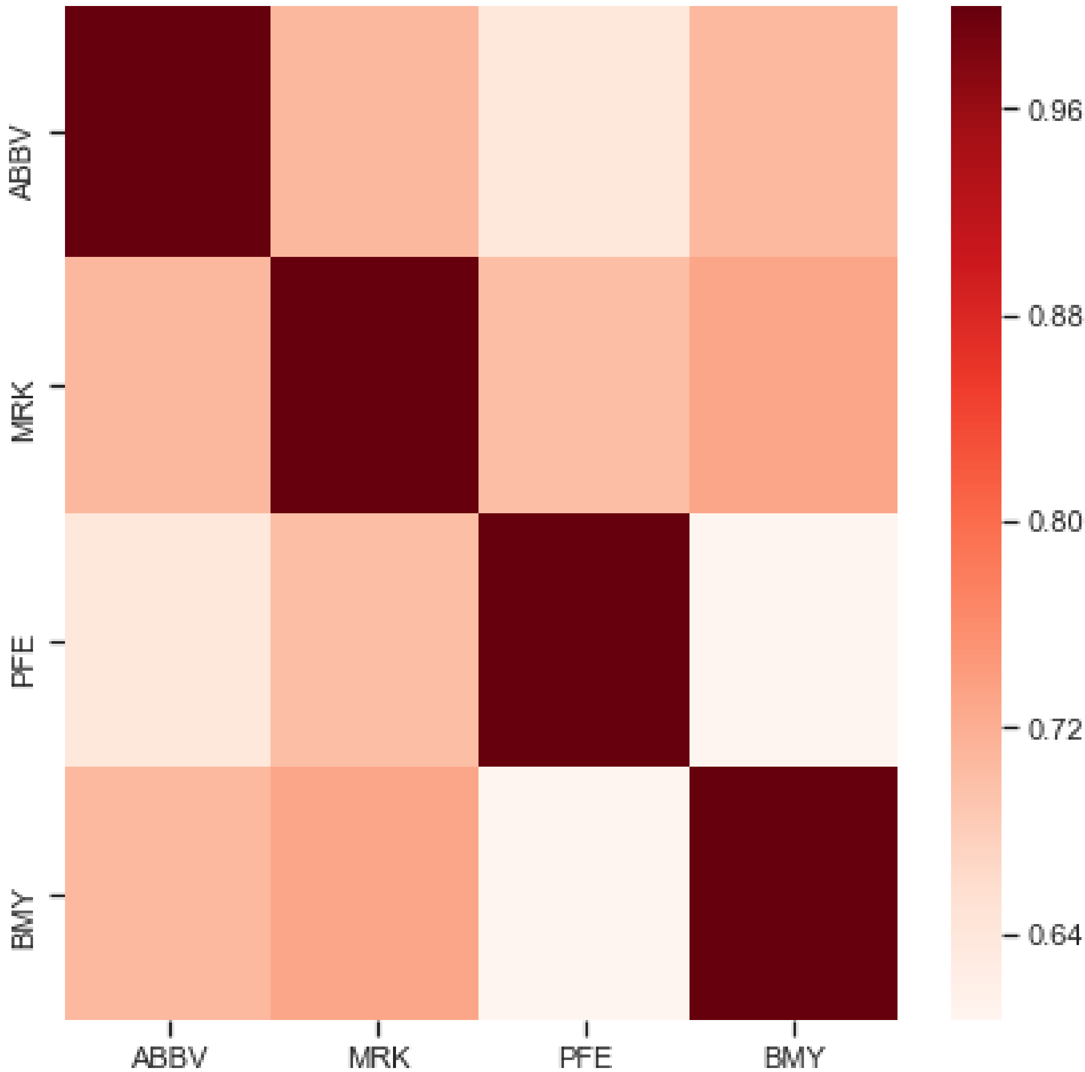


[16]:
```python
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



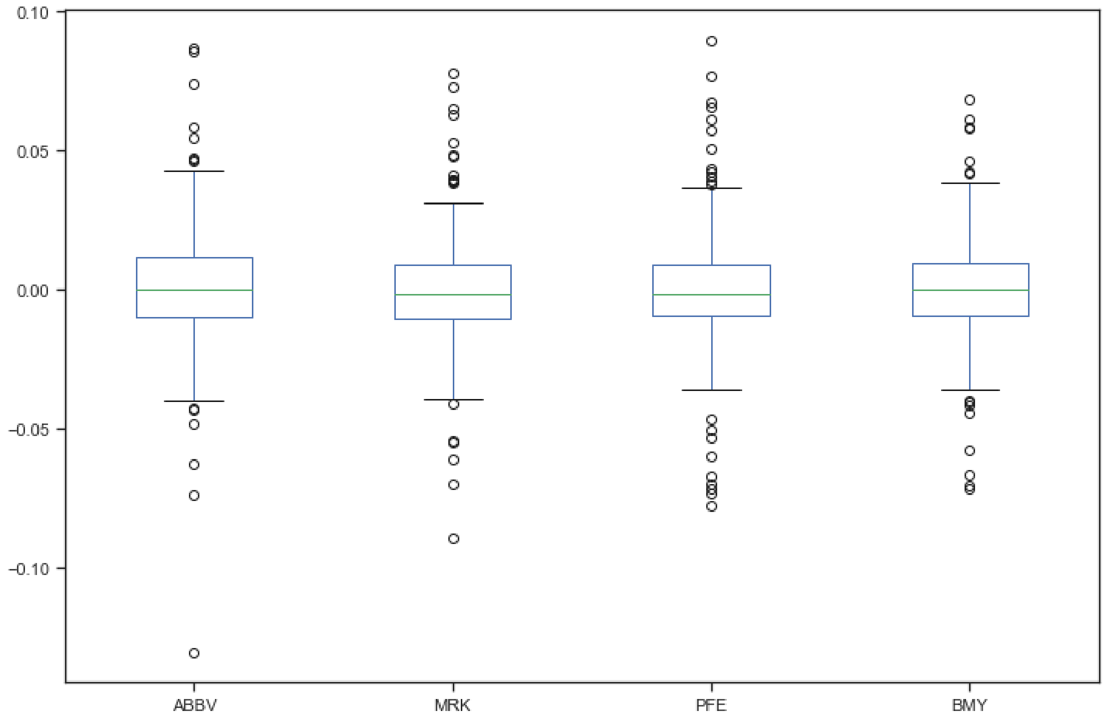

```
[17]: plt.figure(figsize=(7,7))
      corr = stock_rets.corr()

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

```
[17]: <matplotlib.axes._subplots.AxesSubplot at 0x2521d597240>
```

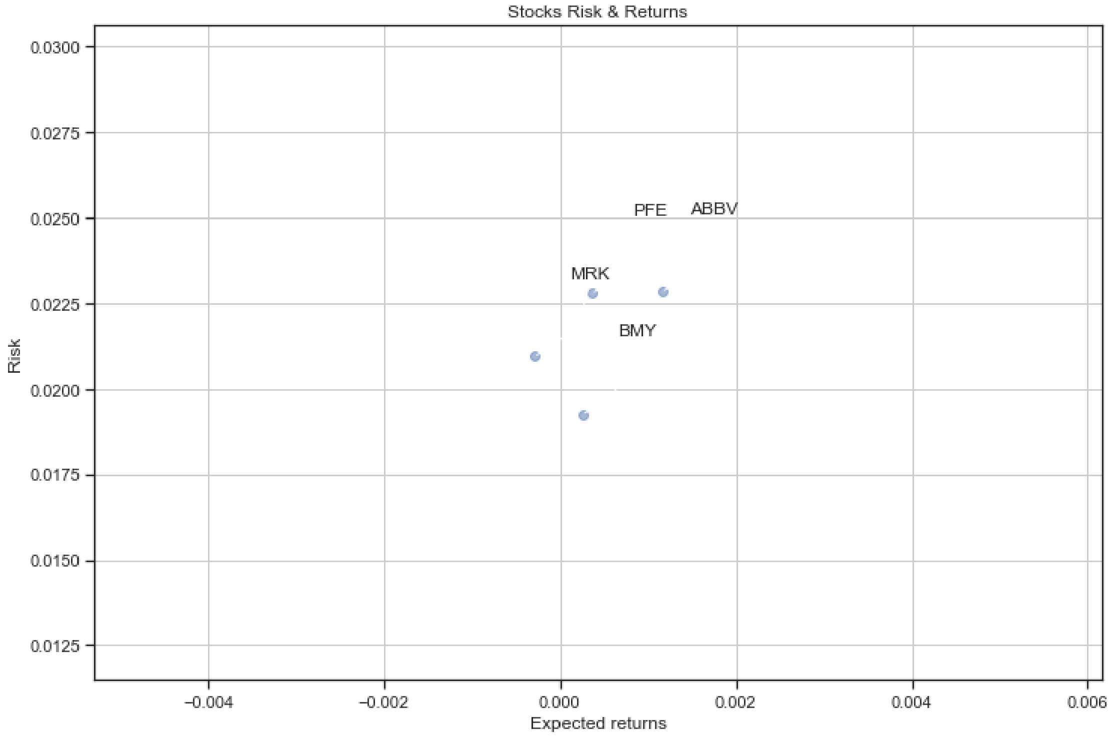


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

[18]: <matplotlib.axes._subplots.AxesSubplot at 0x2521e9077b8>



[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]:
```
BMY   BMY     1.000000
PFE   PFE     1.000000
MRK   MRK     1.000000
ABBV  ABBV    1.000000
BMY   MRK     0.730678
MRK   BMY     0.730678
      ABBV    0.708299
ABBV  MRK     0.708299
BMY   ABBV    0.706911
ABBV  BMY     0.706911
PFE   MRK     0.701532
MRK   PFE     0.701532
PFE   ABBV    0.640402
ABBV  PFE     0.640402
BMY   PFE     0.606196
PFE   BMY     0.606196
dtype: float64
```

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

[22]:
```
                ABBV       MRK       PFE       BMY
Date
2020-01-03  0.554937  0.481979  0.431144  0.446546
2020-01-06  0.634973  0.559048  0.455590  0.532701
2020-01-07  0.572374  0.373827  0.443254  0.617934
2020-01-08  0.631270  0.493109  0.511199  0.502036
2020-01-09  0.634126  0.586201  0.437214  0.688237
```

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

[23]:
```
          ABBV       MRK       PFE       BMY
ABBV  1.000000  0.708299  0.640402  0.706911
MRK   0.708299  1.000000  0.701532  0.730678
PFE   0.640402  0.701532  1.000000  0.606196
BMY   0.706911  0.730678  0.606196  1.000000
```

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

[24]:
```
BMY   BMY     1.000000
PFE   PFE     1.000000
MRK   MRK     1.000000
ABBV  ABBV    1.000000
BMY   MRK     0.730678
MRK   BMY     0.730678
      ABBV    0.708299
ABBV  MRK     0.708299
BMY   ABBV    0.706911
ABBV  BMY     0.706911
PFE   MRK     0.701532
MRK   PFE     0.701532
PFE   ABBV    0.640402
ABBV  PFE     0.640402
BMY   PFE     0.606196
PFE   BMY     0.606196
dtype: float64
```

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

```
Stock returns:
ABBV    0.001163
MRK    -0.000291
PFE     0.000362
BMY     0.000253
dtype: float64
--------------------------------------------------
Stock risks:
ABBV    0.022844
MRK     0.020943
PFE     0.022804
BMY     0.019263
dtype: float64
```

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

[26]:

	Returns	Risk
MRK	-0.000291	0.020943
BMY	0.000253	0.019263
PFE	0.000362	0.022804
ABBV	0.001163	0.022844

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

[27]:

	Returns	Risk
BMY	0.000253	0.019263
MRK	-0.000291	0.020943
PFE	0.000362	0.022804
ABBV	0.001163	0.022844

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

[28]:

	Returns	Risk	Sharpe Ratio
ABBV	0.001163	0.022844	-0.386856
MRK	-0.000291	0.020943	-0.491361
PFE	0.000362	0.022804	-0.422622
BMY	0.000253	0.019263	-0.506008

[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  \
ABBV  0.001163  0.022844     -0.386856     0.087174    -0.130022
MRK  -0.000291  0.020943     -0.491361     0.077836    -0.088990
PFE   0.000362  0.022804     -0.422622     0.089607    -0.077346
BMY   0.000253  0.019263     -0.506008     0.068419    -0.071178

      Median Returns  Total Return
ABBV        0.000535      0.230856
MRK        -0.001376     -0.099828
PFE        -0.001306     -0.191256
BMY         0.000249     -0.601077
```

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

[33]:
```
         Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
ABBV  0.001163  0.022844     -0.386856     0.087174    -0.130022
MRK  -0.000291  0.020943     -0.491361     0.077836    -0.088990
PFE   0.000362  0.022804     -0.422622     0.089607    -0.077346
BMY   0.000253  0.019263     -0.506008     0.068419    -0.071178

      Median Returns  Total Return  Average Return Days
ABBV        0.000535      0.230856             0.000007
MRK        -0.001376     -0.099828            -0.000003
PFE        -0.001306     -0.191256            -0.000006
BMY         0.000249     -0.601077            -0.000018
```

[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  \
ABBV  0.001163  0.022844     -0.386856     0.087174    -0.130022
MRK  -0.000291  0.020943     -0.491361     0.077836    -0.088990
PFE   0.000362  0.022804     -0.422622     0.089607    -0.077346
BMY   0.000253  0.019263     -0.506008     0.068419    -0.071178

      Median Returns  Total Return  Average Return Days      CAGR
ABBV        0.000535      0.230856             0.000007  0.170937
MRK        -0.001376     -0.099828            -0.000003 -0.085305
```

```
PFE        -0.001306     -0.191256            -0.000006  0.018312
BMY         0.000249     -0.601077            -0.000018  0.011910
```

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

[35]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
BMY   0.000253  0.019263     -0.506008     0.068419    -0.071178
PFE   0.000362  0.022804     -0.422622     0.089607    -0.077346
MRK  -0.000291  0.020943     -0.491361     0.077836    -0.088990
ABBV  0.001163  0.022844     -0.386856     0.087174    -0.130022

      Median Returns  Total Return  Average Return Days      CAGR
BMY         0.000249     -0.601077            -0.000018  0.011910
PFE        -0.001306     -0.191256            -0.000006  0.018312
MRK        -0.001376     -0.099828            -0.000003 -0.085305
ABBV        0.000535      0.230856             0.000007  0.170937
```