Tech_Portfolio

September 29, 2021

1 Technology Portfolio

1.1 Tech Stocks

[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")

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

[2]:
```
# input
symbols = ['TSLA','GOOGL','MSFT','NVDA']
start = '2011-01-01'
end = '2019-01-01'
title = "Technology Portfolio"

# Read data
df = yf.download(symbols,start,end)['Adj Close']

# View Columns
df.head()
```

```
[*********************100%***********************]  4 of 4 completed
```

[2]:

	GOOGL	MSFT	NVDA	TSLA
Date				
2011-01-03	302.477478	22.358212	14.553763	26.620001
2011-01-04	301.361359	22.446114	14.507762	26.670000
2011-01-05	304.839844	22.374191	15.620916	26.830000
2011-01-06	307.057068	23.029436	17.782816	27.879999
2011-01-07	308.528534	22.853636	18.279594	28.240000

[3]:
```
df.tail()
```

[3]:

	GOOGL	MSFT	NVDA	TSLA
Date				
2018-12-24	984.669983	92.248878	126.452255	295.390015
2018-12-26	1047.849976	98.550377	132.442535	326.089996
2018-12-27	1052.900024	99.158005	130.522049	316.130005
2018-12-28	1046.680054	98.383781	132.989807	333.869995
2018-12-31	1044.959961	99.540192	132.840530	332.799988

[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?
8 years
```

1.1.1 Starting Cash with 100k to invest in Technology

[5]:
```
Cash = 100000
print('Percentage of invest:')
percent_invest = [0.25, 0.25, 0.25, 0.25]
for i, x in zip(df.columns, percent_invest):
    cost = x * Cash
    print('{}: {}'.format(i, cost))
```

```
Percentage of invest:
GOOGL: 25000.0
MSFT: 25000.0
NVDA: 25000.0
TSLA: 25000.0
```

[6]:
```
print('Number of Shares:')
percent_invest = [0.25, 0.25, 0.25, 0.25]
for i, x, y in zip(df.columns, percent_invest, df.iloc[0]):
    cost = x * Cash
    shares = int(cost/y)
    print('{}: {}'.format(i, shares))
```

```
Number of Shares:
GOOGL: 82
MSFT: 1118
```

```
NVDA: 1717
TSLA: 939
```

[7]:
```
print('Beginning Value:')
percent_invest = [0.25, 0.25, 0.25, 0.25]
for i, x, y in zip(df.columns, percent_invest, df.iloc[0]):
    cost = x * Cash
    shares = int(cost/y)
    Begin_Value = round(shares * y, 2)
    print('{}: ${}'.format(i, Begin_Value))
```

```
Beginning Value:
GOOGL: $24803.15
MSFT: $24996.48
NVDA: $24988.81
TSLA: $24996.18
```

[8]:
```
df.ix[-1]
```

[8]:
```
GOOGL    1044.959961
MSFT       99.540192
NVDA      132.840530
TSLA      332.799988
Name: 2018-12-31 00:00:00, dtype: float64
```

[9]:
```
print('Current Value:')
percent_invest = [0.25, 0.25, 0.25, 0.25]
for i, x, y, z in zip(df.columns, percent_invest, df.ix[0], df.ix[-1]):
    cost = x * Cash
    shares = int(cost/y)
    Current_Value = round(shares * z, 2)
    print('{}: ${}'.format(i, Current_Value))
```

```
Current Value:
GOOGL: $85686.72
MSFT: $111285.93
NVDA: $228087.19
TSLA: $312499.19
```

[10]:
```
result = []
percent_invest = [0.25, 0.25, 0.25, 0.25]
for i, x, y, z in zip(df.columns, percent_invest, df.iloc[0], df.iloc[-1]):
    cost = x * Cash
    shares = int(cost/y)
    Current_Value = round(shares * z, 2)
    result.append(Current_Value)
print('Total Value: $%s' % round(sum(result),2))
```

Total Value: $737559.03

[11]:
```
# Calculate Daily Returns
returns = df.pct_change()
returns = returns.dropna()
```

[12]:
```
# Calculate mean returns
meanDailyReturns = returns.mean()
print(meanDailyReturns)
```

```
GOOGL    0.000729
MSFT     0.000849
NVDA     0.001416
TSLA     0.001749
dtype: float64
```

[13]:
```
# Calculate std returns
stdDailyReturns = returns.std()
print(stdDailyReturns)
```

```
GOOGL    0.015087
MSFT     0.014583
NVDA     0.025336
TSLA     0.031572
dtype: float64
```

[14]:
```
# Define weights for the portfolio
weights = np.array([0.50, 0.10, 0.20, 0.20])
```

[15]:
```
# Calculate the covariance matrix on daily returns
cov_matrix = (returns.cov())*250
print (cov_matrix)
```

```
          GOOGL      MSFT      NVDA      TSLA
GOOGL  0.056903  0.029132  0.038131  0.034590
MSFT   0.029132  0.053164  0.040668  0.031326
NVDA   0.038131  0.040668  0.160477  0.053355
TSLA   0.034590  0.031326  0.053355  0.249197
```

[16]:
```
# Calculate expected portfolio performance
portReturn = np.sum(meanDailyReturns*weights)
```

[17]:
```
# Print the portfolio return
print(portReturn)
```

```
0.0010827309074405308
```

[18]:
```
# Create portfolio returns column
returns['Portfolio'] = returns.dot(weights)
```

[19]:
```
returns.head()
```

[19]:
```
                GOOGL      MSFT      NVDA      TSLA  Portfolio
Date
2011-01-04 -0.003690  0.003932 -0.003161  0.001878  -0.001708
2011-01-05  0.011543 -0.003204  0.076728  0.005999   0.021996
2011-01-06  0.007273  0.029286  0.138398  0.039135   0.042072
2011-01-07  0.004792 -0.007634  0.027936  0.012913   0.009802
2011-01-10 -0.003618 -0.013287  0.038249  0.007436   0.006000
```

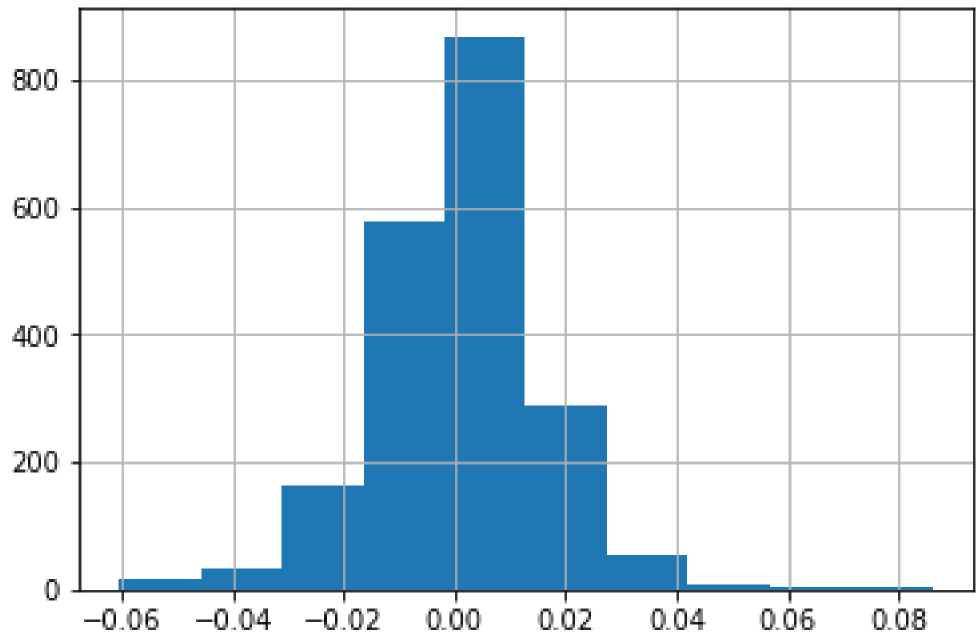
[20]:
```
returns.tail()
```

[20]:
```
                GOOGL      MSFT      NVDA      TSLA  Portfolio
Date
2018-12-24 -0.006638 -0.041739 -0.019218 -0.076242  -0.026585
2018-12-26  0.064164  0.068310  0.047372  0.103930   0.069173
2018-12-27  0.004819  0.006166 -0.014501 -0.030544  -0.005983
2018-12-28 -0.005907 -0.007808  0.018907  0.056116   0.011270
2018-12-31 -0.001643  0.011754 -0.001122 -0.003205  -0.000512
```

[21]:
```
# Calculate cumulative returns
daily_cum_ret=(1+returns).cumprod()
print(daily_cum_ret.tail())
```

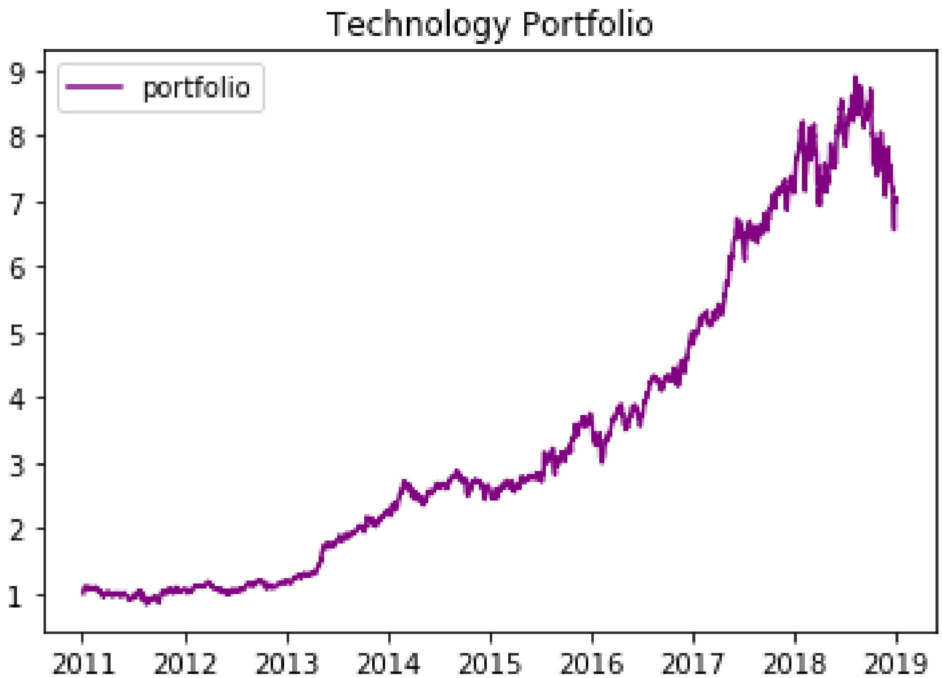
```
               GOOGL      MSFT      NVDA       TSLA  Portfolio
Date
2018-12-24  3.255350  4.125951  8.688629  11.096544   6.558954
2018-12-26  3.464225  4.407793  9.100226  12.249812   7.012658
2018-12-27  3.480920  4.434970  8.968268  11.875657   6.970704
2018-12-28  3.460357  4.400342  9.137829  12.542073   7.049264
2018-12-31  3.454670  4.452064  9.127572  12.501877   7.045657
```

[22]:
```
returns['Portfolio'].hist()
plt.show()
```



[23]:

```
import matplotlib.dates

# Plot the portfolio cumulative returns only
fig, ax = plt.subplots()
ax.plot(daily_cum_ret.index, daily_cum_ret.Portfolio, color='purple',␣
↪label="portfolio")
ax.xaxis.set_major_locator(matplotlib.dates.YearLocator())
plt.title(title)
plt.legend()
plt.show()
```



[24]:
```
# Print the mean
print("mean : ", returns['Portfolio'].mean()*100)

# Print the standard deviation
print("Std. dev: ", returns['Portfolio'].std()*100)

# Print the skewness
print("skew: ", returns['Portfolio'].skew())

# Print the kurtosis
print("kurt: ", returns['Portfolio'].kurtosis())
```

```
mean :  0.10827309074405318
Std. dev:  1.4933191419850007
skew:  -0.008350990342117304
kurt:  2.402583341549402
```

[25]:
```
# Calculate the standard deviation by taking the square root
port_standard_dev = np.sqrt(np.dot(weights.T, np.dot(weights, cov_matrix)))

# Print the results
print(str(np.round(port_standard_dev, 4) * 100) + '%')
```

```
23.61%
```

[26]:
```python
# Calculate the portfolio variance
port_variance = np.dot(weights.T, np.dot(cov_matrix, weights))

# Print the result
print(str(np.round(port_variance, 4) * 100) + '%')
```

```
5.58%
```

[27]:
```python
# Calculate total return and annualized return from price data
total_return = (returns['Portfolio'][-1] - returns['Portfolio'][0]) /␣
↪returns['Portfolio'][0]

# Annualize the total return over 5 year
annualized_return = ((total_return + 1)**(1/5))-1
```

[28]:
```python
# Calculate annualized volatility from the standard deviation
vol_port = returns['Portfolio'].std() * np.sqrt(250)
```

[29]:
```python
# Calculate the Sharpe ratio
rf = 0.01
sharpe_ratio = ((annualized_return - rf) / vol_port)
print(sharpe_ratio)
```

```
-0.9496495611598165
```

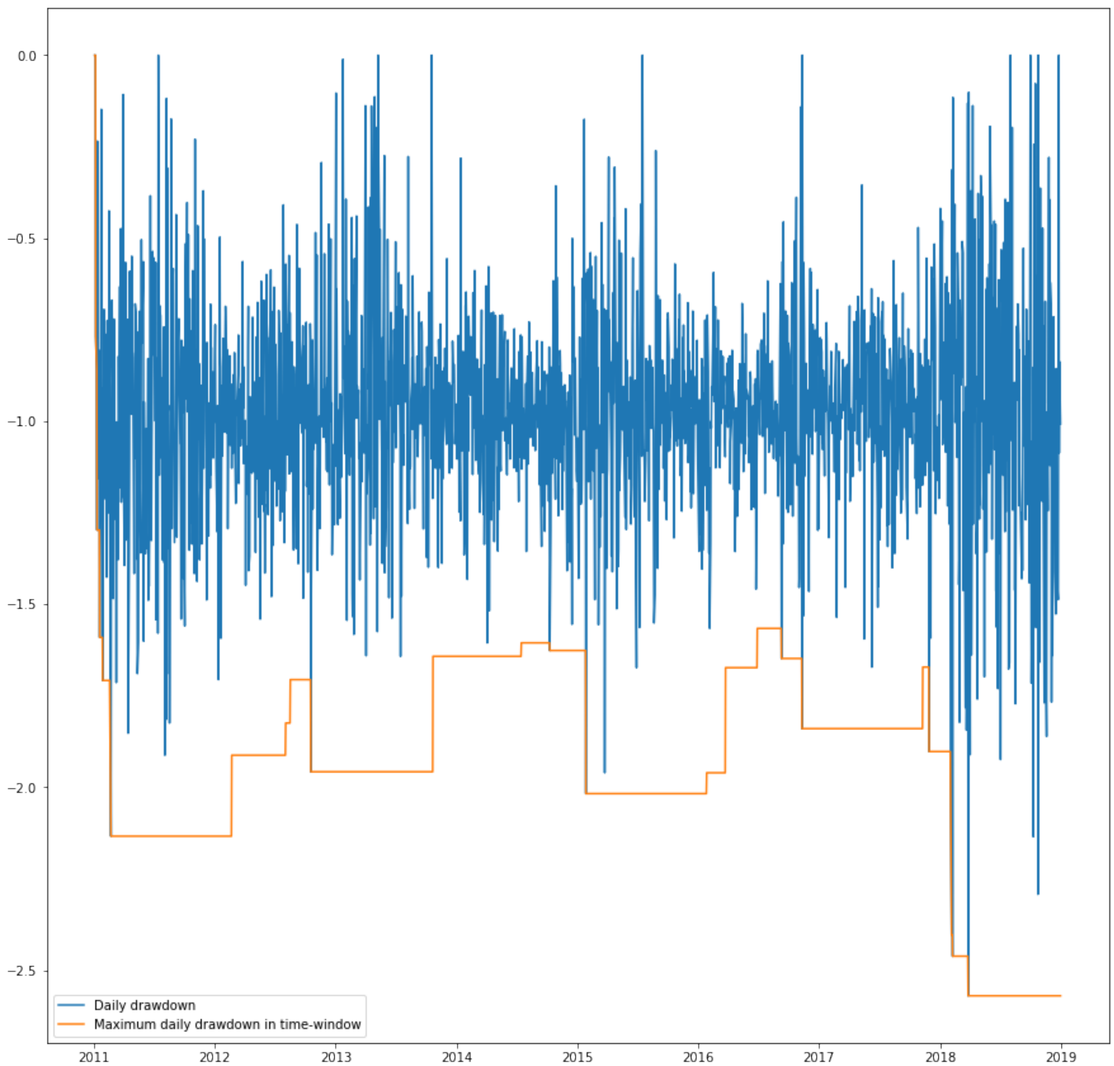
[30]:
```python
# Create a downside return column with the negative returns only
target = 0
downside_returns = returns.loc[returns['Portfolio'] < target]

# Calculate expected return and std dev of downside
expected_return = returns['Portfolio'].mean()
down_stdev = downside_returns.std()

# Calculate the sortino ratio
rf = 0.01
sortino_ratio = (expected_return - rf)/down_stdev

# Print the results
print("Expected return: ", expected_return*100)
print('-' * 50)
print("Downside risk:")
print(down_stdev*100)
print('-' * 50)
print("Sortino ratio:")
print(sortino_ratio)
```

```
Expected return:  0.10827309074405318
--------------------------------------------------
```

```
Downside risk:
GOOGL        1.199141
MSFT         1.320950
NVDA         2.013994
TSLA         2.454544
Portfolio    1.037424
dtype: float64
--------------------------------------------------
Sortino ratio:
GOOGL       -0.743638
MSFT        -0.675065
NVDA        -0.442765
TSLA        -0.363296
Portfolio   -0.859559
dtype: float64
```

[31]:

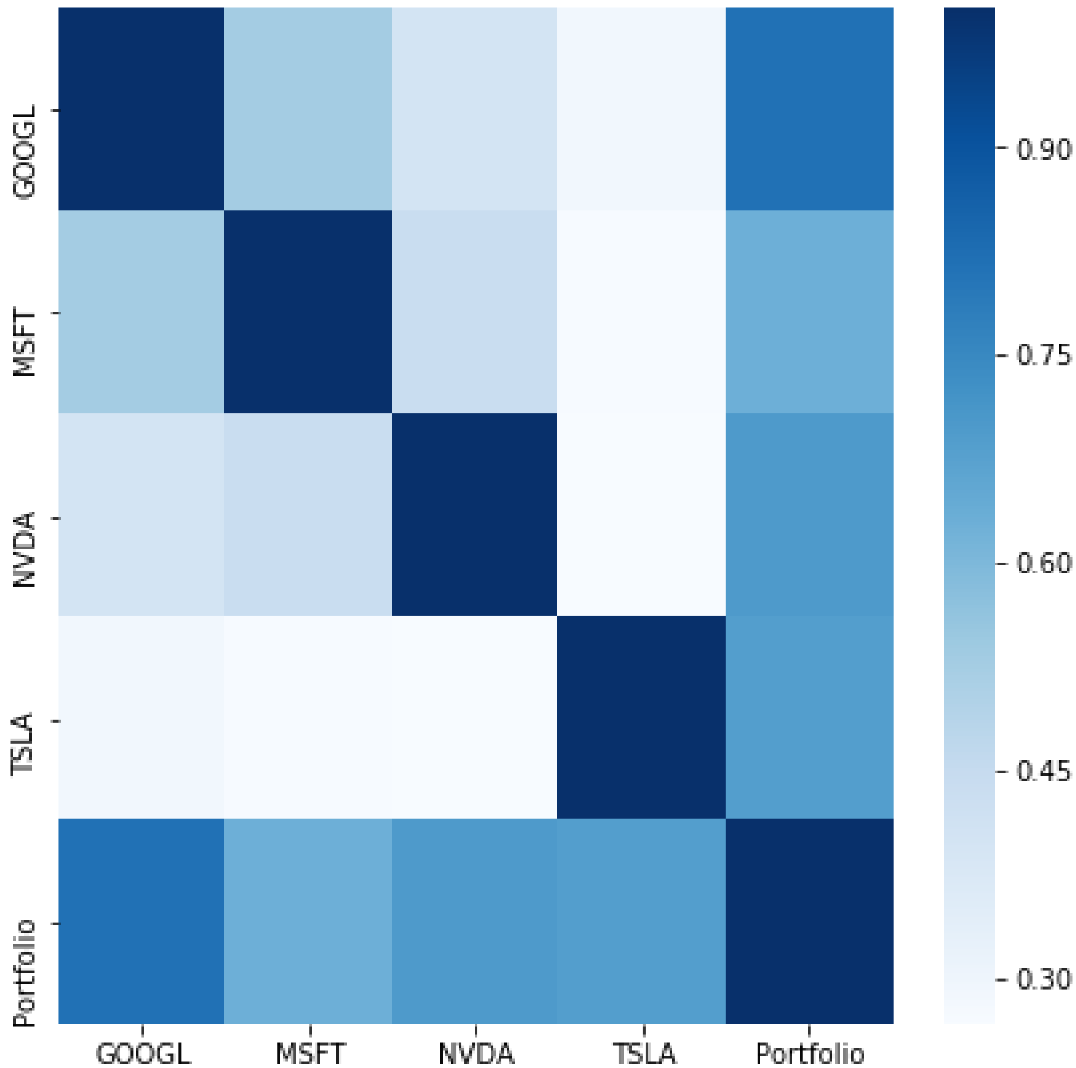
```
# Calculate the max value
roll_max = returns['Portfolio'].rolling(center=False,min_periods=1,window=252).
 ↪max()

# Calculate the daily draw-down relative to the max
daily_draw_down = returns['Portfolio']/roll_max - 1.0

# Calculate the minimum (negative) daily draw-down
max_daily_draw_down = daily_draw_down.
 ↪rolling(center=False,min_periods=1,window=252).min()

# Plot the results
plt.figure(figsize=(15,15))
plt.plot(returns.index, daily_draw_down, label='Daily drawdown')
plt.plot(returns.index, max_daily_draw_down, label='Maximum daily drawdown in␣
 ↪time-window')
plt.legend()
plt.show()
```



[32]:

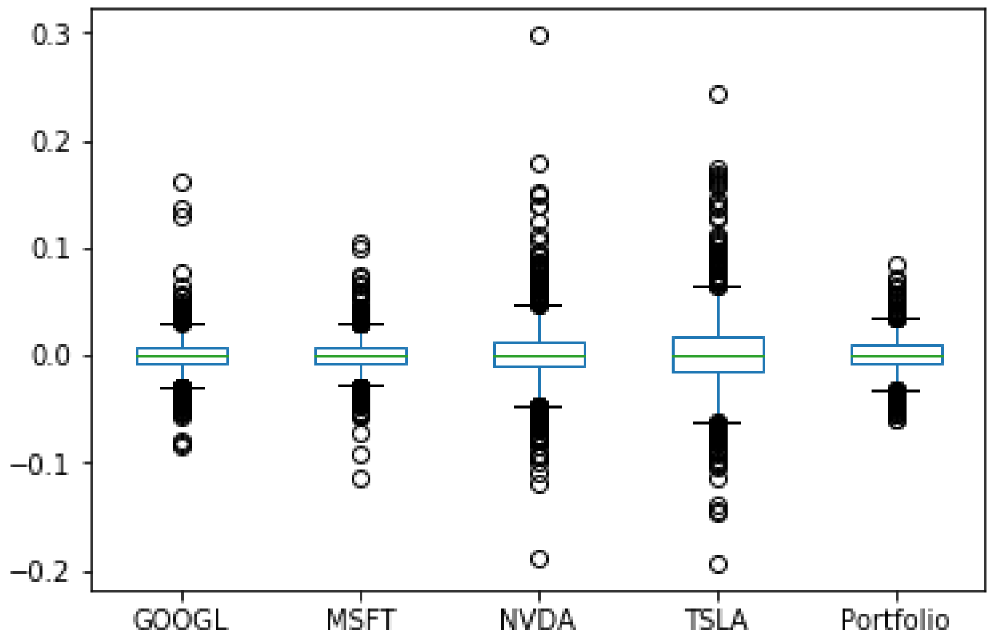
```
plt.figure(figsize=(7,7))
corr = returns.corr()

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

[32]: <matplotlib.axes._subplots.AxesSubplot at 0x16fb8a0a898>

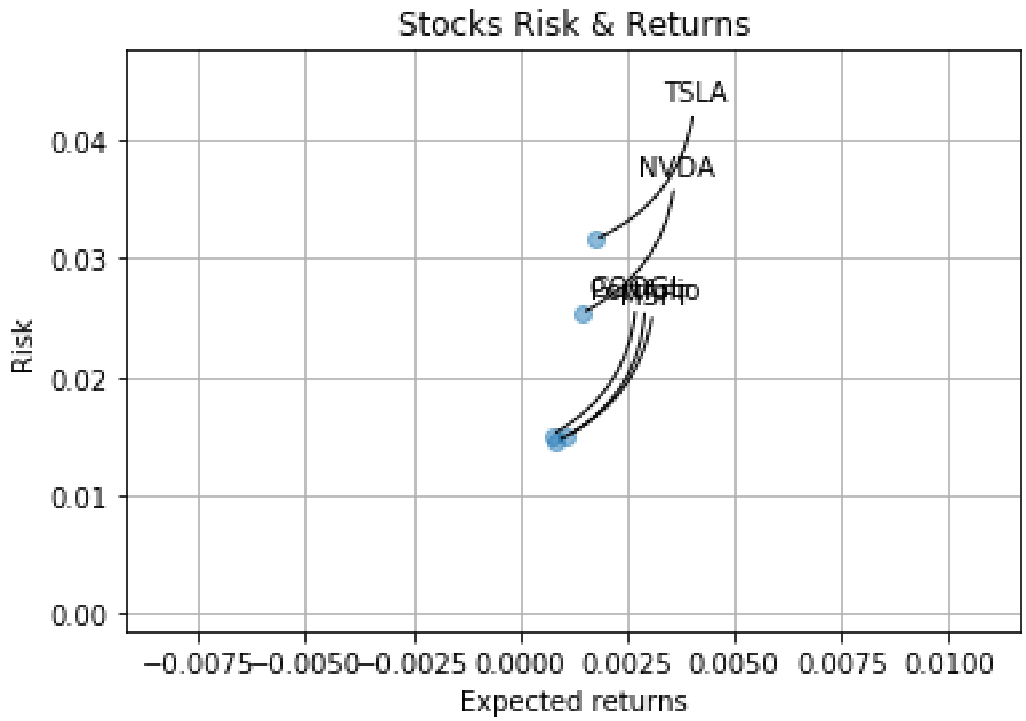


[33]:
```
# Box plot
returns.plot(kind='box')
```

[33]: <matplotlib.axes._subplots.AxesSubplot at 0x16fb8a6bd68>

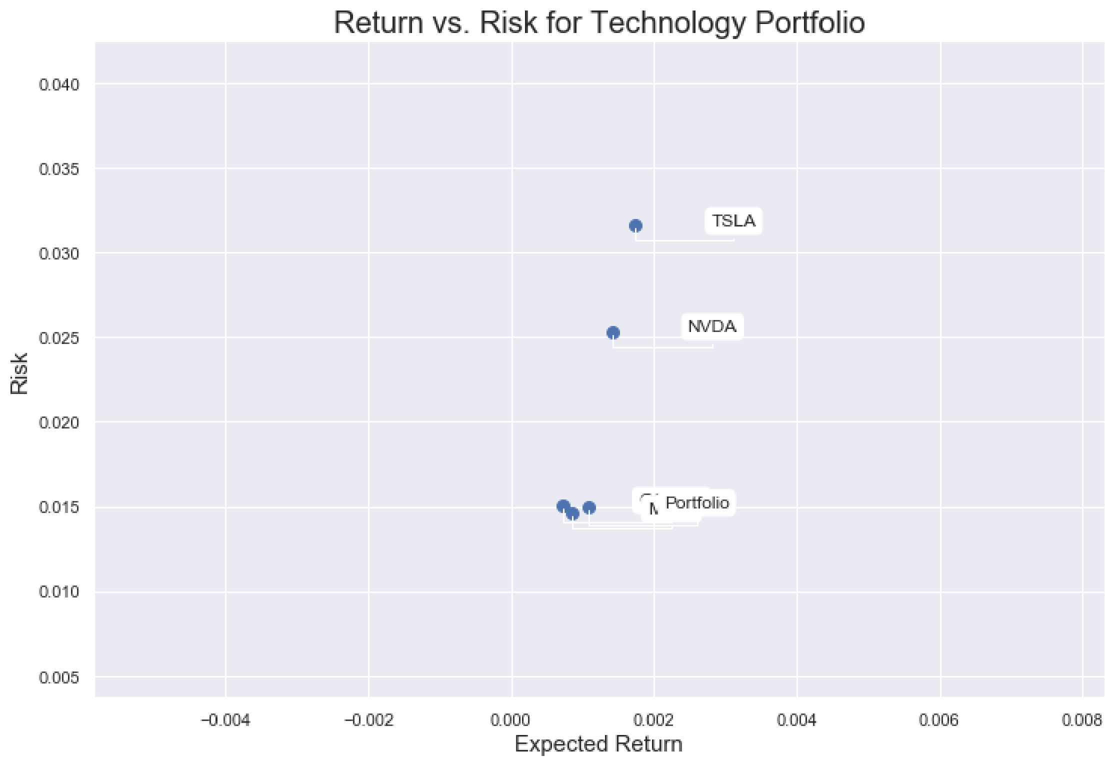


[34]:
```
rets = returns.dropna()

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'))
```



[35]:

```
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 " + title, 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"))
```



[36]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risk:")
print(rets.std())
```

```
Stock returns:
GOOGL        0.000729
MSFT         0.000849
NVDA         0.001416
TSLA         0.001749
Portfolio    0.001083
dtype: float64
--------------------------------------------------
Stock risk:
GOOGL        0.015087
MSFT         0.014583
NVDA         0.025336
TSLA         0.031572
Portfolio    0.014933
dtype: float64
```

[37]:
```python
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[37]:

	Returns	Risk
GOOGL	0.000729	0.015087
MSFT	0.000849	0.014583
Portfolio	0.001083	0.014933
NVDA	0.001416	0.025336
TSLA	0.001749	0.031572

[38]:
```python
table.sort_values(by='Risk')
```

[38]:

	Returns	Risk
MSFT	0.000849	0.014583
Portfolio	0.001083	0.014933
GOOGL	0.000729	0.015087
NVDA	0.001416	0.025336
TSLA	0.001749	0.031572

[39]:
```python
table['Sharpe_Ratio'] = (table['Returns'] / table['Risk']) * np.sqrt(252)
table
```

[39]:

	Returns	Risk	Sharpe_Ratio
GOOGL	0.000729	0.015087	0.767509
MSFT	0.000849	0.014583	0.924273
NVDA	0.001416	0.025336	0.887340
TSLA	0.001749	0.031572	0.879580
Portfolio	0.001083	0.014933	1.150981