Apple_Tesla_Split

September 29, 2021

1 Apple and Tesla Split on 8/31

[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")

# yahoo finance data
import yfinance as yf
yf.pdr_override()
```

[2]:
```python
# input
# Coronavirus 2nd Wave
title = "Apple and Tesla"
symbols = ['AAPL', 'TSLA']
start = '2020-01-01'
end = '2020-08-31'
```

[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
```

[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?
0 years
```

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

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

[6]:
```
242
```

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

[7]:
```
                 AAPL       TSLA
Date
2020-01-02  74.573036  86.052002
2020-01-03  73.848030  88.601997
2020-01-06  74.436470  90.307999
2020-01-07  74.086395  93.811996
2020-01-08  75.278160  98.428001
```

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

[8]:
```
                  AAPL        TSLA
Date
2020-08-25  124.824997  404.667999
2020-08-26  126.522499  430.634003
2020-08-27  125.010002  447.750000
2020-08-28  124.807503  442.679993
2020-08-31         NaN         NaN
```

[9]:
```python
df.min()
```

[9]:
```
AAPL    55.840385
TSLA    72.244003
dtype: float64
```

[10]:
```python
df.max()
```

[10]:
```
AAPL    126.522499
TSLA    447.750000
dtype: float64
```

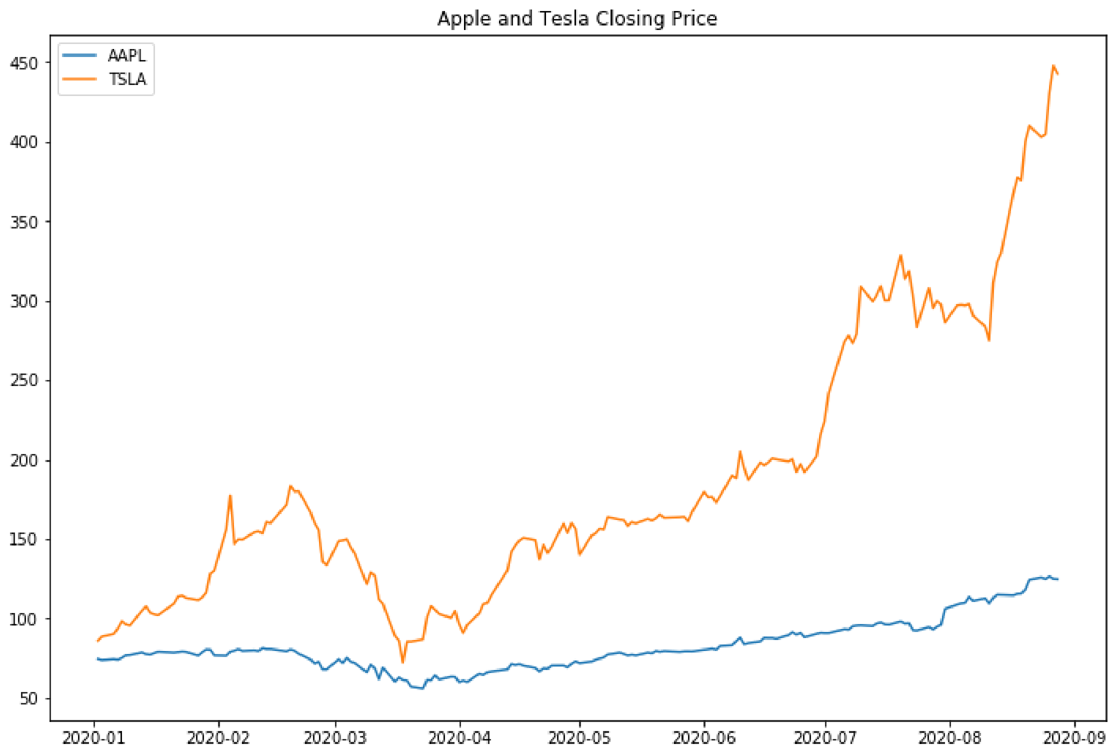
[11]:
```python
df.describe()
```

[11]:
```
             AAPL        TSLA
count  167.000000  167.000000
mean    82.843209  188.159688
```

std	16.027406	87.092657
min	55.840385	72.244003
25%	71.973801	127.504002
50%	79.166336	160.666000
75%	91.040852	219.944000
max	126.522499	447.750000

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

[12]: <matplotlib.legend.Legend at 0x18afaaba208>



[13]:
```
# Normalize the data
normalize = (df - df.min())/ (df.max() - df.min())
```

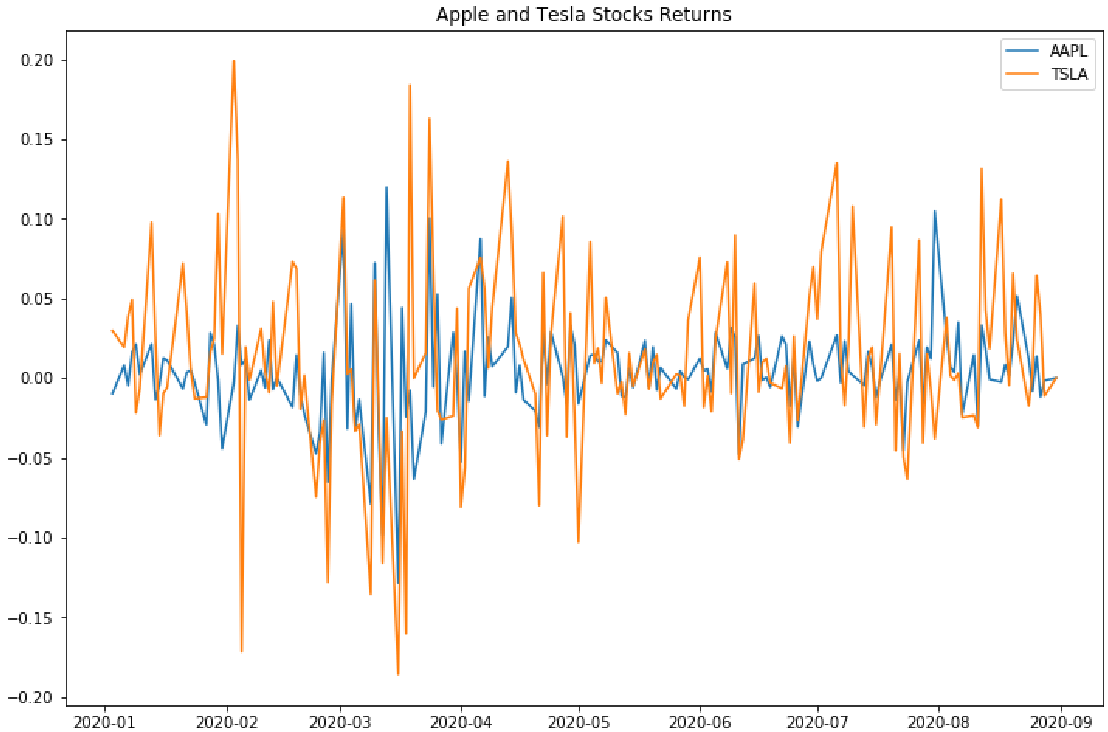
[14]:
```
plt.figure(figsize=(18,12))
plt.plot(normalize)
plt.title(title + ' Stocks Normalize')
plt.legend(labels=normalize.columns)
```

[14]: <matplotlib.legend.Legend at 0x18afad45e80>

[15]:
```
stock_rets = df.pct_change().dropna()
```

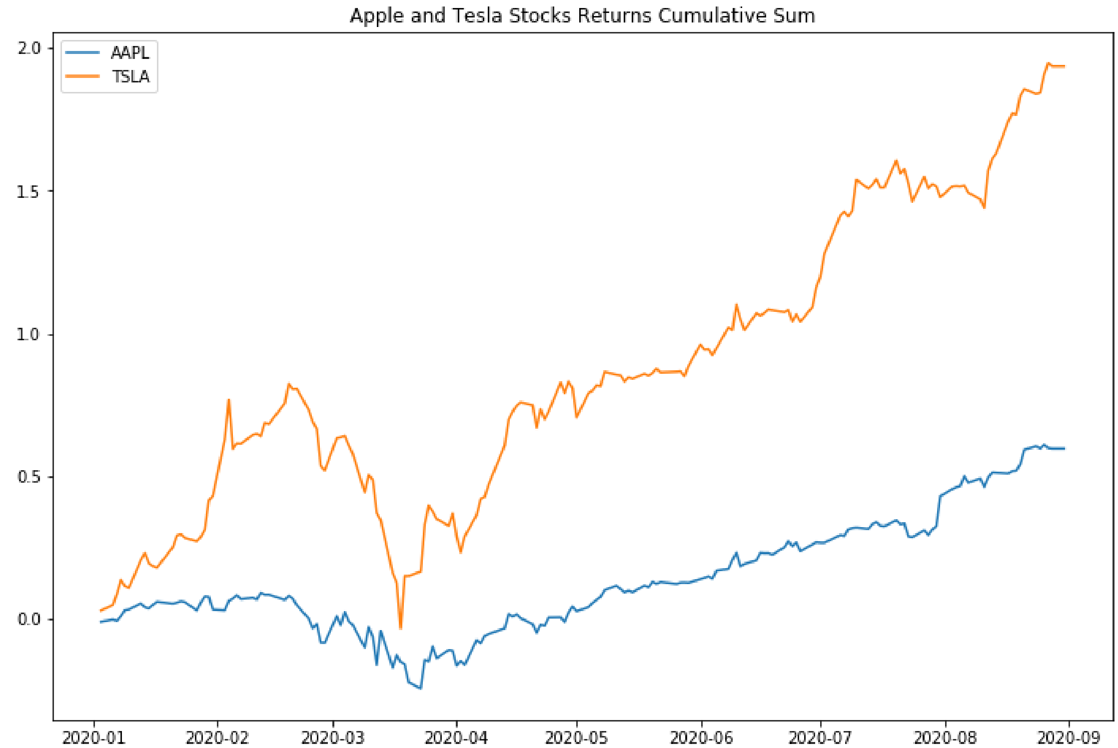
[16]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title(title + ' Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[16]: <matplotlib.legend.Legend at 0x18afab026a0>



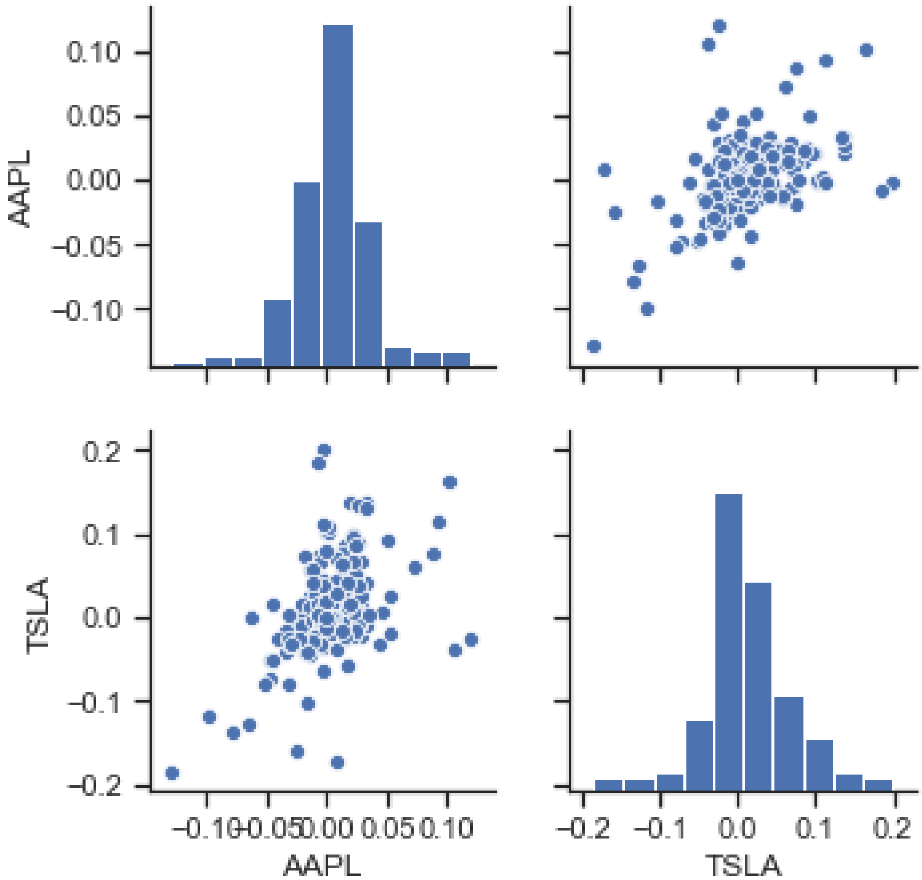
[17]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title(title + ' Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

[17]: <matplotlib.legend.Legend at 0x18afab5cb70>

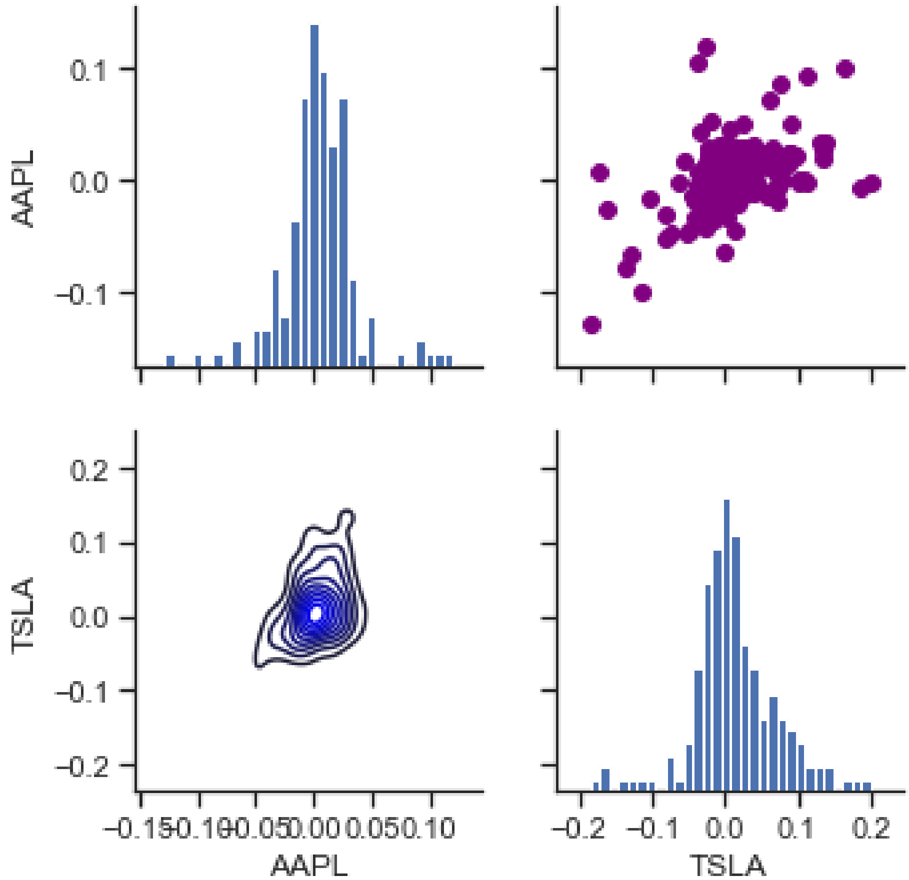


[18]:
```
sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

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)
```



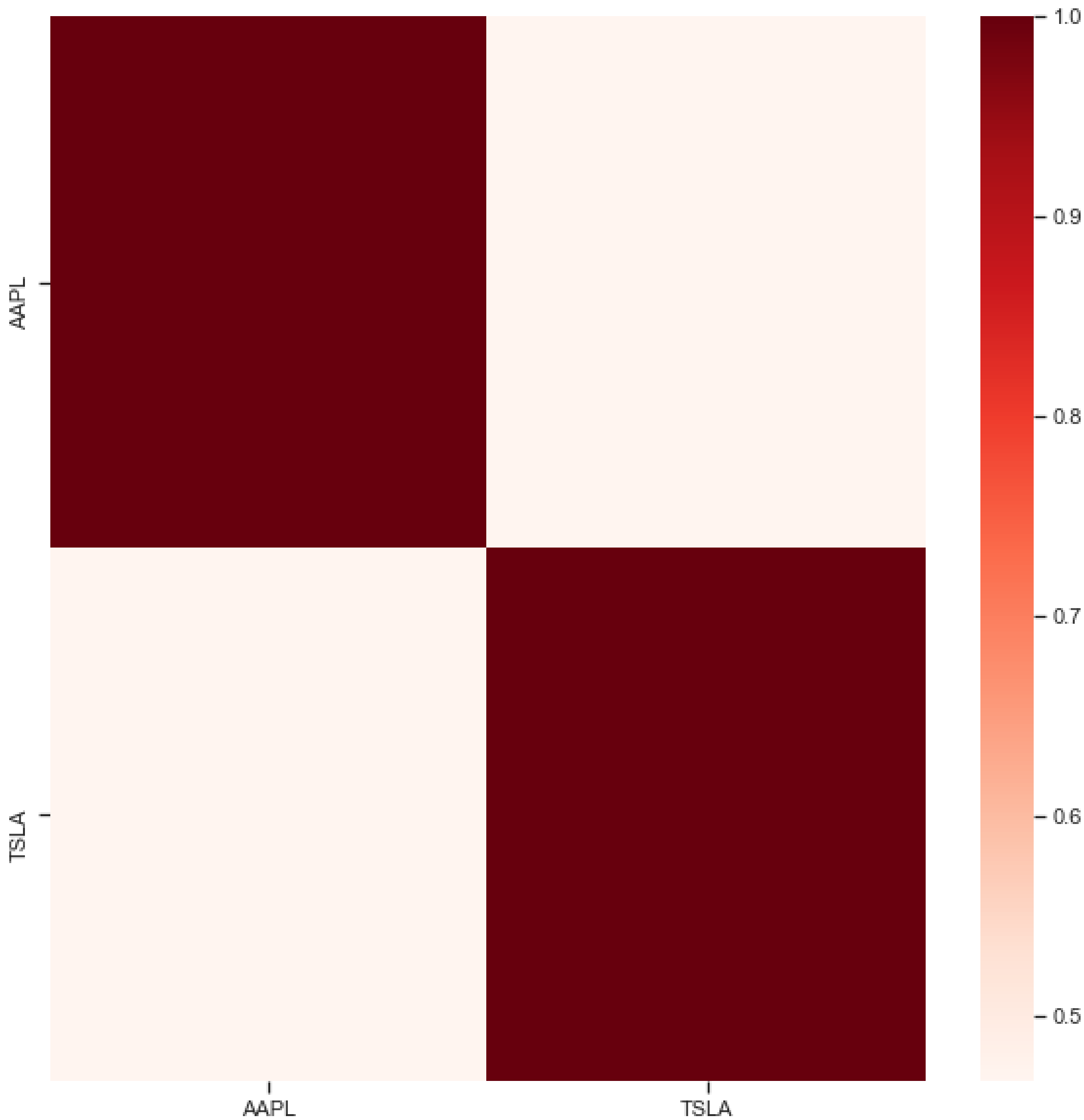
[19]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



[20]:
```
plt.figure(figsize=(10,10))
corr = stock_rets.corr()

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

[20]: <matplotlib.axes._subplots.AxesSubplot at 0x18afbf26358>



[21]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(24,8))
```

[21]: <matplotlib.axes._subplots.AxesSubplot at 0x18afc62e898>

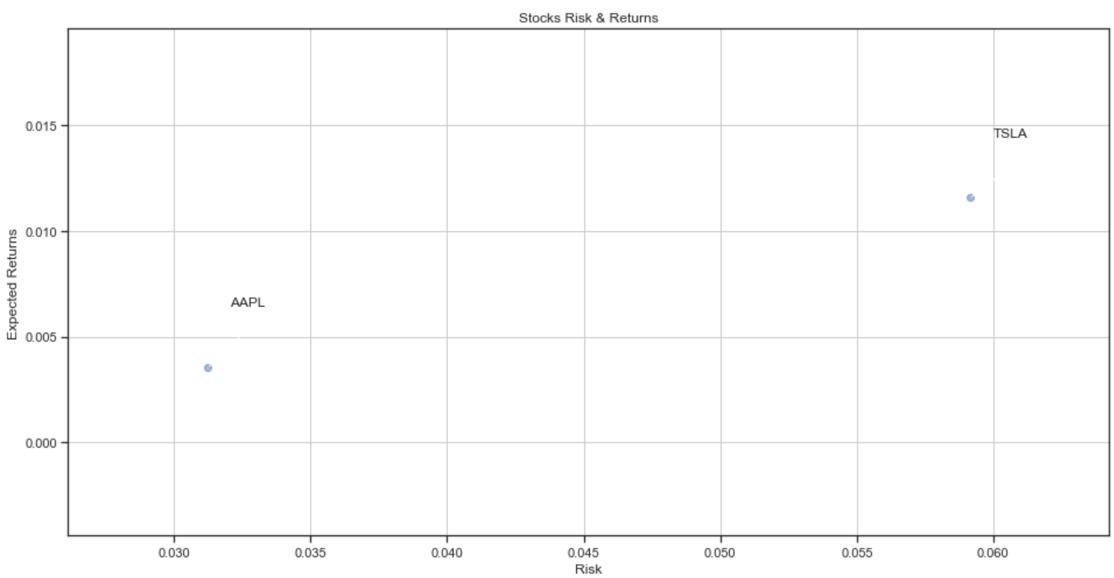
[22]:

```
rets = stock_rets.dropna()

plt.figure(figsize=(16,8))
plt.scatter(rets.std(), rets.mean(),alpha = 0.5)

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

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



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

sns.set(style='darkgrid')
plt.figure(figsize=(16,8))
plt.scatter(rets.std(), rets.mean(), s=area)
plt.xlabel("Risk", fontsize=15)
plt.ylabel("Expected Return", fontsize=15)
plt.title("Return vs. Risk for Stocks", fontsize=20)

for label, x, y in zip(rets.columns, rets.std(), rets.mean()) :
    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"))
```


```
[24]: def annual_risk_return(stock_rets):
    tradeoff = stock_rets.agg(["mean", "std"]).T
    tradeoff.columns = ["Return", "Risk"]
    tradeoff.Return = tradeoff.Return*252
    tradeoff.Risk = tradeoff.Risk * np.sqrt(252)
    return tradeoff
```

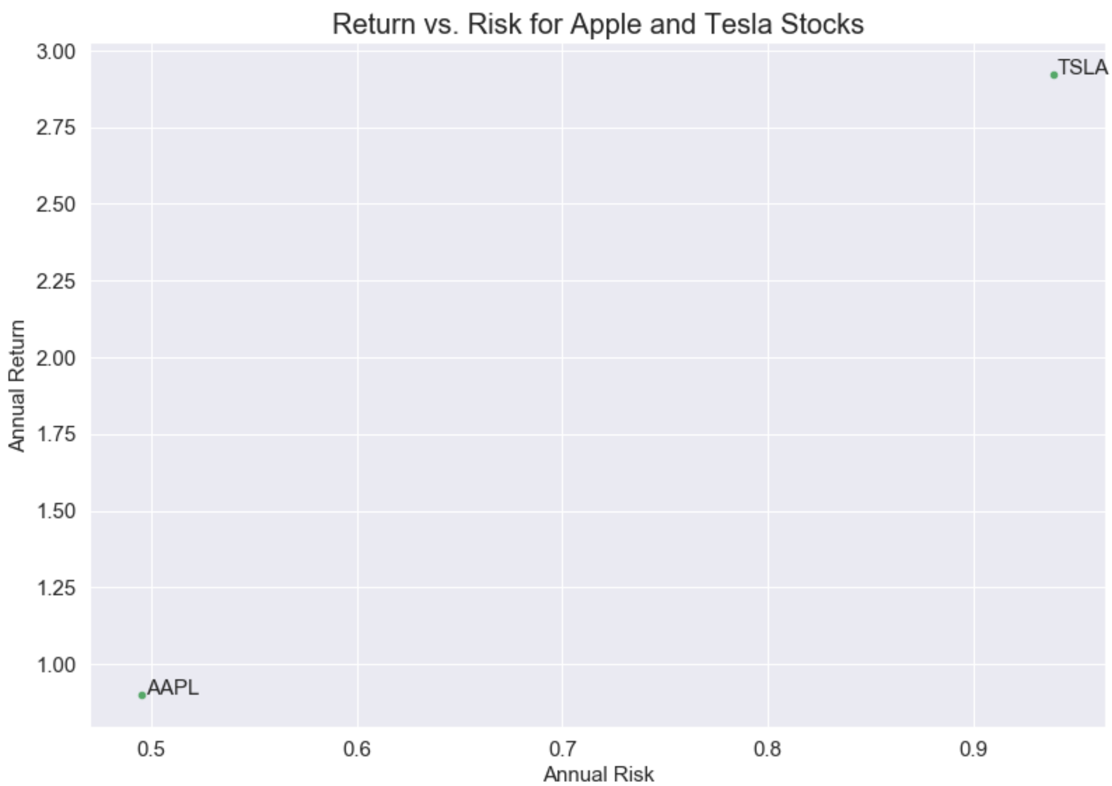
```
[25]: tradeoff = annual_risk_return(stock_rets)
tradeoff
```

[25]:
```
         Return      Risk
AAPL   0.900223  0.495463
TSLA   2.920598  0.938995
```

[26]:
```
import itertools

colors = itertools.cycle(["r", "b", "g"])

tradeoff.plot(x = "Risk", y = "Return", kind = "scatter", figsize = (13,9), s =␣
 ↪20, fontsize = 15, c='g')
for i in tradeoff.index:
    plt.annotate(i, xy=(tradeoff.loc[i, "Risk"]+0.002, tradeoff.loc[i,␣
 ↪"Return"]+0.002), size = 15)
plt.xlabel("Annual Risk", fontsize = 15)
plt.ylabel("Annual Return", fontsize = 15)
plt.title("Return vs. Risk for " + title + " Stocks", fontsize = 20)
plt.show()
```



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

[27]:
```
TSLA  TSLA    1.000000
AAPL  AAPL    1.000000
TSLA  AAPL    0.467117
AAPL  TSLA    0.467117
dtype: float64
```

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

[28]:
```
                AAPL      TSLA
Date
2020-01-03  0.478657  0.559907
2020-01-06  0.549859  0.532931
2020-01-07  0.498858  0.583735
2020-01-08  0.582532  0.610779
2020-01-09  0.603279  0.425843
```

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

[29]:
```
          AAPL      TSLA
AAPL  1.000000  0.467117
TSLA  0.467117  1.000000
```

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

[30]:
```
TSLA  TSLA    1.000000
AAPL  AAPL    1.000000
TSLA  AAPL    0.467117
AAPL  TSLA    0.467117
dtype: float64
```

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

```
Stock returns:
AAPL    0.003572
TSLA    0.011590
dtype: float64
--------------------------------------------------
Stock risks:
AAPL    0.031211
```

```
TSLA    0.059151
dtype: float64
```

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

[32]:
```
       Returns      Risk
AAPL  0.003572  0.031211
TSLA  0.011590  0.059151
```

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

[33]:
```
       Returns      Risk
AAPL  0.003572  0.031211
TSLA  0.011590  0.059151
```

[34]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[34]:
```
       Returns      Risk  Sharpe Ratio
AAPL  0.003572  0.031211     -0.205941
TSLA  0.011590  0.059151      0.026875
```

[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  \
AAPL  0.003572  0.031211     -0.205941     0.119808    -0.128647
TSLA  0.011590  0.059151      0.026875     0.198949    -0.185778

      Median Returns  Total Return
AAPL        0.003570           0.0
TSLA        0.004635           0.0
```

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

[39]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AAPL  0.003572  0.031211     -0.205941     0.119808    -0.128647
TSLA  0.011590  0.059151      0.026875     0.198949    -0.185778

      Median Returns  Total Return  Average Return Days
AAPL        0.003570           0.0                  0.0
TSLA        0.004635           0.0                  0.0
```

[40]:
```python
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  \
AAPL  0.003572  0.031211     -0.205941     0.119808    -0.128647
TSLA  0.011590  0.059151      0.026875     0.198949    -0.185778

      Median Returns  Total Return  Average Return Days  CAGR
AAPL        0.003570           0.0                  0.0   NaN
TSLA        0.004635           0.0                  0.0   NaN
```

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

[41]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AAPL  0.003572  0.031211     -0.205941     0.119808    -0.128647
TSLA  0.011590  0.059151      0.026875     0.198949    -0.185778

      Median Returns  Total Return  Average Return Days  CAGR
AAPL        0.003570           0.0                  0.0   NaN
TSLA        0.004635           0.0                  0.0   NaN
```