Cloud_Platform_Portfolio

September 29, 2021

1 Cloud Platform Portfolio

[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 data
import yfinance as yf
yf.pdr_override()
```

[2]:

```
# input
# Cloud Business
title = "Cloud Stock"
symbols = ['MSFT', 'AMZN', 'BOX','BABA','TEAM','ECOM', 'AVLR', 'ZM']
start = '2019-12-01'
end = '2020-06-01'
```

[3]:

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

```
[*********************100%***********************]  1 of 1 completed
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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]:
```
179
```

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

[7]:
```
                  MSFT         AMZN        BOX        BABA        TEAM  ECOM  \
Date
2019-12-02  148.728424  1781.599976  18.100000  196.309998  120.839996  9.09
2019-12-03  148.489731  1769.959961  18.110001  194.899994  123.550003  9.12
2019-12-04  149.026764  1760.689941  17.600000  193.740005  123.470001  9.14
2019-12-05  149.106323  1740.479980  17.389999  200.000000  123.949997  9.11
2019-12-06  150.916321  1751.599976  17.340000  201.889999  123.360001  9.21

                 AVLR         ZM
Date
2019-12-02  74.449997  68.930000
2019-12-03  75.470001  70.019997
2019-12-04  75.230003  69.959999
2019-12-05  75.760002  69.669998
2019-12-06  75.589996  62.740002
```

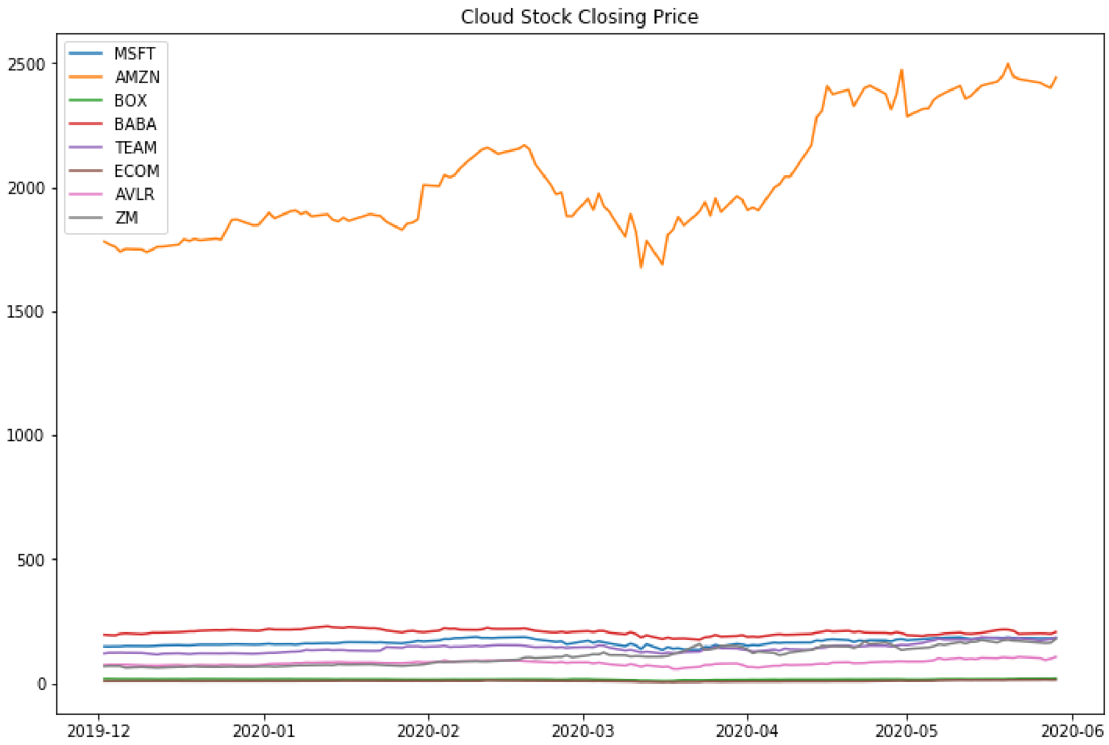
[8]:
```
df.tail()
```

[8]:
```
                  MSFT         AMZN        BOX        BABA        TEAM   ECOM  \
Date
2020-05-22  183.509995  2436.879883  19.090000  199.699997  182.600006  13.47
2020-05-26  181.570007  2421.860107  19.520000  201.720001  173.059998  13.82
2020-05-27  181.809998  2410.389893  19.639999  201.179993  175.309998  14.27
2020-05-28  181.399994  2401.100098  19.490000  199.490005  178.320007  13.71
2020-05-29  183.250000  2442.370117  19.980000  207.389999  185.300003  13.95

                  AVLR          ZM
Date
2020-05-22  107.019997  171.059998
```

```
2020-05-26  102.000000  164.000000
2020-05-27   94.080002  161.970001
2020-05-28   99.279999  163.550003
2020-05-29  107.059998  179.479996
```

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

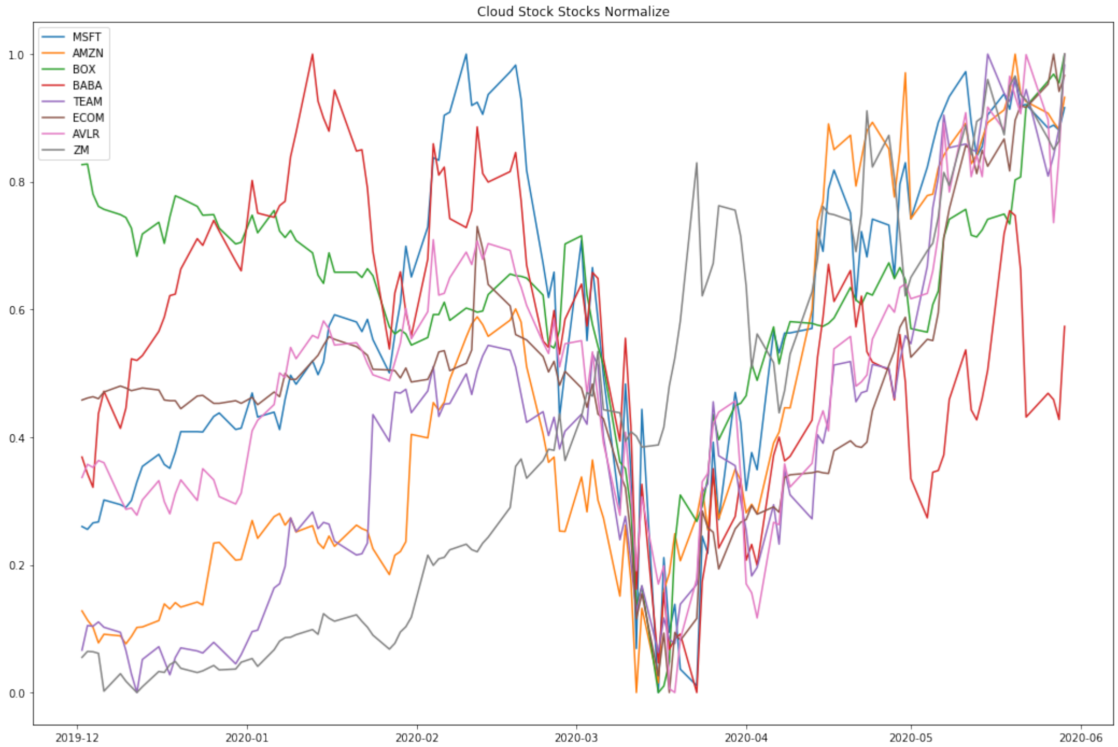
```
[9]: <matplotlib.legend.Legend at 0x1db125e6f28>
```



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

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

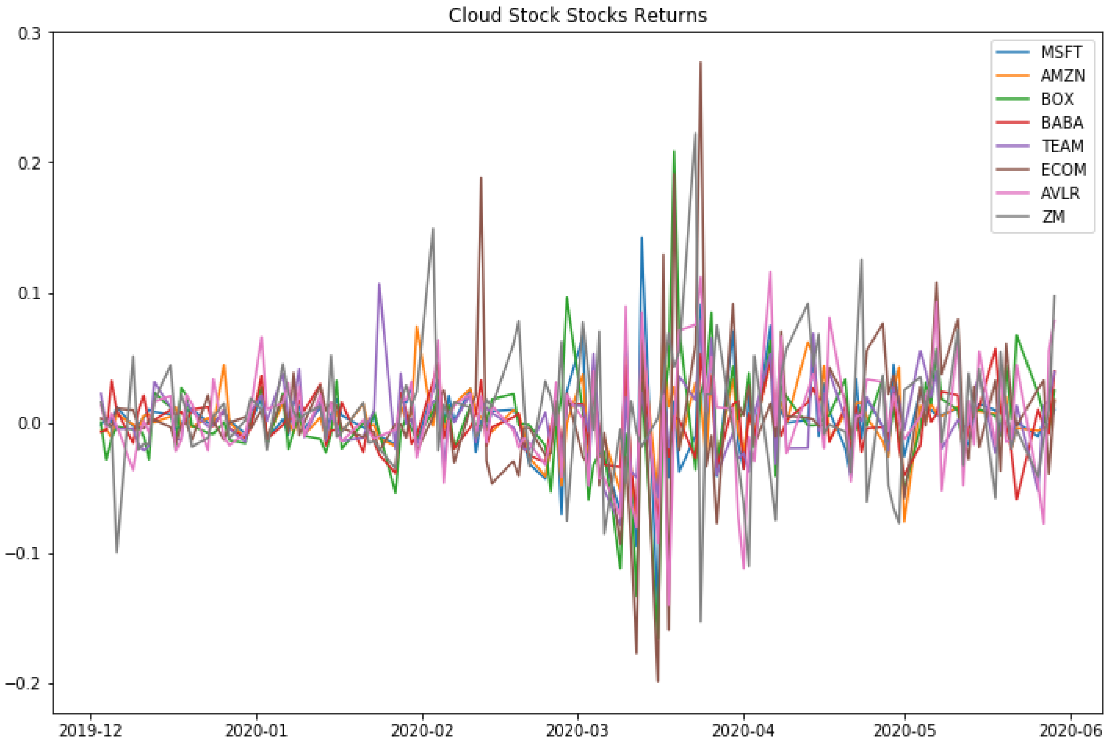
```
[11]: <matplotlib.legend.Legend at 0x1db1384bc18>
```



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

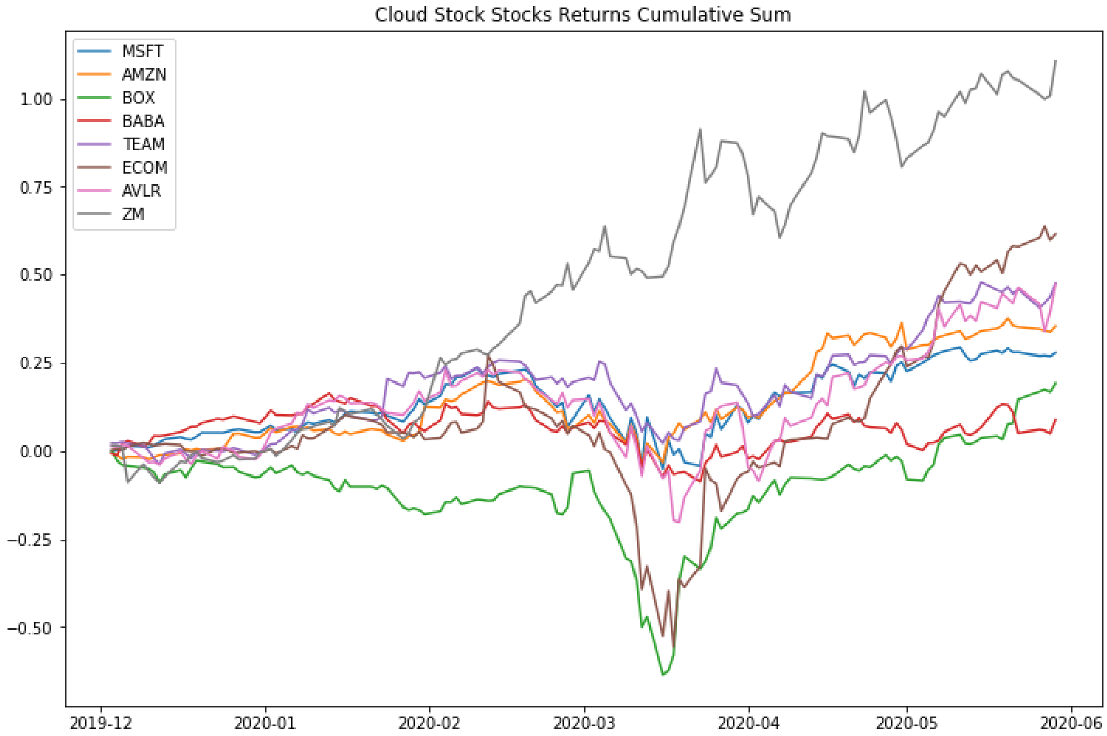
```
[13]: plt.figure(figsize=(12,8))
      plt.plot(stock_rets)
      plt.title(title + ' Stocks Returns')
      plt.legend(labels=stock_rets.columns)
```

```
[13]: <matplotlib.legend.Legend at 0x1db126b2780>
```



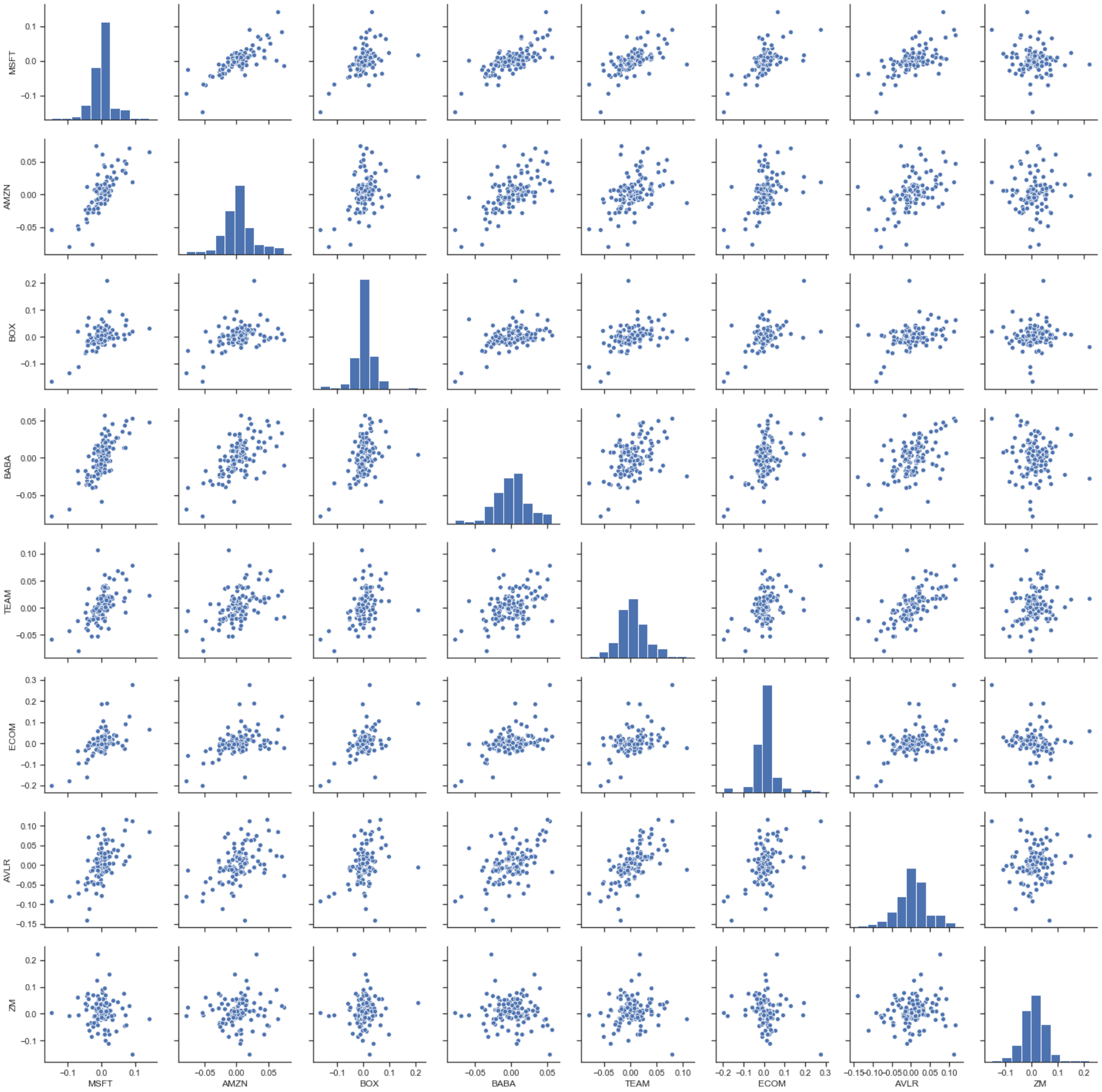
[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title(title + ' Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

[14]:
```
<matplotlib.legend.Legend at 0x1db1270ec18>
```

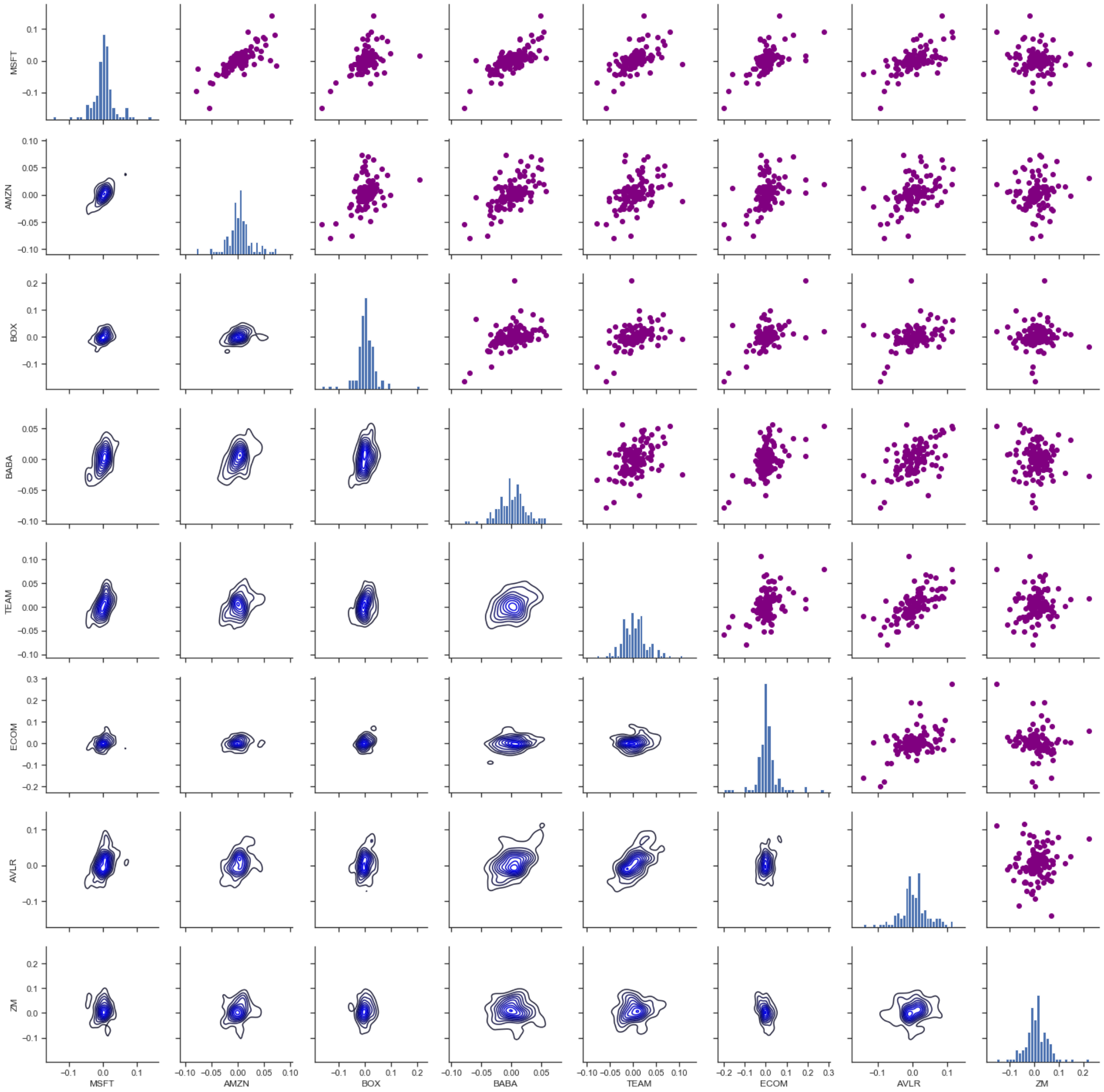


[15]:

```
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)
```

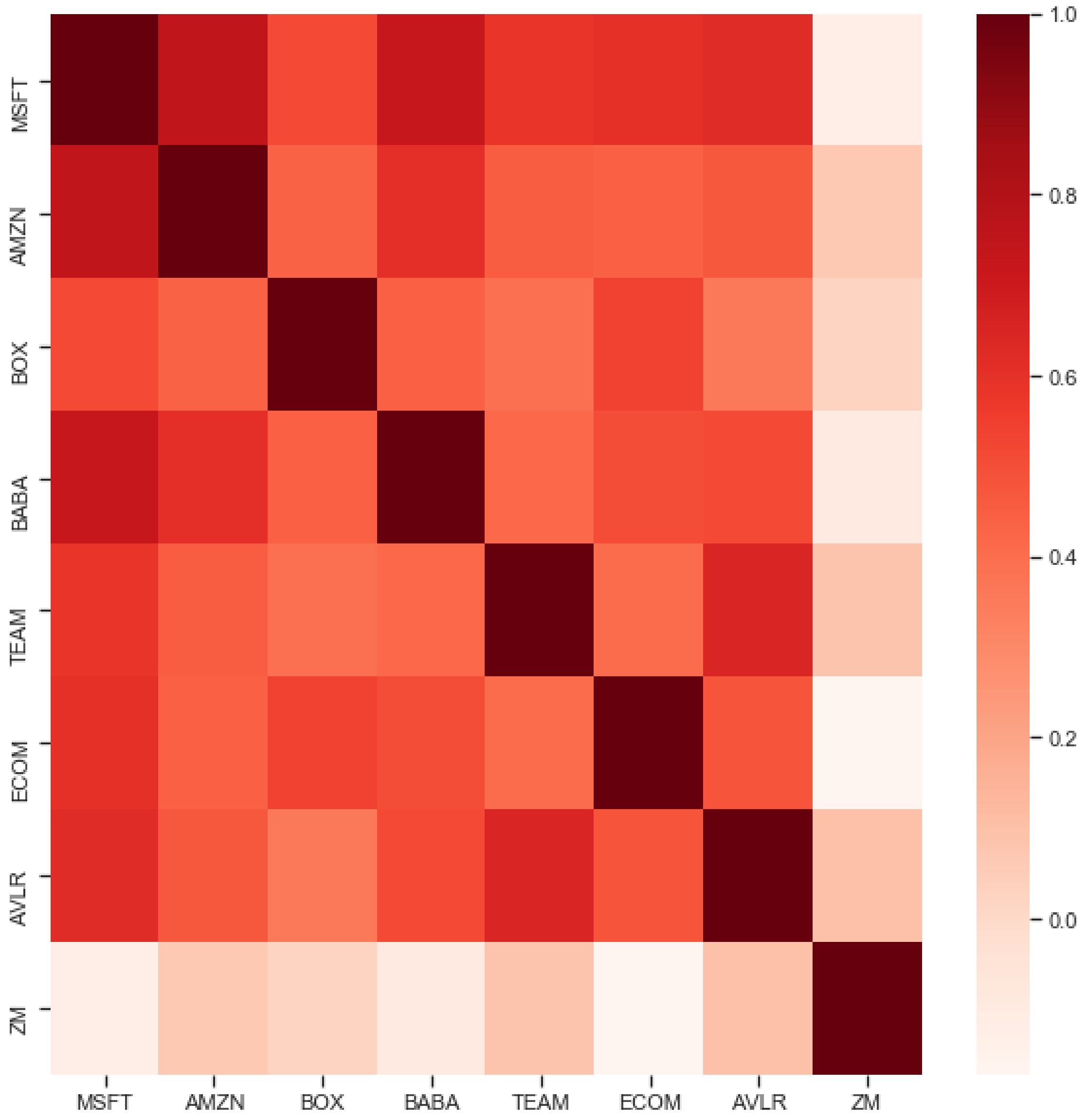


[16]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



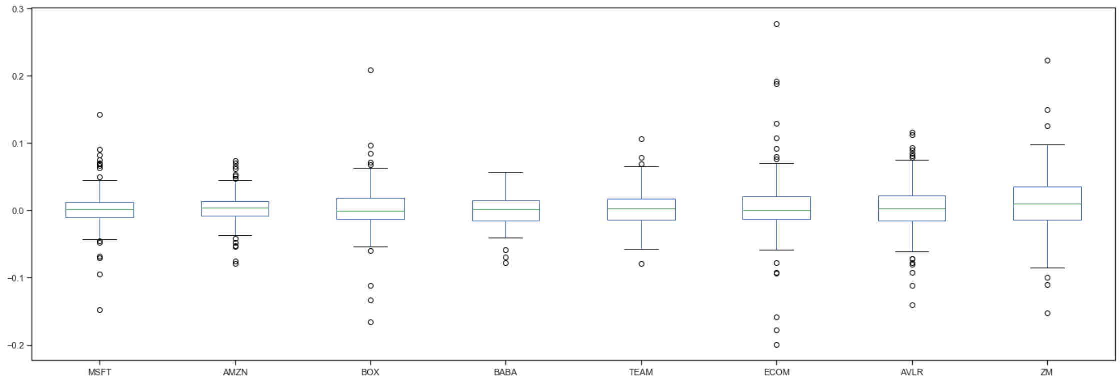
[17]:
```
plt.figure(figsize=(10,10))
corr = stock_rets.corr()

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

[17]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1db1a2c4470>
```



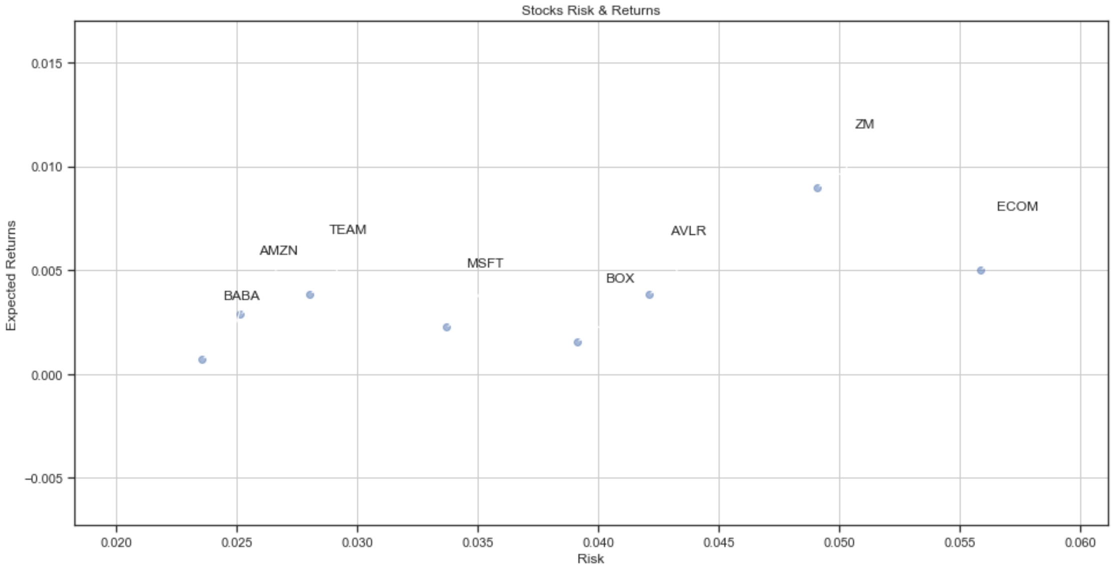
```
[18]: # Box plot
      stock_rets.plot(kind='box',figsize=(24,8))
```

```
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x1db1a1802b0>
```



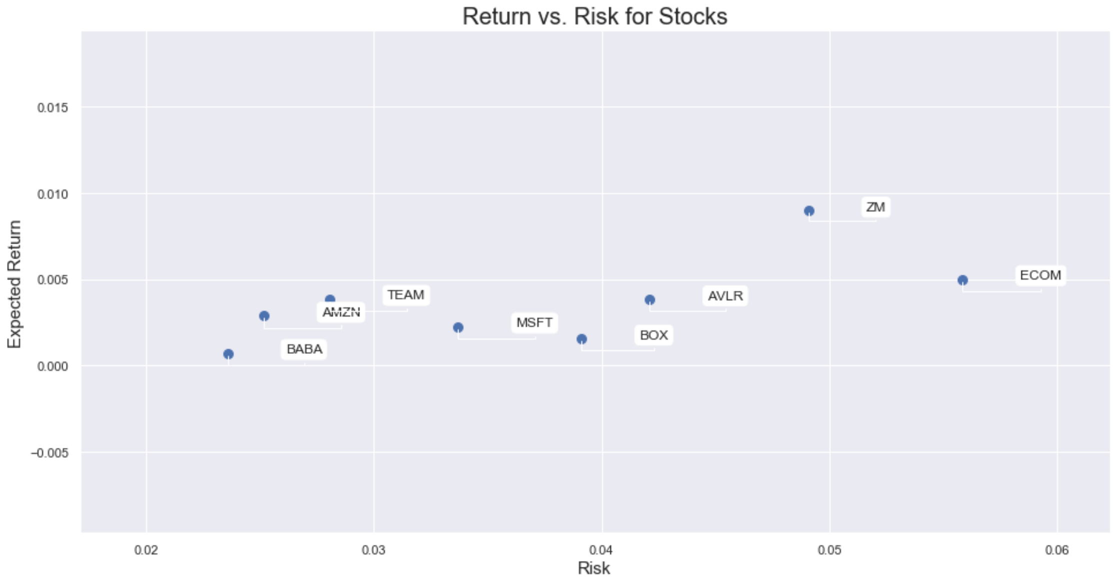
[19]:

```python
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'))
```



[20]:

```
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"))
```



[21]:

```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[21]:

```
ZM    ZM      1.000000
AVLR  AVLR    1.000000
AMZN  AMZN    1.000000
BOX   BOX     1.000000
BABA  BABA    1.000000
```

```
TEAM  TEAM    1.000000
ECOM  ECOM    1.000000
MSFT  MSFT    1.000000
AMZN  MSFT    0.751667
MSFT  AMZN    0.751667
BABA  MSFT    0.727818
MSFT  BABA    0.727818
AVLR  TEAM    0.649127
TEAM  AVLR    0.649127
MSFT  AVLR    0.621726
AVLR  MSFT    0.621726
AMZN  BABA    0.610477
BABA  AMZN    0.610477
ECOM  MSFT    0.602911
MSFT  ECOM    0.602911
      TEAM    0.583097
TEAM  MSFT    0.583097
ECOM  BOX     0.537930
BOX   ECOM    0.537930
AVLR  BABA    0.518445
BABA  AVLR    0.518445
MSFT  BOX     0.514382
BOX   MSFT    0.514382
ECOM  BABA    0.508249
BABA  ECOM    0.508249
                …
AMZN  TEAM    0.450339
TEAM  AMZN    0.450339
BOX   BABA    0.445309
BABA  BOX     0.445309
AMZN  ECOM    0.442798
ECOM  AMZN    0.442798
BOX   AMZN    0.439672
AMZN  BOX     0.439672
BABA  TEAM    0.418024
TEAM  BABA    0.418024
ECOM  TEAM    0.407615
TEAM  ECOM    0.407615
BOX   TEAM    0.393006
TEAM  BOX     0.393006
BOX   AVLR    0.363039
AVLR  BOX     0.363039
ECOM  ZM      0.173027
ZM    ECOM    0.173027
      MSFT    0.127018
MSFT  ZM      0.127018
AVLR  ZM      0.100528
```

```
ZM    AVLR    0.100528
      BABA    0.092025
BABA  ZM      0.092025
ZM    TEAM    0.087617
TEAM  ZM      0.087617
AMZN  ZM      0.069392
ZM    AMZN    0.069392
BOX   ZM      0.027906
ZM    BOX     0.027906
Length: 64, dtype: float64
```

[22]:

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

[22]:

```
                MSFT      AMZN       BOX      BABA      TEAM      ECOM  \
Date
2019-12-03  0.503474  0.475043  0.444131  0.525086  0.545490  0.424976
2019-12-04  0.521506  0.483513  0.367378  0.534201  0.421017  0.422646
2019-12-05  0.510860  0.442726  0.410760  0.817536  0.445481  0.411127
2019-12-06  0.550939  0.559497  0.434969  0.648249  0.398832  0.441126
2019-12-09  0.500141  0.509944  0.428780  0.462737  0.400021  0.438591

                AVLR        ZM
Date
2019-12-03  0.600548  0.449612
2019-12-04  0.534521  0.405159
2019-12-05  0.574515  0.396391
2019-12-06  0.538182  0.142200
2019-12-09  0.404661  0.543452
```

[23]:

```
Normalized_Value.corr()
```

[23]:

```
          MSFT      AMZN       BOX      BABA      TEAM      ECOM      AVLR  \
MSFT  1.000000  0.751667  0.514382  0.727818  0.583097  0.602911  0.621726
AMZN  0.751667  1.000000  0.439672  0.610477  0.450339  0.442798  0.471472
BOX   0.514382  0.439672  1.000000  0.445309  0.393006  0.537930  0.363039
BABA  0.727818  0.610477  0.445309  1.000000  0.418024  0.508249  0.518445
TEAM  0.583097  0.450339  0.393006  0.418024  1.000000  0.407615  0.649127
ECOM  0.602911  0.442798  0.537930  0.508249  0.407615  1.000000  0.480489
AVLR  0.621726  0.471472  0.363039  0.518445  0.649127  0.480489  1.000000
ZM   -0.127018  0.069392  0.027906 -0.092025  0.087617 -0.173027  0.100528

            ZM
MSFT -0.127018
AMZN  0.069392
BOX   0.027906
```

```
BABA -0.092025
TEAM  0.087617
ECOM -0.173027
AVLR  0.100528
ZM    1.000000
```

[24]:

```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[24]:

```
ZM    ZM      1.000000
AVLR  AVLR    1.000000
AMZN  AMZN    1.000000
BOX   BOX     1.000000
BABA  BABA    1.000000
TEAM  TEAM    1.000000
ECOM  ECOM    1.000000
MSFT  MSFT    1.000000
AMZN  MSFT    0.751667
MSFT  AMZN    0.751667
BABA  MSFT    0.727818
MSFT  BABA    0.727818
AVLR  TEAM    0.649127
TEAM  AVLR    0.649127
MSFT  AVLR    0.621726
AVLR  MSFT    0.621726
AMZN  BABA    0.610477
BABA  AMZN    0.610477
ECOM  MSFT    0.602911
MSFT  ECOM    0.602911
      TEAM    0.583097
TEAM  MSFT    0.583097
ECOM  BOX     0.537930
BOX   ECOM    0.537930
AVLR  BABA    0.518445
BABA  AVLR    0.518445
MSFT  BOX     0.514382
BOX   MSFT    0.514382
ECOM  BABA    0.508249
BABA  ECOM    0.508249
                …
AMZN  TEAM    0.450339
TEAM  AMZN    0.450339
BOX   BABA    0.445309
BABA  BOX     0.445309
AMZN  ECOM    0.442798
ECOM  AMZN    0.442798
```

```
BOX   AMZN    0.439672
AMZN  BOX     0.439672
BABA  TEAM    0.418024
TEAM  BABA    0.418024
ECOM  TEAM    0.407615
TEAM  ECOM    0.407615
BOX   TEAM    0.393006
TEAM  BOX     0.393006
BOX   AVLR    0.363039
AVLR  BOX     0.363039
ECOM  ZM      0.173027
ZM    ECOM    0.173027
      MSFT    0.127018
MSFT  ZM      0.127018
AVLR  ZM      0.100528
ZM    AVLR    0.100528
      BABA    0.092025
BABA  ZM      0.092025
ZM    TEAM    0.087617
TEAM  ZM      0.087617
AMZN  ZM      0.069392
ZM    AMZN    0.069392
BOX   ZM      0.027906
ZM    BOX     0.027906
Length: 64, dtype: float64
```

[25]:

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

```
Stock returns:
MSFT    0.002263
AMZN    0.002881
BOX     0.001562
BABA    0.000723
TEAM    0.003868
ECOM    0.005007
AVLR    0.003840
ZM      0.008986
dtype: float64
--------------------------------------------------
Stock risks:
MSFT    0.033700
AMZN    0.025151
BOX     0.039116
```

```
BABA    0.023570
TEAM    0.028044
ECOM    0.055849
AVLR    0.042101
ZM      0.049077
dtype: float64
```

[26]:

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

[26]:

```
       Returns      Risk
BABA  0.000723  0.023570
BOX   0.001562  0.039116
MSFT  0.002263  0.033700
AMZN  0.002881  0.025151
AVLR  0.003840  0.042101
TEAM  0.003868  0.028044
ECOM  0.005007  0.055849
ZM    0.008986  0.049077
```

[27]:

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

[27]:

```
       Returns      Risk
BABA  0.000723  0.023570
AMZN  0.002881  0.025151
TEAM  0.003868  0.028044
MSFT  0.002263  0.033700
BOX   0.001562  0.039116
AVLR  0.003840  0.042101
ZM    0.008986  0.049077
ECOM  0.005007  0.055849
```

[28]:

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

[28]:

```
       Returns      Risk  Sharpe Ratio
MSFT  0.002263  0.033700     -0.229579
AMZN  0.002881  0.025151     -0.283029
BOX   0.001562  0.039116     -0.215711
BABA  0.000723  0.023570     -0.393575
TEAM  0.003868  0.028044     -0.218661
ECOM  0.005007  0.055849     -0.089397
AVLR  0.003840  0.042101     -0.146316
ZM    0.008986  0.049077     -0.020652
```

[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  \
MSFT  0.002263  0.033700     -0.229579     0.142169    -0.147390
AMZN  0.002881  0.025151     -0.283029     0.073791    -0.079221
BOX   0.001562  0.039116     -0.215711     0.208506    -0.165599
BABA  0.000723  0.023570     -0.393575     0.056952    -0.078093
TEAM  0.003868  0.028044     -0.218661     0.106680    -0.078692
ECOM  0.005007  0.055849     -0.089397     0.276632    -0.198708
AVLR  0.003840  0.042101     -0.146316     0.115826    -0.139837
ZM    0.008986  0.049077     -0.020652     0.222214    -0.152795

      Median Returns  Total Return
MSFT        0.001828      1.019849
AMZN        0.003638      1.718796
BOX        -0.001301      2.514109
BABA        0.001700      3.960095
TEAM        0.002327      3.914309
ECOM        0.000000      1.750545
AVLR        0.002832      7.836421
ZM          0.009621      9.740136
```

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

[33]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
MSFT  0.002263  0.033700     -0.229579     0.142169    -0.147390
AMZN  0.002881  0.025151     -0.283029     0.073791    -0.079221
BOX   0.001562  0.039116     -0.215711     0.208506    -0.165599
BABA  0.000723  0.023570     -0.393575     0.056952    -0.078093
TEAM  0.003868  0.028044     -0.218661     0.106680    -0.078692
ECOM  0.005007  0.055849     -0.089397     0.276632    -0.198708
AVLR  0.003840  0.042101     -0.146316     0.115826    -0.139837
ZM    0.008986  0.049077     -0.020652     0.222214    -0.152795

      Median Returns  Total Return  Average Return Days
MSFT        0.001828      1.019849             0.000057
AMZN        0.003638      1.718796             0.000095
BOX        -0.001301      2.514109             0.000139
```

```
BABA         0.001700      3.960095             0.000217
TEAM         0.002327      3.914309             0.000215
ECOM         0.000000      1.750545             0.000097
AVLR         0.002832      7.836421             0.000422
ZM           0.009621      9.740136             0.000519
```

[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  \
MSFT  0.002263  0.033700     -0.229579     0.142169    -0.147390
AMZN  0.002881  0.025151     -0.283029     0.073791    -0.079221
BOX   0.001562  0.039116     -0.215711     0.208506    -0.165599
BABA  0.000723  0.023570     -0.393575     0.056952    -0.078093
TEAM  0.003868  0.028044     -0.218661     0.106680    -0.078692
ECOM  0.005007  0.055849     -0.089397     0.276632    -0.198708
AVLR  0.003840  0.042101     -0.146316     0.115826    -0.139837
ZM    0.008986  0.049077     -0.020652     0.222214    -0.152795

      Median Returns  Total Return  Average Return Days      CAGR
MSFT        0.001828      1.019849             0.000057  0.341588
AMZN        0.003638      1.718796             0.000095  0.559098
BOX        -0.001301      2.514109             0.000139  0.149263
BABA        0.001700      3.960095             0.000217  0.080364
TEAM        0.002327      3.914309             0.000215  0.825504
ECOM        0.000000      1.750545             0.000097  0.827550
AVLR        0.002832      7.836421             0.000422  0.667637
ZM          0.009621      9.740136             0.000519  2.846816
```

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

[35]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
MSFT  0.002263  0.033700     -0.229579     0.142169    -0.147390
AMZN  0.002881  0.025151     -0.283029     0.073791    -0.079221
ECOM  0.005007  0.055849     -0.089397     0.276632    -0.198708
BOX   0.001562  0.039116     -0.215711     0.208506    -0.165599
TEAM  0.003868  0.028044     -0.218661     0.106680    -0.078692
BABA  0.000723  0.023570     -0.393575     0.056952    -0.078093
AVLR  0.003840  0.042101     -0.146316     0.115826    -0.139837
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```

```
BOX        -0.001301      2.514109             0.000139  0.149263
TEAM        0.002327      3.914309             0.000215  0.825504
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```