Big_Data_Portfolio

September 29, 2021

1 Big Data Portfolio Risk and Returns

[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")

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

[2]:

```
# input
# Big Data Stock
symbols =␣
 ↪['SPLK','NEWR','AYX','DOMO','ESTC','CLDR','TLND','YEXT','HDP','ORCL','MDB']
start = '2018-01-01'
end = '2019-01-01'
```

[3]:

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

```
[*********************100%***********************]  12 of 12 downloaded
```

[4]:

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

[5]:

```
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
```

[6]:
```
number_of_years = delta.years
```

[7]:
```
days = (df.index[-1] - df.index[0]).days
days
```

[7]:
```
363
```

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

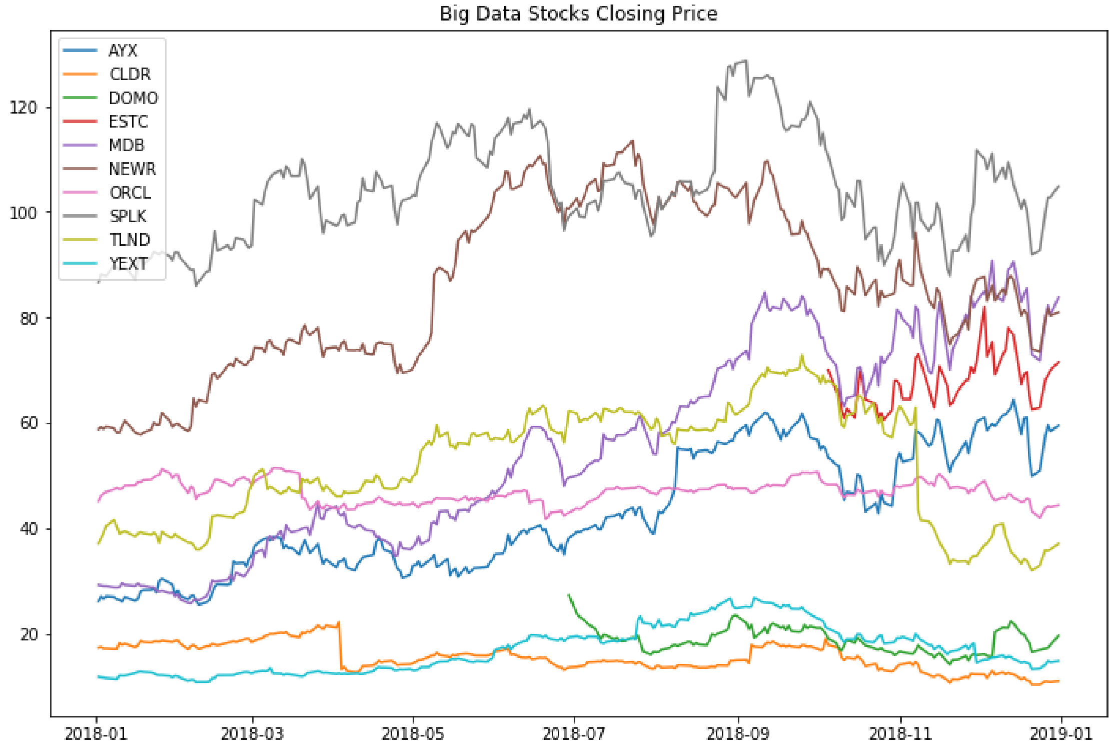
[8]:
```
                  AYX       CLDR  DOMO  ESTC        MDB       NEWR       ORCL  \
2018-01-02  26.170000  17.389999   NaN   NaN  29.250000  58.799999  45.122593
2018-01-03  27.070000  17.530001   NaN   NaN  29.150000  59.220001  46.167679
2018-01-04  26.629999  17.250000   NaN   NaN  29.049999  58.860001  46.622482
2018-01-05  27.090000  17.250000   NaN   NaN  29.049999  59.310001  46.903114
2018-01-08  26.969999  17.150000   NaN   NaN  28.809999  58.959999  47.396618

                 SPLK       TLND   YEXT
2018-01-02  86.629997  37.119999  11.85
2018-01-03  88.160004  38.049999  11.75
2018-01-04  87.949997  39.139999  11.70
2018-01-05  87.879997  40.490002  11.59
2018-01-08  89.980003  41.610001  11.45
```

[9]:
```
df.tail()
```

[9]:
```
                  AYX   CLDR       DOMO       ESTC        MDB       NEWR  \
2018-12-24  50.990002  10.37  16.990000  62.869999  71.779999  73.500000
2018-12-26  57.480000  11.00  17.240000  68.099998  79.690002  79.529999
2018-12-27  59.599998  10.95  17.370001  69.000000  82.290001  81.750000
2018-12-28  58.400002  10.88  17.910000  69.989998  80.500000  80.279999
2018-12-31  59.470001  11.06  19.629999  71.480003  83.739998  80.970001

                 ORCL        SPLK       TLND   YEXT
2018-12-24  41.974194   92.720001  33.000000  13.44
2018-12-26  43.842335   99.769997  35.869999  14.11
2018-12-27  44.215961  102.739998  35.770000  14.88
2018-12-28  44.068474  102.790001  36.009998  14.61
2018-12-31  44.392948  104.849998  37.080002  14.85
```

[10]:
```
plt.figure(figsize=(12,8))
plt.plot(df)
plt.title('Big Data Stocks Closing Price')
plt.legend(labels=df.columns)
```

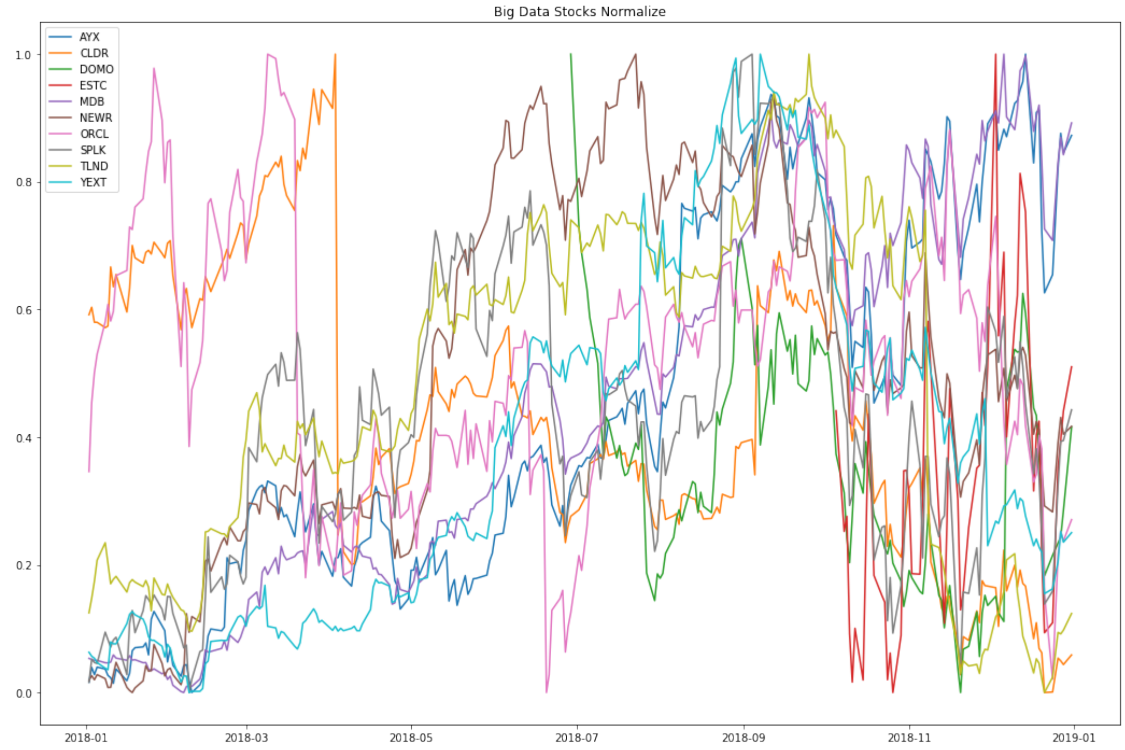
[10]:
```
<matplotlib.legend.Legend at 0x187c2466e10>
```



[11]:
```
# Normalize the data
normalize = (df - df.min())/ (df.max() - df.min())
```

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

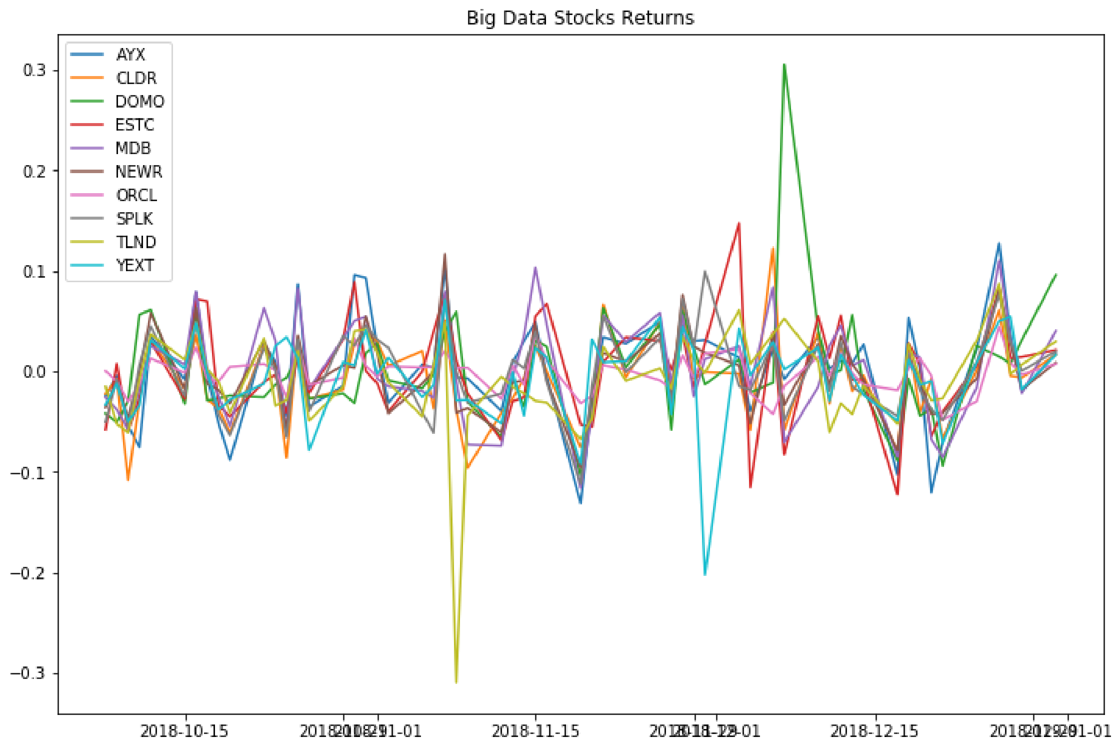
[12]:
```
<matplotlib.legend.Legend at 0x187c24d6780>
```



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

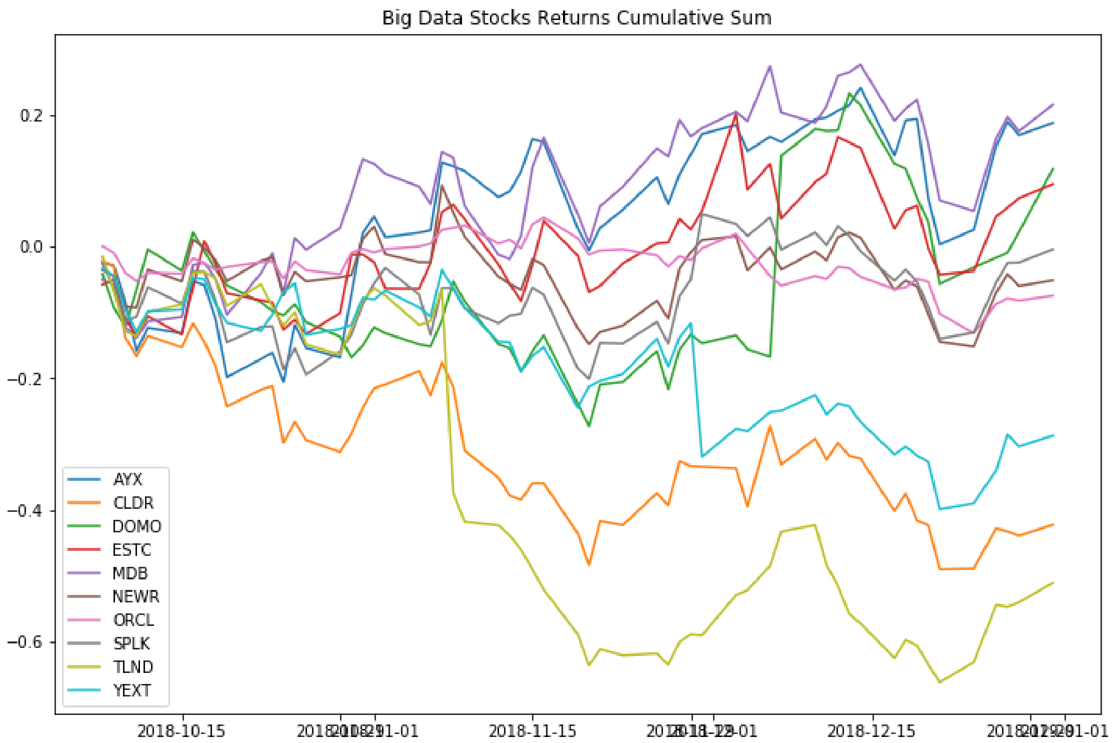
```
[14]: plt.figure(figsize=(12,8))
      plt.plot(stock_rets)
      plt.title('Big Data Stocks Returns')
      plt.legend(labels=stock_rets.columns)
```

```
[14]: <matplotlib.legend.Legend at 0x187c253dda0>
```

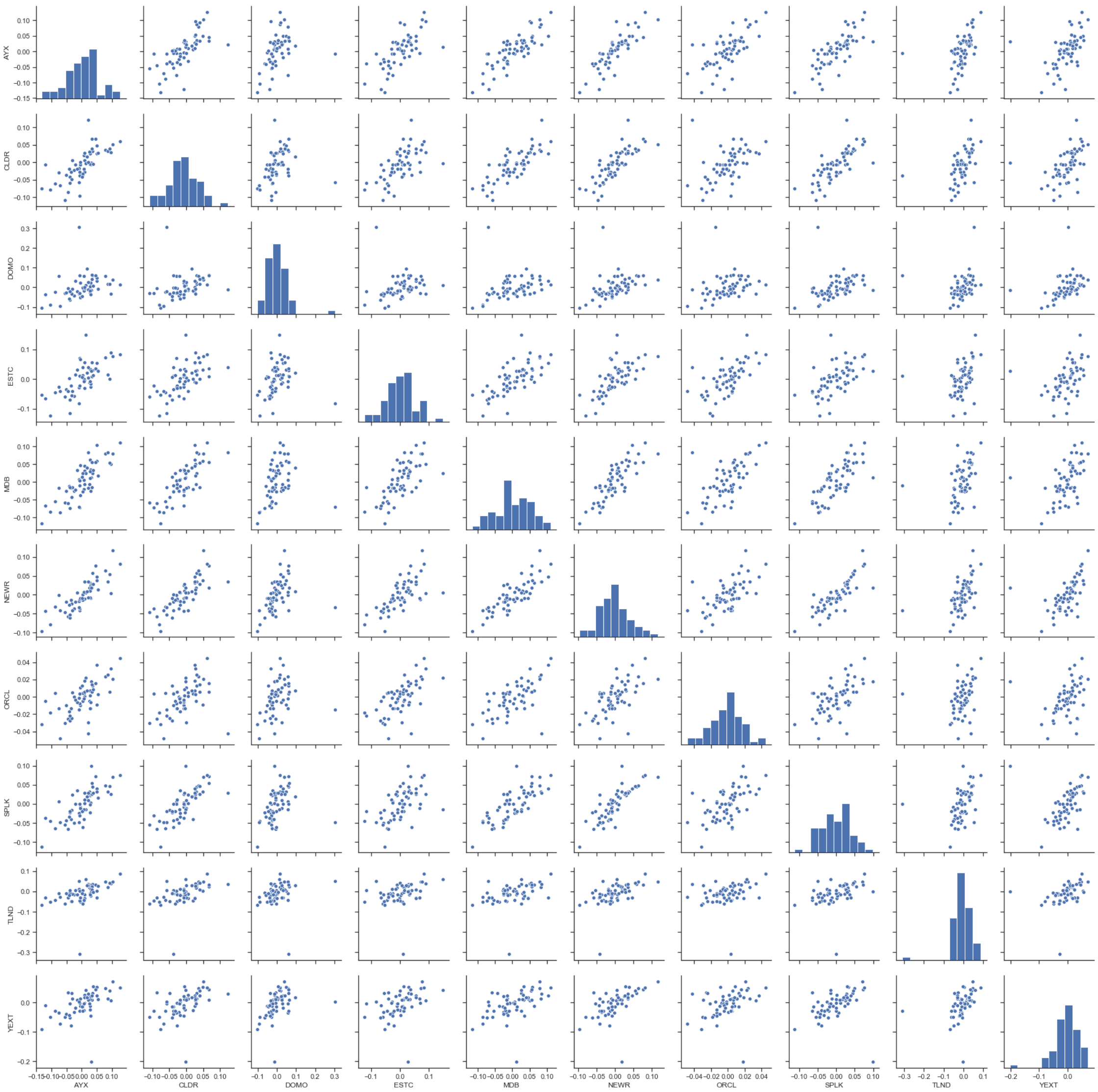


[15]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Big Data Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

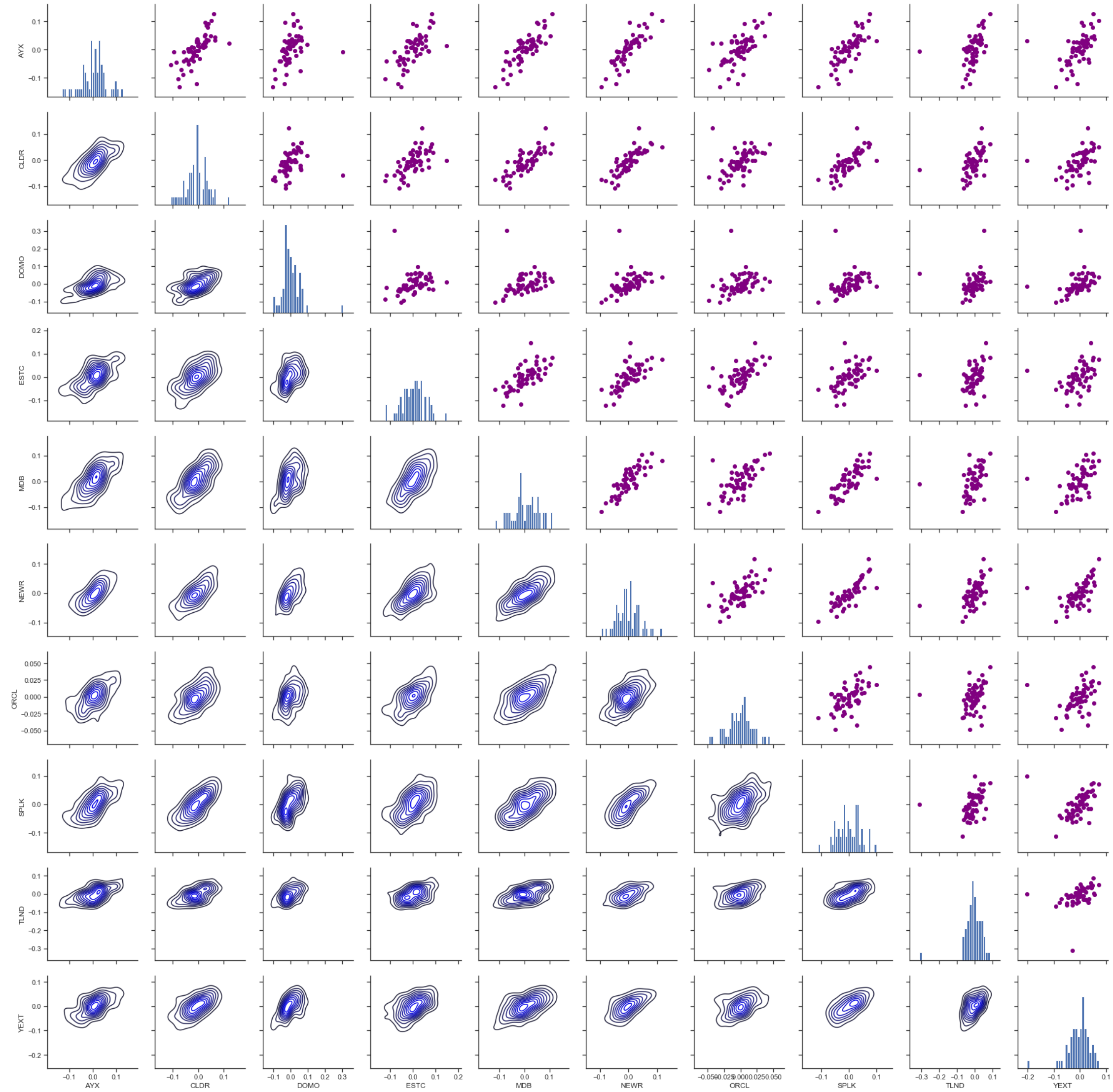
[15]:
```
<matplotlib.legend.Legend at 0x187c25a95f8>
```



```
[16]: 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)
```

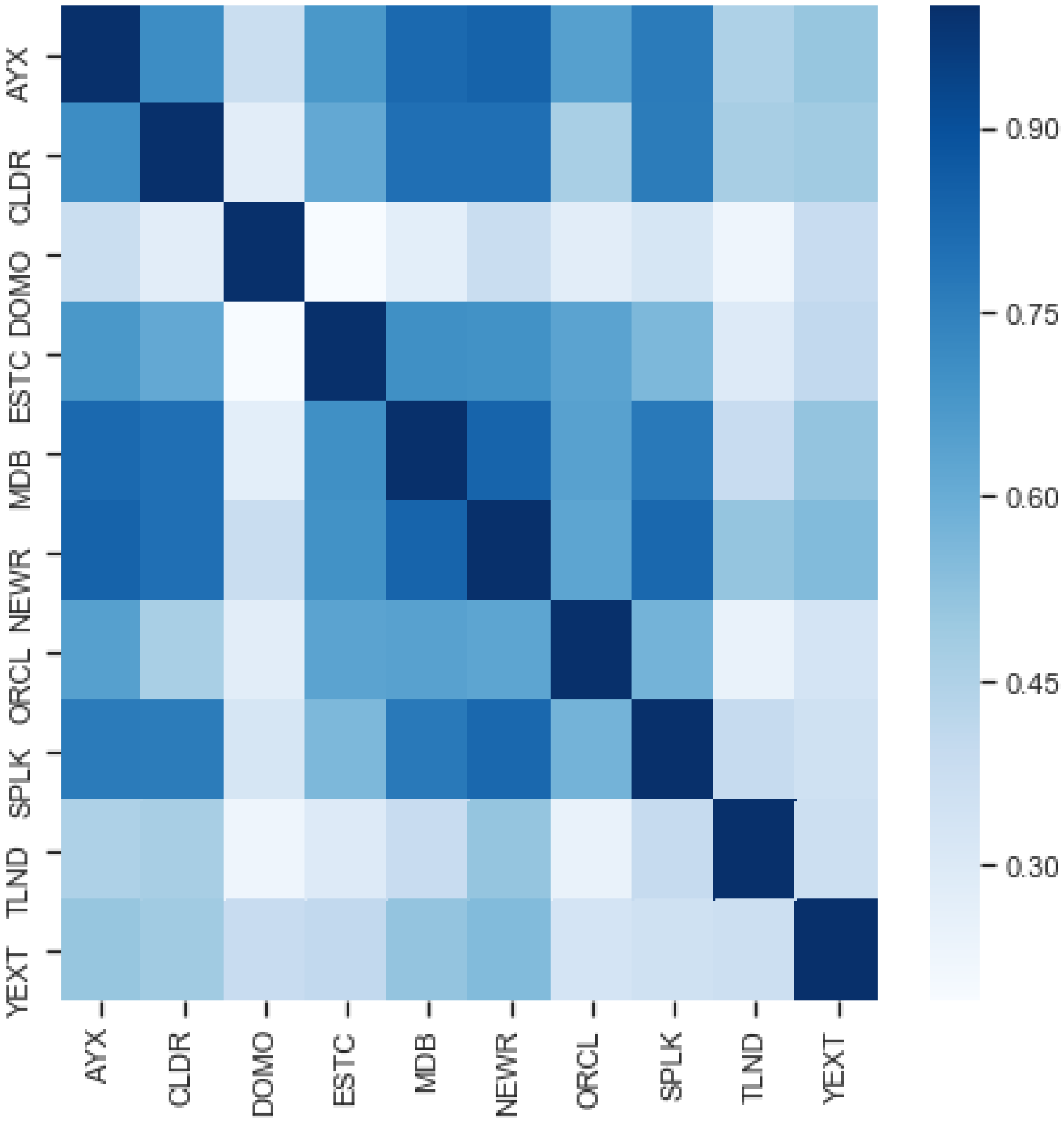


```
[17]: ax = sns.PairGrid(stock_rets)
      ax.map_upper(plt.scatter, color='purple')
      ax.map_lower(sns.kdeplot, color='blue')
      ax.map_diag(plt.hist, bins=30)
      for i in range(nplot) :
          for j in range(nplot) :
              ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)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



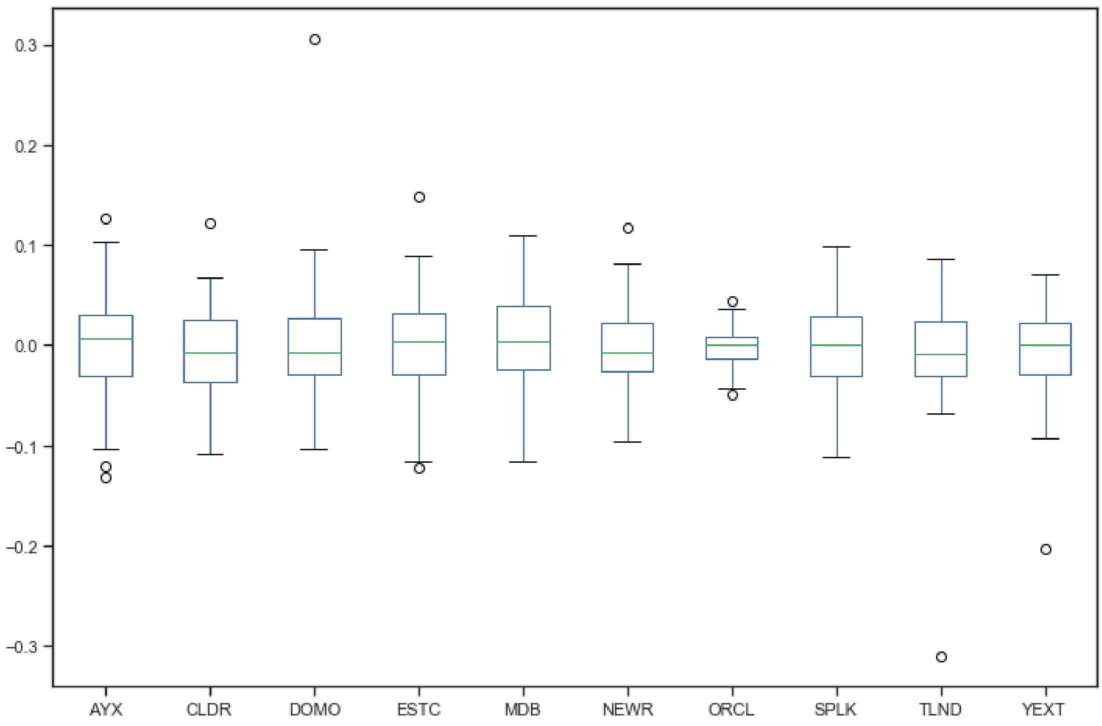
[18]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

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

[18]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x187ca36d5f8>
```



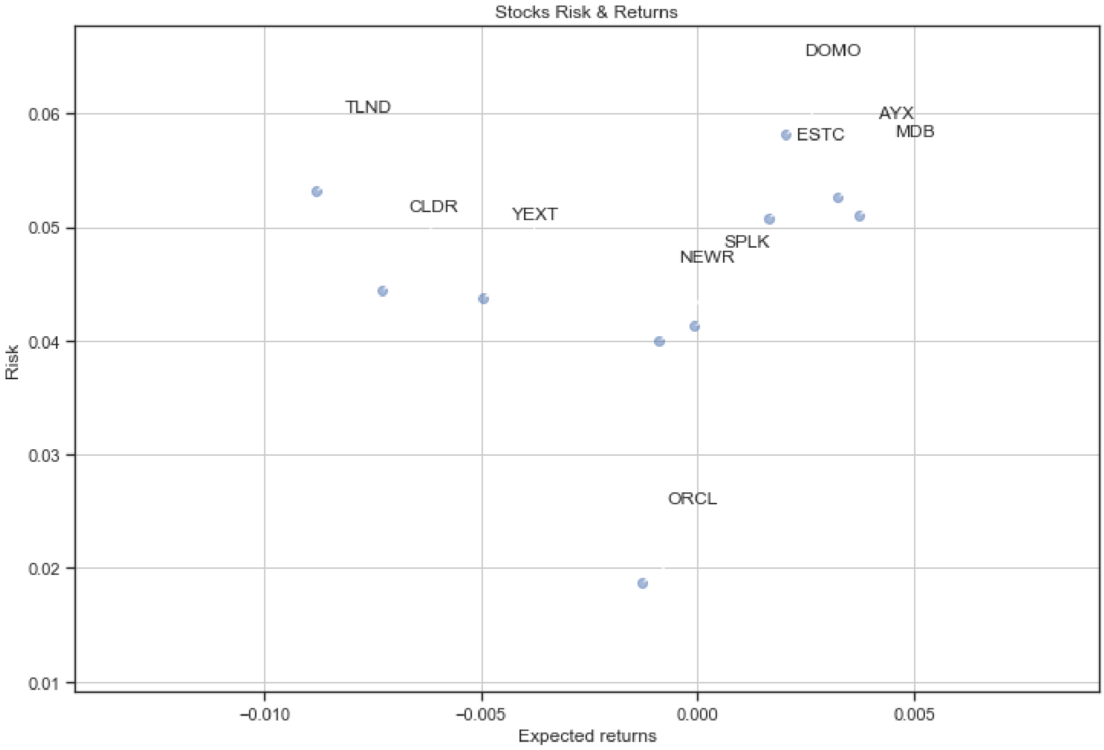
```
[19]: # Box plot
      stock_rets.plot(kind='box',figsize=(12,8))
```

```
[19]: <matplotlib.axes._subplots.AxesSubplot at 0x187cbab3940>
```



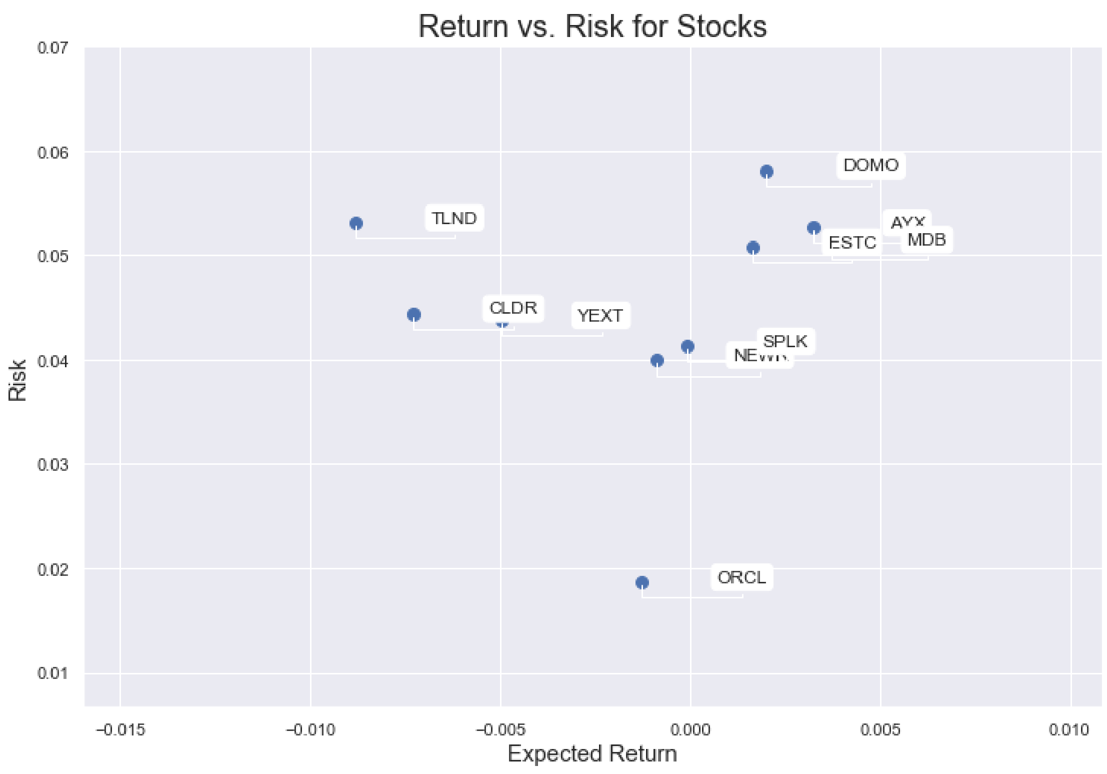
[20]:

```
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'))
```



[21]:

```
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"))
```



[22]:

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

[22]:

```
YEXT  YEXT    1.000000
TLND  TLND    1.000000
CLDR  CLDR    1.000000
DOMO  DOMO    1.000000
ESTC  ESTC    1.000000
MDB   MDB     1.000000
NEWR  NEWR    1.000000
ORCL  ORCL    1.000000
SPLK  SPLK    1.000000
AYX   AYX     1.000000
NEWR  AYX     0.839757
AYX   NEWR    0.839757
NEWR  MDB     0.838562
MDB   NEWR    0.838562
SPLK  NEWR    0.825942
NEWR  SPLK    0.825942
AYX   MDB     0.821357
MDB   AYX     0.821357
NEWR  CLDR    0.801571
```

```
CLDR  NEWR    0.801571
MDB   CLDR    0.800946
CLDR  MDB     0.800946
SPLK  MDB     0.773489
MDB   SPLK    0.773489
SPLK  AYX     0.768405
AYX   SPLK    0.768405
SPLK  CLDR    0.764985
CLDR  SPLK    0.764985
      AYX     0.711166
AYX   CLDR    0.711166
                …
TLND  MDB     0.385999
MDB   TLND    0.385999
YEXT  DOMO    0.383395
DOMO  YEXT    0.383395
NEWR  DOMO    0.382964
DOMO  NEWR    0.382964
      AYX     0.374495
AYX   DOMO    0.374495
TLND  YEXT    0.369411
YEXT  TLND    0.369411
SPLK  YEXT    0.355414
YEXT  SPLK    0.355414
ORCL  YEXT    0.335501
YEXT  ORCL    0.335501
DOMO  SPLK    0.324427
SPLK  DOMO    0.324427
TLND  ESTC    0.296159
ESTC  TLND    0.296159
CLDR  DOMO    0.278694
DOMO  CLDR    0.278694
      ORCL    0.276631
ORCL  DOMO    0.276631
MDB   DOMO    0.272076
DOMO  MDB     0.272076
ORCL  TLND    0.249252
TLND  ORCL    0.249252
DOMO  TLND    0.228751
TLND  DOMO    0.228751
DOMO  ESTC    0.190156
ESTC  DOMO    0.190156
Length: 100, dtype: float64
```

[23]:

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

[23]:

```
                 AYX      CLDR      DOMO      ESTC       MDB      NEWR  \
2018-10-08  0.411701  0.372202  0.151382  0.238585  0.399050  0.281599
2018-10-09  0.491025  0.436850  0.129509  0.481958  0.346169  0.409913
2018-10-10  0.297658  0.000000  0.182025  0.233242  0.256698  0.231219
2018-10-11  0.214628  0.343146  0.391809  0.356765  0.438085  0.442852
2018-10-12  0.643104  0.604470  0.403683  0.563415  0.624896  0.723631

                ORCL      SPLK      TLND      YEXT
2018-10-08  0.523354  0.290447  0.742101  0.618178
2018-10-09  0.414372  0.492709  0.648875  0.694922
2018-10-10  0.197559  0.269368  0.626512  0.557779
2018-10-11  0.380450  0.560434  0.760350  0.615304
2018-10-12  0.659160  0.742206  0.873658  0.853001
```

[24]:

```python
Normalized_Value.corr()
```

[24]:

```
           AYX      CLDR      DOMO      ESTC       MDB      NEWR      ORCL  \
AYX   1.000000  0.711166  0.374495  0.677116  0.821357  0.839757  0.647294
CLDR  0.711166  1.000000  0.278694  0.615171  0.800946  0.801571  0.466280
DOMO  0.374495  0.278694  1.000000  0.190156  0.272076  0.382964  0.276631
ESTC  0.677116  0.615171  0.190156  1.000000  0.700910  0.694637  0.633784
MDB   0.821357  0.800946  0.272076  0.700910  1.000000  0.838562  0.641628
NEWR  0.839757  0.801571  0.382964  0.694637  0.838562  1.000000  0.626717
ORCL  0.647294  0.466280  0.276631  0.633784  0.641628  0.626717  1.000000
SPLK  0.768405  0.764985  0.324427  0.559077  0.773489  0.825942  0.576106
TLND  0.454054  0.471570  0.228751  0.296159  0.385999  0.510230  0.249252
YEXT  0.508367  0.485470  0.383395  0.404563  0.514344  0.549297  0.335501

          SPLK      TLND      YEXT
AYX   0.768405  0.454054  0.508367
CLDR  0.764985  0.471570  0.485470
DOMO  0.324427  0.228751  0.383395
ESTC  0.559077  0.296159  0.404563
MDB   0.773489  0.385999  0.514344
NEWR  0.825942  0.510230  0.549297
ORCL  0.576106  0.249252  0.335501
SPLK  1.000000  0.393394  0.355414
TLND  0.393394  1.000000  0.369411
YEXT  0.355414  0.369411  1.000000
```

[25]:

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

[25]:

```
YEXT  YEXT    1.000000
TLND  TLND    1.000000
CLDR  CLDR    1.000000
```

```
DOMO  DOMO    1.000000
ESTC  ESTC    1.000000
MDB   MDB     1.000000
NEWR  NEWR    1.000000
ORCL  ORCL    1.000000
SPLK  SPLK    1.000000
AYX   AYX     1.000000
NEWR  AYX     0.839757
AYX   NEWR    0.839757
NEWR  MDB     0.838562
MDB   NEWR    0.838562
SPLK  NEWR    0.825942
NEWR  SPLK    0.825942
AYX   MDB     0.821357
MDB   AYX     0.821357
NEWR  CLDR    0.801571
CLDR  NEWR    0.801571
MDB   CLDR    0.800946
CLDR  MDB     0.800946
SPLK  MDB     0.773489
MDB   SPLK    0.773489
SPLK  AYX     0.768405
AYX   SPLK    0.768405
SPLK  CLDR    0.764985
CLDR  SPLK    0.764985
      AYX     0.711166
AYX   CLDR    0.711166
                 …
TLND  MDB     0.385999
MDB   TLND    0.385999
YEXT  DOMO    0.383395
DOMO  YEXT    0.383395
NEWR  DOMO    0.382964
DOMO  NEWR    0.382964
      AYX     0.374495
AYX   DOMO    0.374495
TLND  YEXT    0.369411
YEXT  TLND    0.369411
SPLK  YEXT    0.355414
YEXT  SPLK    0.355414
ORCL  YEXT    0.335501
YEXT  ORCL    0.335501
DOMO  SPLK    0.324427
SPLK  DOMO    0.324427
TLND  ESTC    0.296159
ESTC  TLND    0.296159
CLDR  DOMO    0.278694
```

```
DOMO  CLDR    0.278694
      ORCL    0.276631
ORCL  DOMO    0.276631
MDB   DOMO    0.272076
DOMO  MDB     0.272076
ORCL  TLND    0.249252
TLND  ORCL    0.249252
DOMO  TLND    0.228751
TLND  DOMO    0.228751
DOMO  ESTC    0.190156
ESTC  DOMO    0.190156
Length: 100, dtype: float64
```

[26]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
AYX     0.003232
CLDR   -0.007291
DOMO    0.002027
ESTC    0.001629
MDB     0.003710
NEWR   -0.000889
ORCL   -0.001291
SPLK   -0.000078
TLND   -0.008810
YEXT   -0.004957
dtype: float64
--------------------------------------------------
Stock risks:
AYX     0.052644
CLDR    0.044421
DOMO    0.058110
ESTC    0.050789
MDB     0.051023
NEWR    0.039974
ORCL    0.018682
SPLK    0.041292
TLND    0.053132
YEXT    0.043776
dtype: float64
```

[27]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
```

```
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[27]:
```
       Returns      Risk
TLND -0.008810  0.053132
CLDR -0.007291  0.044421
YEXT -0.004957  0.043776
ORCL -0.001291  0.018682
NEWR -0.000889  0.039974
SPLK -0.000078  0.041292
ESTC  0.001629  0.050789
DOMO  0.002027  0.058110
AYX   0.003232  0.052644
MDB   0.003710  0.051023
```

[28]:
```
table.sort_values(by='Risk')
```

[28]:
```
       Returns      Risk
ORCL -0.001291  0.018682
NEWR -0.000889  0.039974
SPLK -0.000078  0.041292
YEXT -0.004957  0.043776
CLDR -0.007291  0.044421
ESTC  0.001629  0.050789
MDB   0.003710  0.051023
AYX   0.003232  0.052644
TLND -0.008810  0.053132
DOMO  0.002027  0.058110
```

[29]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[29]:
```
       Returns      Risk  Sharpe Ratio
AYX   0.003232  0.052644     -0.128561
CLDR -0.007291  0.044421     -0.389244
DOMO  0.002027  0.058110     -0.137214
ESTC  0.001629  0.050789     -0.164828
MDB   0.003710  0.051023     -0.123283
NEWR -0.000889  0.039974     -0.272407
ORCL -0.001291  0.018682     -0.604375
SPLK -0.000078  0.041292     -0.244068
TLND -0.008810  0.053132     -0.354022
YEXT -0.004957  0.043776     -0.341664
```

[30]:
```
table['Max Returns'] = rets.max()
```

[31]:
```
table['Min Returns'] = rets.min()
```

[32]:
```
table['Median Returns'] = rets.median()
```

[33]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[33]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AYX   0.003232  0.052644     -0.128561     0.127280    -0.131090
CLDR -0.007291  0.044421     -0.389244     0.122519    -0.108233
DOMO  0.002027  0.058110     -0.137214     0.305182    -0.103849
ESTC  0.001629  0.050789     -0.164828     0.147656    -0.122441
MDB   0.003710  0.051023     -0.123283     0.110198    -0.116405
NEWR -0.000889  0.039974     -0.272407     0.116649    -0.095811
ORCL -0.001291  0.018682     -0.604375     0.044507    -0.048443
SPLK -0.000078  0.041292     -0.244068     0.099380    -0.111918
TLND -0.008810  0.053132     -0.354022     0.086970    -0.309539
YEXT -0.004957  0.043776     -0.341664     0.071237    -0.202636

      Median Returns  Total Return
AYX         0.007438      1.832190
CLDR       -0.006549      1.654412
DOMO       -0.006957      9.603568
ESTC        0.003453      2.128883
MDB         0.004443      4.024842
NEWR       -0.007506      0.859494
ORCL        0.000623      0.736295
SPLK        0.000194      2.004083
TLND       -0.008269      2.971408
YEXT        0.000408      1.642710
```

[34]:
```
table['Average Return Yearly'] = (1 + total_return)**(1 / number_of_years) - 1
table
```

[34]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AYX   0.003232  0.052644     -0.128561     0.127280    -0.131090
CLDR -0.007291  0.044421     -0.389244     0.122519    -0.108233
DOMO  0.002027  0.058110     -0.137214     0.305182    -0.103849
ESTC  0.001629  0.050789     -0.164828     0.147656    -0.122441
MDB   0.003710  0.051023     -0.123283     0.110198    -0.116405
NEWR -0.000889  0.039974     -0.272407     0.116649    -0.095811
ORCL -0.001291  0.018682     -0.604375     0.044507    -0.048443
SPLK -0.000078  0.041292     -0.244068     0.099380    -0.111918
TLND -0.008810  0.053132     -0.354022     0.086970    -0.309539
YEXT -0.004957  0.043776     -0.341664     0.071237    -0.202636
```

```
      Median Returns  Total Return  Average Return Yearly
AYX         0.007438      1.832190               0.018322
CLDR       -0.006549      1.654412               0.016544
DOMO       -0.006957      9.603568               0.096036
ESTC        0.003453      2.128883               0.021289
MDB         0.004443      4.024842               0.040248
NEWR       -0.007506      0.859494               0.008595
ORCL        0.000623      0.736295               0.007363
SPLK        0.000194      2.004083               0.020041
TLND       -0.008269      2.971408               0.029714
YEXT        0.000408      1.642710               0.016427
```

[35]:

```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[35]:

```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AYX   0.003232  0.052644     -0.128561     0.127280    -0.131090
CLDR -0.007291  0.044421     -0.389244     0.122519    -0.108233
DOMO  0.002027  0.058110     -0.137214     0.305182    -0.103849
ESTC  0.001629  0.050789     -0.164828     0.147656    -0.122441
MDB   0.003710  0.051023     -0.123283     0.110198    -0.116405
NEWR -0.000889  0.039974     -0.272407     0.116649    -0.095811
ORCL -0.001291  0.018682     -0.604375     0.044507    -0.048443
SPLK -0.000078  0.041292     -0.244068     0.099380    -0.111918
TLND -0.008810  0.053132     -0.354022     0.086970    -0.309539
YEXT -0.004957  0.043776     -0.341664     0.071237    -0.202636

      Median Returns  Total Return  Average Return Yearly      CAGR
AYX         0.007438      1.832190               0.018322  0.768005
CLDR       -0.006549      1.654412               0.016544 -0.269608
DOMO       -0.006957      9.603568               0.096036       NaN
ESTC        0.003453      2.128883               0.021289       NaN
MDB         0.004443      4.024842               0.040248  1.075498
NEWR       -0.007506      0.859494               0.008595  0.248702
ORCL        0.000623      0.736295               0.007363 -0.011254
SPLK        0.000194      2.004083               0.020041  0.141696
TLND       -0.008269      2.971408               0.029714 -0.000748
YEXT        0.000408      1.642710               0.016427  0.169604
```

[36]:

```
table.sort_values(by='Average Return Yearly')
```

[36]:

```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
ORCL -0.001291  0.018682     -0.604375     0.044507    -0.048443
NEWR -0.000889  0.039974     -0.272407     0.116649    -0.095811
YEXT -0.004957  0.043776     -0.341664     0.071237    -0.202636
```

```
CLDR -0.007291  0.044421     -0.389244     0.122519    -0.108233
AYX   0.003232  0.052644     -0.128561     0.127280    -0.131090
SPLK -0.000078  0.041292     -0.244068     0.099380    -0.111918
ESTC  0.001629  0.050789     -0.164828     0.147656    -0.122441
TLND -0.008810  0.053132     -0.354022     0.086970    -0.309539
MDB   0.003710  0.051023     -0.123283     0.110198    -0.116405
DOMO  0.002027  0.058110     -0.137214     0.305182    -0.103849

      Median Returns  Total Return  Average Return Yearly       CAGR
ORCL        0.000623      0.736295              0.007363 -0.011254
NEWR       -0.007506      0.859494              0.008595  0.248702
YEXT        0.000408      1.642710              0.016427  0.169604
CLDR       -0.006549      1.654412              0.016544 -0.269608
AYX         0.007438      1.832190              0.018322  0.768005
SPLK        0.000194      2.004083              0.020041  0.141696
ESTC        0.003453      2.128883              0.021289       NaN
TLND       -0.008269      2.971408              0.029714 -0.000748
MDB         0.004443      4.024842              0.040248  1.075498
DOMO       -0.006957      9.603568              0.096036       NaN
```