COVID-19_Portfolio

September 29, 2021

1 COVID-19 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")

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

[2]:
```
# input
# Online Gaming
title = "COVID-19"
symbols = ['PRGO', 'AMED', 'EHC', 'LHCG', 'CNC', 'TDOC', 'DXCM', 'HOLX', 'BIO',␣
 ↪'DHR', 'TMO', 'ANTM', 'BMY', 'GH', 'IOVA', 'IQV', 'MDT', 'VEEV', 'WST',␣
 ↪'FSPHX', 'BHCFX', 'PRHSX','IHI', 'RYH', 'XLV', 'XHE']
start = '2018-01-01'
end = '2020-06-26'
```

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

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[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?
2 years
```

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

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

[6]:
```
905
```

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

[7]:

Date	PRGO	AMED	EHC	LHCG	CNC	TDOC	\
2018-01-02	86.560356	53.790001	49.234493	61.619999	51.294998	36.200001	
2018-01-03	86.319077	52.689999	48.745792	61.919998	52.215000	36.849998	
2018-01-04	87.901848	53.049999	50.259811	64.510002	51.250000	37.200001	
2018-01-05	87.998344	52.889999	50.278976	64.339996	52.744999	37.500000	
2018-01-08	86.984993	50.509998	47.969620	61.259998	52.459999	36.049999	

	DXCM	HOLX	BIO	DHR	…	MDT	\

```
Date                                                          …
2018-01-02  57.990002  42.869999  241.419998  91.191078  …  77.746536
2018-01-03  58.080002  43.490002  250.470001  92.404449  …  79.363701
2018-01-04  52.250000  43.770000  248.490005  92.848373  …  79.552849
2018-01-05  53.259998  43.980000  249.050003  93.430397  …  80.895760
2018-01-08  55.439999  44.419998  251.000000  93.963112  …  80.867371

                 VEEV         WST      FSPHX  BHCFX      PRHSX         IHI  \
Date
2018-01-02  55.070000   98.237854  19.940559    NaN  63.421398  175.057892
2018-01-03  56.279999   98.356316  20.119801    NaN  64.103729  176.905106
2018-01-04  56.900002   98.326698  20.077627    NaN  63.837891  176.905106
2018-01-05  57.439999   99.560852  20.205027    NaN  64.289825  178.921112
2018-01-08  57.709999  100.123627  20.168125    NaN  63.802444  179.944061

                  RYH        XLV        XHE
Date
2018-01-02  179.344879  79.736702  65.242516
2018-01-03  180.951279  80.499641  65.332390
2018-01-04  181.246933  80.614067  65.212547
2018-01-05  182.804062  81.300713  65.901535
2018-01-08  182.784348  81.005074  66.300941

[5 rows x 26 columns]
```

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

[8]:
```
                 PRGO        AMED        EHC        LHCG        CNC  \
Date
2020-06-19  54.869999  198.580002  63.943573  168.830002  64.220001
2020-06-22  55.180000  197.600006  63.445885  168.520004  63.099998
2020-06-23  55.070000  198.309998  62.878510  168.940002  63.770000
2020-06-24  53.950001  192.000000  60.609032  166.759995  61.880001
2020-06-25  54.730000  198.649994  60.250690  172.100006  63.360001

                 TDOC        DXCM       HOLX         BIO         DHR  …  \
Date                                                                  …
2020-06-19  201.529999  409.359985  55.160000  451.959991  172.768433  …
2020-06-22  204.940002  406.329987  55.209999  456.489990  174.656448  …
2020-06-23  198.080002  406.899994  55.500000  451.779999  175.405655  …
2020-06-24  197.009995  394.299988  53.669998  432.420013  171.279999  …
2020-06-25  201.699997  398.089996  54.570000  437.239990  172.149994  …

                 MDT        VEEV         WST      FSPHX  BHCFX      PRHSX  \
Date
2020-06-19  93.297523  226.669998  216.589996  30.320000  14.49  87.500000
2020-06-22  92.721306  238.919998  217.800003  30.450001  14.60  87.809998
```

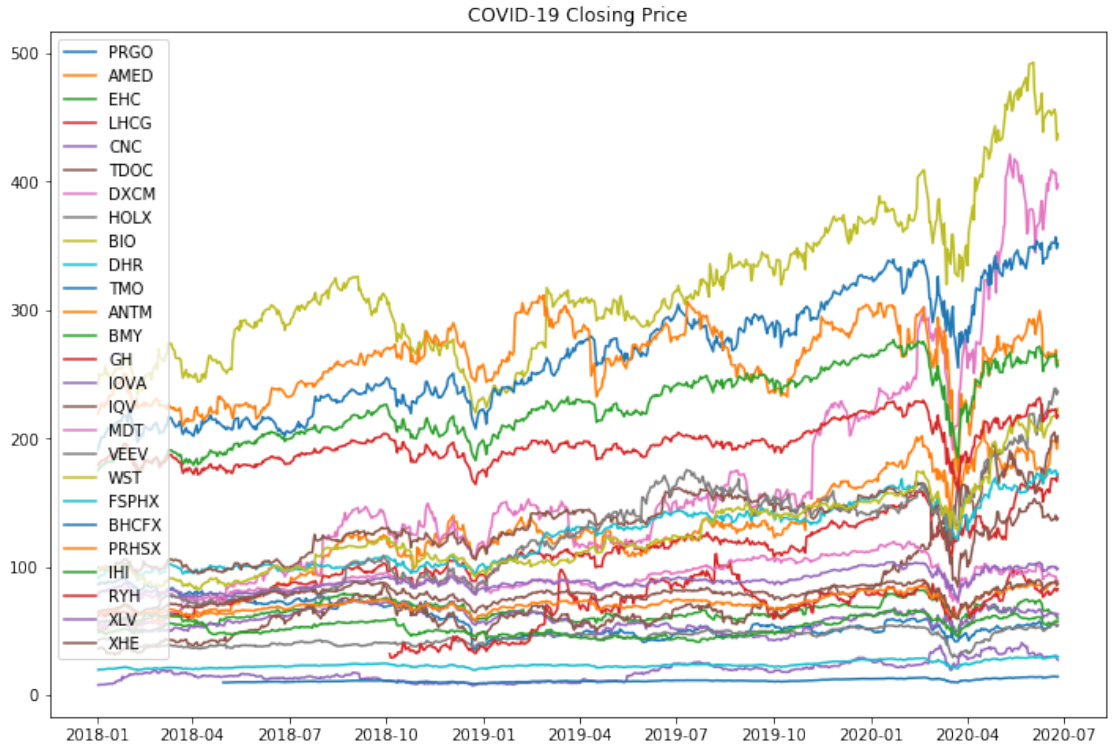
```
2020-06-23  92.780907  239.100006  217.539993  30.580000  14.73  88.419998
2020-06-24  88.349998  234.309998  216.509995  29.730000  14.31  86.000000
2020-06-25  88.860001  236.820007  223.360001  30.150000  14.53  87.050003
```

Date	IHI	RYH	XLV	XHE
2020-06-19	264.149994	222.500992	100.325005	87.790001
2020-06-22	263.920013	221.979996	99.940002	88.029999
2020-06-23	265.769989	222.949997	100.370003	88.989998
2020-06-24	255.690002	215.949997	97.750000	85.790001
2020-06-25	257.720001	217.919998	98.709999	86.820000

[5 rows x 26 columns]

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

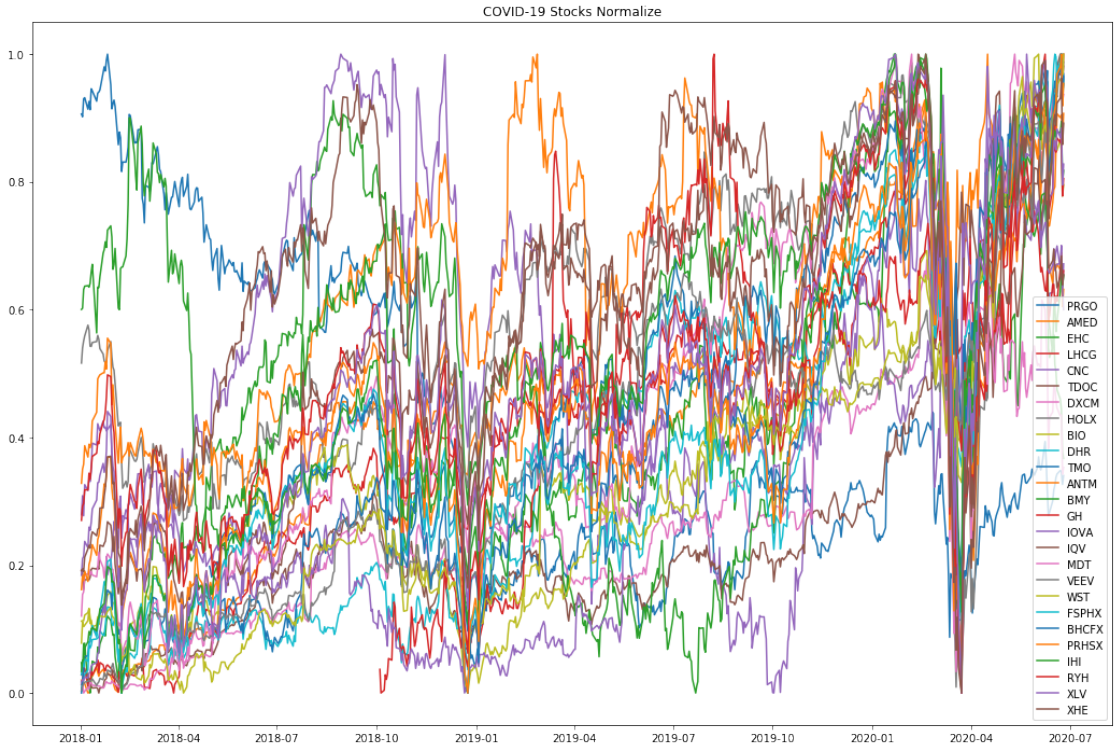
[9]: <matplotlib.legend.Legend at 0x24fe02d2eb8>



[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)
```

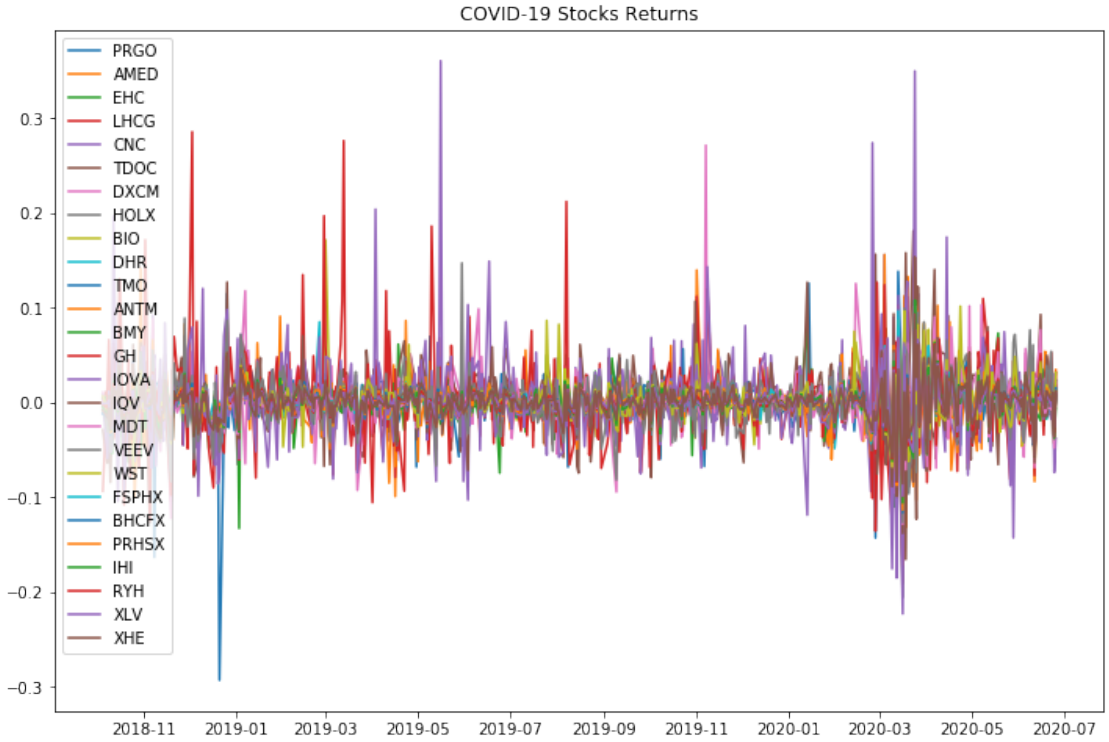
[11]: <matplotlib.legend.Legend at 0x24fe0330cc0>



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

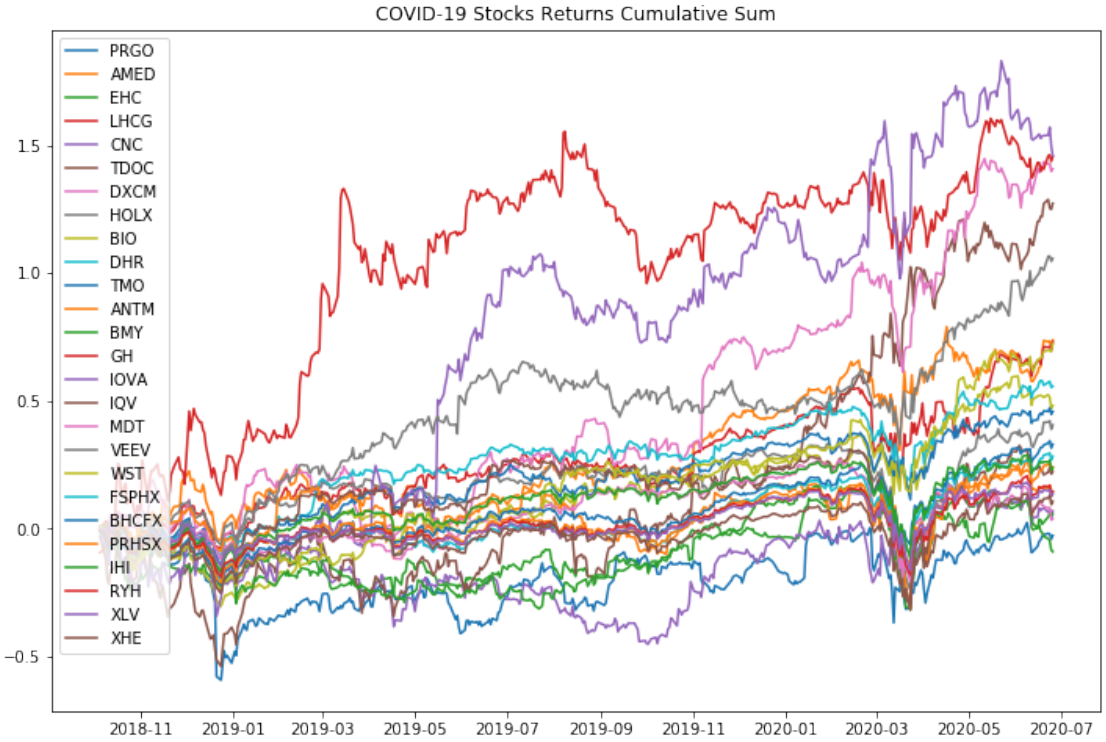
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title(title + ' Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x24fe03aae80>

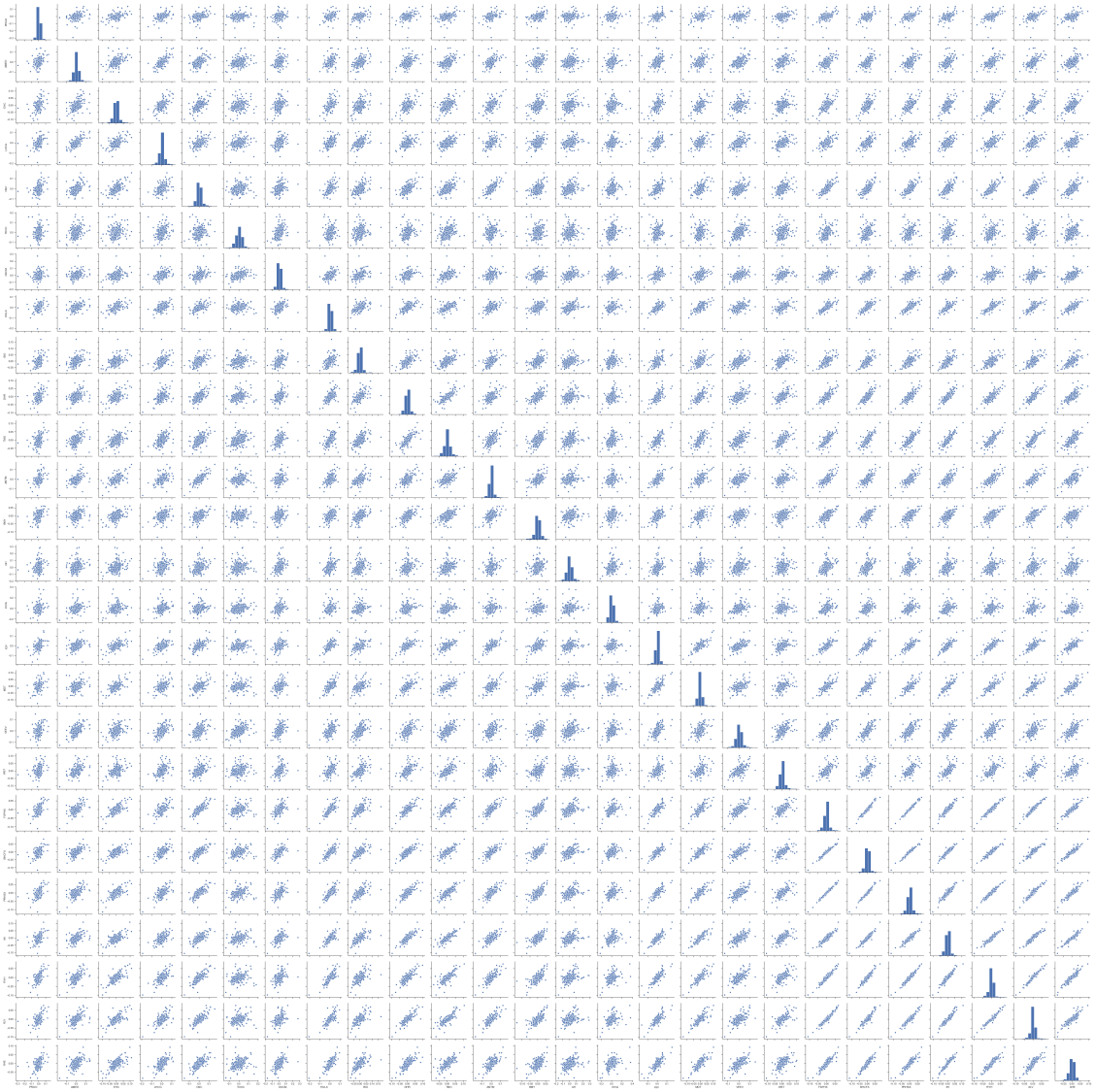


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title(title + ' Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

[14]: <matplotlib.legend.Legend at 0x24fe046af28>



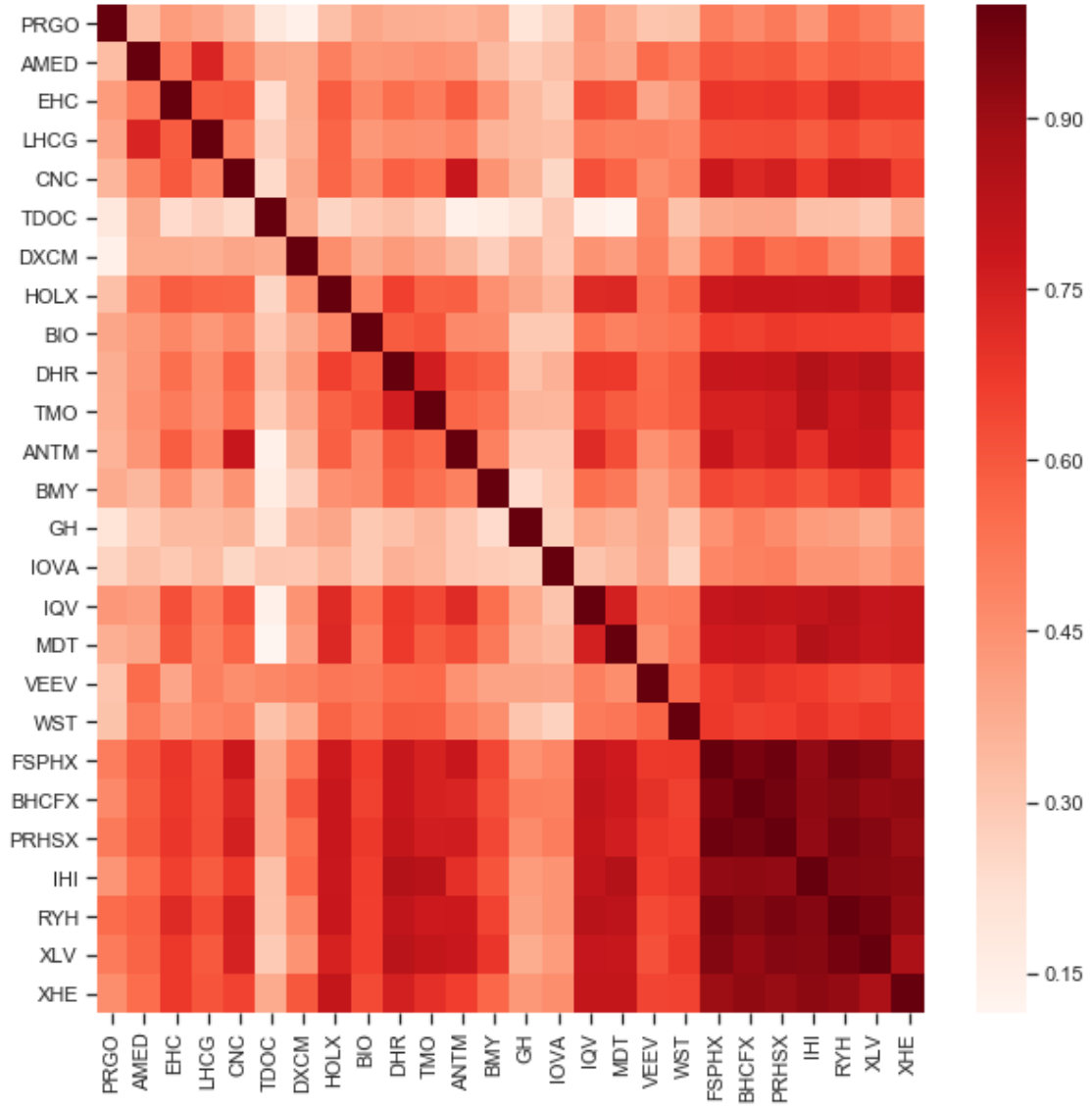
[15]:
```
sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

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)
```

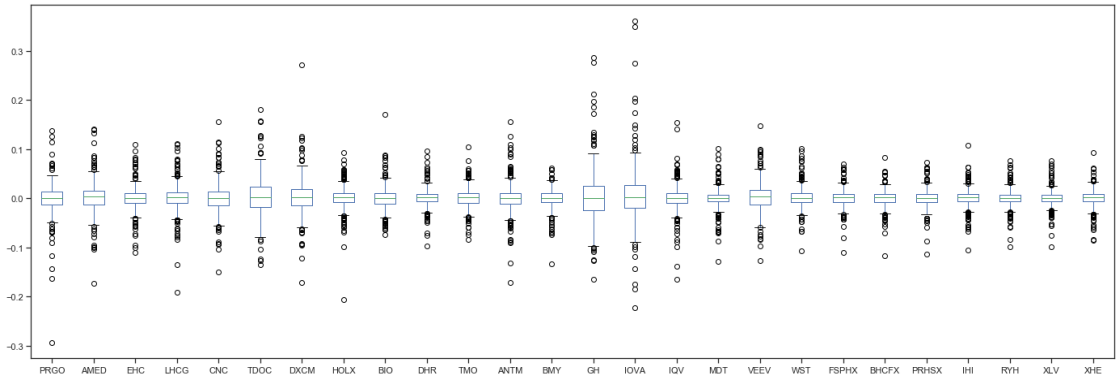
[17]:
```
plt.figure(figsize=(10,10))
corr = stock_rets.corr()

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

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x24ff2c2bcf8>

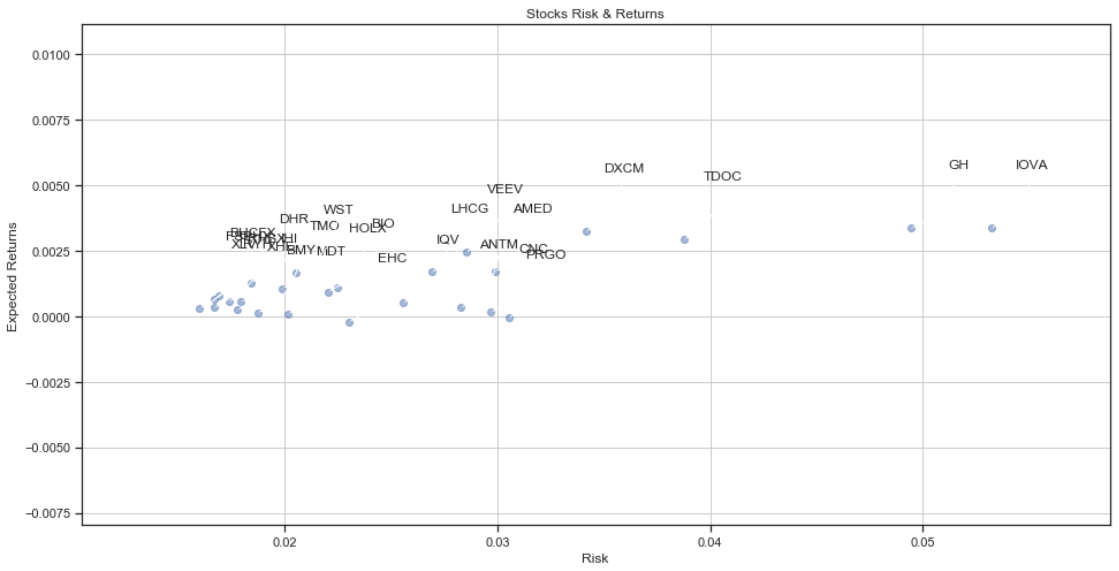


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(24,8))
```

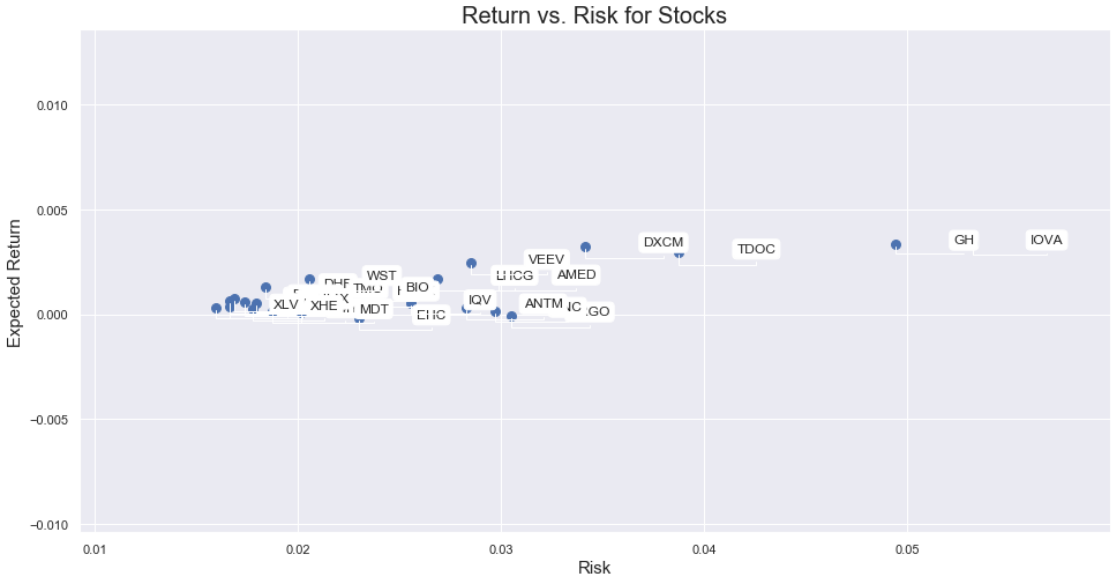
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x24ff749bda0>



[19]:
```
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"))
```



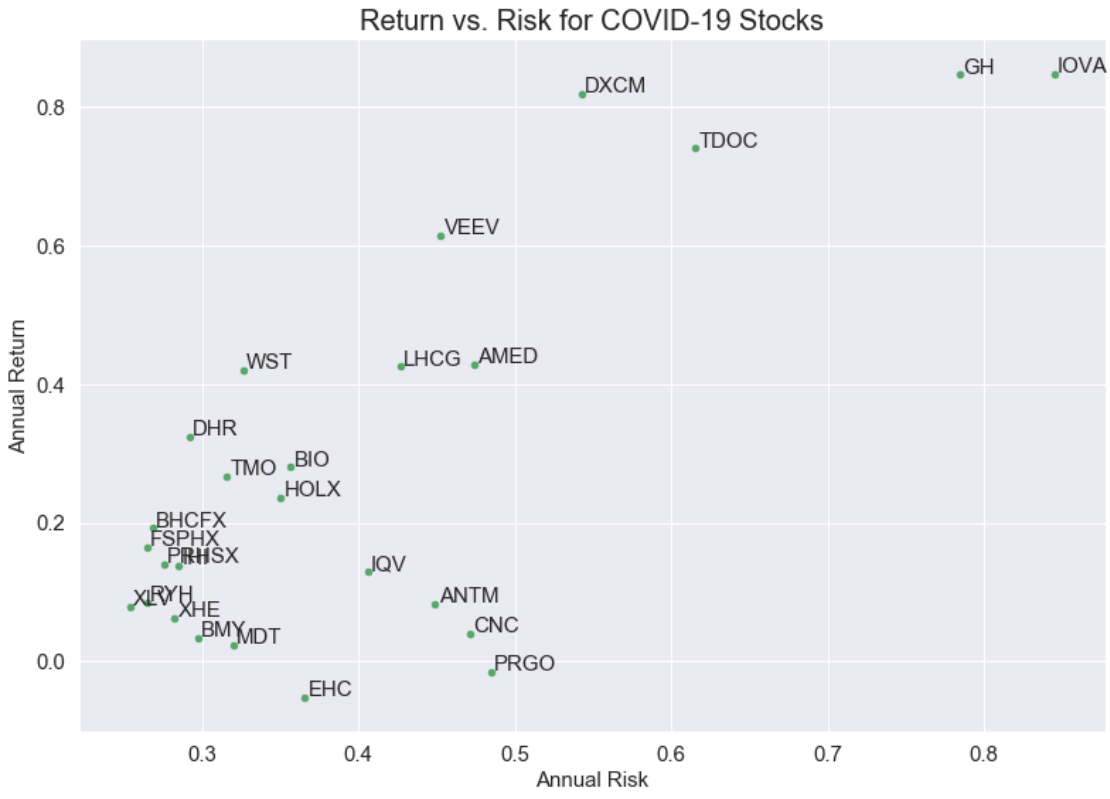
[21]:
```
def annual_risk_return(stock_rets):
    tradeoff = stock_rets.agg(["mean", "std"]).T
    tradeoff.columns = ["Return", "Risk"]
    tradeoff.Return = tradeoff.Return*252
    tradeoff.Risk = tradeoff.Risk * np.sqrt(252)
    return tradeoff
```

[22]:
```
tradeoff = annual_risk_return(stock_rets)
tradeoff
```

[22]:

	Return	Risk
PRGO	-0.015248	0.484617
AMED	0.429228	0.474288
EHC	-0.051871	0.365559
LHCG	0.425654	0.426948
CNC	0.040352	0.471479
TDOC	0.740640	0.615577
DXCM	0.818884	0.542420
HOLX	0.236323	0.350276
BIO	0.280522	0.356767
DHR	0.324552	0.292127
TMO	0.266928	0.315727
ANTM	0.082531	0.449037
BMY	0.033065	0.297355
GH	0.847142	0.784935
IOVA	0.848977	0.844912
IQV	0.130354	0.405695
MDT	0.023347	0.320116
VEEV	0.615006	0.452665
WST	0.421413	0.326266
FSPHX	0.164696	0.264559
BHCFX	0.192423	0.268106
PRHSX	0.140757	0.275709
IHI	0.138372	0.284967
RYH	0.085491	0.264726
XLV	0.079399	0.253971
XHE	0.062220	0.282395

[23]:
```
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()
```



[24]:
```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[24]:
```
XHE    XHE      1.000000
BMY    BMY      1.000000
IHI    IHI      1.000000
PRHSX  PRHSX    1.000000
BHCFX  BHCFX    1.000000
FSPHX  FSPHX    1.000000
WST    WST      1.000000
VEEV   VEEV     1.000000
MDT    MDT      1.000000
IQV    IQV      1.000000
IOVA   IOVA     1.000000
GH     GH       1.000000
ANTM   ANTM     1.000000
XLV    XLV      1.000000
TMO    TMO      1.000000
DHR    DHR      1.000000
BIO    BIO      1.000000
HOLX   HOLX     1.000000
```

```
DXCM   DXCM     1.000000
TDOC   TDOC     1.000000
CNC    CNC      1.000000
LHCG   LHCG     1.000000
EHC    EHC      1.000000
AMED   AMED     1.000000
RYH    RYH      1.000000
PRGO   PRGO     1.000000
FSPHX  PRHSX    0.988098
PRHSX  FSPHX    0.988098
BHCFX  PRHSX    0.975807
PRHSX  BHCFX    0.975807
                  …
IOVA   WST      0.269274
WST    IOVA     0.269274
IOVA   PRGO     0.266580
PRGO   IOVA     0.266580
TDOC   HOLX     0.258916
HOLX   TDOC     0.258916
CNC    IOVA     0.254692
IOVA   CNC      0.254692
CNC    TDOC     0.245909
TDOC   CNC      0.245909
GH     BMY      0.242537
BMY    GH       0.242537
TDOC   EHC      0.239568
EHC    TDOC     0.239568
GH     TDOC     0.210314
TDOC   GH       0.210314
GH     PRGO     0.201491
PRGO   GH       0.201491
TDOC   PRGO     0.185020
PRGO   TDOC     0.185020
BMY    TDOC     0.166238
TDOC   BMY      0.166238
       ANTM     0.140352
ANTM   TDOC     0.140352
IQV    TDOC     0.137542
TDOC   IQV      0.137542
DXCM   PRGO     0.137146
PRGO   DXCM     0.137146
MDT    TDOC     0.114734
TDOC   MDT      0.114734
Length: 676, dtype: float64
```

[25]:
```
# Normalized Returns Data
Normalized_Value = ((rets[:] - rets[:].min()) /(rets[:].max() - rets[:].min()))
```

```
Normalized_Value.head()
```

[25]:
```
                PRGO      AMED       EHC      LHCG       CNC      TDOC  \
Date
2018-10-05  0.690260  0.562359  0.536978  0.649706  0.513586  0.336857
2018-10-08  0.707617  0.579870  0.485790  0.672598  0.461456  0.226329
2018-10-09  0.637191  0.605416  0.521362  0.664687  0.496914  0.349628
2018-10-10  0.724004  0.509101  0.413736  0.563156  0.466513  0.162076
2018-10-11  0.580602  0.446580  0.454827  0.498729  0.420770  0.377676

                DXCM      HOLX       BIO       DHR  …       MDT      VEEV  \
Date                                                 …
2018-10-05  0.411107  0.684928  0.271427  0.499725  …  0.565751  0.457761
2018-10-08  0.332200  0.703995  0.209373  0.434754  …  0.503575  0.350733
2018-10-09  0.369690  0.746034  0.280333  0.555288  …  0.567200  0.432260
2018-10-10  0.304817  0.624936  0.190669  0.361276  …  0.506642  0.270761
2018-10-11  0.469028  0.588099  0.208958  0.373264  …  0.467653  0.453715

                WST     FSPHX     BHCFX     PRHSX       IHI       RYH  \
Date
2018-10-05  0.544863  0.591899  0.523060  0.585188  0.474131  0.551651
2018-10-08  0.481377  0.545449  0.504099  0.551223  0.426491  0.534070
2018-10-09  0.479968  0.591609  0.549262  0.598717  0.497223  0.568636
2018-10-10  0.365599  0.450244  0.408990  0.436530  0.356251  0.426445
2018-10-11  0.469955  0.527043  0.567226  0.524940  0.438002  0.423063

                XLV       XHE
Date
2018-10-05  0.554712  0.433003
2018-10-08  0.558932  0.390249
2018-10-09  0.571010  0.444912
2018-10-10  0.426885  0.318880
2018-10-11  0.407576  0.448707

[5 rows x 26 columns]
```

[26]:
```
Normalized_Value.corr()
```

[26]:
```
           PRGO      AMED       EHC      LHCG       CNC      TDOC      DXCM  \
PRGO   1.000000  0.330321  0.421733  0.397212  0.351381  0.185020  0.137146
AMED   0.330321  1.000000  0.519656  0.739781  0.493172  0.384234  0.374164
EHC    0.421733  0.519656  1.000000  0.590691  0.598567  0.239568  0.376651
LHCG   0.397212  0.739781  0.590691  1.000000  0.500541  0.280427  0.369352
CNC    0.351381  0.493172  0.598567  0.500541  1.000000  0.245909  0.394574
TDOC   0.185020  0.384234  0.239568  0.280427  0.245909  1.000000  0.379764
DXCM   0.137146  0.374164  0.376651  0.369352  0.394574  0.379764  1.000000
HOLX   0.323019  0.501502  0.586990  0.567759  0.567670  0.258916  0.461830
```

BIO	0.394771	0.435589	0.475801	0.435204	0.475005	0.298191	0.384244
DHR	0.372117	0.439176	0.546099	0.458314	0.579102	0.325537	0.422699
TMO	0.367520	0.452512	0.511957	0.456771	0.550337	0.289287	0.395989
ANTM	0.360116	0.438720	0.585543	0.479001	0.786171	0.140352	0.344115
BMY	0.380199	0.345322	0.450837	0.360346	0.442385	0.166238	0.278441
GH	0.201491	0.291030	0.338835	0.337941	0.355004	0.210314	0.367041
IOVA	0.266580	0.323435	0.295945	0.329814	0.254692	0.301562	0.299718
IQV	0.430048	0.416765	0.620265	0.510660	0.616209	0.137542	0.443854
MDT	0.370139	0.392256	0.600765	0.491939	0.571048	0.114734	0.416064
VEEV	0.307317	0.553329	0.397144	0.499758	0.463816	0.477715	0.491907
WST	0.312676	0.503020	0.437905	0.479871	0.497678	0.315361	0.387376
FSPHX	0.502238	0.604170	0.684917	0.622924	0.780172	0.382295	0.529738
BHCFX	0.471266	0.591088	0.676603	0.624295	0.729304	0.392995	0.605759
PRHSX	0.513622	0.600802	0.683284	0.627216	0.756161	0.396068	0.545473
IHI	0.437217	0.547192	0.661016	0.588734	0.675662	0.323259	0.561182
RYH	0.552704	0.583548	0.722278	0.632329	0.754814	0.320719	0.482979
XLV	0.510095	0.573477	0.677864	0.597185	0.749223	0.292672	0.445336
XHE	0.460672	0.547343	0.677175	0.605994	0.653368	0.380840	0.600303

	HOLX	BIO	DHR	…	MDT	VEEV	WST	\
PRGO	0.323019	0.394771	0.372117	…	0.370139	0.307317	0.312676	
AMED	0.501502	0.435589	0.439176	…	0.392256	0.553329	0.503020	
EHC	0.586990	0.475801	0.546099	…	0.600765	0.397144	0.437905	
LHCG	0.567759	0.435204	0.458314	…	0.491939	0.499758	0.479871	
CNC	0.567670	0.475005	0.579102	…	0.571048	0.463816	0.497678	
TDOC	0.258916	0.298191	0.325537	…	0.114734	0.477715	0.315361	
DXCM	0.461830	0.384244	0.422699	…	0.416064	0.491907	0.387376	
HOLX	1.000000	0.480939	0.660976	…	0.729050	0.523549	0.571468	
BIO	0.480939	1.000000	0.594643	…	0.492226	0.517494	0.531894	
DHR	0.660976	0.594643	1.000000	…	0.674131	0.555986	0.595404	
TMO	0.576608	0.605998	0.764567	…	0.594334	0.558454	0.585442	
ANTM	0.582206	0.471716	0.600962	…	0.629930	0.446765	0.498745	
BMY	0.451035	0.464550	0.576484	…	0.518727	0.401997	0.461805	
GH	0.393455	0.297195	0.319698	…	0.360988	0.400795	0.307824	
IOVA	0.348367	0.294601	0.365089	…	0.336476	0.396784	0.269274	
IQV	0.722497	0.532304	0.677941	…	0.756665	0.498632	0.509864	
MDT	0.729050	0.492226	0.674131	…	1.000000	0.462105	0.524977	
VEEV	0.523549	0.517494	0.555986	…	0.462105	1.000000	0.574280	
WST	0.571468	0.531894	0.595404	…	0.524977	0.574280	1.000000	
FSPHX	0.774596	0.666729	0.794327	…	0.768838	0.673689	0.676464	
BHCFX	0.787361	0.657117	0.787094	…	0.775133	0.697796	0.656592	
PRHSX	0.788606	0.676330	0.806280	…	0.764672	0.675546	0.664424	
IHI	0.785022	0.665213	0.845266	…	0.847653	0.665481	0.689419	
RYH	0.791210	0.661519	0.811404	…	0.820833	0.635087	0.660132	
XLV	0.746226	0.661616	0.830435	…	0.792783	0.619297	0.675793	
XHE	0.802116	0.631179	0.757714	…	0.805099	0.646572	0.652869	

	FSPHX	BHCFX	PRHSX	IHI	RYH	XLV	XHE
PRGO	0.502238	0.471266	0.513622	0.437217	0.552704	0.510095	0.460672
AMED	0.604170	0.591088	0.600802	0.547192	0.583548	0.573477	0.547343
EHC	0.684917	0.676603	0.683284	0.661016	0.722278	0.677864	0.677175
LHCG	0.622924	0.624295	0.627216	0.588734	0.632329	0.597185	0.605994
CNC	0.780172	0.729304	0.756161	0.675662	0.754814	0.749223	0.653368
TDOC	0.382295	0.392995	0.396068	0.323259	0.320719	0.292672	0.380840
DXCM	0.529738	0.605759	0.545473	0.561182	0.482979	0.445336	0.600303
HOLX	0.774596	0.787361	0.788606	0.785022	0.791210	0.746226	0.802116
BIO	0.666729	0.657117	0.676330	0.665213	0.661519	0.661616	0.631179
DHR	0.794327	0.787094	0.806280	0.845266	0.811404	0.830435	0.757714
TMO	0.746848	0.746235	0.762318	0.835980	0.772319	0.800791	0.704831
ANTM	0.788420	0.738368	0.767376	0.703434	0.778565	0.785593	0.664249
BMY	0.637179	0.621884	0.638797	0.608214	0.653393	0.684434	0.563695
GH	0.447053	0.499969	0.465724	0.420193	0.410415	0.376313	0.434427
IOVA	0.479196	0.494499	0.504954	0.442845	0.441325	0.420033	0.459511
IQV	0.799427	0.812867	0.805533	0.810938	0.836432	0.798516	0.804789
MDT	0.768838	0.775133	0.764672	0.847653	0.820833	0.792783	0.805099
VEEV	0.673689	0.697796	0.675546	0.665481	0.635087	0.619297	0.646572
WST	0.676464	0.656592	0.664424	0.689419	0.660132	0.675793	0.652869
FSPHX	1.000000	0.968210	0.988098	0.922114	0.963555	0.950730	0.903873
BHCFX	0.968210	1.000000	0.975807	0.929828	0.944187	0.916014	0.924436
PRHSX	0.988098	0.975807	1.000000	0.923149	0.963641	0.945235	0.910925
IHI	0.922114	0.929828	0.923149	1.000000	0.945555	0.937979	0.933514
RYH	0.963555	0.944187	0.963641	0.945555	1.000000	0.973813	0.919130
XLV	0.950730	0.916014	0.945235	0.937979	0.973813	1.000000	0.865151
XHE	0.903873	0.924436	0.910925	0.933514	0.919130	0.865151	1.000000

[26 rows x 26 columns]

[27]:
```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[27]:
```
XHE    XHE      1.000000
BMY    BMY      1.000000
IHI    IHI      1.000000
PRHSX  PRHSX    1.000000
BHCFX  BHCFX    1.000000
FSPHX  FSPHX    1.000000
WST    WST      1.000000
VEEV   VEEV     1.000000
MDT    MDT      1.000000
IQV    IQV      1.000000
IOVA   IOVA     1.000000
GH     GH       1.000000
ANTM   ANTM     1.000000
```

XLV	XLV	1.000000
TMO	TMO	1.000000
DHR	DHR	1.000000
BIO	BIO	1.000000
HOLX	HOLX	1.000000
DXCM	DXCM	1.000000
TDOC	TDOC	1.000000
CNC	CNC	1.000000
LHCG	LHCG	1.000000
EHC	EHC	1.000000
AMED	AMED	1.000000
RYH	RYH	1.000000
PRGO	PRGO	1.000000
FSPHX	PRHSX	0.988098
PRHSX	FSPHX	0.988098
BHCFX	PRHSX	0.975807
PRHSX	BHCFX	0.975807
		…
IOVA	WST	0.269274
WST	IOVA	0.269274
IOVA	PRGO	0.266580
PRGO	IOVA	0.266580
TDOC	HOLX	0.258916
HOLX	TDOC	0.258916
CNC	IOVA	0.254692
IOVA	CNC	0.254692
CNC	TDOC	0.245909
TDOC	CNC	0.245909
GH	BMY	0.242537
BMY	GH	0.242537
TDOC	EHC	0.239568
EHC	TDOC	0.239568
GH	TDOC	0.210314
TDOC	GH	0.210314
GH	PRGO	0.201491
PRGO	GH	0.201491
TDOC	PRGO	0.185020
PRGO	TDOC	0.185020
BMY	TDOC	0.166238
TDOC	BMY	0.166238
	ANTM	0.140352
ANTM	TDOC	0.140352
IQV	TDOC	0.137542
TDOC	IQV	0.137542
DXCM	PRGO	0.137146
PRGO	DXCM	0.137146
MDT	TDOC	0.114734

```
TDOC   MDT      0.114734
Length: 676, dtype: float64
```

[28]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
PRGO    -0.000061
AMED     0.001703
EHC     -0.000206
LHCG     0.001689
CNC      0.000160
TDOC     0.002939
DXCM     0.003250
HOLX     0.000938
BIO      0.001113
DHR      0.001288
TMO      0.001059
ANTM     0.000328
BMY      0.000131
GH       0.003362
IOVA     0.003369
IQV      0.000517
MDT      0.000093
VEEV     0.002441
WST      0.001672
FSPHX    0.000654
BHCFX    0.000764
PRHSX    0.000559
IHI      0.000549
RYH      0.000339
XLV      0.000315
XHE      0.000247
dtype: float64
--------------------------------------------------
Stock risks:
PRGO     0.030528
AMED     0.029877
EHC      0.023028
LHCG     0.026895
CNC      0.029700
TDOC     0.038778
DXCM     0.034169
HOLX     0.022065
```

```
BIO      0.022474
DHR      0.018402
TMO      0.019889
ANTM     0.028287
BMY      0.018732
GH       0.049446
IOVA     0.053224
IQV      0.025556
MDT      0.020165
VEEV     0.028515
WST      0.020553
FSPHX    0.016666
BHCFX    0.016889
PRHSX    0.017368
IHI      0.017951
RYH      0.016676
XLV      0.015999
XHE      0.017789
dtype: float64
```

[29]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[29]:

	Returns	Risk
EHC	-0.000206	0.023028
PRGO	-0.000061	0.030528
MDT	0.000093	0.020165
BMY	0.000131	0.018732
CNC	0.000160	0.029700
XHE	0.000247	0.017789
XLV	0.000315	0.015999
ANTM	0.000328	0.028287
RYH	0.000339	0.016676
IQV	0.000517	0.025556
IHI	0.000549	0.017951
PRHSX	0.000559	0.017368
FSPHX	0.000654	0.016666
BHCFX	0.000764	0.016889
HOLX	0.000938	0.022065
TMO	0.001059	0.019889
BIO	0.001113	0.022474
DHR	0.001288	0.018402
WST	0.001672	0.020553
LHCG	0.001689	0.026895
AMED	0.001703	0.029877

```
VEEV   0.002441  0.028515
TDOC   0.002939  0.038778
DXCM   0.003250  0.034169
GH     0.003362  0.049446
IOVA   0.003369  0.053224
```

[30]:
```
table.sort_values(by='Risk')
```

[30]:
```
         Returns      Risk
XLV     0.000315  0.015999
FSPHX   0.000654  0.016666
RYH     0.000339  0.016676
BHCFX   0.000764  0.016889
PRHSX   0.000559  0.017368
XHE     0.000247  0.017789
IHI     0.000549  0.017951
DHR     0.001288  0.018402
BMY     0.000131  0.018732
TMO     0.001059  0.019889
MDT     0.000093  0.020165
WST     0.001672  0.020553
HOLX    0.000938  0.022065
BIO     0.001113  0.022474
EHC    -0.000206  0.023028
IQV     0.000517  0.025556
LHCG    0.001689  0.026895
ANTM    0.000328  0.028287
VEEV    0.002441  0.028515
CNC     0.000160  0.029700
AMED    0.001703  0.029877
PRGO   -0.000061  0.030528
DXCM    0.003250  0.034169
TDOC    0.002939  0.038778
GH      0.003362  0.049446
IOVA    0.003369  0.053224
```

[31]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[31]:
```
         Returns      Risk  Sharpe Ratio
PRGO   -0.000061  0.030528     -0.329550
AMED    0.001703  0.029877     -0.277692
EHC    -0.000206  0.023028     -0.443192
LHCG    0.001689  0.026895     -0.309010
CNC     0.000160  0.029700     -0.331305
TDOC    0.002939  0.038778     -0.182088
```

```
DXCM   0.003250  0.034169     -0.197559
HOLX   0.000938  0.022065     -0.410700
BIO    0.001113  0.022474     -0.395423
DHR    0.001288  0.018402     -0.473425
TMO    0.001059  0.019889     -0.449534
ANTM   0.000328  0.028287     -0.341946
BMY    0.000131  0.018732     -0.526852
GH     0.003362  0.049446     -0.134253
IOVA   0.003369  0.053224     -0.124586
IQV    0.000517  0.025556     -0.371051
MDT    0.000093  0.020165     -0.491305
VEEV   0.002441  0.028515     -0.265104
WST    0.001672  0.020553     -0.405186
FSPHX  0.000654  0.016666     -0.560820
BHCFX  0.000764  0.016889     -0.546886
PRHSX  0.000559  0.017368     -0.543610
IHI    0.000549  0.017951     -0.526477
RYH    0.000339  0.016676     -0.579315
XLV    0.000315  0.015999     -0.605359
XHE    0.000247  0.017789     -0.548260
```

[32]:
```
table['Max Returns'] = rets.max()
```

[33]:
```
table['Min Returns'] = rets.min()
```

[34]:
```
table['Median Returns'] = rets.median()
```

[35]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[35]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
PRGO	-0.000061	0.030528	-0.329550	0.138465	-0.292781	
AMED	0.001703	0.029877	-0.277692	0.141639	-0.173284	
EHC	-0.000206	0.023028	-0.443192	0.109984	-0.109981	
LHCG	0.001689	0.026895	-0.309010	0.112102	-0.190281	
CNC	0.000160	0.029700	-0.331305	0.156024	-0.150071	
TDOC	0.002939	0.038778	-0.182088	0.181318	-0.135371	
DXCM	0.003250	0.034169	-0.197559	0.271552	-0.170970	
HOLX	0.000938	0.022065	-0.410700	0.092626	-0.205274	
BIO	0.001113	0.022474	-0.395423	0.171687	-0.074554	
DHR	0.001288	0.018402	-0.473425	0.096982	-0.097249	
TMO	0.001059	0.019889	-0.449534	0.104700	-0.082875	
ANTM	0.000328	0.028287	-0.341946	0.156174	-0.171266	
BMY	0.000131	0.018732	-0.526852	0.061207	-0.132641	
GH	0.003362	0.049446	-0.134253	0.285754	-0.165394	
IOVA	0.003369	0.053224	-0.124586	0.360641	-0.222753	

```
IQV    0.000517  0.025556     -0.371051     0.153691    -0.165382
MDT    0.000093  0.020165     -0.491305     0.101893    -0.128237
VEEV   0.002441  0.028515     -0.265104     0.147297    -0.126228
WST    0.001672  0.020553     -0.405186     0.101693    -0.107043
FSPHX  0.000654  0.016666     -0.560820     0.069865    -0.109649
BHCFX  0.000764  0.016889     -0.546886     0.083417    -0.116017
PRHSX  0.000559  0.017368     -0.543610     0.073700    -0.113336
IHI    0.000549  0.017951     -0.526477     0.108216    -0.105726
RYH    0.000339  0.016676     -0.579315     0.076366    -0.098705
XLV    0.000315  0.015999     -0.605359     0.077057    -0.098610
XHE    0.000247  0.017789     -0.548260     0.093513    -0.085537

       Median Returns  Total Return
PRGO         0.001090      1.445781
AMED         0.003788      3.463538
EHC          0.000301     -0.591234
LHCG         0.002478      3.202214
CNC          0.000000      2.391725
TDOC         0.002820      2.380591
DXCM         0.002858      0.961199
HOLX         0.001533      1.676917
BIO          0.001435      1.114652
DHR          0.001522      0.507937
TMO          0.002349      1.092085
ANTM         0.000472      1.434069
BMY          0.000328      0.727148
GH           0.001368      1.894919
IOVA         0.002001     -3.764377
IQV          0.001366      0.974574
MDT          0.000910      0.577252
VEEV         0.003163      1.071235
WST          0.001156      3.163829
FSPHX        0.001630      1.412715
BHCFX        0.002096      1.537382
PRHSX        0.001448      1.220934
IHI          0.001749      0.793930
RYH          0.001428      0.912249
XLV          0.000967      0.982096
XHE          0.001527      1.200605
```

[36]:
```
table['Average Return Days'] = (1 + total_return)**(1 / days) - 1
table
```

[36]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
PRGO  -0.000061  0.030528     -0.329550     0.138465    -0.292781
AMED   0.001703  0.029877     -0.277692     0.141639    -0.173284
EHC   -0.000206  0.023028     -0.443192     0.109984    -0.109981
```

LHCG	0.001689	0.026895	-0.309010	0.112102	-0.190281
CNC	0.000160	0.029700	-0.331305	0.156024	-0.150071
TDOC	0.002939	0.038778	-0.182088	0.181318	-0.135371
DXCM	0.003250	0.034169	-0.197559	0.271552	-0.170970
HOLX	0.000938	0.022065	-0.410700	0.092626	-0.205274
BIO	0.001113	0.022474	-0.395423	0.171687	-0.074554
DHR	0.001288	0.018402	-0.473425	0.096982	-0.097249
TMO	0.001059	0.019889	-0.449534	0.104700	-0.082875
ANTM	0.000328	0.028287	-0.341946	0.156174	-0.171266
BMY	0.000131	0.018732	-0.526852	0.061207	-0.132641
GH	0.003362	0.049446	-0.134253	0.285754	-0.165394
IOVA	0.003369	0.053224	-0.124586	0.360641	-0.222753
IQV	0.000517	0.025556	-0.371051	0.153691	-0.165382
MDT	0.000093	0.020165	-0.491305	0.101893	-0.128237
VEEV	0.002441	0.028515	-0.265104	0.147297	-0.126228
WST	0.001672	0.020553	-0.405186	0.101693	-0.107043
FSPHX	0.000654	0.016666	-0.560820	0.069865	-0.109649
BHCFX	0.000764	0.016889	-0.546886	0.083417	-0.116017
PRHSX	0.000559	0.017368	-0.543610	0.073700	-0.113336
IHI	0.000549	0.017951	-0.526477	0.108216	-0.105726
RYH	0.000339	0.016676	-0.579315	0.076366	-0.098705
XLV	0.000315	0.015999	-0.605359	0.077057	-0.098610
XHE	0.000247	0.017789	-0.548260	0.093513	-0.085537

	Median Returns	Total Return	Average Return Days
PRGO	0.001090	1.445781	0.000016
AMED	0.003788	3.463538	0.000038
EHC	0.000301	-0.591234	-0.000007
LHCG	0.002478	3.202214	0.000035
CNC	0.000000	2.391725	0.000026
TDOC	0.002820	2.380591	0.000026
DXCM	0.002858	0.961199	0.000011
HOLX	0.001533	1.676917	0.000018
BIO	0.001435	1.114652	0.000012
DHR	0.001522	0.507937	0.000006
TMO	0.002349	1.092085	0.000012
ANTM	0.000472	1.434069	0.000016
BMY	0.000328	0.727148	0.000008
GH	0.001368	1.894919	0.000021
IOVA	0.002001	-3.764377	-0.000042
IQV	0.001366	0.974574	0.000011
MDT	0.000910	0.577252	0.000006
VEEV	0.003163	1.071235	0.000012
WST	0.001156	3.163829	0.000034
FSPHX	0.001630	1.412715	0.000016
BHCFX	0.002096	1.537382	0.000017
PRHSX	0.001448	1.220934	0.000013

```
IHI          0.001749      0.793930              0.000009
RYH          0.001428      0.912249              0.000010
XLV          0.000967      0.982096              0.000011
XHE          0.001527      1.200605              0.000013
```

[37]:
```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[37]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	Median Returns	Total Return	Average Return Days	CAGR
PRGO	-0.000061	0.030528	-0.329550	0.138465	-0.292781	0.001090	1.445781	0.000016	-0.119840
AMED	0.001703	0.029877	-0.277692	0.141639	-0.173284	0.003788	3.463538	0.000038	0.438768
EHC	-0.000206	0.023028	-0.443192	0.109984	-0.109981	0.000301	-0.591234	-0.000007	0.057836
LHCG	0.001689	0.026895	-0.309010	0.112102	-0.190281	0.002478	3.202214	0.000035	0.331087
CNC	0.000160	0.029700	-0.331305	0.156024	-0.150071	0.000000	2.391725	0.000026	0.060585
TDOC	0.002939	0.038778	-0.182088	0.181318	-0.135371	0.002820	2.380591	0.000026	0.613337
DXCM	0.003250	0.034169	-0.197559	0.271552	-0.170970	0.002858	0.961199	0.000011	0.709864
HOLX	0.000938	0.022065	-0.410700	0.092626	-0.205274	0.001533	1.676917	0.000018	0.069503
BIO	0.001113	0.022474	-0.395423	0.171687	-0.074554				
DHR	0.001288	0.018402	-0.473425	0.096982	-0.097249				
TMO	0.001059	0.019889	-0.449534	0.104700	-0.082875				
ANTM	0.000328	0.028287	-0.341946	0.156174	-0.171266				
BMY	0.000131	0.018732	-0.526852	0.061207	-0.132641				
GH	0.003362	0.049446	-0.134253	0.285754	-0.165394				
IOVA	0.003369	0.053224	-0.124586	0.360641	-0.222753				
IQV	0.000517	0.025556	-0.371051	0.153691	-0.165382				
MDT	0.000093	0.020165	-0.491305	0.101893	-0.128237				
VEEV	0.002441	0.028515	-0.265104	0.147297	-0.126228				
WST	0.001672	0.020553	-0.405186	0.101693	-0.107043				
FSPHX	0.000654	0.016666	-0.560820	0.069865	-0.109649				
BHCFX	0.000764	0.016889	-0.546886	0.083417	-0.116017				
PRHSX	0.000559	0.017368	-0.543610	0.073700	-0.113336				
IHI	0.000549	0.017951	-0.526477	0.108216	-0.105726				
RYH	0.000339	0.016676	-0.579315	0.076366	-0.098705				
XLV	0.000315	0.015999	-0.605359	0.077057	-0.098610				
XHE	0.000247	0.017789	-0.548260	0.093513	-0.085537				

BIO	0.001435	1.114652	0.000012	0.179848	
DHR	0.001522	0.507937	0.000006	0.193549	
TMO	0.002349	1.092085	0.000012	0.184277	
ANTM	0.000472	1.434069	0.000016	0.049712	
BMY	0.000328	0.727148	0.000008	0.006490	
GH	0.001368	1.894919	0.000021	NaN	
IOVA	0.002001	-3.764377	-0.000042	0.407016	
IQV	0.001366	0.974574	0.000011	0.094120	
MDT	0.000910	0.577252	0.000006	0.037904	
VEEV	0.003163	1.071235	0.000012	0.501070	
WST	0.001156	3.163829	0.000034	0.256989	
FSPHX	0.001630	1.412715	0.000016	0.122009	
BHCFX	0.002096	1.537382	0.000017	NaN	
PRHSX	0.001448	1.220934	0.000013	0.092186	
IHI	0.001749	0.793930	0.000009	0.113707	
RYH	0.001428	0.912249	0.000010	0.055746	
XLV	0.000967	0.982096	0.000011	0.061239	
XHE	0.001527	1.200605	0.000013	0.082812	

[38]:
```
table.sort_values(by='Average Return Days')
```

[38]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
IOVA	0.003369	0.053224	-0.124586	0.360641	-0.222753	
EHC	-0.000206	0.023028	-0.443192	0.109984	-0.109981	
DHR	0.001288	0.018402	-0.473425	0.096982	-0.097249	
MDT	0.000093	0.020165	-0.491305	0.101893	-0.128237	
BMY	0.000131	0.018732	-0.526852	0.061207	-0.132641	
IHI	0.000549	0.017951	-0.526477	0.108216	-0.105726	
RYH	0.000339	0.016676	-0.579315	0.076366	-0.098705	
DXCM	0.003250	0.034169	-0.197559	0.271552	-0.170970	
IQV	0.000517	0.025556	-0.371051	0.153691	-0.165382	
XLV	0.000315	0.015999	-0.605359	0.077057	-0.098610	
VEEV	0.002441	0.028515	-0.265104	0.147297	-0.126228	
TMO	0.001059	0.019889	-0.449534	0.104700	-0.082875	
BIO	0.001113	0.022474	-0.395423	0.171687	-0.074554	
XHE	0.000247	0.017789	-0.548260	0.093513	-0.085537	
PRHSX	0.000559	0.017368	-0.543610	0.073700	-0.113336	
FSPHX	0.000654	0.016666	-0.560820	0.069865	-0.109649	
ANTM	0.000328	0.028287	-0.341946	0.156174	-0.171266	
PRGO	-0.000061	0.030528	-0.329550	0.138465	-0.292781	
BHCFX	0.000764	0.016889	-0.546886	0.083417	-0.116017	
HOLX	0.000938	0.022065	-0.410700	0.092626	-0.205274	
GH	0.003362	0.049446	-0.134253	0.285754	-0.165394	
TDOC	0.002939	0.038778	-0.182088	0.181318	-0.135371	
CNC	0.000160	0.029700	-0.331305	0.156024	-0.150071	
WST	0.001672	0.020553	-0.405186	0.101693	-0.107043	
LHCG	0.001689	0.026895	-0.309010	0.112102	-0.190281	

```
AMED   0.001703  0.029877     -0.277692     0.141639    -0.173284
```

	Median Returns	Total Return	Average Return Days	CAGR
IOVA	0.002001	-3.764377	-0.000042	0.407016
EHC	0.000301	-0.591234	-0.000007	0.057836
DHR	0.001522	0.507937	0.000006	0.193549
MDT	0.000910	0.577252	0.000006	0.037904
BMY	0.000328	0.727148	0.000008	0.006490
IHI	0.001749	0.793930	0.000009	0.113707
RYH	0.001428	0.912249	0.000010	0.055746
DXCM	0.002858	0.961199	0.000011	0.709864
IQV	0.001366	0.974574	0.000011	0.094120
XLV	0.000967	0.982096	0.000011	0.061239
VEEV	0.003163	1.071235	0.000012	0.501070
TMO	0.002349	1.092085	0.000012	0.184277
BIO	0.001435	1.114652	0.000012	0.179848
XHE	0.001527	1.200605	0.000013	0.082812
PRHSX	0.001448	1.220934	0.000013	0.092186
FSPHX	0.001630	1.412715	0.000016	0.122009
ANTM	0.000472	1.434069	0.000016	0.049712
PRGO	0.001090	1.445781	0.000016	-0.119840
BHCFX	0.002096	1.537382	0.000017	NaN
HOLX	0.001533	1.676917	0.000018	0.069503
GH	0.001368	1.894919	0.000021	NaN
TDOC	0.002820	2.380591	0.000026	0.613337
CNC	0.000000	2.391725	0.000026	0.060585
WST	0.001156	3.163829	0.000034	0.256989
LHCG	0.002478	3.202214	0.000035	0.331087
AMED	0.003788	3.463538	0.000038	0.438768