

# Healthcare\_Portfolio

September 29, 2021

## 1 Healthcare 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
# Healthcare Stock
symbols = [
    'UNH', 'ISRG', 'TAK', 'BSX', 'ALXN', 'IDXX', 'ZTS', 'LHCG', 'EHC', 'ENSG', 'GWPH', 'ABMD', 'VHT', 'JNJ'
]
start = '2016-01-01'
end = '2019-01-01'
```

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

[\*\*\*\*\*100%\*\*\*\*\*] 22 of 22 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?

3 years

[6]: number\_of\_years = delta.years

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

[7]: 1092

[8]: df.head()

[8]:

	ABMD	ALXN	BRKR	BSX	EHC	ENSG	\
2016-01-04	85.239998	184.679993	23.170813	17.990000	32.182846	19.809750	
2016-01-05	85.000000	184.899994	23.503780	18.180000	32.257118	19.846268	
2016-01-06	85.300003	184.070007	23.180599	18.000000	32.461334	19.864527	
2016-01-07	81.919998	174.369995	22.162104	17.639999	31.523788	19.280275	
2016-01-08	84.580002	168.130005	22.044584	17.430000	32.368504	19.115953	

	EW	GH	GWPH	IDXX	...	ISRG	JNJ	\
2016-01-04	78.839996	NaN	68.459999	71.120003	...	182.463333	90.186127	
2016-01-05	80.010002	NaN	68.370003	71.830002	...	183.986664	90.563103	
2016-01-06	80.440002	NaN	63.860001	71.320000	...	184.413330	90.105339	
2016-01-07	77.559998	NaN	61.810001	69.809998	...	178.966660	89.055214	
2016-01-08	76.040001	NaN	59.860001	69.099998	...	178.846664	88.103813	

	LHCG	MRK	RYH	TAK	UNH	\
2016-01-04	42.970001	46.589718	147.931290	21.372053	109.414070	
2016-01-05	42.560001	47.184521	148.697845	21.389389	109.620773	
2016-01-06	44.099998	46.536442	147.174576	21.276718	108.502785	
2016-01-07	43.500000	46.128082	143.892258	21.406723	105.308441	
2016-01-08	42.240002	45.346848	141.740051	20.938719	103.495232	

	VHT	VRTX	ZTS	
2016-01-04	122.920502	122.889999	45.972393	
2016-01-05	123.486664	123.449997	46.692066	
2016-01-06	122.222260	122.230003	46.701801	
2016-01-07	119.523621	114.959999	45.281872	
2016-01-08	117.787430	110.709999	44.620541	

[5 rows x 21 columns]

[9]: df.tail()

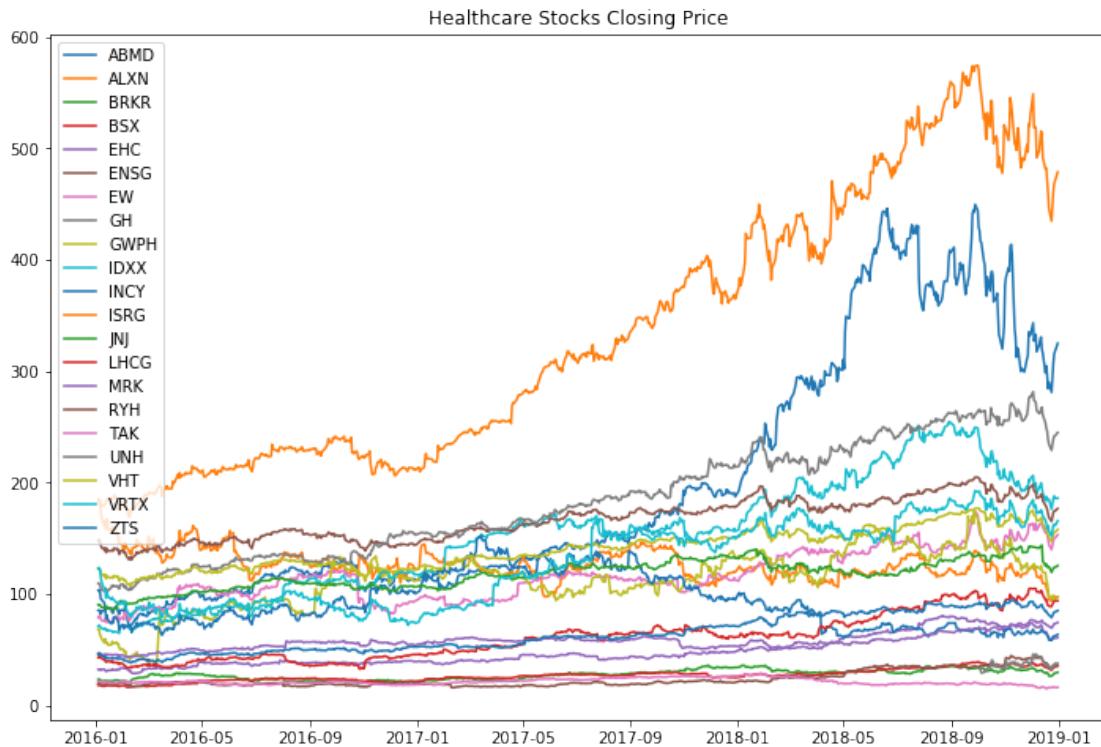
```
[9]:
```

	ABMD	ALXN	BRKR	BSX	EHC	ENSG	\
2018-12-24	281.079987	93.940002	26.352285	31.730000	58.493076	33.941807	
2018-12-26	307.440002	97.870003	27.627552	33.680000	60.870125	36.158653	
2018-12-27	315.670013	98.099998	28.713528	34.480000	60.467407	35.692928	
2018-12-28	318.170013	97.209999	29.012419	34.669998	60.251305	35.793648	
2018-12-31	325.040009	97.360001	29.660019	35.340000	60.872860	36.176018	
	EW	GH	GWPH	IDXX	...	ISRG	\
2018-12-24	139.919998	32.529999	98.050003	176.179993	...	434.890015	
2018-12-26	147.990005	35.459999	98.279999	185.600006	...	461.980011	
2018-12-27	150.009995	35.630001	94.360001	187.949997	...	468.700012	
2018-12-28	150.410004	37.709999	95.400002	185.880005	...	471.200012	
2018-12-31	153.169998	37.590000	97.389999	186.020004	...	478.920013	
	JNJ	LHCG	MRK	RYH	TAK	\	
2018-12-24	119.472168	88.790001	69.263184	165.200867	15.936852		
2018-12-26	123.236069	92.639999	72.037590	173.176147	16.530653		
2018-12-27	123.916885	93.529999	73.380989	174.679611	16.233753		
2018-12-28	123.780724	93.750000	73.371269	174.550186	16.032627		
2018-12-31	125.511925	93.879997	74.383682	176.760559	16.109245		
	UNH	VHT	VRTX	ZTS			
2018-12-24	229.066162	147.163574	151.910004	78.777962			
2018-12-26	239.303040	153.978455	161.839996	82.394913			
2018-12-27	241.879486	155.414185	162.369995	83.795990			
2018-12-28	242.144989	155.620697	161.419998	83.954971			
2018-12-31	244.977097	157.931641	165.710007	84.998329			

[5 rows x 21 columns]

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

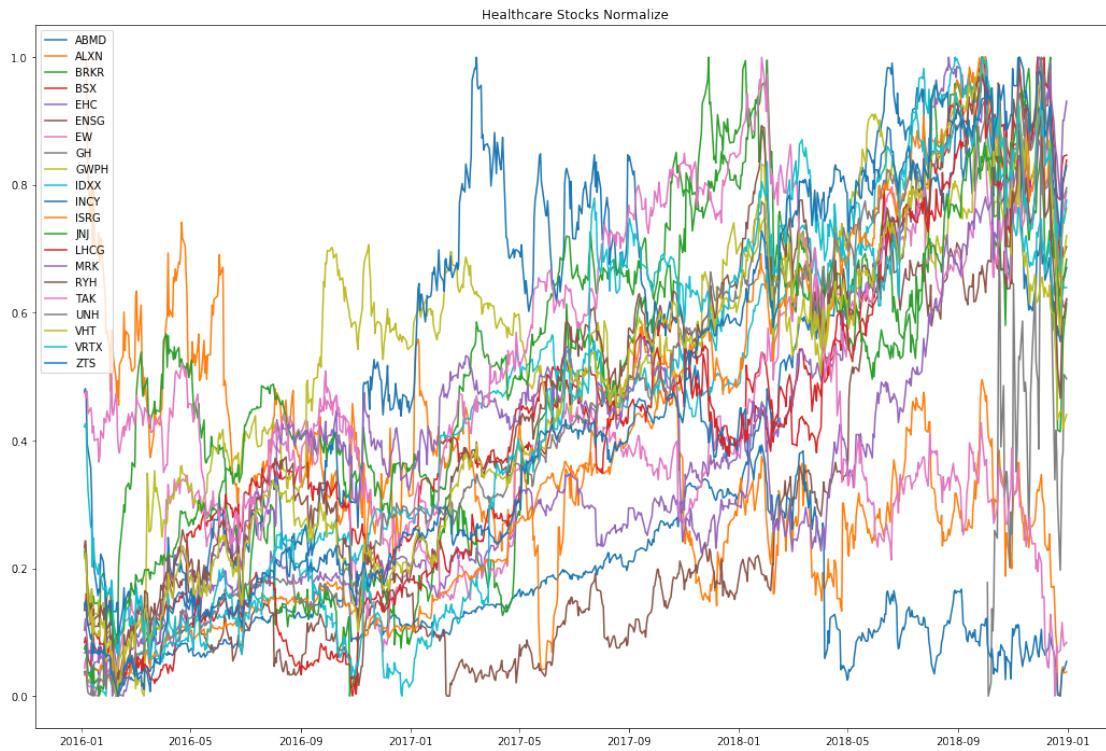
```
[10]: <matplotlib.legend.Legend at 0x1f74d41b198>
```



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

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

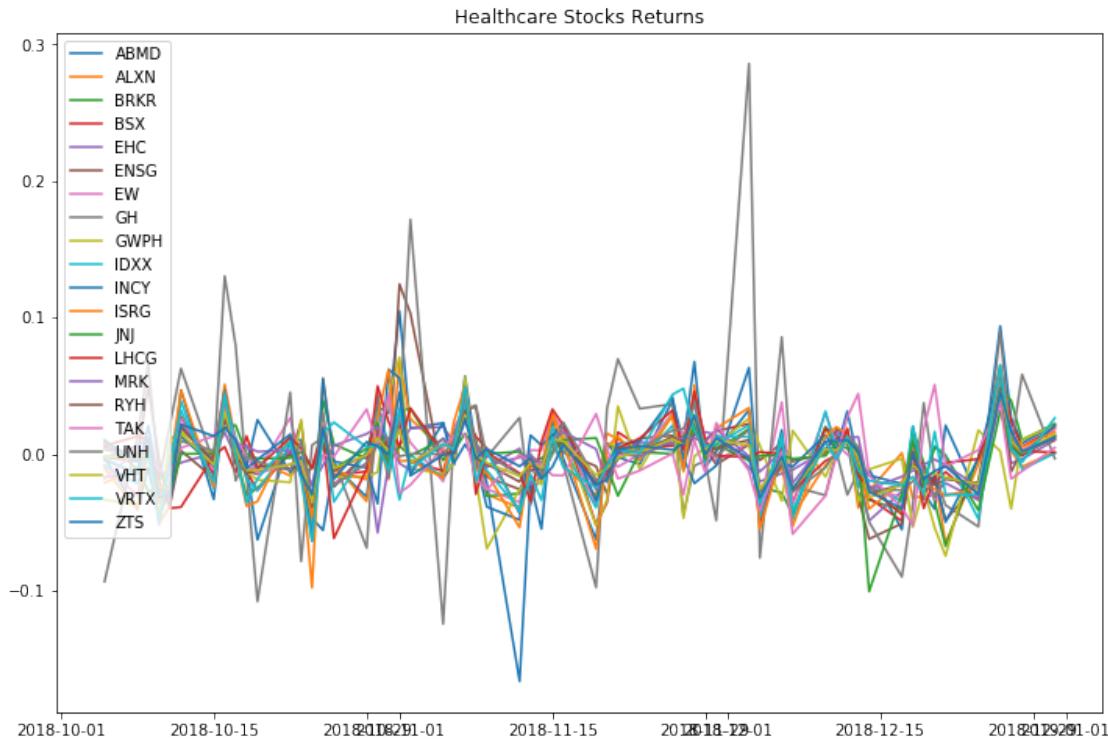
```
[12]: <matplotlib.legend.Legend at 0x1f75042a898>
```



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

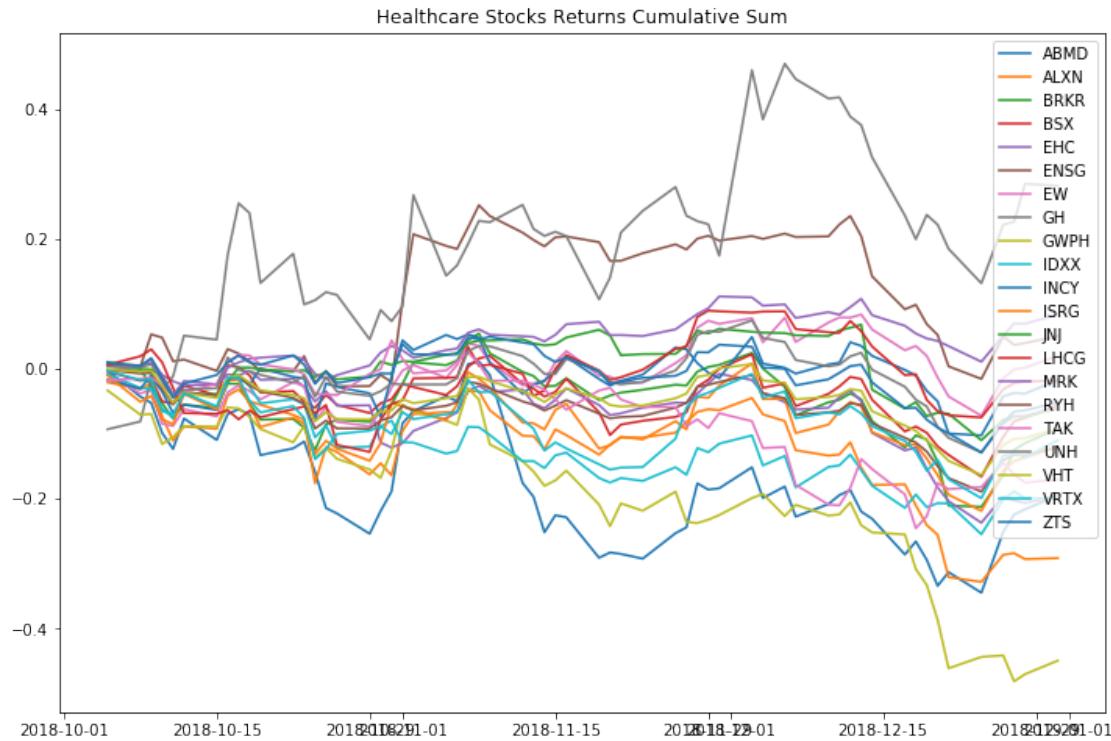
```
[14]: plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Healthcare Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

```
[14]: <matplotlib.legend.Legend at 0x1f7504c9630>
```



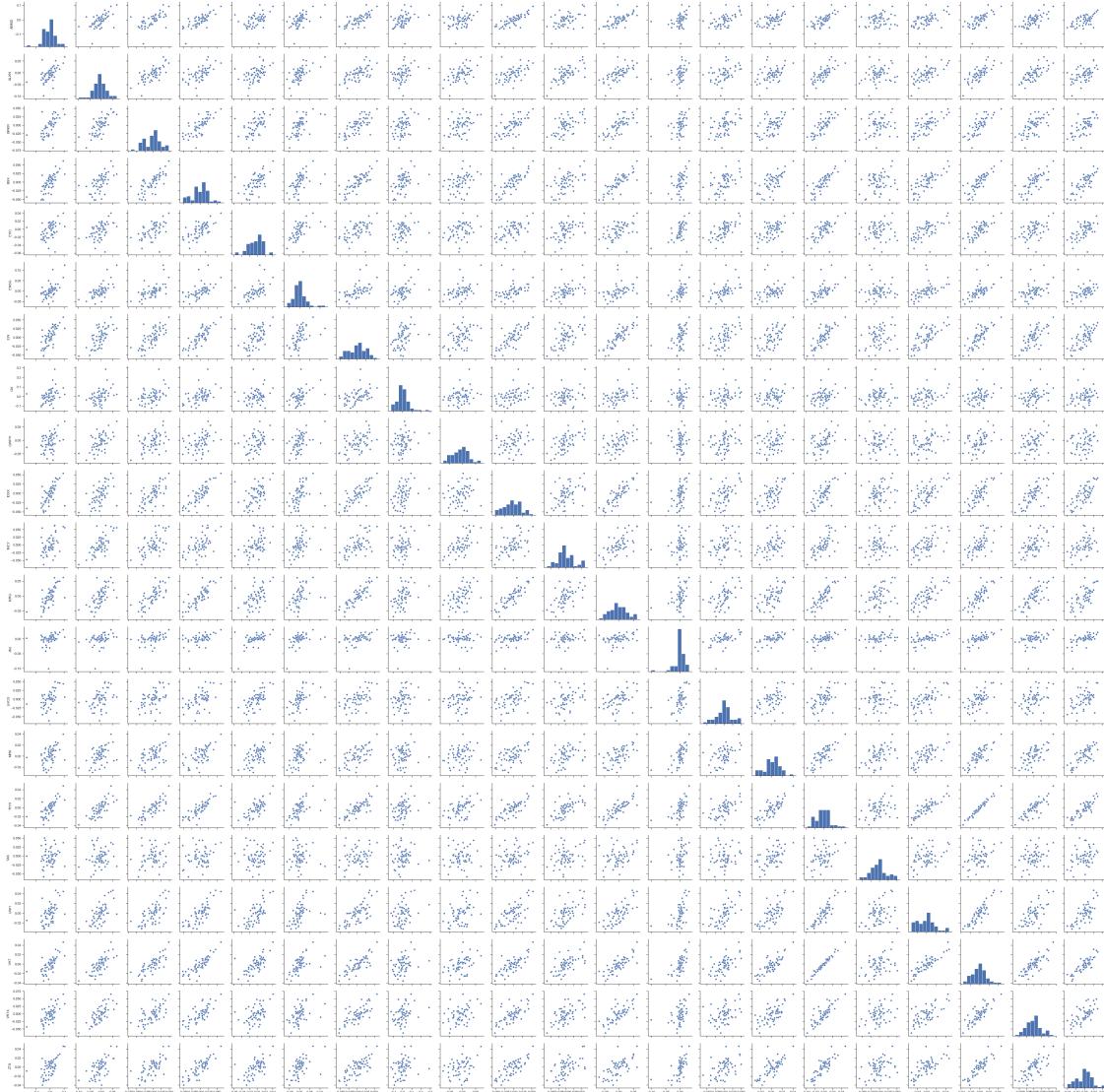
```
[15]: plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Healthcare Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

```
[15]: <matplotlib.legend.Legend at 0x1f750563438>
```

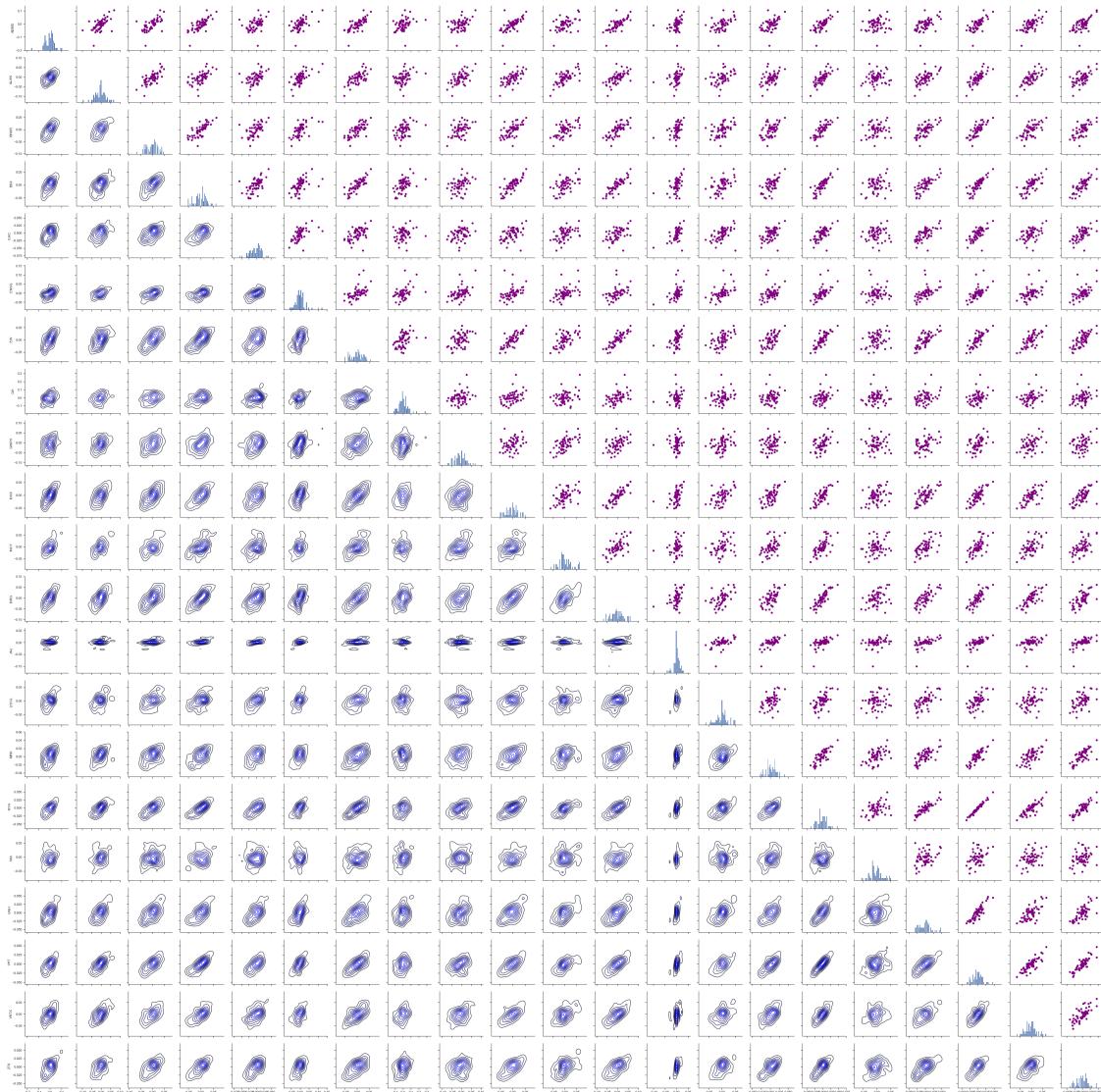


```
[16]: sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

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)
```



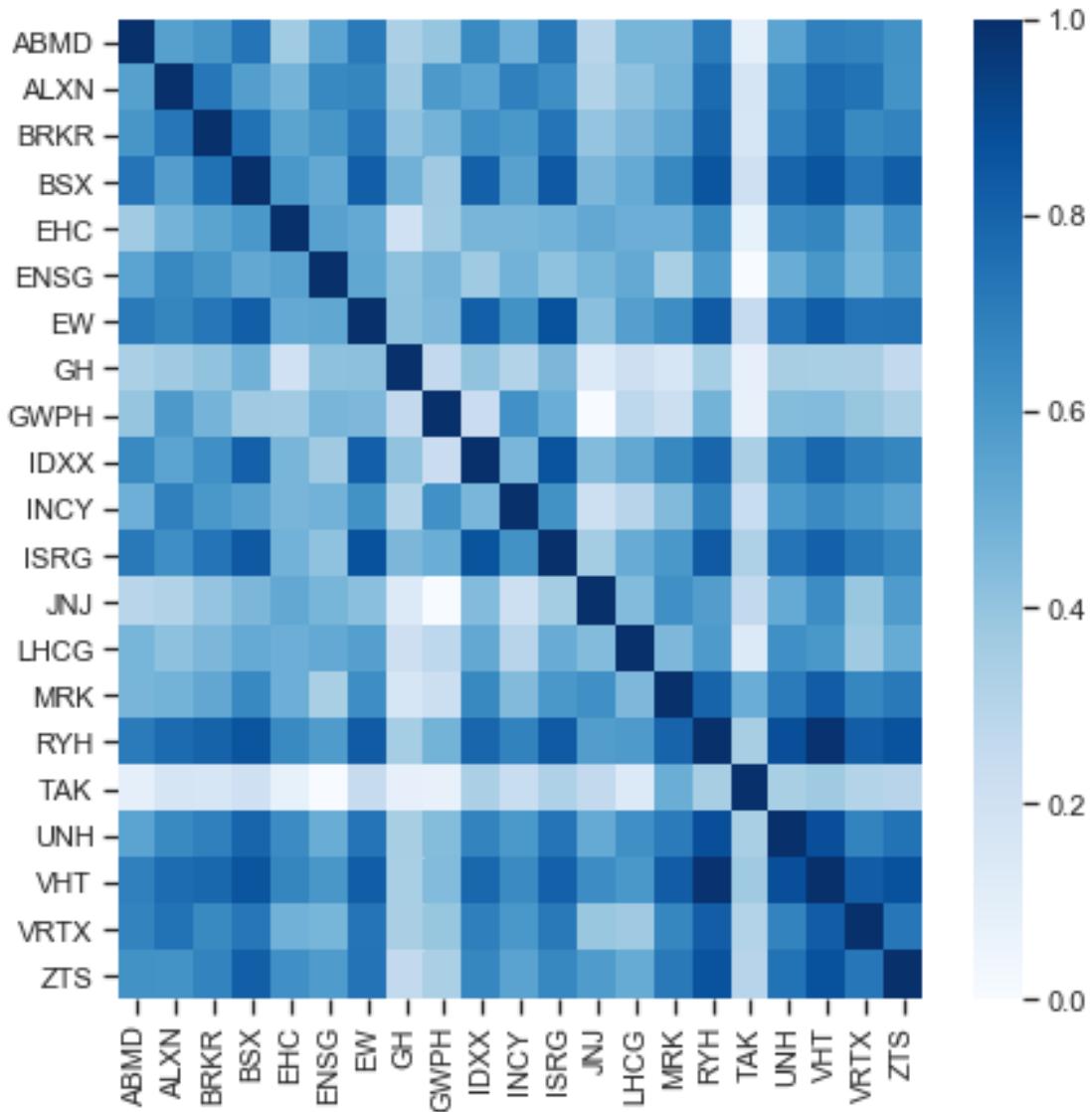
```
[17]: ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



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

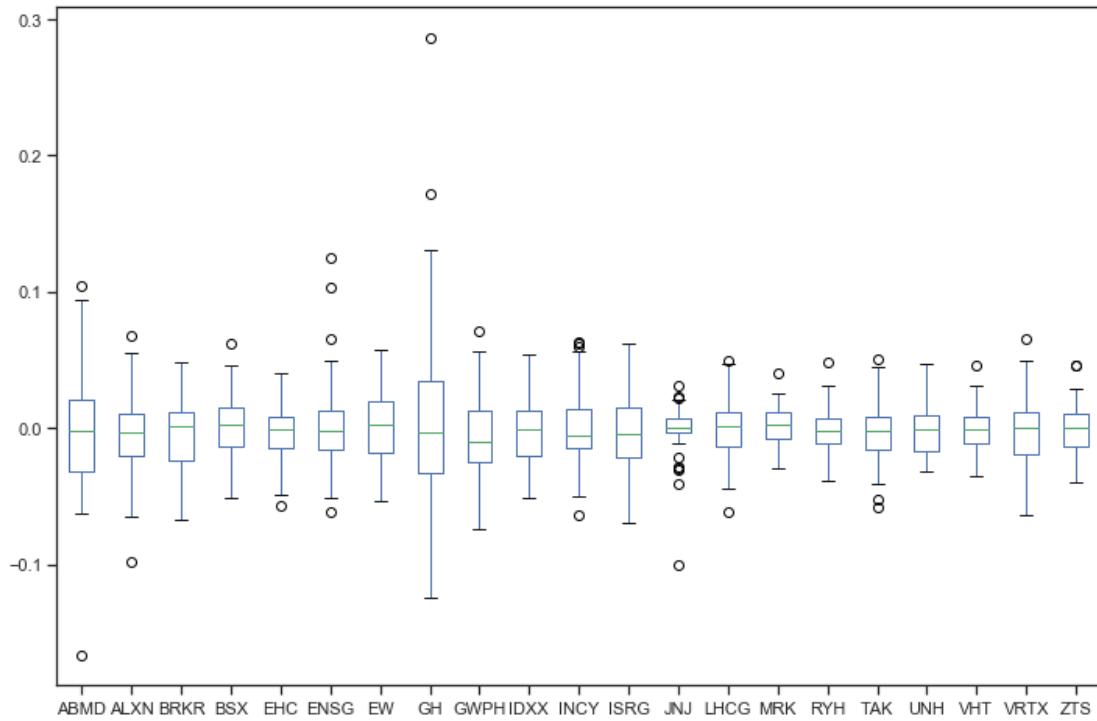
```
# plot the heatmap
sns.heatmap(corr,
            xticklabels=corr.columns,
            yticklabels=corr.columns,
            cmap="Blues")
```

```
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x1f774201cc0>
```



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

```
[19]: <matplotlib.axes._subplots.AxesSubplot at 0x1f75da35438>
```

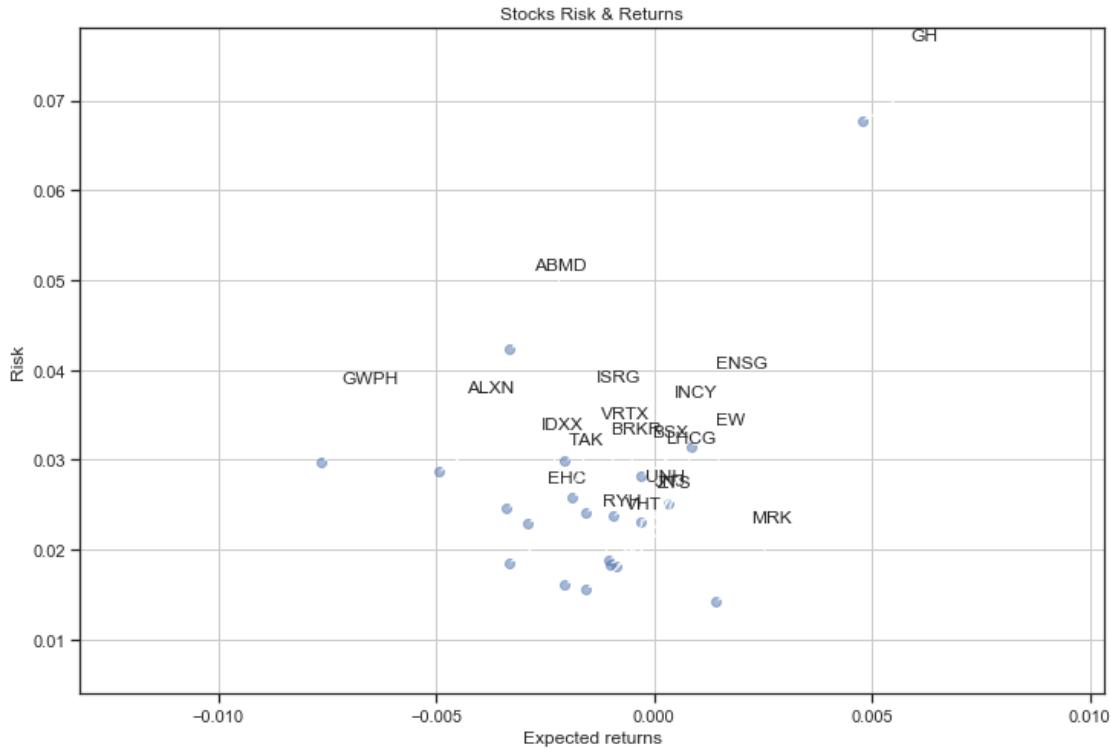


```
[20]: rets = stock_rets.dropna()

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')

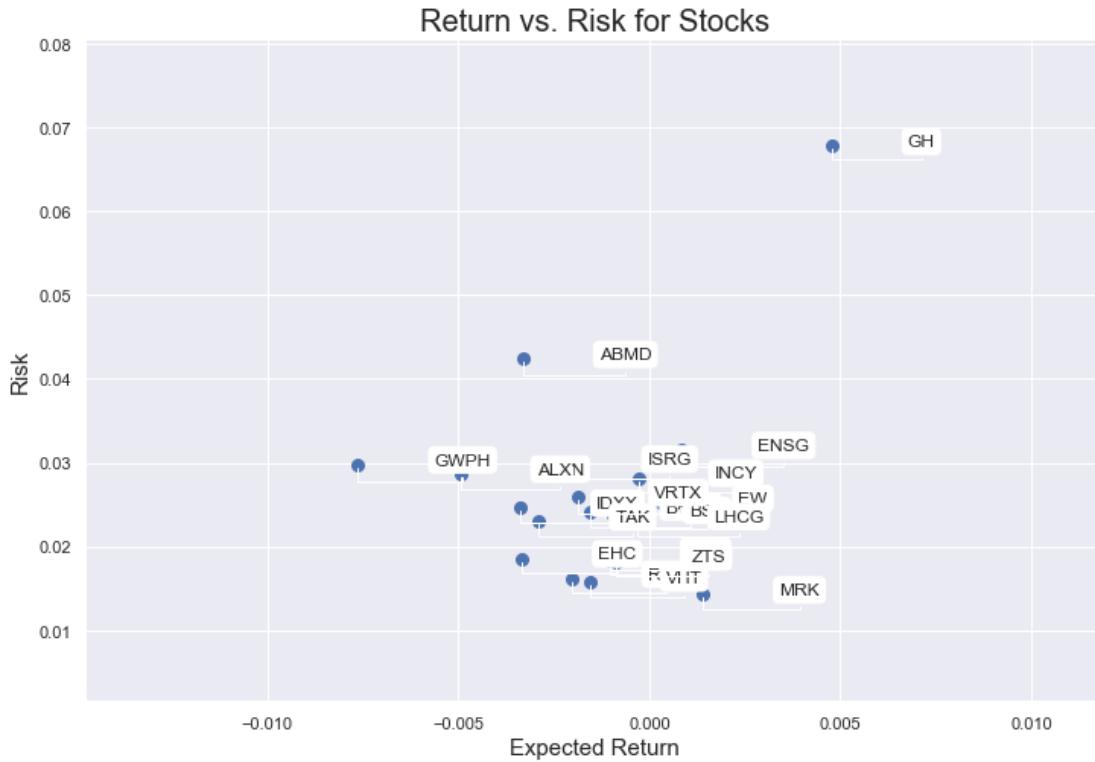
for label, x, y in zip(rets.columns, rets.mean(), rets.std()):
    plt.annotate(
        label,
        xy = (x, y), xytext = (50, 50),
        textcoords = 'offset points', ha = 'right', va = 'bottom',
        arrowprops = dict(arrowstyle = '-', connectionstyle = 'arc3,rad=-0.3'))
```



```
[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]: ZTS      ZTS      1.000000
IDXX     IDXX     1.000000
UNH      UNH      1.000000
TAK      TAK      1.000000
RYH      RYH      1.000000
MRK      MRK      1.000000
LHCG     LHCG     1.000000
JNJ      JNJ      1.000000
ISRG     ISRG     1.000000
GWPH     GWPH     1.000000
VRTX     VRTX     1.000000
GH       GH       1.000000
EW       EW       1.000000
ENSG     ENSG     1.000000
EHC      EHC      1.000000
BSX      BSX      1.000000
BRKR     BRKR     1.000000
ALXN     ALXN     1.000000
VHT      VHT      1.000000
```

```

INCY  INCY    1.000000
ABMD  ABMD    1.000000
RYH   VHT     0.986803
VHT   RYH     0.986803
UNH   VHT     0.886695
VHT   UNH     0.886695
RYH   UNH     0.883594
UNH   RYH     0.883594
ZTS   VHT     0.871395
VHT   ZTS     0.871395
EW    ISRG    0.871233
...
LHCG  GH      0.216570
GH    LHCG    0.216570
INCY  JNJ     0.214591
JNJ   INCY    0.214591
BSX   TAK     0.207357
TAK   BSX     0.207357
GH    EHC     0.204516
EHC   GH      0.204516
ALXN  TAK     0.168423
TAK   ALXN    0.168423
MRK   GH      0.168115
GH    MRK     0.168115
BRKR  TAK     0.165041
TAK   BRKR    0.165041
GH    JNJ     0.140036
JNJ   GH      0.140036
TAK   LHCG    0.137446
LHCG  TAK     0.137446
ABMD  TAK     0.091254
TAK   ABMD    0.091254
GH    GH      0.082460
GH    TAK     0.082460
EHC   TAK     0.078394
TAK   EHC     0.078394
GWPH  GWPH    0.074562
GWPH  TAK     0.074562
JNJ   JNJ     0.003744
JNJ   GWPH    0.003744
ENSG  TAK     0.000276
TAK   ENSG    0.000276
Length: 441, dtype: float64

```

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

[23] :

	ABMD	ALXN	BRKR	BSX	EHC	ENSG	\
2018-10-05	0.603733	0.463182	0.672497	0.421878	0.668474	0.360730	
2018-10-08	0.464994	0.526453	0.486220	0.328326	0.553627	0.321250	
2018-10-09	0.576938	0.641386	0.349817	0.482838	0.633434	0.599947	
2018-10-10	0.443327	0.284660	0.356814	0.149604	0.391961	0.305672	
2018-10-11	0.521713	0.361427	0.378280	0.429843	0.484154	0.137092	

	EW	GH	GWPH	IDXX	..	ISRG	JNJ	\
2018-10-05	0.408502	0.075604	0.282738	0.411918	...	0.447568	0.747515	
2018-10-08	0.212295	0.332131	0.255350	0.282935	...	0.217876	0.776927	
2018-10-09	0.529680	0.464701	0.518465	0.472605	...	0.594664	0.750782	
2018-10-10	0.014023	0.257212	0.193928	0.203776	...	0.254114	0.681045	
2018-10-11	0.450634	0.356541	0.586831	0.352875	...	0.466926	0.546963	

	LHCG	MRK	RYH	TAK	UNH	VHT	\
2018-10-05	0.607667	0.385977	0.417552	0.371507	0.446368	0.417203	
2018-10-08	0.669859	0.511321	0.381987	0.557275	0.396287	0.402060	
2018-10-09	0.648366	0.601302	0.451919	0.548035	0.456536	0.445388	
2018-10-10	0.372533	0.048830	0.164255	0.428822	0.078118	0.145193	
2018-10-11	0.197500	0.000000	0.157407	0.390492	0.120487	0.123371	

	VRTX	ZTS
2018-10-05	0.469781	0.576499
2018-10-08	0.381482	0.402624
2018-10-09	0.506596	0.601549
2018-10-10	0.107777	0.095013
2018-10-11	0.459374	0.120805

[5 rows x 21 columns]

[24] : Normalized\_Value.corr()

[24] :

	ABMD	ALXN	BRKR	BSX	EHC	ENSG	EW	\
ABMD	1.000000	0.565058	0.608675	0.737376	0.365432	0.550875	0.718761	
ALXN	0.565058	1.000000	0.729538	0.573435	0.472962	0.660652	0.675779	
BRKR	0.608675	0.729538	1.000000	0.747967	0.543869	0.607987	0.728057	
BSX	0.737376	0.573435	0.747967	1.000000	0.599251	0.527255	0.817485	
EHC	0.365432	0.472962	0.543869	0.599251	1.000000	0.555922	0.522953	
ENSG	0.550875	0.660652	0.607987	0.527255	0.555922	1.000000	0.534234	
EW	0.718761	0.675779	0.728057	0.817485	0.522953	0.534234	1.000000	
GH	0.333494	0.373529	0.408946	0.485773	0.204516	0.416874	0.420095	
GWPH	0.398008	0.591635	0.472917	0.374663	0.367744	0.466257	0.455279	
IDXX	0.655212	0.550273	0.629213	0.810446	0.465980	0.374506	0.813047	
INCY	0.494891	0.691760	0.600846	0.555752	0.467702	0.482371	0.623193	
ISRG	0.720695	0.634907	0.737662	0.842449	0.484101	0.412589	0.871233	
JNJ	0.296104	0.315276	0.398897	0.460795	0.526013	0.469924	0.423021	
LHCG	0.470064	0.416902	0.458691	0.519657	0.496985	0.522897	0.567793	

MRK	0.468294	0.476904	0.529655	0.662448	0.497541	0.342952	0.638808
RYH	0.711962	0.772055	0.801791	0.856942	0.653487	0.583111	0.834367
TAK	0.091254	0.168423	0.165041	0.207357	0.078394	0.000276	0.247497
UNH	0.550854	0.655190	0.694914	0.794442	0.646029	0.506154	0.736039
VHT	0.692581	0.767020	0.785361	0.855853	0.673937	0.605197	0.822168
VRTX	0.683414	0.743176	0.654595	0.726769	0.485123	0.472600	0.736392
ZTS	0.622653	0.620727	0.682574	0.818069	0.632048	0.582494	0.739152

	GH	GWPH	IDXX	...	ISRG	JNJ	LHCG	\
ABMD	0.333494	0.398008	0.655212	...	0.720695	0.296104	0.470064	
ALXN	0.373529	0.591635	0.550273	...	0.634907	0.315276	0.416902	
BRKR	0.408946	0.472917	0.629213	...	0.737662	0.398897	0.458691	
BSX	0.485773	0.374663	0.810446	...	0.842449	0.460795	0.519657	
EHC	0.204516	0.367744	0.465980	...	0.484101	0.526013	0.496985	
ENSG	0.416874	0.466257	0.374506	...	0.412589	0.469924	0.522897	
EW	0.420095	0.455279	0.813047	...	0.871233	0.423021	0.567793	
GH	1.000000	0.262638	0.406610	...	0.460684	0.140036	0.216570	
GWPH	0.262638	1.000000	0.232220	...	0.501740	0.003744	0.278250	
IDXX	0.406610	0.232220	1.000000	...	0.859839	0.444847	0.525890	
INCY	0.309096	0.627292	0.461403	...	0.624653	0.214591	0.299716	
ISRG	0.460684	0.501740	0.859839	...	1.000000	0.356680	0.510320	
JNJ	0.140036	0.003744	0.444847	...	0.356680	1.000000	0.444304	
LHCG	0.216570	0.278250	0.525890	...	0.510320	0.444304	1.000000	
MRK	0.168115	0.219727	0.658925	...	0.601350	0.631574	0.454451	
RYH	0.355631	0.477281	0.790254	...	0.838749	0.577569	0.588811	
TAK	0.082460	0.074562	0.334110	...	0.324077	0.260077	0.137446	
UNH	0.344249	0.438609	0.682926	...	0.736524	0.516229	0.631736	
VHT	0.340181	0.443372	0.788255	...	0.811645	0.641970	0.599012	
VRTX	0.337549	0.392012	0.696582	...	0.721709	0.390341	0.371427	
ZTS	0.261910	0.333987	0.670101	...	0.665362	0.582544	0.514786	

	MRK	RYH	TAK	UNH	VHT	VRTX	ZTS
ABMD	0.468294	0.711962	0.091254	0.550854	0.692581	0.683414	0.622653
ALXN	0.476904	0.772055	0.168423	0.655190	0.767020	0.743176	0.620727
BRKR	0.529655	0.801791	0.165041	0.694914	0.794442	0.855853	0.818069
BSX	0.662448	0.856942	0.207357	0.794442	0.855853	0.726769	0.818069
EHC	0.497541	0.653487	0.078394	0.646029	0.673937	0.485123	0.632048
ENSG	0.342952	0.583111	0.000276	0.506154	0.605197	0.472600	0.582494
EW	0.638808	0.834367	0.247497	0.736039	0.822168	0.736392	0.739152
GH	0.168115	0.355631	0.082460	0.344249	0.340181	0.337549	0.261910
GWPH	0.219727	0.477281	0.074562	0.438609	0.443372	0.392012	0.333987
IDXX	0.658925	0.790254	0.334110	0.682926	0.788255	0.696582	0.670101
INCY	0.445715	0.684071	0.236582	0.597060	0.651267	0.597989	0.552004
ISRG	0.601350	0.838749	0.324077	0.736524	0.811645	0.721709	0.665362
JNJ	0.631574	0.577569	0.260077	0.516229	0.641970	0.390341	0.582544
LHCG	0.454451	0.588811	0.137446	0.631736	0.599012	0.371427	0.514786
MRK	1.000000	0.800027	0.500427	0.714837	0.829313	0.670228	0.722682

```

RYH    0.800027  1.000000  0.346309  0.883594  0.986803  0.825727  0.867440
TAK    0.500427  0.346309  1.000000  0.341864  0.373765  0.310363  0.300167
UNH    0.714837  0.883594  0.341864  1.000000  0.886695  0.683381  0.744341
VHT    0.829313  0.986803  0.373765  0.886695  1.000000  0.828681  0.871395
VRTX   0.670228  0.825727  0.310363  0.683381  0.828681  1.000000  0.727634
ZTS    0.722682  0.867440  0.300167  0.744341  0.871395  0.727634  1.000000

```

[21 rows x 21 columns]

```

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

```

```

[25]: ZTS    ZTS    1.000000
IDXX   IDXX   1.000000
UNH    UNH    1.000000
TAK    TAK    1.000000
RYH    RYH    1.000000
MRK    MRK    1.000000
LHCG   LHCG   1.000000
JNJ    JNJ    1.000000
ISRG   ISRG   1.000000
GWPH   GWPH   1.000000
VRTX   VRTX   1.000000
GH     GH     1.000000
EW     EW     1.000000
ENSG   ENSG   1.000000
EHC    EHC    1.000000
BSX    BSX    1.000000
BRKR   BRKR   1.000000
ALXN   ALXN   1.000000
VHT    VHT    1.000000
INCY   INCY   1.000000
ABMD   ABMD   1.000000
RYH    VHT    0.986803
VHT    RYH    0.986803
UNH    VHT    0.886695
VHT    UNH    0.886695
RYH    UNH    0.883594
UNH    RYH    0.883594
ZTS    VHT    0.871395
VHT    ZTS    0.871395
EW     ISRG   0.871233
...
LHCG   GH     0.216570
GH     LHCG   0.216570
INCY   JNJ    0.214591

```

```
JNJ    INCY    0.214591
BSX    TAK     0.207357
TAK    BSX     0.207357
GH     EHC     0.204516
EHC    GH      0.204516
ALXN   TAK     0.168423
TAK    ALXN   0.168423
MRK    GH      0.168115
GH     MRK     0.168115
BRKR   TAK     0.165041
TAK    BRKR   0.165041
GH     JNJ     0.140036
JNJ    GH      0.140036
TAK    LHC G   0.137446
LHC G  TAK     0.137446
ABMD   TAK     0.091254
TAK    ABMD   0.091254
          GH     0.082460
GH     TAK     0.082460
EHC    TAK     0.078394
TAK    EHC     0.078394
          GWPH   0.074562
GWPH   TAK     0.074562
          JNJ    0.003744
JNJ    GWPH   0.003744
ENSG   TAK     0.000276
TAK    ENSG   0.000276
Length: 441, dtype: float64
```

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

```
Stock returns:
ABMD   -0.003303
ALXN   -0.004942
BRKR   -0.001563
BSX    -0.000951
EHC    -0.003328
ENSG   0.000853
EW     0.000339
GH     0.004775
GWPH   -0.007617
IDXX   -0.003373
INCY   -0.000291
```

```
ISRG   -0.002040
JNJ    -0.001021
LHCG   -0.000310
MRK    0.001411
RYH    -0.002040
TAK    -0.002889
UNH    -0.001029
VHT    -0.001557
VRTX   -0.001864
ZTS    -0.000875
dtype: float64
```

---

```
Stock risks:
ABMD   0.042357
ALXN   0.028678
BRKR   0.024146
BSX    0.023759
EHC    0.018561
ENSG   0.031501
EW     0.025175
GH     0.067781
GWPH   0.029778
IDXX   0.024616
INCY   0.028192
ISRG   0.029864
JNJ    0.018384
LHCG   0.023038
MRK    0.014247
RYH    0.016160
TAK    0.022975
UNH    0.018894
VHT    0.015684
VRTX   0.025864
ZTS    0.018208
dtype: float64
```

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

```
[27]:      Returns      Risk
GWPH -0.007617  0.029778
ALXN -0.004942  0.028678
IDXX -0.003373  0.024616
EHC  -0.003328  0.018561
ABMD -0.003303  0.042357
```

```
TAK -0.002889 0.022975
ISRG -0.002040 0.029864
RYH -0.002040 0.016160
VRTX -0.001864 0.025864
BRKR -0.001563 0.024146
VHT -0.001557 0.015684
UNH -0.001029 0.018894
JNJ -0.001021 0.018384
BSX -0.000951 0.023759
ZTS -0.000875 0.018208
LHCG -0.000310 0.023038
INCY -0.000291 0.028192
EW 0.000339 0.025175
ENSG 0.000853 0.031501
MRK 0.001411 0.014247
GH 0.004775 0.067781
```

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

```
Returns      Risk
MRK  0.001411 0.014247
VHT -0.001557 0.015684
RYH -0.002040 0.016160
ZTS -0.000875 0.018208
JNJ -0.001021 0.018384
EHC -0.003328 0.018561
UNH -0.001029 0.018894
TAK -0.002889 0.022975
LHCG -0.000310 0.023038
BSX -0.000951 0.023759
BRKR -0.001563 0.024146
IDXX -0.003373 0.024616
EW  0.000339 0.025175
VRTX -0.001864 0.025864
INCY -0.000291 0.028192
ALXN -0.004942 0.028678
GWPH -0.007617 0.029778
ISRG -0.002040 0.029864
ENSG 0.000853 0.031501
ABMD -0.003303 0.042357
GH  0.004775 0.067781
```

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

```
[29]:      Returns      Risk  Sharpe Ratio
ABMD -0.003303  0.042357   -0.314061
ALXN -0.004942  0.028678   -0.521019
BRKR -0.001563  0.024146   -0.478896
BSX  -0.000951  0.023759   -0.460900
EHC  -0.003328  0.018561   -0.718068
ENSG  0.000853  0.031501   -0.290388
EW    0.000339  0.025175   -0.383765
GH    0.004775  0.067781   -0.077087
GWPH -0.007617  0.029778   -0.591599
IDXX -0.003373  0.024616   -0.543270
INCY -0.000291  0.028192   -0.365033
ISRG -0.002040  0.029864   -0.403150
JNJ  -0.001021  0.018384   -0.599469
LHCG -0.000310  0.023038   -0.447515
MRK   0.001411  0.014247   -0.602832
RYH  -0.002040  0.016160   -0.745008
TAK   -0.002889  0.022975   -0.561018
UNH  -0.001029  0.018894   -0.583738
VHT   -0.001557  0.015684   -0.736824
VRTX -0.001864  0.025864   -0.458699
ZTS   -0.000875  0.018208   -0.597269
```

```
[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
```

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
ABMD	-0.003303	0.042357	-0.314061	0.104748	-0.166128	
ALXN	-0.004942	0.028678	-0.521019	0.068082	-0.097642	
BRKR	-0.001563	0.024146	-0.478896	0.048393	-0.067230	
BSX	-0.000951	0.023759	-0.460900	0.061456	-0.051675	
EHC	-0.003328	0.018561	-0.718068	0.040638	-0.057401	
ENSG	0.000853	0.031501	-0.290388	0.124460	-0.061993	
EW	0.000339	0.025175	-0.383765	0.057676	-0.053540	
GH	0.004775	0.067781	-0.077087	0.285754	-0.124159	
GWPH	-0.007617	0.029778	-0.591599	0.070987	-0.074440	
IDXX	-0.003373	0.024616	-0.543270	0.053468	-0.051210	
INCY	-0.000291	0.028192	-0.365033	0.063346	-0.063346	
ISRG	-0.002040	0.029864	-0.403150	0.062292	-0.069175	
JNJ	-0.001021	0.018384	-0.599469	0.031504	-0.100379	

LHCG	-0.000310	0.023038	-0.447515	0.049847	-0.061456
MRK	0.001411	0.014247	-0.602832	0.040056	-0.029524
RYH	-0.002040	0.016160	-0.745008	0.048276	-0.038261
TAK	-0.002889	0.022975	-0.561018	0.050848	-0.058329
UNH	-0.001029	0.018894	-0.583738	0.047339	-0.032243
VHT	-0.001557	0.015684	-0.736824	0.046308	-0.035561
VRTX	-0.001864	0.025864	-0.458699	0.065368	-0.063616
ZTS	-0.000875	0.018208	-0.597269	0.045913	-0.039683

	Median Returns	Total Return
ABMD	-0.002283	2.159222
ALXN	-0.003690	0.154307
BRKR	0.000979	2.232148
BSX	0.002949	1.932512
EHC	-0.000417	1.031604
ENSG	-0.002095	1.068262
EW	0.002667	1.834980
GH	-0.003182	-0.318215
GWPH	-0.010458	2.085951
IDXX	-0.000731	0.075317
INCY	-0.005289	2.103406
ISRG	-0.004170	1.638370
JNJ	0.000287	1.398603
LHCG	0.001387	0.138663
MRK	0.002046	1.379849
RYH	-0.002127	1.266325
TAK	-0.001543	0.477888
UNH	-0.000362	1.169592
VHT	-0.001405	1.484985
VRTX	0.000162	2.657669
ZTS	0.000431	1.242759

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

```
[34]:   Returns      Risk  Sharpe Ratio  Max Returns  Min Returns \
ABMD -0.003303  0.042357  -0.314061  0.104748  -0.166128
ALXN -0.004942  0.028678  -0.521019  0.068082  -0.097642
BRKR -0.001563  0.024146  -0.478896  0.048393  -0.067230
BSX  -0.000951  0.023759  -0.460900  0.061456  -0.051675
EHC  -0.003328  0.018561  -0.718068  0.040638  -0.057401
ENSG  0.000853  0.031501  -0.290388  0.124460  -0.061993
EW   0.000339  0.025175  -0.383765  0.057676  -0.053540
GH   0.004775  0.067781  -0.077087  0.285754  -0.124159
GWPH -0.007617  0.029778  -0.591599  0.070987  -0.074440
IDXX -0.003373  0.024616  -0.543270  0.053468  -0.051210
INCY -0.000291  0.028192  -0.365033  0.063346  -0.063346
```

ISRG	-0.002040	0.029864	-0.403150	0.062292	-0.069175
JNJ	-0.001021	0.018384	-0.599469	0.031504	-0.100379
LHCG	-0.000310	0.023038	-0.447515	0.049847	-0.061456
MRK	0.001411	0.014247	-0.602832	0.040056	-0.029524
RYH	-0.002040	0.016160	-0.745008	0.048276	-0.038261
TAK	-0.002889	0.022975	-0.561018	0.050848	-0.058329
UNH	-0.001029	0.018894	-0.583738	0.047339	-0.032243
VHT	-0.001557	0.015684	-0.736824	0.046308	-0.035561
VRTX	-0.001864	0.025864	-0.458699	0.065368	-0.063616
ZTS	-0.000875	0.018208	-0.597269	0.045913	-0.039683

	Median Returns	Total Return	Average Return	Yearly
ABMD	-0.002283	2.159222		0.007146
ALXN	-0.003690	0.154307		0.000514
BRKR	0.000979	2.232148		0.007386
BSX	0.002949	1.932512		0.006401
EHC	-0.000417	1.031604		0.003427
ENSG	-0.002095	1.068262		0.003548
EW	0.002667	1.834980		0.006080
GH	-0.003182	-0.318215		-0.001062
GWPH	-0.010458	2.085951		0.006905
IDXX	-0.000731	0.075317		0.000251
INCY	-0.005289	2.103406		0.006963
ISRG	-0.004170	1.638370		0.005432
JNJ	0.000287	1.398603		0.004640
LHCG	0.001387	0.138663		0.000462
MRK	0.002046	1.379849		0.004579
RYH	-0.002127	1.266325		0.004203
TAK	-0.001543	0.477888		0.001590
UNH	-0.000362	1.169592		0.003884
VHT	-0.001405	1.484985		0.004926
VRTX	0.000162	2.657669		0.008782
ZTS	0.000431	1.242759		0.004125

```
[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 \
ABMD -0.003303  0.042357   -0.314061    0.104748  -0.166128
ALXN -0.004942  0.028678   -0.521019    0.068082  -0.097642
BRKR -0.001563  0.024146   -0.478896    0.048393  -0.067230
BSX  -0.000951  0.023759   -0.460900    0.061456  -0.051675
EHC  -0.003328  0.018561   -0.718068    0.040638  -0.057401
ENSG  0.000853  0.031501   -0.290388    0.124460  -0.061993
EW   0.000339  0.025175   -0.383765    0.057676  -0.053540
```

GH	0.004775	0.067781	-0.077087	0.285754	-0.124159
GWPH	-0.007617	0.029778	-0.591599	0.070987	-0.074440
IDXX	-0.003373	0.024616	-0.543270	0.053468	-0.051210
INCY	-0.000291	0.028192	-0.365033	0.063346	-0.063346
ISRG	-0.002040	0.029864	-0.403150	0.062292	-0.069175
JNJ	-0.001021	0.018384	-0.599469	0.031504	-0.100379
LHCG	-0.000310	0.023038	-0.447515	0.049847	-0.061456
MRK	0.001411	0.014247	-0.602832	0.040056	-0.029524
RYH	-0.002040	0.016160	-0.745008	0.048276	-0.038261
TAK	-0.002889	0.022975	-0.561018	0.050848	-0.058329
UNH	-0.001029	0.018894	-0.583738	0.047339	-0.032243
VHT	-0.001557	0.015684	-0.736824	0.046308	-0.035561
VRTX	-0.001864	0.025864	-0.458699	0.065368	-0.063616
ZTS	-0.000875	0.018208	-0.597269	0.045913	-0.039683

	Median Returns	Total Return	Average Return	Yearly	CAGR
ABMD	-0.002283	2.159222		0.007146	0.361898
ALXN	-0.003690	0.154307		0.000514	-0.137345
BRKR	0.000979	2.232148		0.007386	0.058633
BSX	0.002949	1.932512		0.006401	0.168610
EHC	-0.000417	1.031604		0.003427	0.158449
ENSG	-0.002095	1.068262		0.003548	0.149095
EW	0.002667	1.834980		0.006080	0.165628
GH	-0.003182	-0.318215		-0.001062	NaN
GWPH	-0.010458	2.085951		0.006905	0.084740
IDXX	-0.000731	0.075317		0.000251	0.248423
INCY	-0.005289	2.103406		0.006963	-0.105964
ISRG	-0.004170	1.638370		0.005432	0.249432
JNJ	0.000287	1.398603		0.004640	0.079259
LHCG	0.001387	0.138663		0.000462	0.197636
MRK	0.002046	1.379849		0.004579	0.114011
RYH	-0.002127	1.266325		0.004203	0.041944
TAK	-0.001543	0.477888		0.001590	-0.063154
UNH	-0.000362	1.169592		0.003884	0.204429
VHT	-0.001405	1.484985		0.004926	0.059542
VRTX	0.000162	2.657669		0.008782	0.071424
ZTS	0.000431	1.242759		0.004125	0.152379

```
[36]: table.sort_values(by='Average Return Yearly')
```

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
GH	0.004775	0.067781	-0.077087	0.285754	-0.124159	
IDXX	-0.003373	0.024616	-0.543270	0.053468	-0.051210	
LHCG	-0.000310	0.023038	-0.447515	0.049847	-0.061456	
ALXN	-0.004942	0.028678	-0.521019	0.068082	-0.097642	
TAK	-0.002889	0.022975	-0.561018	0.050848	-0.058329	
EHC	-0.003328	0.018561	-0.718068	0.040638	-0.057401	

ENSG	0.000853	0.031501	-0.290388	0.124460	-0.061993
UNH	-0.001029	0.018894	-0.583738	0.047339	-0.032243
ZTS	-0.000875	0.018208	-0.597269	0.045913	-0.039683
RYH	-0.002040	0.016160	-0.745008	0.048276	-0.038261
MRK	0.001411	0.014247	-0.602832	0.040056	-0.029524
JNJ	-0.001021	0.018384	-0.599469	0.031504	-0.100379
VHT	-0.001557	0.015684	-0.736824	0.046308	-0.035561
ISRG	-0.002040	0.029864	-0.403150	0.062292	-0.069175
EW	0.000339	0.025175	-0.383765	0.057676	-0.053540
BSX	-0.000951	0.023759	-0.460900	0.061456	-0.051675
GWPH	-0.007617	0.029778	-0.591599	0.070987	-0.074440
INCY	-0.000291	0.028192	-0.365033	0.063346	-0.063346
ABMD	-0.003303	0.042357	-0.314061	0.104748	-0.166128
BRKR	-0.001563	0.024146	-0.478896	0.048393	-0.067230
VRTX	-0.001864	0.025864	-0.458699	0.065368	-0.063616

	Median Returns	Total Return	Average Return	Yearly	CAGR
GH	-0.003182	-0.318215		-0.001062	NaN
IDXX	-0.000731	0.075317		0.000251	0.248423
LHCG	0.001387	0.138663		0.000462	0.197636
ALXN	-0.003690	0.154307		0.000514	-0.137345
TAK	-0.001543	0.477888		0.001590	-0.063154
EHC	-0.000417	1.031604		0.003427	0.158449
ENSG	-0.002095	1.068262		0.003548	0.149095
UNH	-0.000362	1.169592		0.003884	0.204429
ZTS	0.000431	1.242759		0.004125	0.152379
RYH	-0.002127	1.266325		0.004203	0.041944
MRK	0.002046	1.379849		0.004579	0.114011
JNJ	0.000287	1.398603		0.004640	0.079259
VHT	-0.001405	1.484985		0.004926	0.059542
ISRG	-0.004170	1.638370		0.005432	0.249432
EW	0.002667	1.834980		0.006080	0.165628
BSX	0.002949	1.932512		0.006401	0.168610
GWPH	-0.010458	2.085951		0.006905	0.084740
INCY	-0.005289	2.103406		0.006963	-0.105964
ABMD	-0.002283	2.159222		0.007146	0.361898
BRKR	0.000979	2.232148		0.007386	0.058633
VRTX	0.000162	2.657669		0.008782	0.071424