

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']
```

```
*****100%***** 1 of 1 completed
```

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[*****100%*****] 1 of 1 completed  
[*****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?

2 years

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

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

```
[6]: 905
```

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

```
[7]:  
          PRGO      AMED      EHC      LHCG      CNC      TDOC  \\\nDate  
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	VEEV	WST	FSPHX	BHCFX	PRHSX	IHI	\
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	
Date	RYH	XLV	XHE				
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()

Date	PRGO	AMED	EHC	LHCG	CNC	\	
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		
Date	TDOC	DXCM	HOLX	BIO	DHR	...	\
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	...	
Date	MDT	VEEV	WST	FSPHX	BHCFX	PRHSX	\
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

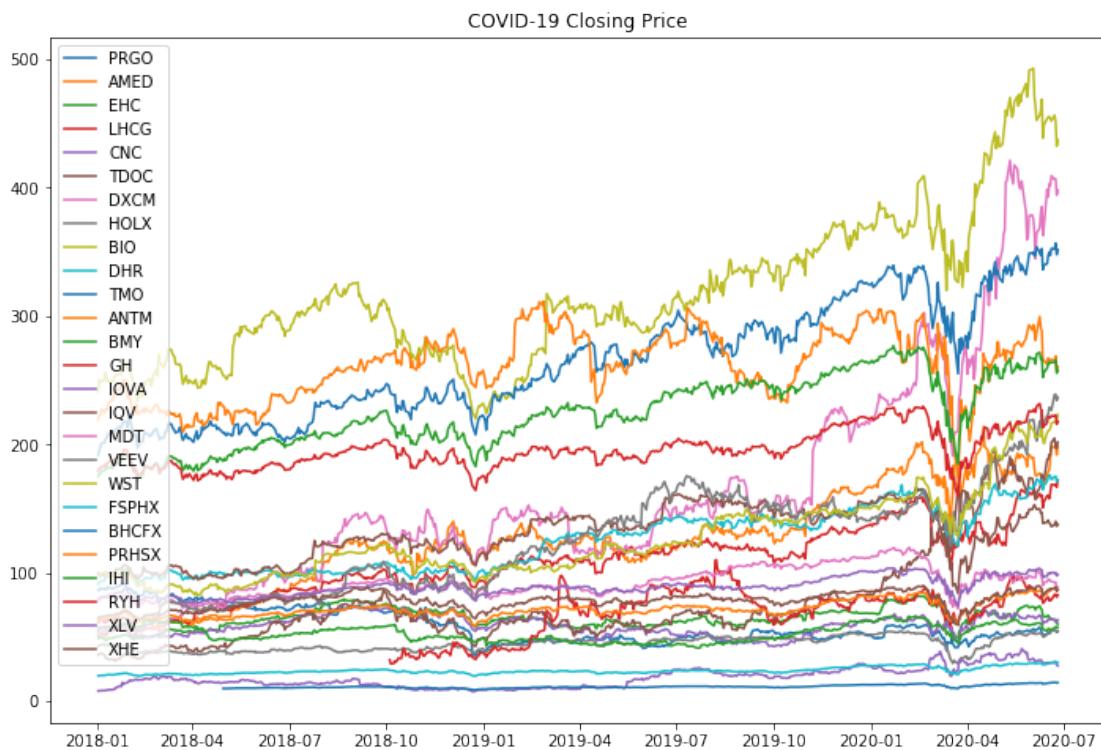
```

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)
```

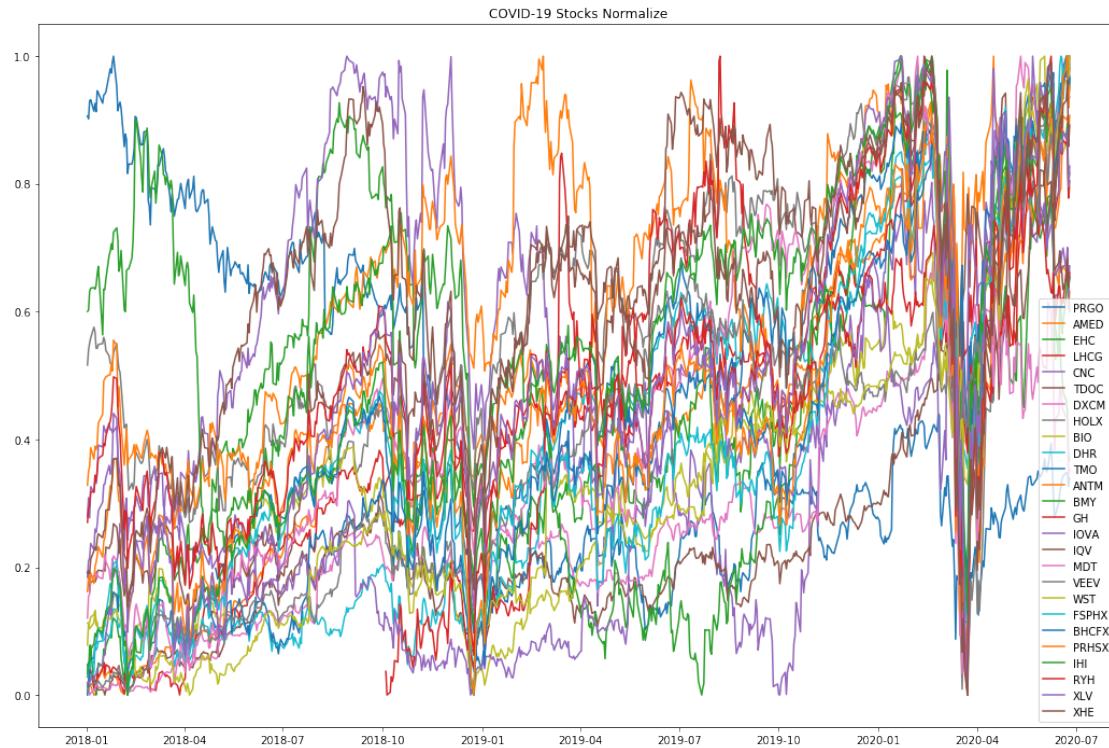
```
[9]: <matplotlib.legend.Legend at 0x24fe02d2eb8>
```



```
[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)
```

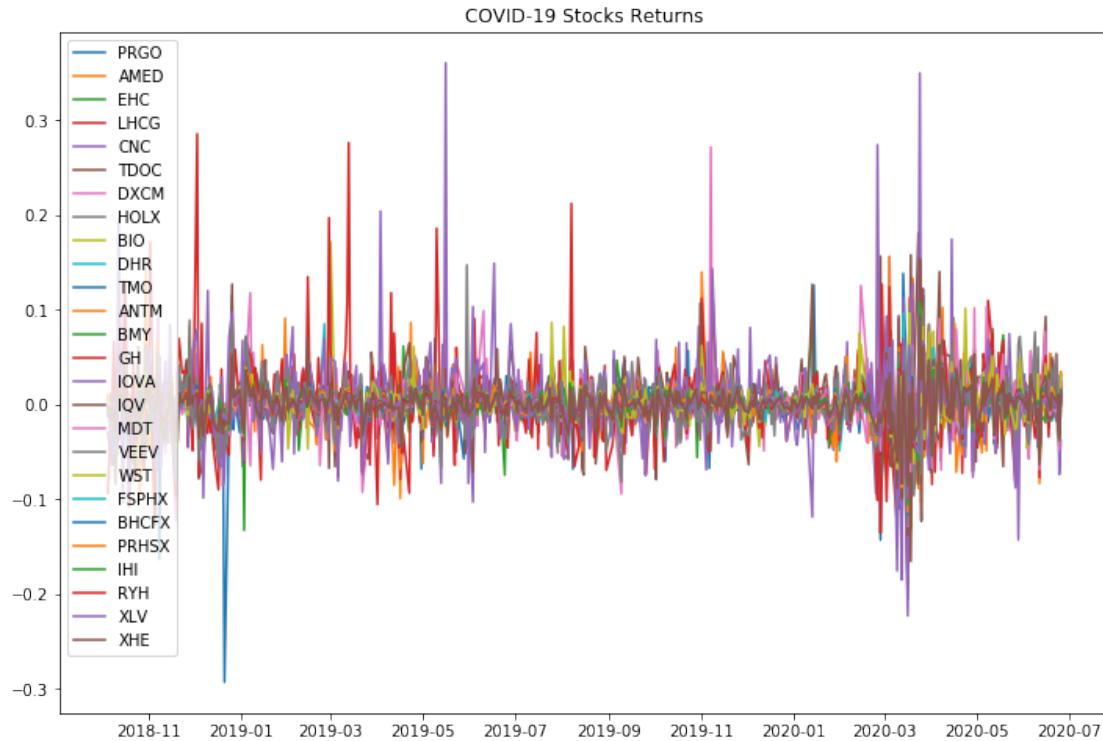
```
[11]: <matplotlib.legend.Legend at 0x24fe0330cc0>
```



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

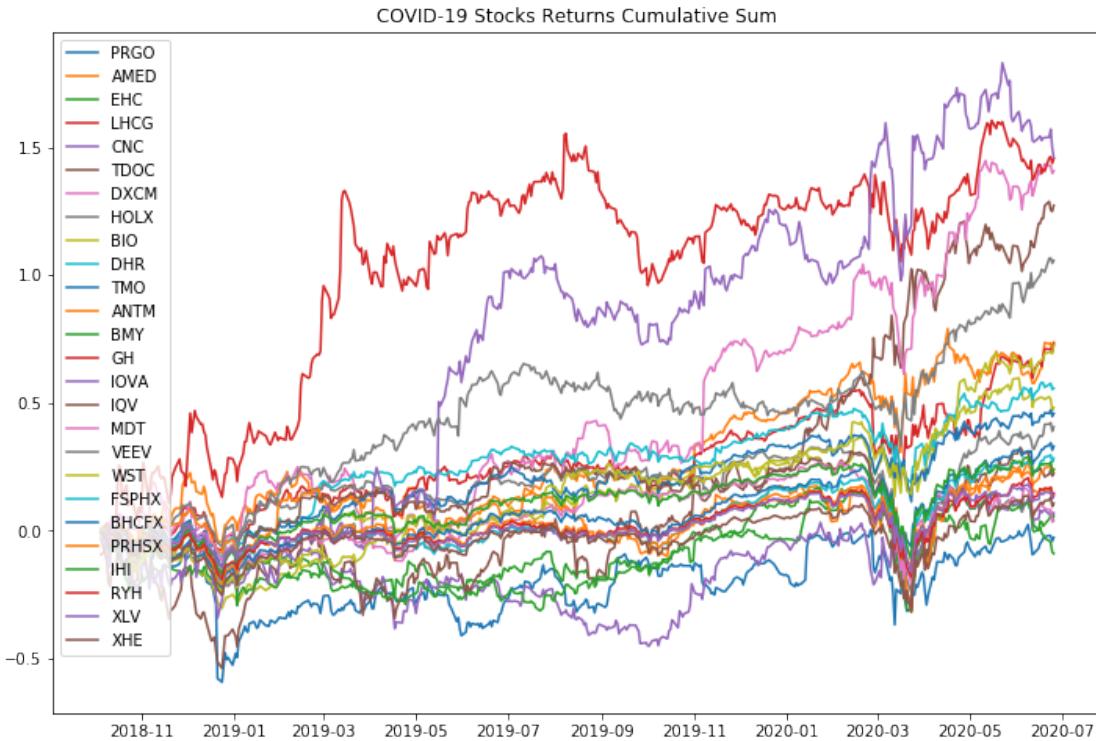
```
[13]: plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title(title + ' Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

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



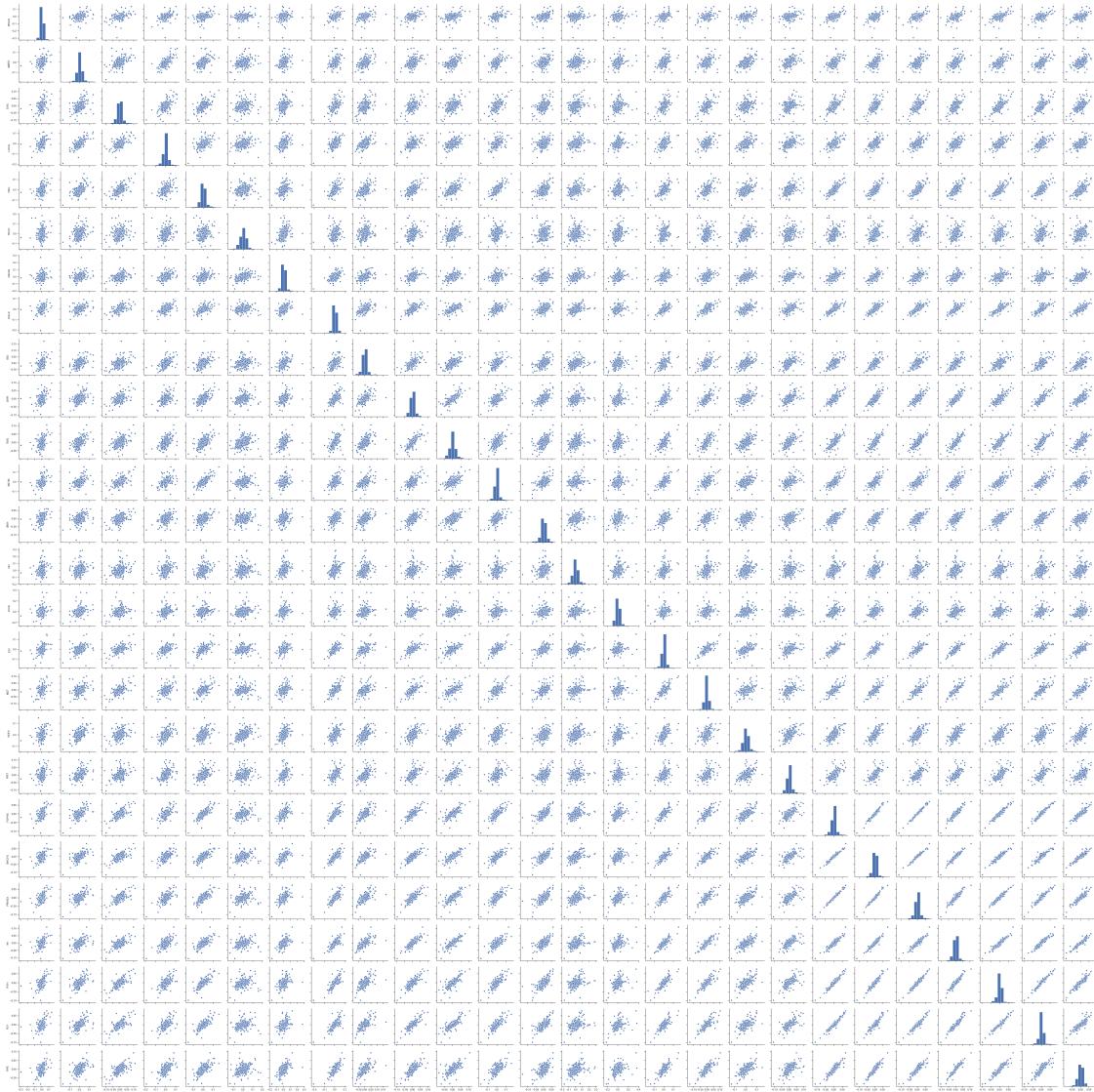
```
[14]: plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title(title + ' Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

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

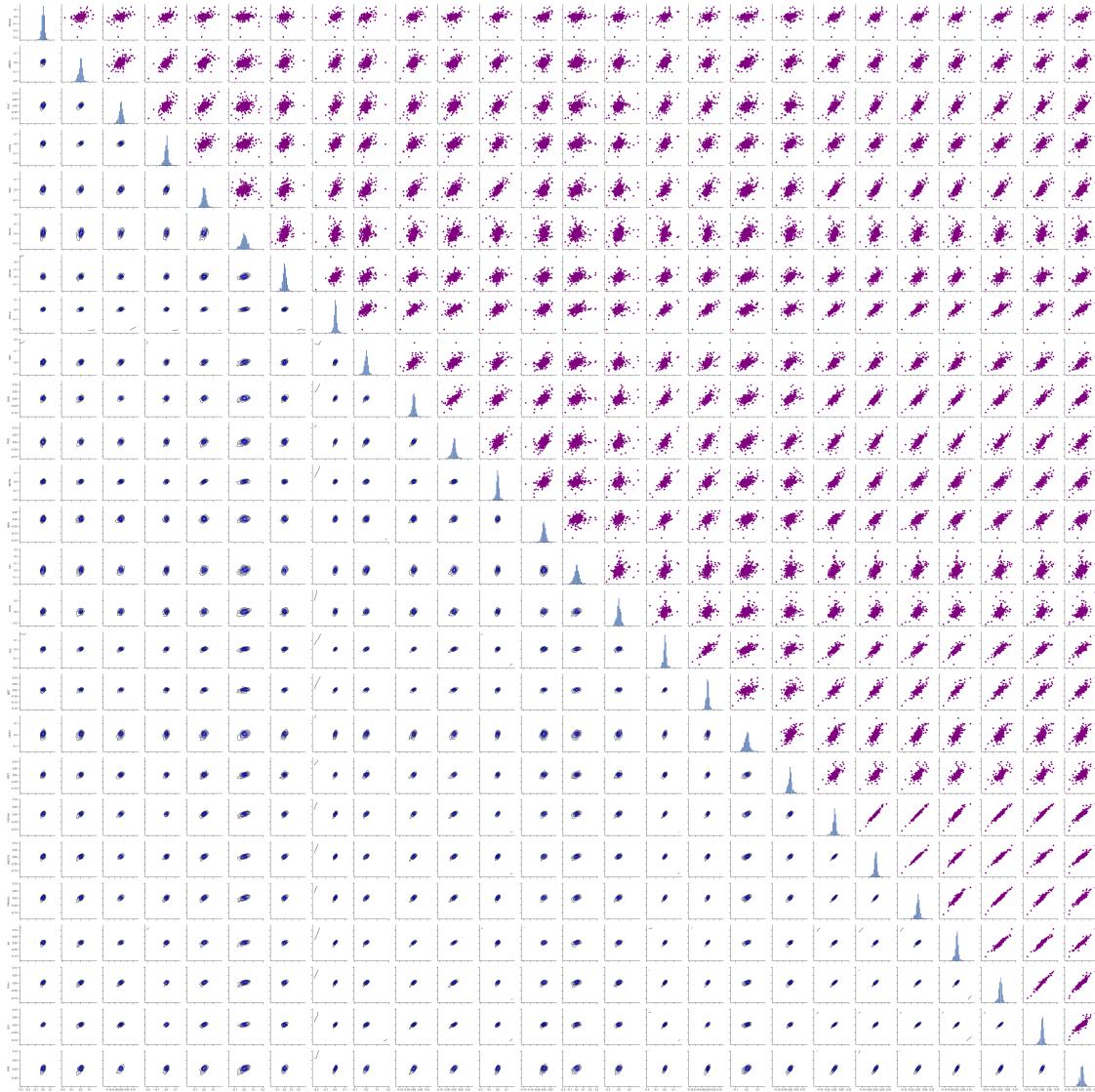


```
[15]: sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

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)
```

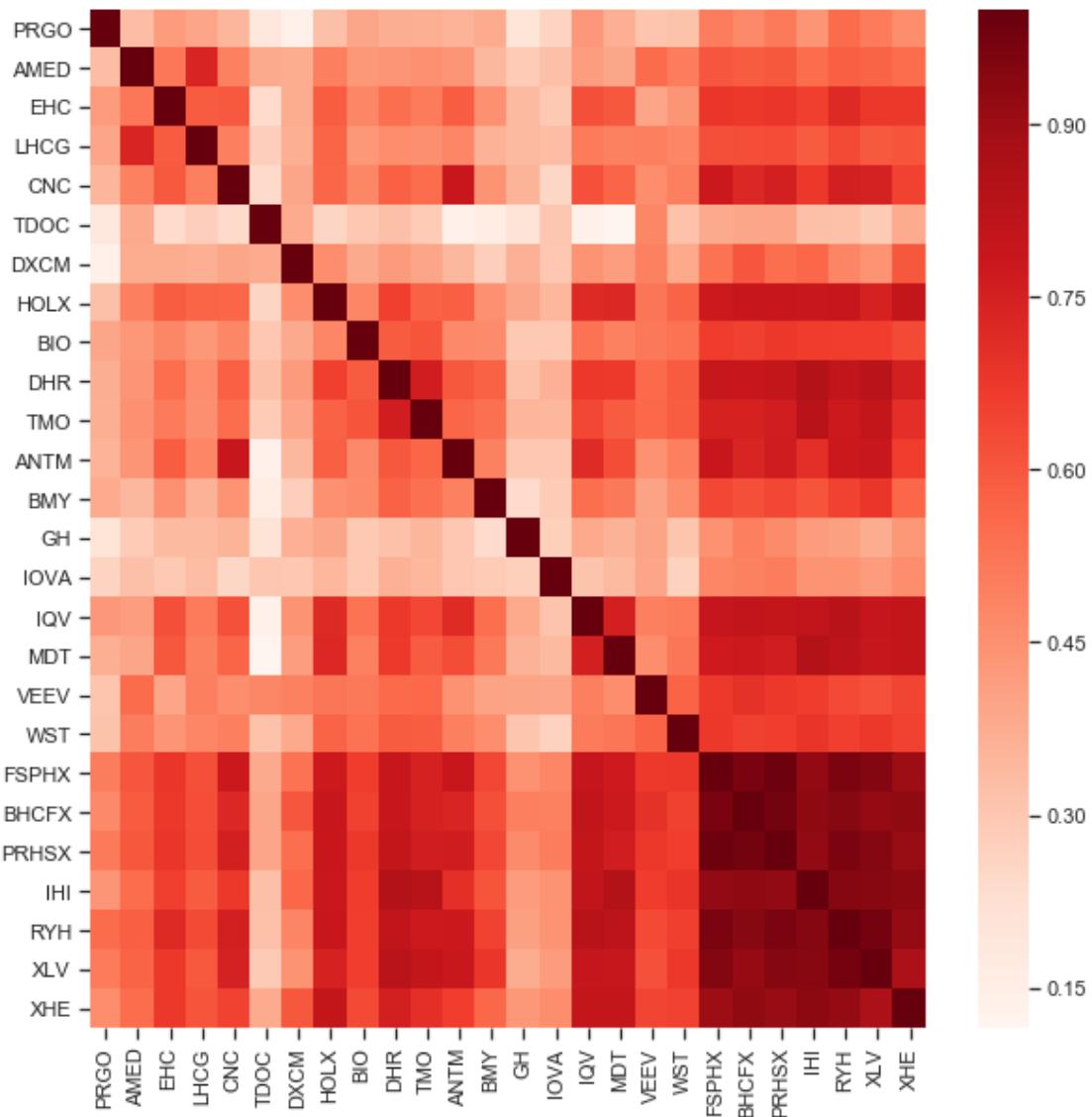


```
[17]: plt.figure(figsize=(10,10))

corr = stock_rets.corr()

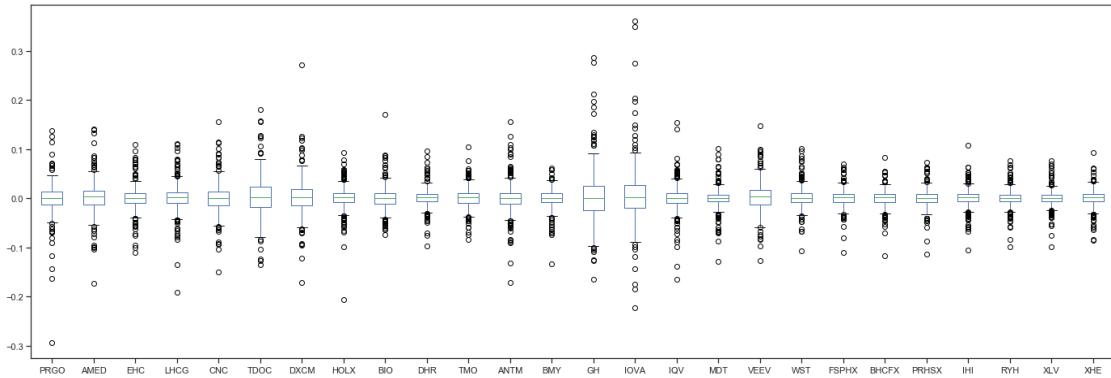
# plot the heatmap
sns.heatmap(corr,
             xticklabels=corr.columns,
             yticklabels=corr.columns,
             cmap="Reds")
```

[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>
```

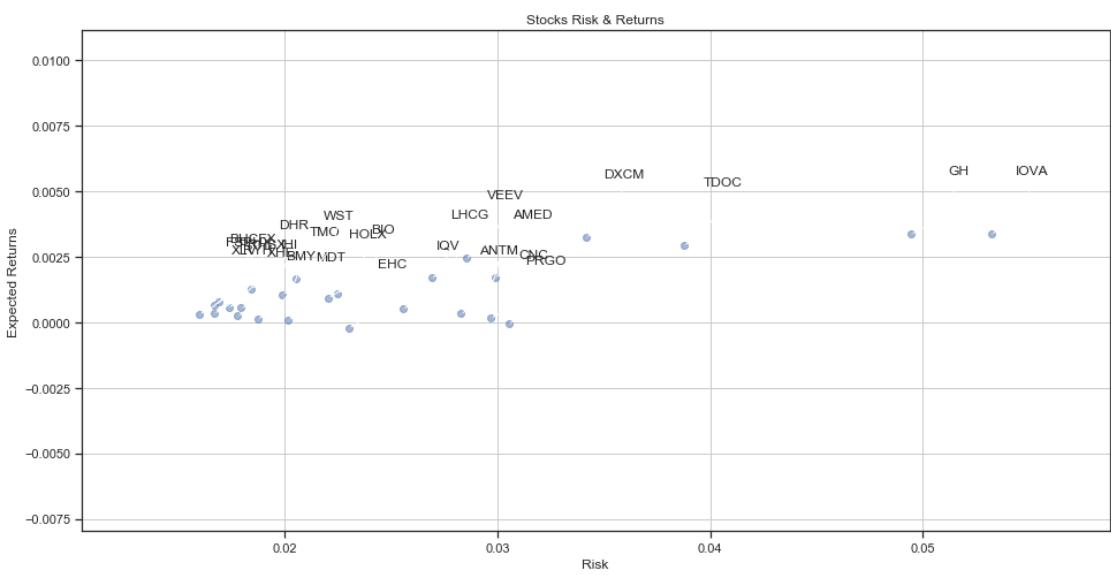


```
[19]: rets = stock_rets.dropna()

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
```

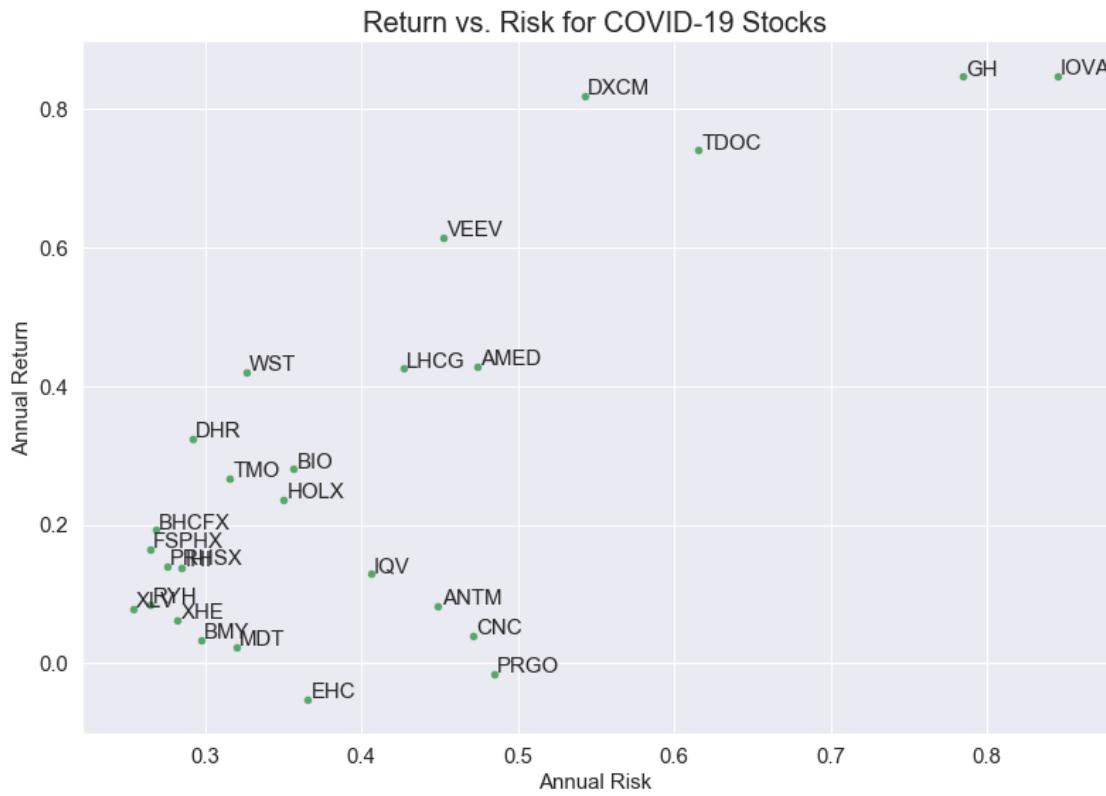
```
[22]: tradeoff = annual_risk_return(stock_rets)
tradeoff
```

```
[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	EMY	0.242537
EMY	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
EMY	TDOC	0.166238
TDOC	EMY	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	EMY	0.242537
EMY	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
EMY	TDOC	0.166238
TDOC	EMY	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
```

	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
```

	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	CAGR
PRGO	0.001090	1.445781	0.000016	-0.119840	
AMED	0.003788	3.463538	0.000038	0.438768	
EHC	0.000301	-0.591234	-0.000007	0.057836	
LHCG	0.002478	3.202214	0.000035	0.331087	
CNC	0.000000	2.391725	0.000026	0.060585	
TDOC	0.002820	2.380591	0.000026	0.613337	
DXCM	0.002858	0.961199	0.000011	0.709864	
HOLX	0.001533	1.676917	0.000018	0.069503	

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

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