Ventilator_Manufacturer_Portfolio

September 29, 2021

1 Ventilator Manufacturer 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 yfinance as yf
yf.pdr_override()
```

[2]:
```
# input
# Ventilator Manufacturer
symbols = ['MDT','RMD','AHPI']
start = '2019-12-01'
end = '2020-04-14'
```

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

```
[**********************100%**********************]  1 of 1 completed
[**********************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?
0 years
```

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

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

[6]:
```
133
```

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

[7]:

Date	MDT	RMD	AHPI
2019-12-02	109.697014	148.676666	1.01
2019-12-03	109.776138	149.135651	1.08
2019-12-04	110.715752	149.814117	1.05
2019-12-05	110.972908	149.844055	1.05
2019-12-06	111.853165	150.253143	1.06

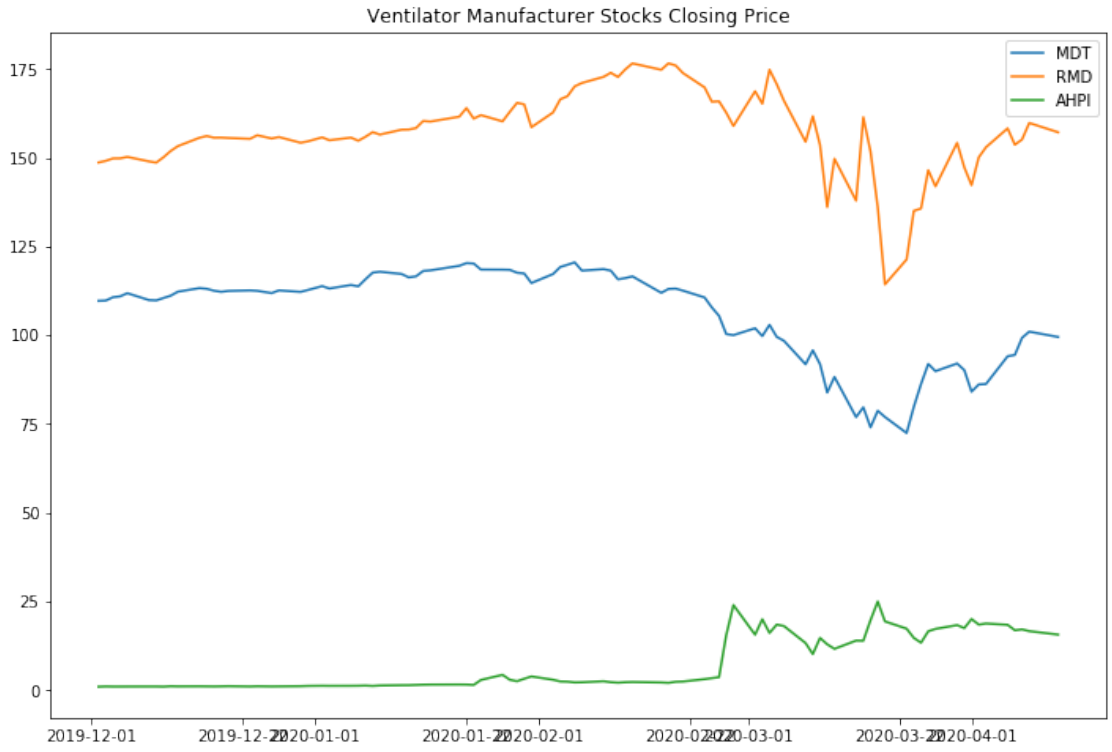
[8]:
```
df.tail()
```

[8]:

Date	MDT	RMD	AHPI
2020-04-06	94.089996	158.300003	18.440001
2020-04-07	94.459999	153.679993	16.900000
2020-04-08	99.279999	155.160004	17.150000
2020-04-09	101.029999	159.820007	16.650000
2020-04-13	99.519997	157.190002	15.680000

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

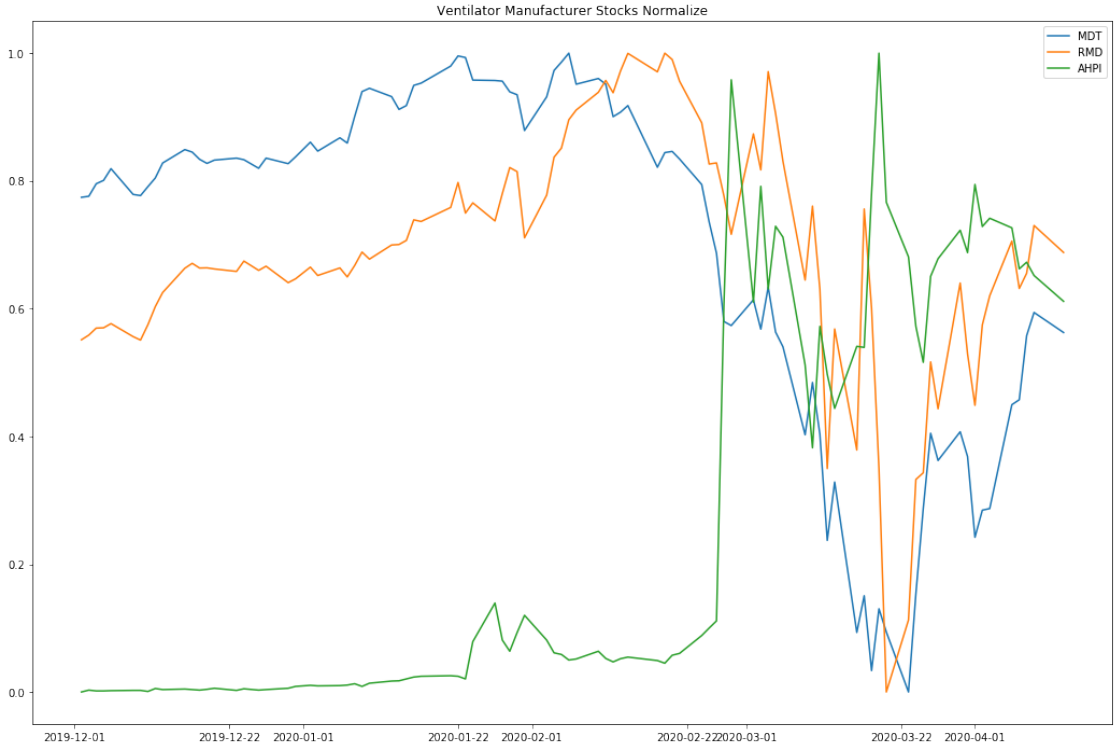
[9]:
```
<matplotlib.legend.Legend at 0x2179a63d550>
```



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

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

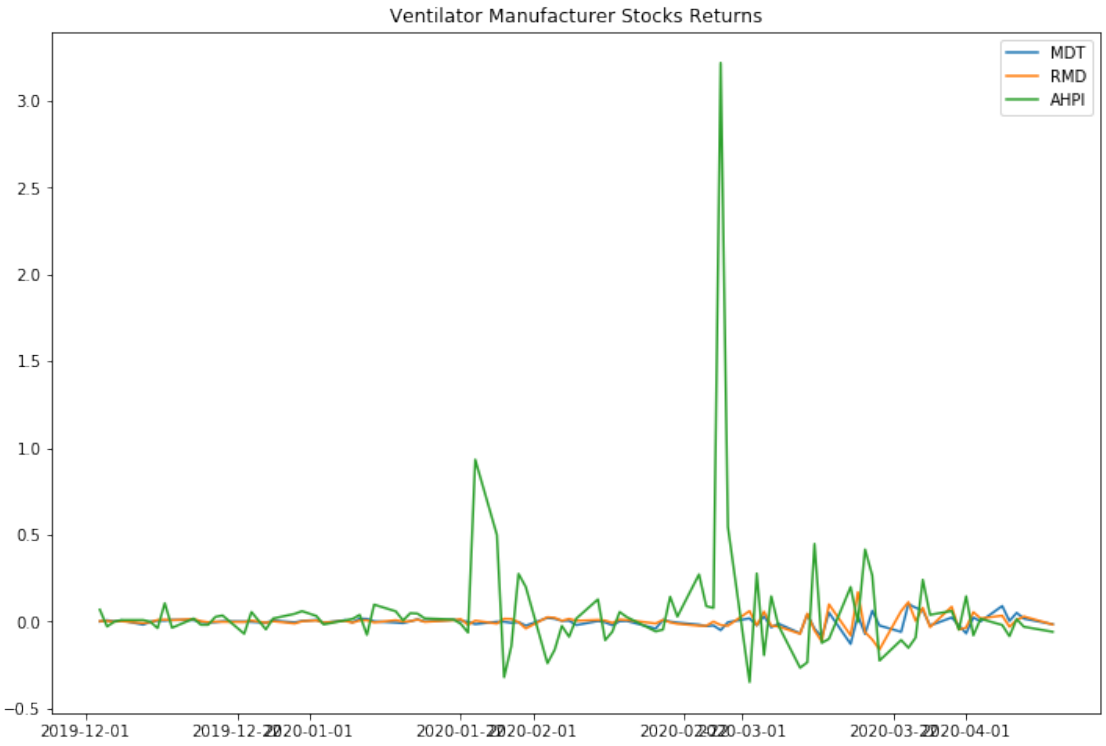
[11]: <matplotlib.legend.Legend at 0x2179aa10940>



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

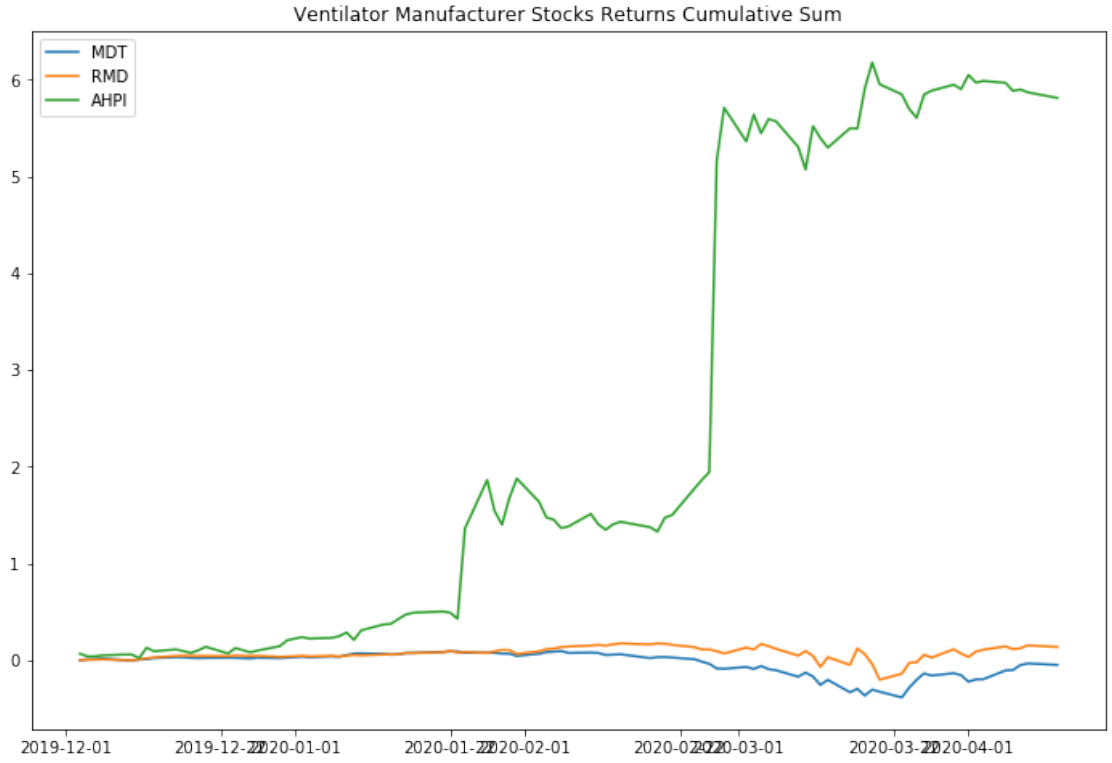
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Ventilator Manufacturer Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]:
```
<matplotlib.legend.Legend at 0x2179a6975f8>
```

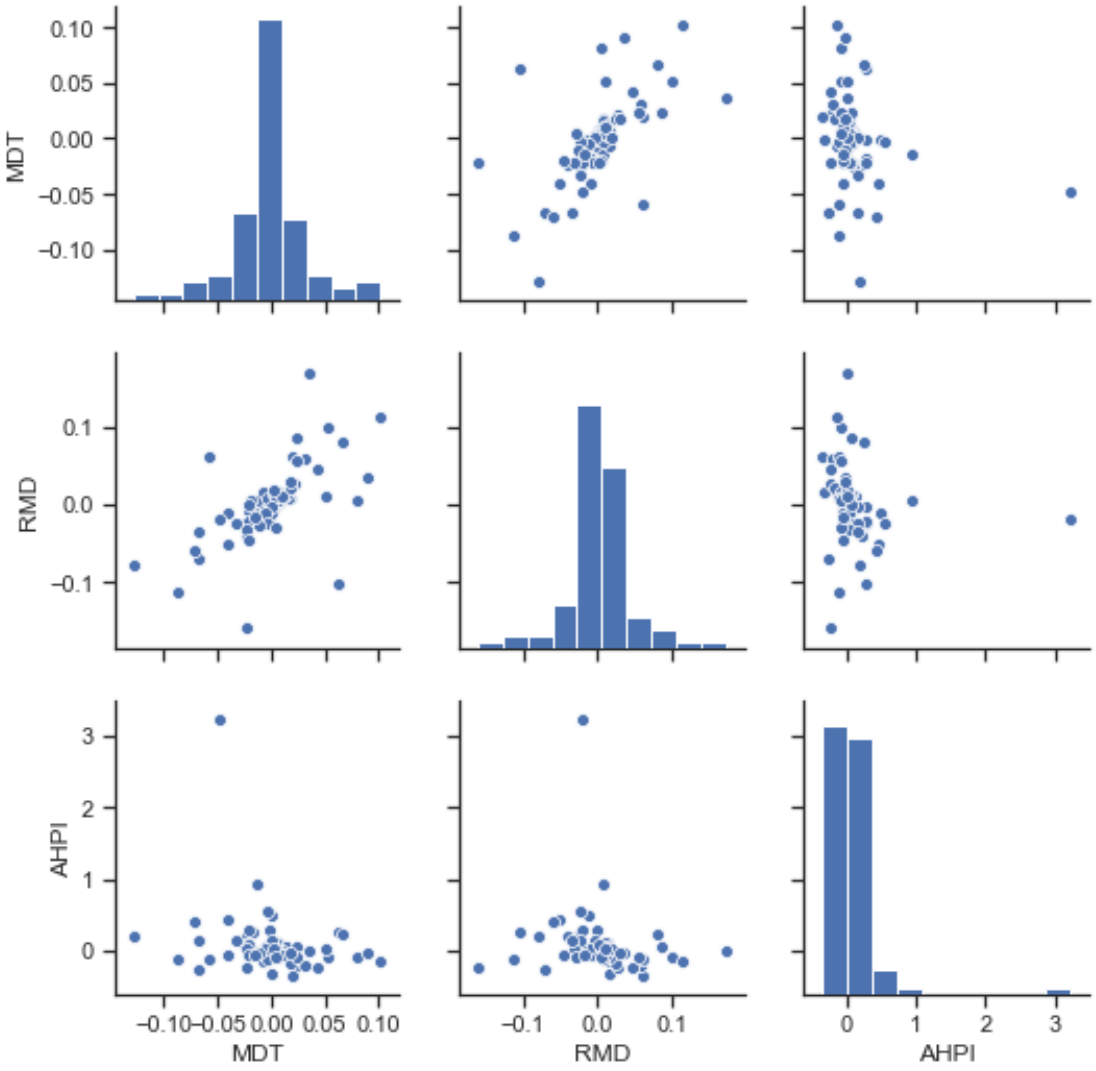


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Ventilator Manufacturer Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

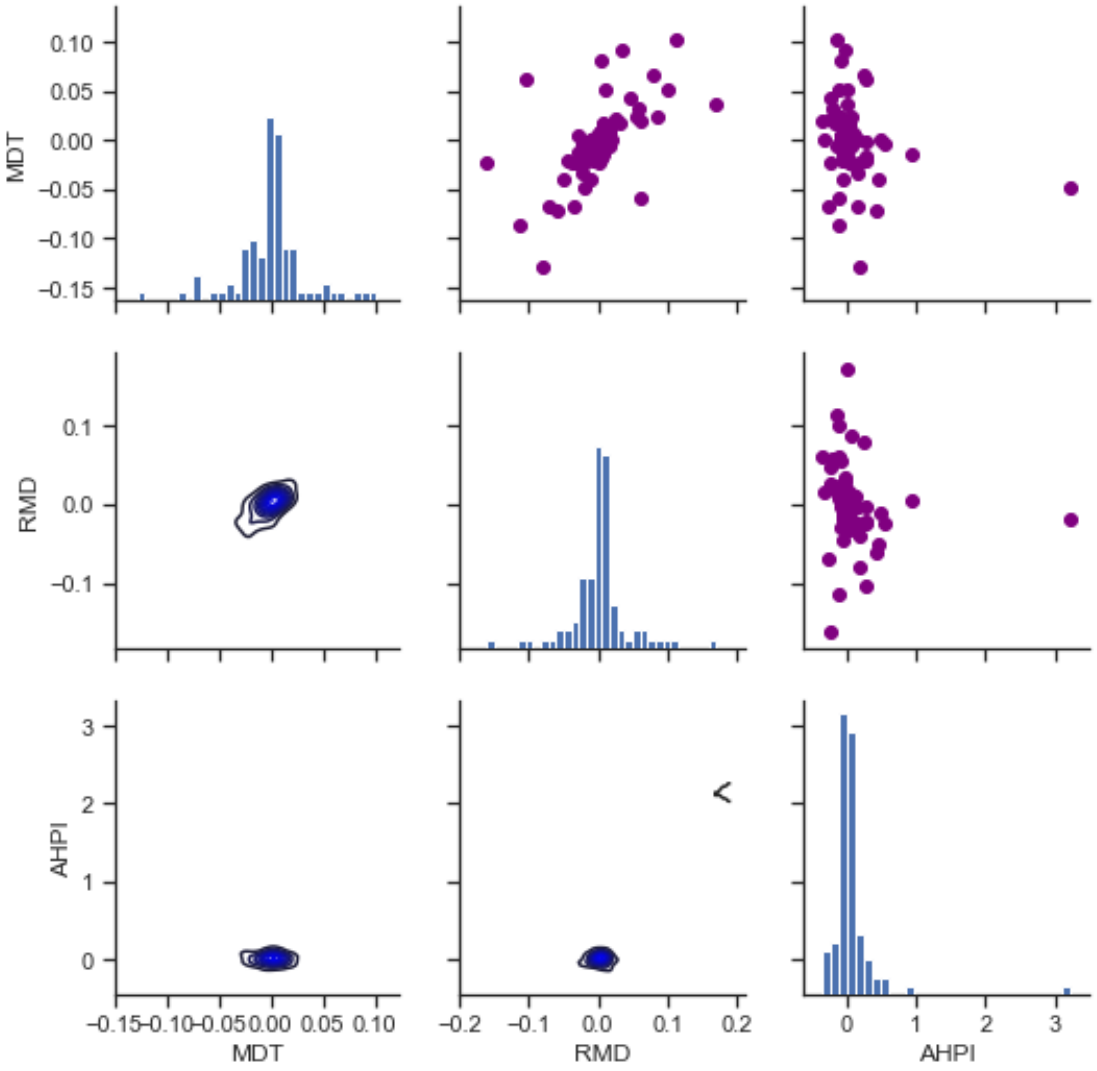
[14]: <matplotlib.legend.Legend at 0x2179a679400>



[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)
```

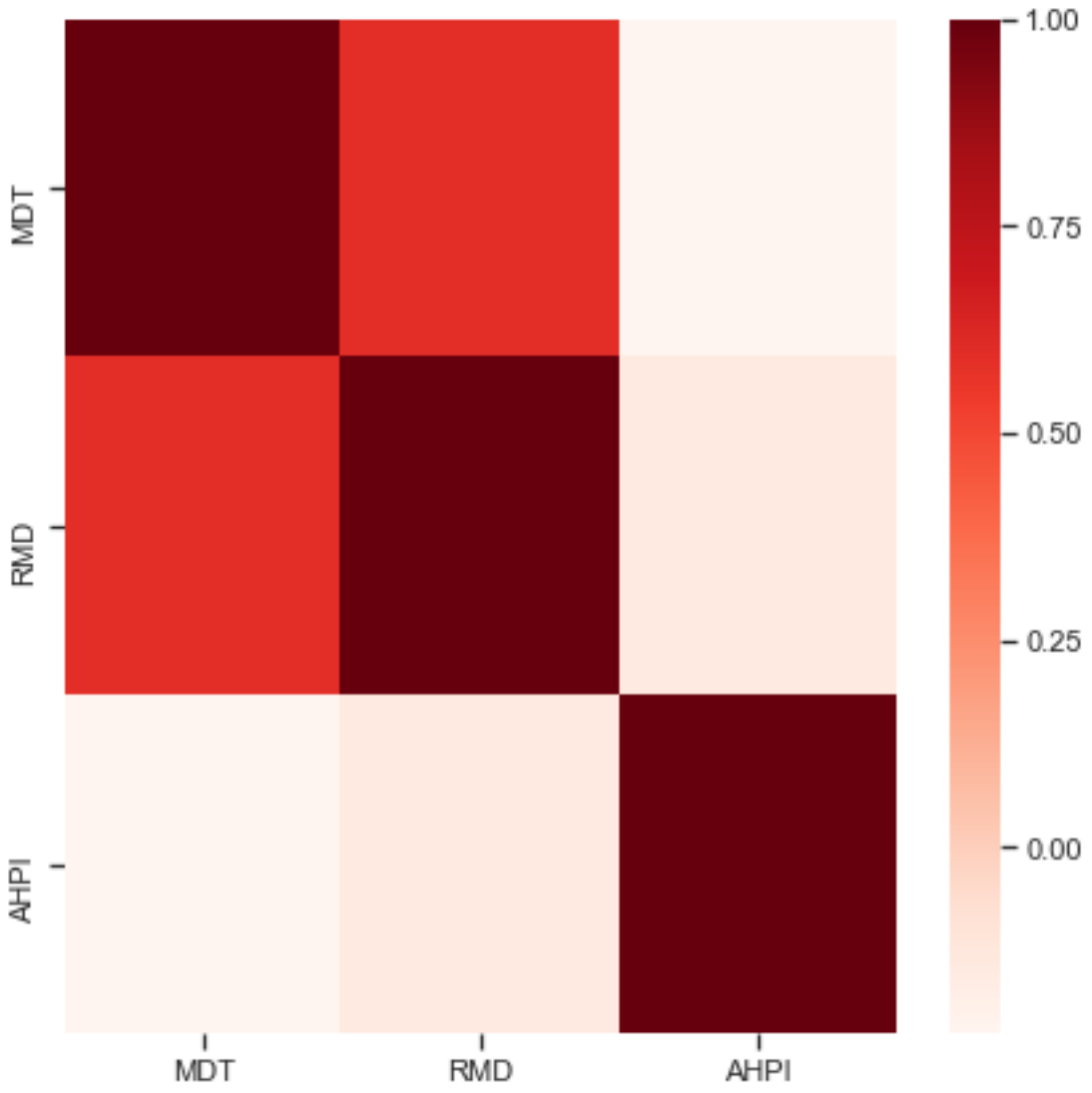


[16]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



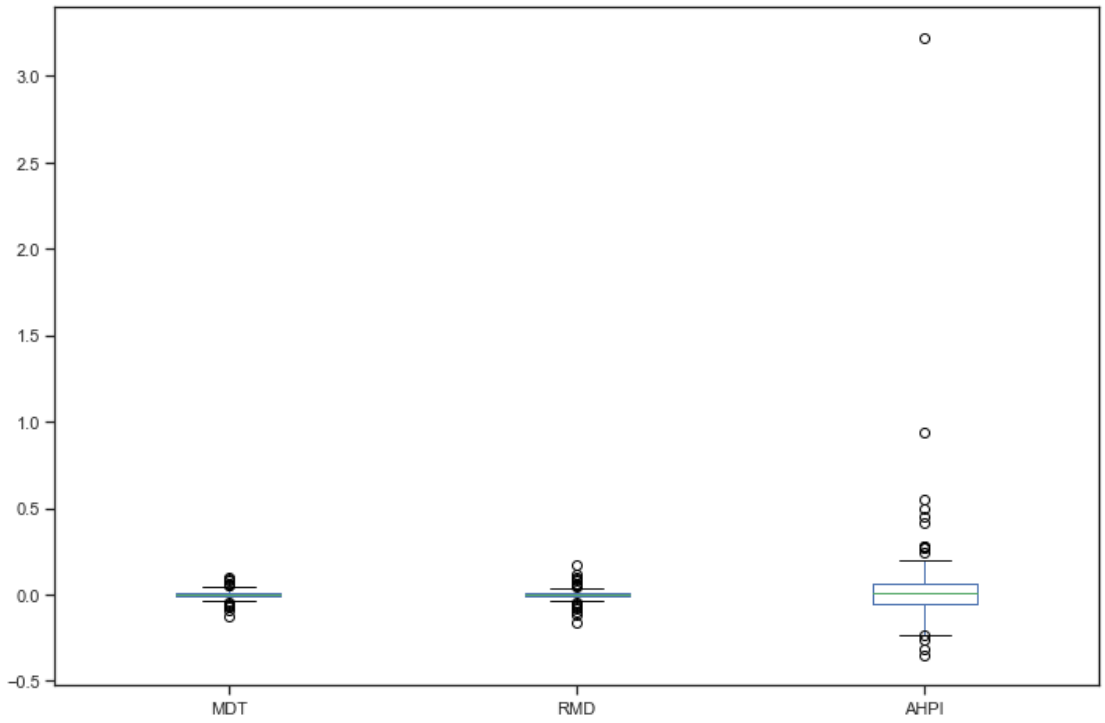
[17]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

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

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x2179adeb2b0>

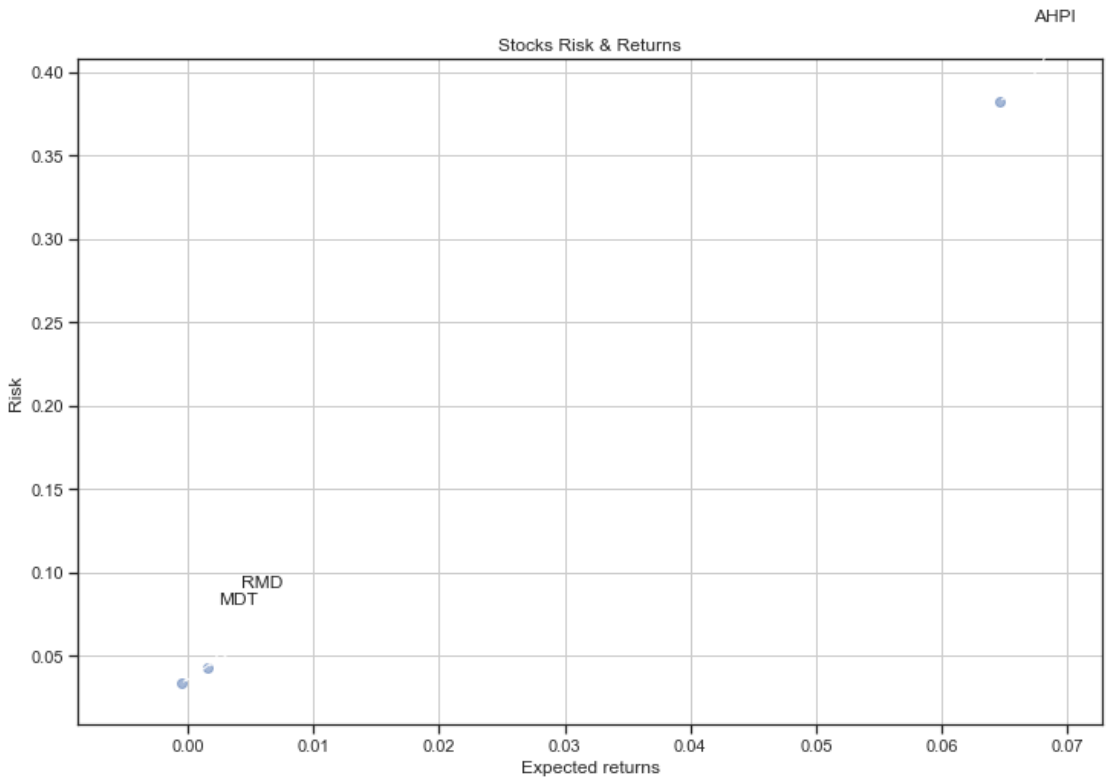


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

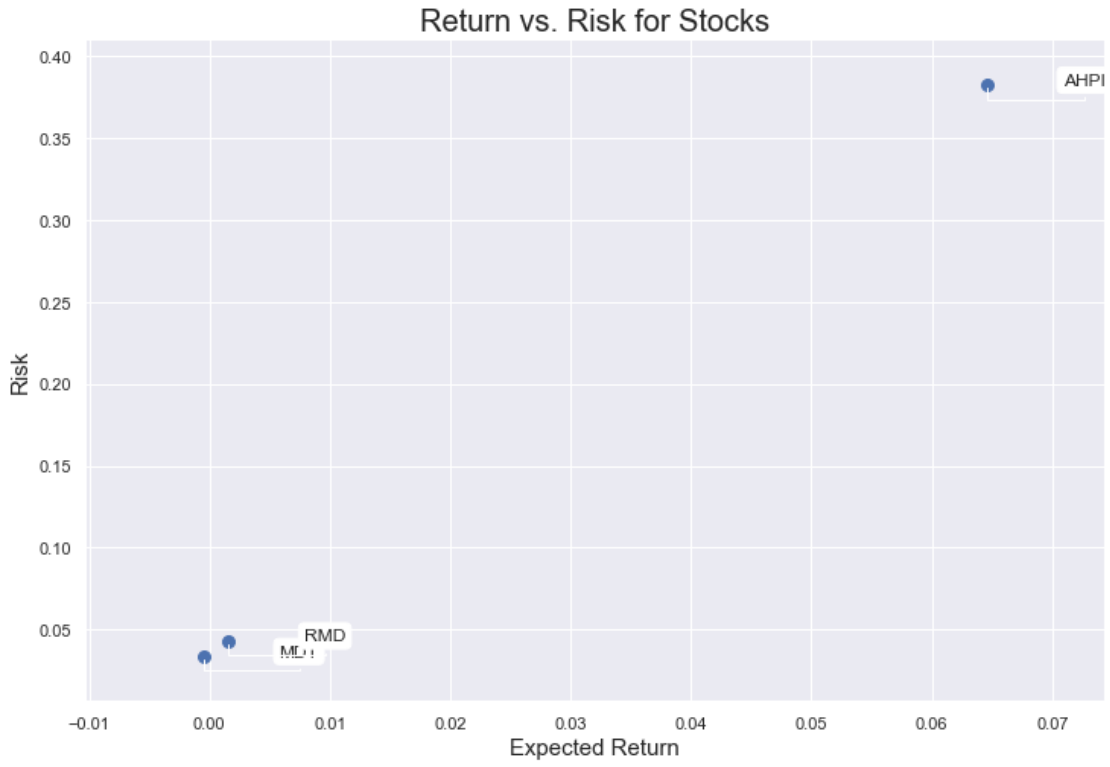
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x2179c7ab2e8>



[19]:
```
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'))
```



[20]:
```
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"))
```



[21]:
```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[21]:
```
AHPI  AHPI    1.000000
RMD   RMD     1.000000
MDT   MDT     1.000000
RMD   MDT     0.594789
MDT   RMD     0.594789
AHPI  MDT     0.225555
MDT   AHPI    0.225555
AHPI  RMD     0.139522
RMD   AHPI    0.139522
dtype: float64
```

[22]:
```
# Normalized Returns Data
Normalized_Value = ((rets[:] - rets[:].min()) /(rets[:].max() - rets[:].min()))
Normalized_Value.head()
```

[22]:

Date	MDT	RMD	AHPI
2019-12-03	0.560373	0.493460	0.117023
2019-12-04	0.594432	0.497888	0.089793

```
2019-12-05  0.567331  0.484718  0.097584
2019-12-06  0.591707  0.492379  0.100255
2019-12-09  0.481927  0.458577  0.100230
```

[23]:
```
Normalized_Value.corr()
```

[23]:
```
            MDT       RMD      AHPI
MDT    1.000000  0.594789 -0.225555
RMD    0.594789  1.000000 -0.139522
AHPI  -0.225555 -0.139522  1.000000
```

[24]:
```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[24]:
```
AHPI  AHPI    1.000000
RMD   RMD     1.000000
MDT   MDT     1.000000
RMD   MDT     0.594789
MDT   RMD     0.594789
AHPI  MDT     0.225555
MDT   AHPI    0.225555
AHPI  RMD     0.139522
RMD   AHPI    0.139522
dtype: float64
```

[25]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
MDT    -0.000514
RMD     0.001543
AHPI    0.064549
dtype: float64
--------------------------------------------------
Stock risks:
MDT     0.033714
RMD     0.043191
AHPI    0.382719
dtype: float64
```

[26]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
```

```
table.sort_values(by='Returns')
```

[26]:
```
        Returns      Risk
MDT   -0.000514  0.033714
RMD    0.001543  0.043191
AHPI   0.064549  0.382719
```

[27]:
```
table.sort_values(by='Risk')
```

[27]:
```
        Returns      Risk
MDT   -0.000514  0.033714
RMD    0.001543  0.043191
AHPI   0.064549  0.382719
```

[28]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[28]:
```
        Returns      Risk  Sharpe Ratio
MDT   -0.000514  0.033714     -0.311864
RMD    0.001543  0.043191     -0.195799
AHPI   0.064549  0.382719      0.142529
```

[29]:
```
table['Max Returns'] = rets.max()
```

[30]:
```
table['Min Returns'] = rets.min()
```

[31]:
```
table['Median Returns'] = rets.median()
```

[32]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[32]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
MDT   -0.000514  0.033714     -0.311864     0.101893    -0.128237
RMD    0.001543  0.043191     -0.195799     0.170376    -0.159883
AHPI   0.064549  0.382719      0.142529     3.217391    -0.347917

       Median Returns  Total Return
MDT          0.001055     -1.494608
RMD          0.002681     -1.645604
AHPI         0.011012     -5.825822
```

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

[33]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
MDT   -0.000514  0.033714     -0.311864     0.101893    -0.128237
RMD    0.001543  0.043191     -0.195799     0.170376    -0.159883
AHPI   0.064549  0.382719      0.142529     3.217391    -0.347917

      Median Returns  Total Return  Average Return Days
MDT         0.001055     -1.494608            -0.000113
RMD         0.002681     -1.645604            -0.000125
AHPI        0.011012     -5.825822            -0.000451
```

[34]:
```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[34]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
MDT   -0.000514  0.033714     -0.311864     0.101893    -0.128237
RMD    0.001543  0.043191     -0.195799     0.170376    -0.159883
AHPI   0.064549  0.382719      0.142529     3.217391    -0.347917

      Median Returns  Total Return  Average Return Days        CAGR
MDT         0.001055     -1.494608            -0.000113   -0.168462
RMD         0.002681     -1.645604            -0.000125    0.111268
AHPI        0.011012     -5.825822            -0.000451  179.583628
```

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

[35]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AHPI   0.064549  0.382719      0.142529     3.217391    -0.347917
RMD    0.001543  0.043191     -0.195799     0.170376    -0.159883
MDT   -0.000514  0.033714     -0.311864     0.101893    -0.128237

      Median Returns  Total Return  Average Return Days        CAGR
AHPI        0.011012     -5.825822            -0.000451  179.583628
RMD         0.002681     -1.645604            -0.000125    0.111268
MDT         0.001055     -1.494608            -0.000113   -0.168462
```