Toilet_Paper_Portfolio

September 29, 2021

1 Toilet Paper 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
# Toilet Paper Stock
symbols = ['CLW','ITP','KMB','PG']
start = '2019-12-01'
end = '2020-04-02'
```

[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
[**********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]:
```
121
```

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

[7]:

Date	CLW	ITP	KMB	PG
2019-12-02	21.540001	0.95	134.302536	121.995300
2019-12-03	21.850000	1.00	134.036499	122.223938
2019-12-04	22.709999	1.02	135.475098	123.794609
2019-12-05	22.530001	0.99	135.534668	123.884079
2019-12-06	22.950001	0.98	135.991333	123.456619

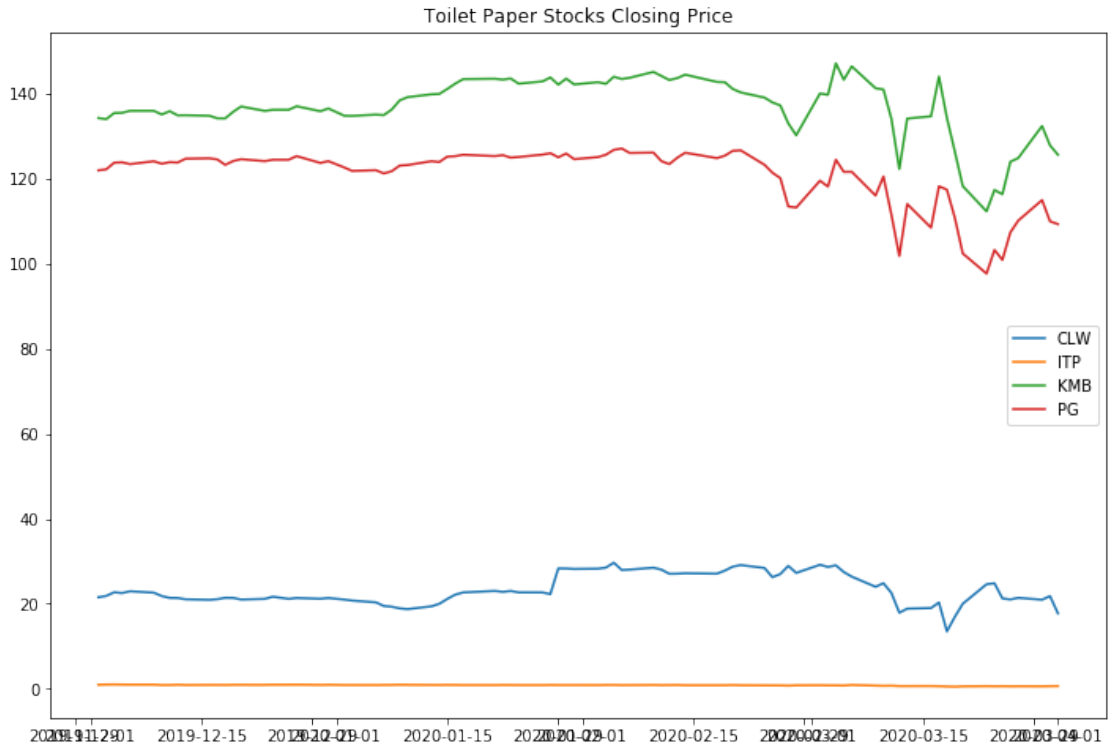
[8]:
```
df.tail()
```

[8]:

Date	CLW	ITP	KMB	PG
2020-03-26	21.020000	0.59	124.010002	107.379997
2020-03-27	21.400000	0.60	124.889999	110.169998
2020-03-30	20.959999	0.59	132.429993	115.000000
2020-03-31	21.809999	0.62	127.870003	110.000000
2020-04-01	17.750000	0.64	125.660004	109.330002

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

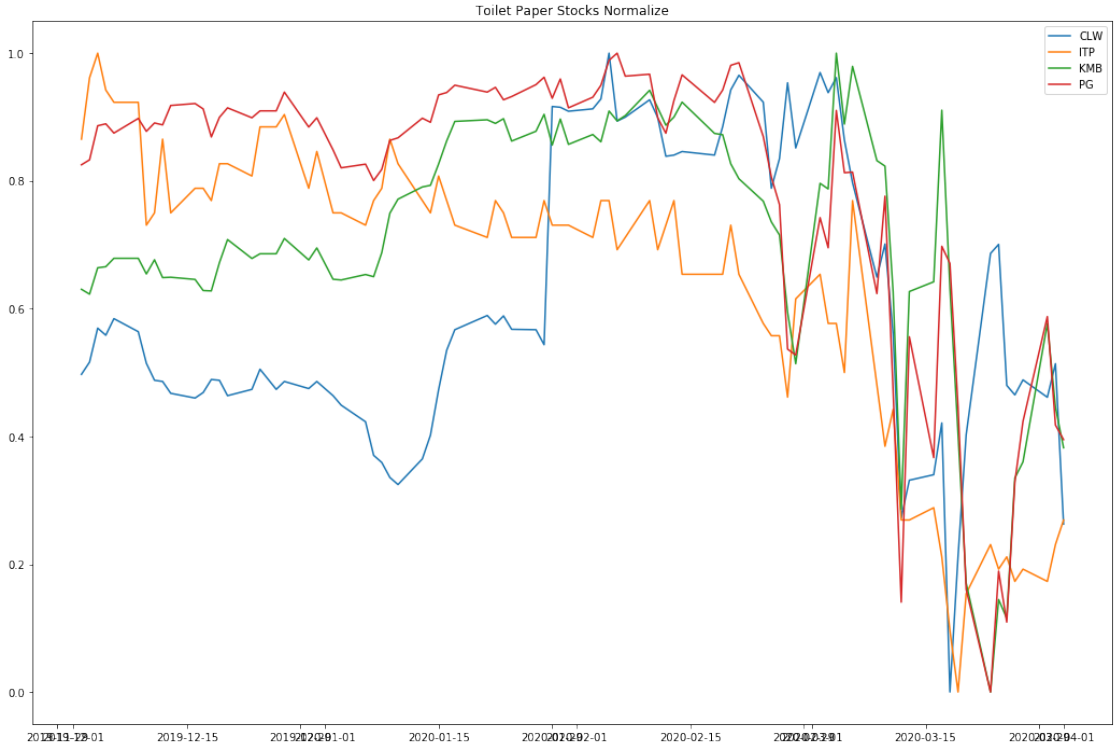
[9]:
```
<matplotlib.legend.Legend at 0x20189270c18>
```



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

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

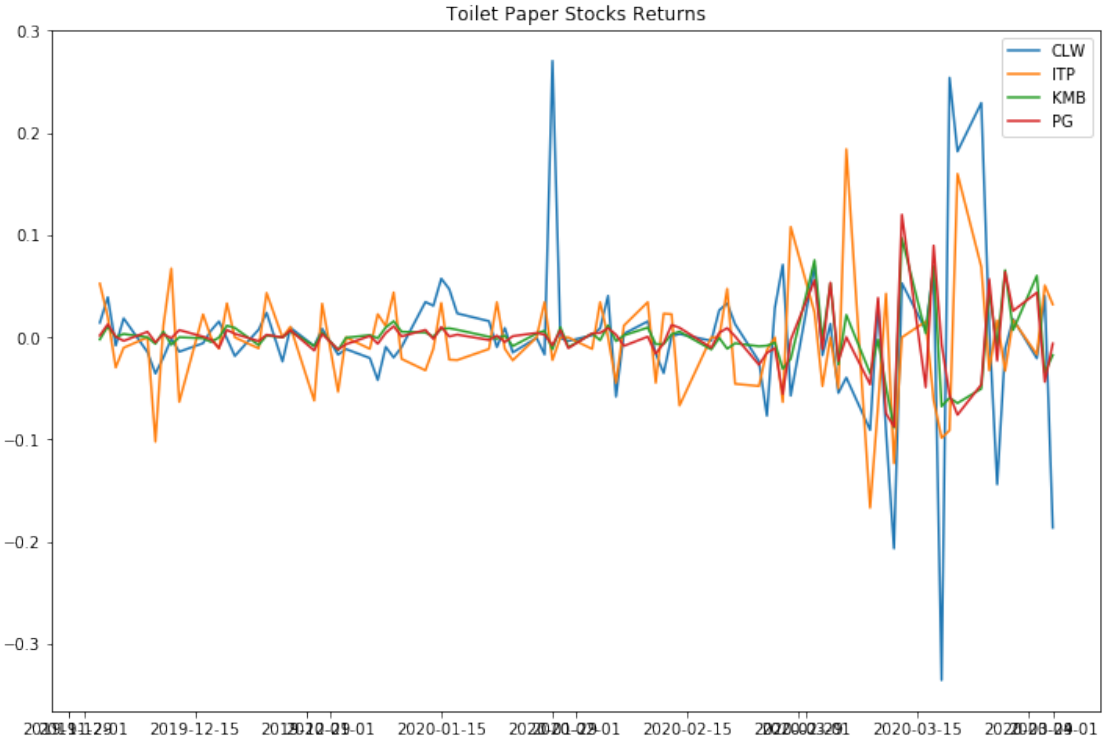
[11]: <matplotlib.legend.Legend at 0x20189515780>



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

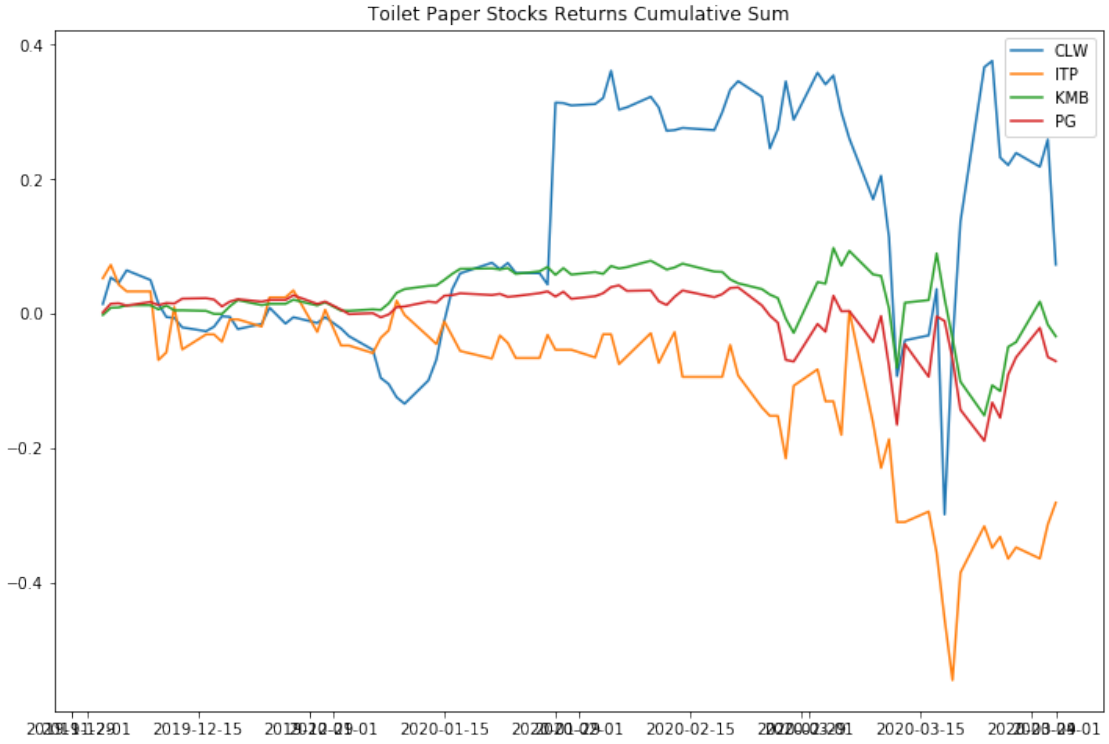
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Toilet Paper Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x201892e74a8>

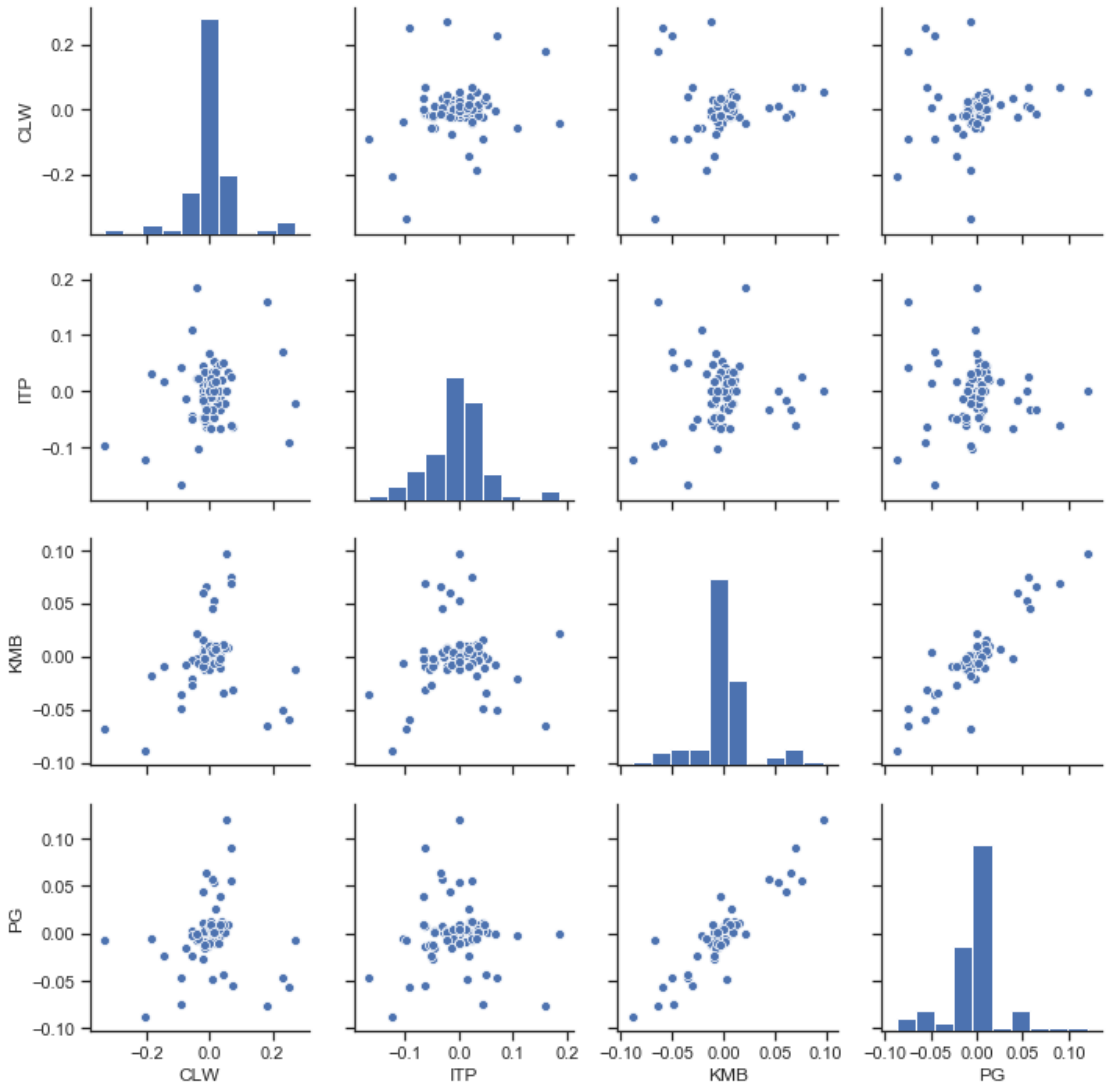


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Toilet Paper Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

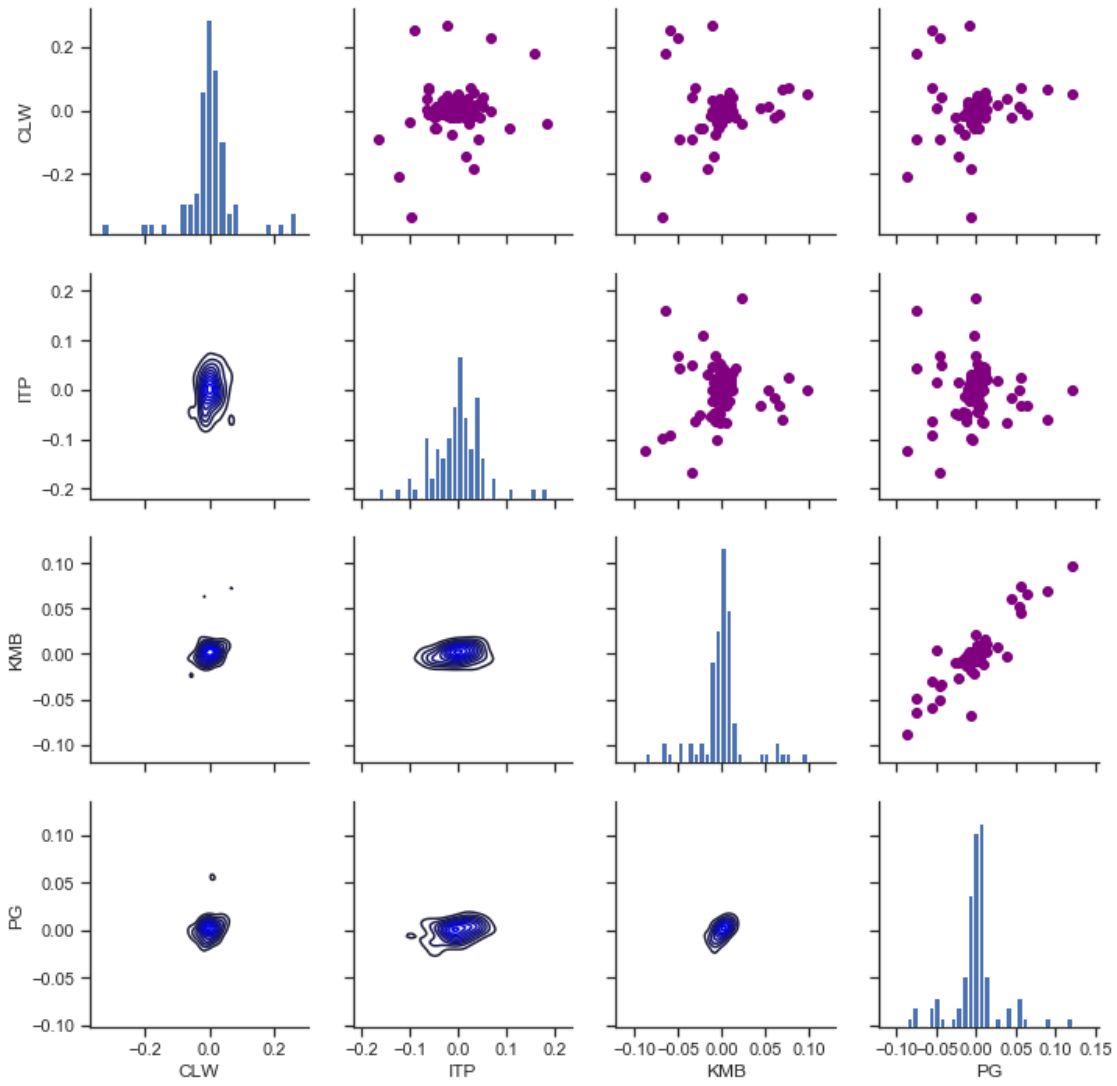
[14]: <matplotlib.legend.Legend at 0x201892cbac8>



[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)
```

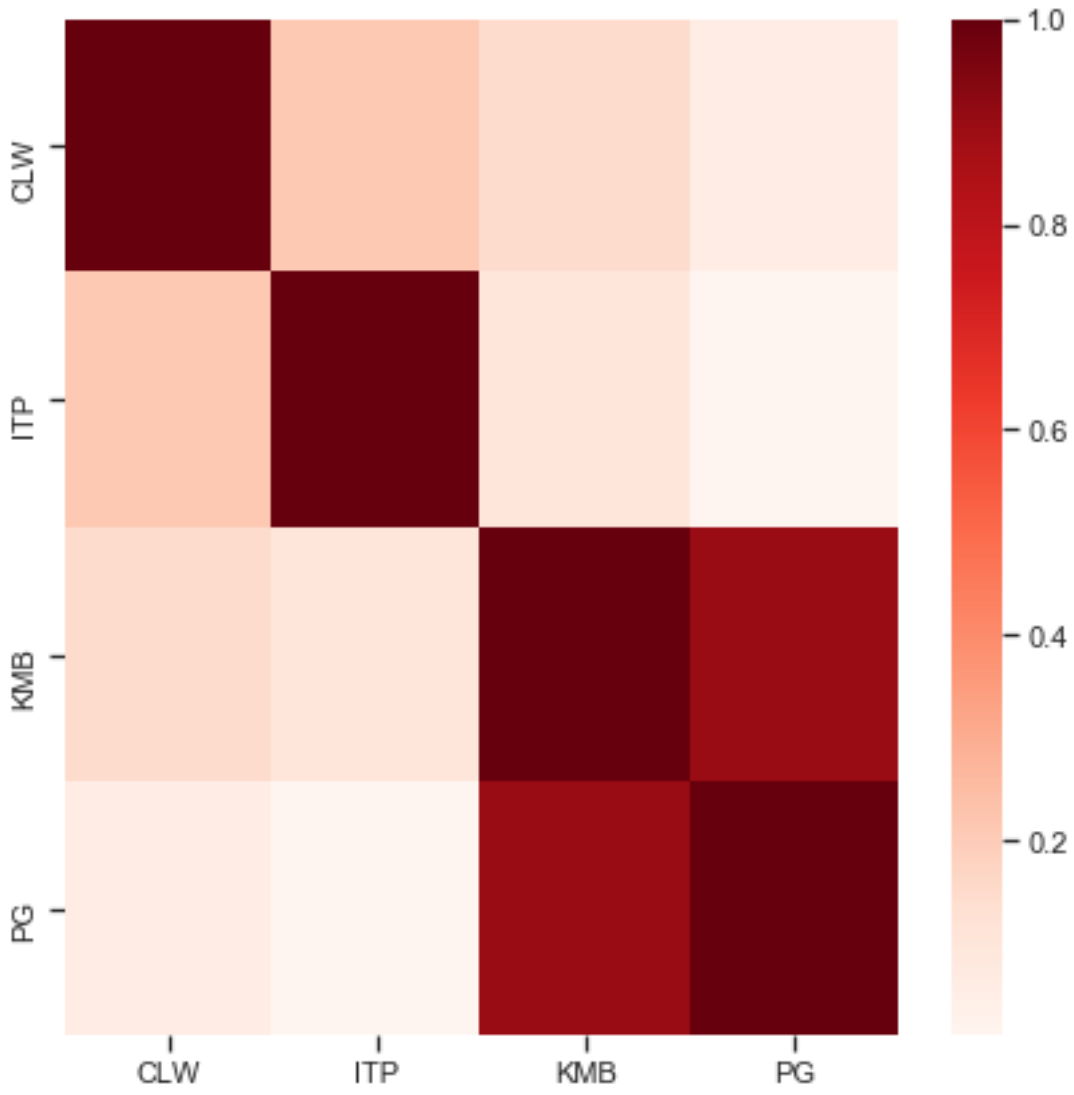


[16]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



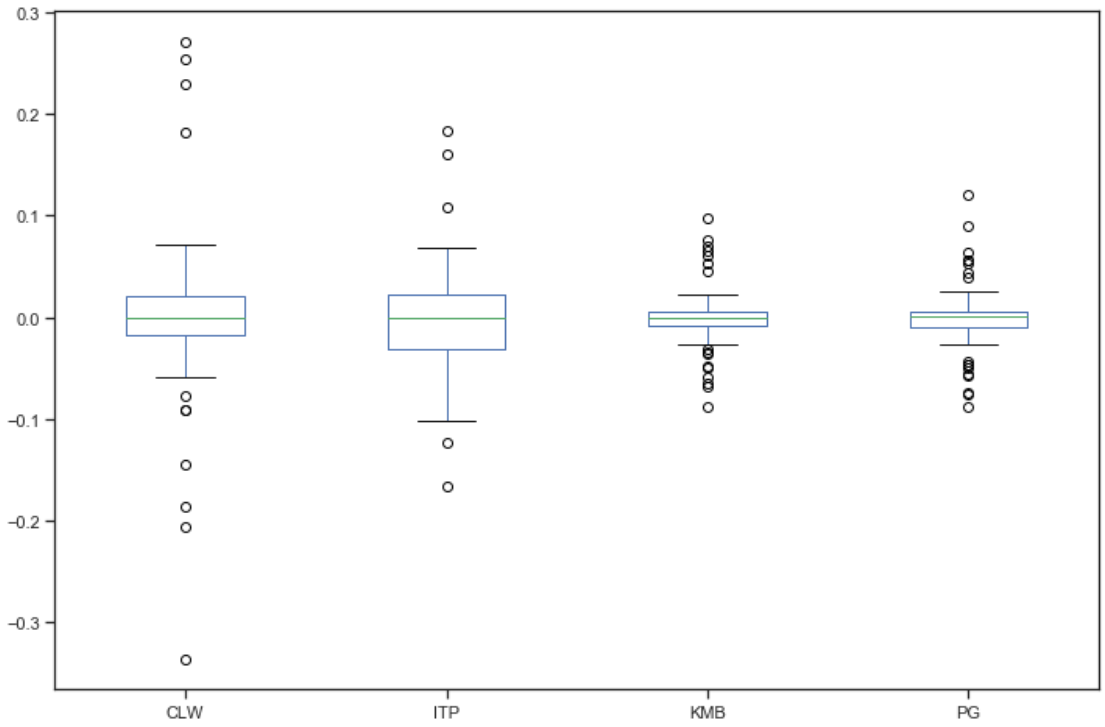
[17]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

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

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x2018a800c18>

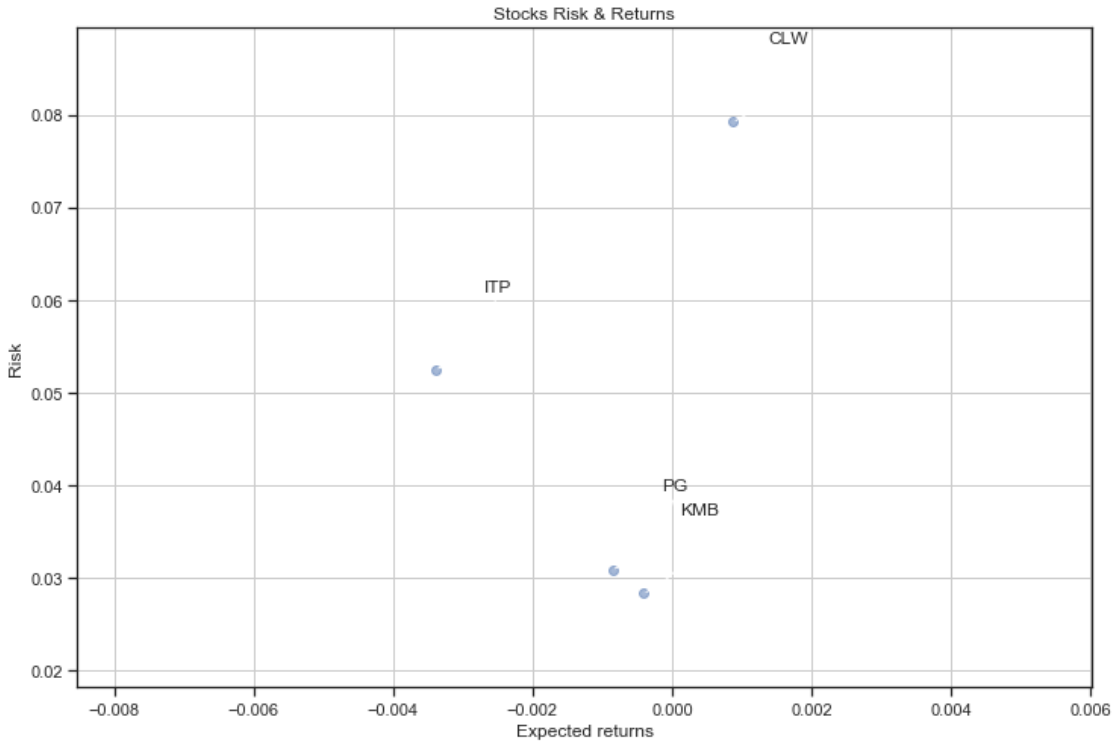


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

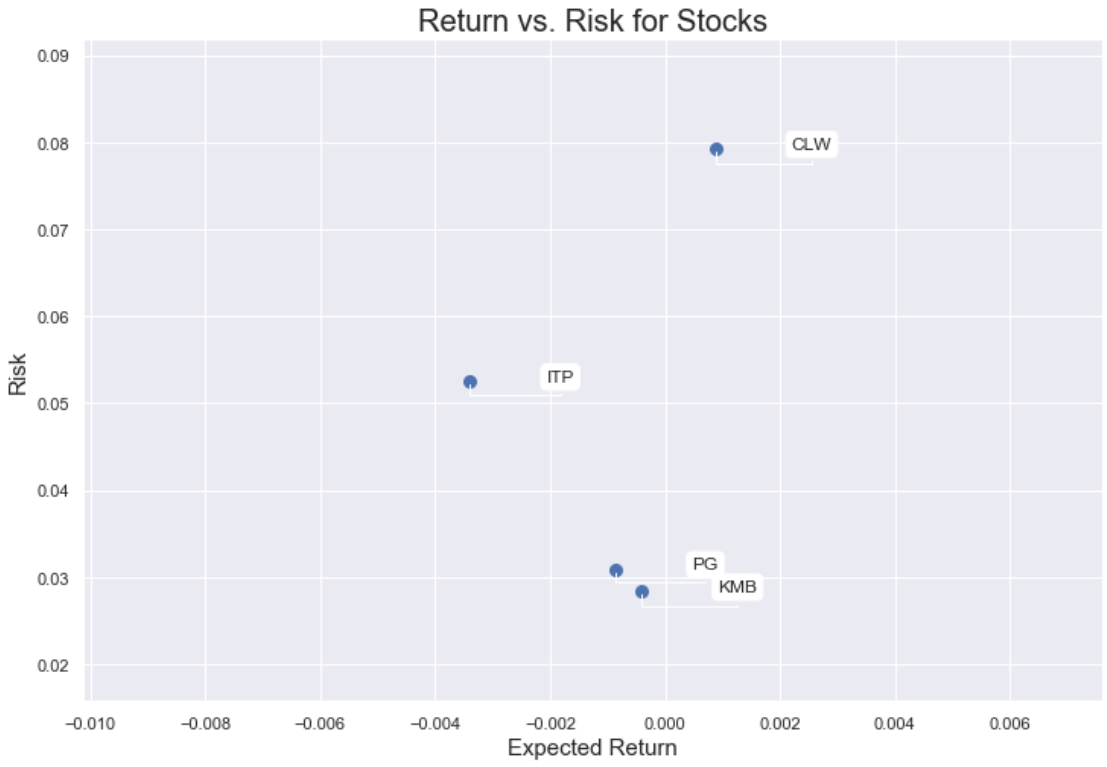
[18]: <matplotlib.axes._subplots.AxesSubplot at 0x2018c84fcc0>



[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]:
```
PG   PG     1.000000
KMB  KMB    1.000000
ITP  ITP    1.000000
CLW  CLW    1.000000
PG   KMB    0.897206
KMB  PG     0.897206
ITP  CLW    0.210960
CLW  ITP    0.210960
KMB  CLW    0.148511
CLW  KMB    0.148511
KMB  ITP    0.102046
ITP  KMB    0.102046
PG   CLW    0.062035
CLW  PG     0.062035
PG   ITP    0.009605
ITP  PG     0.009605
dtype: float64
```

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

[22]:

Date	CLW	ITP	KMB	PG
2019-12-03	0.577218	0.625000	0.465792	0.430184
2019-12-04	0.618430	0.532000	0.534375	0.483092
2019-12-05	0.540380	0.391177	0.478849	0.424634
2019-12-06	0.584233	0.446212	0.494653	0.404518
2019-12-09	0.529728	0.475000	0.476477	0.447543

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

[23]:

	CLW	ITP	KMB	PG
CLW	1.000000	0.210960	0.148511	0.062035
ITP	0.210960	1.000000	0.102046	0.009605
KMB	0.148511	0.102046	1.000000	0.897206
PG	0.062035	0.009605	0.897206	1.000000

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

[24]:
```
PG   PG     1.000000
KMB  KMB    1.000000
ITP  ITP    1.000000
CLW  CLW    1.000000
PG   KMB    0.897206
KMB  PG     0.897206
ITP  CLW    0.210960
CLW  ITP    0.210960
KMB  CLW    0.148511
CLW  KMB    0.148511
KMB  ITP    0.102046
ITP  KMB    0.102046
PG   CLW    0.062035
CLW  PG     0.062035
PG   ITP    0.009605
ITP  PG     0.009605
dtype: float64
```

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

```
Stock returns:
CLW    0.000879
ITP   -0.003388
KMB   -0.000406
PG    -0.000851
dtype: float64
--------------------------------------------------
Stock risks:
CLW    0.079225
ITP    0.052487
KMB    0.028328
PG     0.030906
dtype: float64
```

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

[26]:

	Returns	Risk
ITP	-0.003388	0.052487
PG	-0.000851	0.030906
KMB	-0.000406	0.028328
CLW	0.000879	0.079225

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

[27]:

	Returns	Risk
KMB	-0.000406	0.028328
PG	-0.000851	0.030906
ITP	-0.003388	0.052487
CLW	0.000879	0.079225

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

[28]:

	Returns	Risk	Sharpe Ratio
CLW	0.000879	0.079225	-0.115132
ITP	-0.003388	0.052487	-0.255074
KMB	-0.000406	0.028328	-0.367345
PG	-0.000851	0.030906	-0.351104

[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	\
CLW	0.000879	0.079225	-0.115132	0.270525	-0.335303	
ITP	-0.003388	0.052487	-0.255074	0.184211	-0.166667	
KMB	-0.000406	0.028328	-0.367345	0.097048	-0.088327	
PG	-0.000851	0.030906	-0.351104	0.120090	-0.087373	

	Median Returns	Total Return
CLW	-0.000441	-18.615312
ITP	0.000000	3.225803
KMB	0.000000	-1.728317
PG	0.000723	-0.609089

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

[33]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
CLW	0.000879	0.079225	-0.115132	0.270525	-0.335303	
ITP	-0.003388	0.052487	-0.255074	0.184211	-0.166667	
KMB	-0.000406	0.028328	-0.367345	0.097048	-0.088327	
PG	-0.000851	0.030906	-0.351104	0.120090	-0.087373	

	Median Returns	Total Return	Average Return Days
CLW	-0.000441	-18.615312	-0.001701
ITP	0.000000	3.225803	0.000262
KMB	0.000000	-1.728317	-0.000144
PG	0.000723	-0.609089	-0.000050

[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	\
CLW	0.000879	0.079225	-0.115132	0.270525	-0.335303	
ITP	-0.003388	0.052487	-0.255074	0.184211	-0.166667	
KMB	-0.000406	0.028328	-0.367345	0.097048	-0.088327	
PG	-0.000851	0.030906	-0.351104	0.120090	-0.087373	

	Median Returns	Total Return	Average Return Days	CAGR
CLW	-0.000441	-18.615312	-0.001701	-0.331719
ITP	0.000000	3.225803	0.000262	-0.560726

```
KMB        0.000000     -1.728317            -0.000144 -0.129361
PG         0.000723     -0.609089            -0.000050 -0.204100
```

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

[35]:
```
       Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
CLW  0.000879  0.079225     -0.115132     0.270525    -0.335303
KMB -0.000406  0.028328     -0.367345     0.097048    -0.088327
PG  -0.000851  0.030906     -0.351104     0.120090    -0.087373
ITP -0.003388  0.052487     -0.255074     0.184211    -0.166667

     Median Returns  Total Return  Average Return Days      CAGR
CLW       -0.000441    -18.615312            -0.001701 -0.331719
KMB        0.000000     -1.728317            -0.000144 -0.129361
PG         0.000723     -0.609089            -0.000050 -0.204100
ITP        0.000000      3.225803             0.000262 -0.560726
```