

Project 1

March 4, 2023

1 Purpose

I have two goals for this project:

1. To help you master data manipulation and visualization
2. To help you understand the risk-return tradeoff for several measures of risk

2 Tasks

2.1 Packages and Settings

```
[1]: import matplotlib.pyplot as plt
import numpy as np
import pandas as pd

[2]: %config InlineBackend.figure_format = 'retina'
%precision 4
pd.options.display.float_format = '{:.4f}'.format
```

2.2 Data

I used the following code cell to download the data for this project. Leave this code cell commented out and use the CSV files I provided with this notebook.

```
[3]: # import yfinance as yf
# import pandas_datareader as pdr
# import requests_cache
# session = requests_cache.CachedSession(expire_after=1)

[4]: # wiki = pd.read_html('https://en.wikipedia.org/wiki/Russell_1000_Index')

[5]: # (
#     yf.Tickers(
#         tickers=wiki[2]['Ticker'].str.replace(pat='.', repl='-', regex=False).
#         ↪to_list(),
#         session=session
#     )
#     .history(period='max', auto_adjust=False)
```

```
# .assign(Date = lambda x: x.index.tz_localize(None))
# .set_index('Date')
# .rename_axis(columns=['Variable', 'Ticker'])
# ['Adj Close']
# .pct_change()
# .loc['1962': '2022']
# .to_csv('returns.csv')
# )
```

```
[6]: # (
#     pdr.DataReader(
#         name='F-F_Research_Data_Factors_daily',
#         data_source='famafrench',
#         start='1900',
#         session=session
#     )
#     [0]
#     .rename_axis(columns='Variable')
#     .div(100)
#     .loc['1962': '2022']
#     .to_csv('ff.csv')
# )
```

Run the following code cell to read the data for this project. The `returns.csv` file contains daily returns for the Russell 1000 stocks from 1962 through 2022, and the `ff.csv` contains daily Fama and French factors from 1962 through 2022.

```
[7]: returns = pd.read_csv('returns.csv', index_col='Date', parse_dates=True)
ff = pd.read_csv('ff.csv', index_col='Date', parse_dates=True)
```

2.3 Single Stocks

For this section, use the single stock returns in `returns`. You may select years t and $t + 1$, but only use stocks with complete returns data for years t and $t + 1$.

2.3.1 Task 1: Do mean returns in year t predict mean returns in year $t + 1$?

```
[8]: start_date = '2020-01-01'
end_date = '2021-01-01'
tickers = returns.columns
mean = {}
for x in tickers:
    stock = returns[x].loc[start_date:end_date].dropna(axis=0)
    mean_returns_1 = stock.mean()
    mean[x] = mean_returns_1
output_list = []
for tickers, mean_returns in mean.items():
```

```

output_list.append(f'{tickers}: {mean_returns:.4f}')
print(output_list)

```

```

['A: 0.0016', 'AA: 0.0016', 'AAL: -0.0003', 'AAP: 0.0004', 'AAPL: 0.0028',
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```

```
[9]: mean_returns_array_1 = np.array(list(output_list))
mean_returns_array_1
```

```
[9]: array(['A: 0.0016', 'AA: 0.0016', 'AAL: -0.0003', ..., 'ZM: 0.0077',
'ZS: 0.0067', 'ZTS: 0.0012'], dtype='<U13')
```

```
[10]: start_date = '2021-01-01'
end_date = '2022-01-01'
tickers = returns.columns
mean = {}
for x in tickers:
    stock = returns[x].loc[start_date:end_date].dropna(axis=0)
    mean_returns_2 = stock.mean()
    mean[x] = mean_returns_2
output_list = []
for tickers, mean_returns_2 in mean.items():
    output_list.append(f'{tickers}: {mean_returns_2:.4f}')
print(output_list)
```

```
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 'RGLD: 0.0001', 'RH: 0.0011', 'RHI: 0.0025', 'RITM: 0.0008', 'RIVN: 0.0040',
 'RJF: 0.0020', 'RKT: 0.0001', 'RL: 0.0009', 'RMD: 0.0010', 'RNG: -0.0023', 'RNR:
 0.0002', 'ROK: 0.0015', 'ROKU: -0.0008', 'ROL: -0.0003', 'ROP: 0.0006', 'ROST:
 -0.0001', 'RPM: 0.0006', 'RPRX: -0.0006', 'RRC: 0.0047', 'RRX: 0.0017', 'RS:
 0.0014', 'RSG: 0.0016', 'RTX: 0.0009', 'RUN: -0.0016', 'RXO: nan', 'RYAN:
 0.0036', 'RYN: 0.0015', 'S: 0.0024', 'SAIC: -0.0003', 'SAM: -0.0022', 'SBAC:
 0.0014', 'SBNY: 0.0038', 'SBUX: 0.0005', 'SCCO: 0.0003', 'SCHW: 0.0021', 'SCI:
 0.0016', 'SEB: 0.0012', 'SEE: 0.0017', 'SEIC: 0.0004', 'SF: 0.0015', 'SGEN:

```

-0.0002', 'SGFY: -0.0027', 'SHC: -0.0003', 'SHW: 0.0015', 'SIRI: 0.0002', 'SITE:
0.0019', 'SIVB: 0.0025', 'SIX: 0.0013', 'SJM: 0.0008', 'SKX: 0.0010', 'SLB:
0.0017', 'SLG: 0.0012', 'SLGN: 0.0007', 'SLM: 0.0021', 'SMAR: 0.0009', 'SMG:
-0.0005', 'SNA: 0.0011', 'SNDR: 0.0012', 'SNOW: 0.0013', 'SNPS: 0.0016', 'SNV:
0.0019', 'SNX: 0.0016', 'SO: 0.0007', 'SOFI: 0.0026', 'SON: 0.0001', 'SPB:
0.0013', 'SPG: 0.0029', 'SPGI: 0.0016', 'SPLK: -0.0012', 'SPOT: -0.0008', 'SPR:
0.0009', 'SQ: -0.0007', 'SRC: 0.0010', 'SRCL: -0.0005', 'SRE: 0.0004', 'SRPT:
-0.0013', 'SSNC: 0.0006', 'SSRM: -0.0001', 'ST: 0.0008', 'STE: 0.0011', 'STLD:
0.0025', 'STT: 0.0013', 'STWD: 0.0013', 'STZ: 0.0007', 'SUI: 0.0014', 'SWK:
0.0004', 'SWKS: 0.0004', 'SWN: 0.0026', 'SYF: 0.0015', 'SYK: 0.0005', 'SYNH:
0.0018', 'SYY: 0.0004', 'T: -0.0002', 'TAP: 0.0003', 'TDC: 0.0035', 'TDG:
0.0003', 'TDOC: -0.0025', 'TDY: 0.0006', 'TEAM: 0.0023', 'TECH: 0.0022', 'TER:
0.0016', 'TFC: 0.0011', 'TFSL: 0.0004', 'TFX: -0.0007', 'TGT: 0.0012', 'THC:
0.0031', 'THG: 0.0006', 'THO: 0.0008', 'TJX: 0.0006', 'TKR: -0.0002', 'TMO:
0.0015', 'TMUS: -0.0005', 'TNDM: 0.0021', 'TNL: 0.0012', 'TOL: 0.0023', 'TOST:
-0.0070', 'TPL: 0.0027', 'TPR: 0.0014', 'TPX: 0.0025', 'TREX: 0.0022', 'TRGP:
0.0030', 'TRIP: 0.0004', 'TRMB: 0.0012', 'TROW: 0.0013', 'TRU: 0.0008', 'TRV:
0.0006', 'TSCO: 0.0023', 'TSLA: 0.0022', 'TSN: 0.0014', 'TT: 0.0015', 'TTC:
0.0003', 'TTD: 0.0015', 'TTEK: 0.0017', 'TTWO: -0.0004', 'TW: 0.0020', 'TWKS:
-0.0006', 'TWLO: -0.0004', 'TXG: 0.0009', 'TXN: 0.0008', 'TXT: 0.0020', 'TYL:
0.0010', 'U: 0.0003', 'UA: 0.0011', 'UAA: 0.0012', 'UAL: 0.0004', 'UBER:
-0.0003', 'UDR: 0.0020', 'UGI: 0.0013', 'UHAL: 0.0020', 'UHAL-B: nan', 'UHS:
-0.0001', 'UI: 0.0008', 'ULTA: 0.0016', 'UMPQ: 0.0013', 'UNH: 0.0016', 'UNM:
0.0007', 'UNP: 0.0009', 'UNVR: 0.0018', 'UPS: 0.0012', 'UPST: 0.0086', 'URI:
0.0017', 'USB: 0.0010', 'USFD: 0.0004', 'UTHR: 0.0016', 'UWMC: -0.0024', 'V:
0.0001', 'VAC: 0.0011', 'VEEV: -0.0000', 'VFC: -0.0003', 'VICI: 0.0010', 'VIRT:
0.0009', 'VLO: 0.0016', 'VMC: 0.0015', 'VMI: 0.0016', 'VMW: 0.0002', 'VNO:
0.0009', 'VNT: -0.0002', 'VOYA: 0.0006', 'VRSK: 0.0005', 'VRSN: 0.0007', 'VRT:
0.0013', 'VRTX: -0.0002', 'VSAT: 0.0017', 'VSCO: 0.0033', 'VST: 0.0011', 'VTR:
0.0004', 'VTRS: -0.0010', 'VTS: nan', 'VVV: 0.0021', 'VZ: -0.0003', 'W:
-0.0000', 'WAB: 0.0011', 'WAL: 0.0026', 'WAT: 0.0017', 'WBA: 0.0014', 'WBD:
-0.0004', 'WBS: 0.0015', 'WCC: 0.0024', 'WDAY: 0.0007', 'WDC: 0.0010', 'WE:
-0.0053', 'WEC: 0.0004', 'WELL: 0.0014', 'WEN: 0.0007', 'WEX: -0.0012', 'WFC:
0.0021', 'WH: 0.0018', 'WHR: 0.0013', 'WIX: -0.0012', 'WLK: 0.0010', 'WM:
0.0015', 'WMB: 0.0014', 'WMS: 0.0023', 'WMT: 0.0001', 'WOLF: 0.0010', 'WOOF:
-0.0012', 'WPC: 0.0009', 'WRB: 0.0011', 'WRK: 0.0003', 'WSC: 0.0024', 'WSM:
0.0025', 'WSO: 0.0015', 'WST: 0.0021', 'WTFC: 0.0019', 'WTM: 0.0002', 'WTRG:
0.0007', 'WTW: 0.0007', 'WU: -0.0005', 'WWD: -0.0002', 'WWE: 0.0004', 'WY:
0.0011', 'WYNN: -0.0008', 'X: 0.0022', 'XEL: 0.0002', 'XOM: 0.0020', 'XPO:
0.0007', 'XRAY: 0.0004', 'XYL: 0.0008', 'YETI: 0.0011', 'YUM: 0.0011', 'Z:
-0.0020', 'ZBH: -0.0006', 'ZBRA: 0.0019', 'ZG: -0.0023', 'ZI: 0.0017', 'ZION:
0.0018', 'ZM: -0.0019', 'ZS: 0.0023', 'ZTS: 0.0016']

```

```

[11]: mean_returns_array_2 = np.array(list(output_list))
      mean_returns_array_2

```

```
[11]: array(['A: 0.0013', 'AA: 0.0046', 'AAL: 0.0010', ..., 'ZM: -0.0019',
           'ZS: 0.0023', 'ZTS: 0.0016'], dtype='<U13')
```

```
[12]: start_date_1 = '2020-01-01'
end_date_1 = '2021-01-01'
tickers = returns.columns
mean_1 = {}
for x in tickers:
    stock = returns[x].loc[start_date_1:end_date_1].dropna(axis=0)
    mean_returns_1 = stock.mean()
    mean_1[x] = mean_returns_1

start_date_2 = '2021-01-01'
end_date_2 = '2022-01-01'
mean_2 = {}
for x in tickers:
    stock = returns[x].loc[start_date_2:end_date_2].dropna(axis=0)
    mean_returns_2 = stock.mean()
    mean_2[x] = mean_returns_2

mean_returns_array_1 = np.array(list(mean_1.values()))
mean_returns_array_2 = np.array(list(mean_2.values()))

print('Mean Returns 2020:', mean_returns_array_1)
print('Mean Returns 2021:', mean_returns_array_2)

mask = np.logical_not(np.logical_or(np.isnan(mean_returns_array_1), np.
    ↳ isnan(mean_returns_array_2)))
mean_returns_array_1 = mean_returns_array_1[mask]
mean_returns_array_2 = mean_returns_array_2[mask]

correlation = np.corrcoef(mean_returns_array_1, mean_returns_array_2)[0, 1]
print("Correlation between mean_1 and mean_2:", correlation)
```

```
Mean Returns 2020: [ 0.0016  0.0016 -0.0003 ...  0.0077  0.0067  0.0012]
```

```
Mean Returns 2021: [ 0.0013  0.0046  0.001 ... -0.0019  0.0023  0.0016]
```

```
Correlation between mean_1 and mean_2: 0.02651062378737305
```

The mean is the average, or the arithmetic mean that calculates the ‘sum of a set of values divided by the total number of values in the set’.

We can see the results of the data as: Year $t = 01/01/20$ to $01/01/21$ Year $t + 1 = 01/01/21$ to $01/01/22$

In year t : Mean Returns 2020: [0.0016 0.0016 -0.0003 ... 0.0077 0.0067 0.0012] In year $t + 1$: Mean Returns 2021: [0.0013 0.0046 0.001 ... -0.0019 0.0023 0.0016] Correlation between mean_1 and mean_2: 0.026510623787372928.

The return on investment depends on several factors, including the asset or investment being

considered, market conditions, and the methods used to calculate returns over different time spans. It is important to consider both significant and insignificant factors, which may or may not be known. Some returns may be positive in one year and negative in another, so past performance alone should not be relied upon when making investment decisions.

Mean returns can be used to predict future returns based on various financial factors, reports, industry trends, and regulatory reforms. However, it is crucial to consider other factors and not rely solely on past performance when making investment decisions. Correlation analysis can determine the relationship between two variables, but it cannot determine causality or predictability. Other factors, such as market trends, economic conditions, and company-specific events, can also impact returns.

To determine if mean returns in year t predict mean returns in year $t+1$, a comprehensive analysis is necessary, which takes into account various factors that could affect returns. This may include statistical modeling techniques like regression analysis and factor analysis to establish the strength and direction of any potential relationship. Overall, it is essential to conduct a thorough analysis and consider all factors when making investment decisions to achieve optimal results.

2.3.2 Task 2: Does volatility in year t predict volatility in year $t + 1$?

```
[13]: start_date_1 = '2020-01-01'
end_date_1 = '2021-01-01'
tickers = returns.columns
std_1 = {}
for x in tickers:
    stock = returns[x].loc[start_date_1:end_date_1].dropna(axis=0)
    std_returns_1 = stock.std()
    std_1[x] = std_returns_1

start_date_2 = '2021-01-01'
end_date_2 = '2022-01-01'
std_2 = {}
for x in tickers:
    stock = returns[x].loc[start_date_2:end_date_2].dropna(axis=0)
    std_returns_2 = stock.std()
    std_2[x] = std_returns_2

std_returns_array_1 = np.array(list(std_1.values()))
std_returns_array_2 = np.array(list(std_2.values()))

print('Standard Deviation 2020:',std_returns_array_1)
print('Standard Deviation 2021:',std_returns_array_2)

mask = np.logical_not(np.logical_or(np.isnan(std_returns_array_1), np.
    ↪ isnan(std_returns_array_2)))
std_returns_array_1 = std_returns_array_1[mask]
std_returns_array_2 = std_returns_array_2[mask]
```

```
correlation = np.corrcoef(std_returns_array_1, std_returns_array_2)[0, 1]
print("Correlation between std_1 and std_2:", correlation)
```

```
Standard Deviation 2020: [0.023  0.0513 0.0656 ... 0.0539 0.0437 0.0246]
Standard Deviation 2021: [0.013  0.0396 0.0297 ... 0.0322 0.0283 0.0125]
Correlation between std_1 and std_2: 0.582951195894022
```

Volatility is a measure of the degree of variation or fluctuation in the price of a stock over a given period and is often used as an indicator of risk. High volatility generally indicates higher risk, while low volatility suggests lower risk. The calculation of volatility can be done using methods such as standard deviation and beta, and it can be influenced by various factors such as market conditions, economic factors, and investor sentiment. Trading strategies and portfolio risk management can be determined using volatility.

We can see the results of the data as: Year $t = 01/01/20$ to $01/01/21$ Year $t + 1 = 01/01/21$ to $01/01/22$

```
Standard Deviation 2020: [0.023 0.0513 0.0656 ... 0.0539 0.0437 0.0246] Standard Deviation
2021: [0.013 0.0396 0.0297 ... 0.0322 0.0283 0.0125] Correlation between std_1 and std_2:
0.5829511958940219
```

While correlation and volatility are different measures, they are both important when assessing the risk and potential returns of financial assets. For example, two assets may have a high correlation but very different levels of volatility, or two assets may have a low correlation but similar levels of volatility. Therefore, it is important to consider both measures in conjunction with other factors when making investment decisions.

Risk can be divided into systemic risk and non-systemic risk, and it is generally better to have high systemic risk compared to non-systemic risk. However, high volatility may not always result in higher returns, as increased uncertainty and risk may create expectations of high returns to compensate for the additional risk.

Overall, while volatility can provide information on future returns, it is important to consider other factors and not rely solely on past performance when making investment decisions. There is always a risk of uncertainty as well as non-systematic risk, and a comprehensive analysis of all relevant factors is necessary to make informed investment decisions.

2.3.3 Task 3: Do Sharpe Ratios in year t predict Sharpe Ratios in year $t + 1$?

```
[14]: start_date_1 = '2020-01-01'
end_date_1 = '2021-01-01'
risk_free_rate = ff.loc[start_date_1:end_date_1].dropna(axis=0)
risk_free_rate_1 = risk_free_rate.RF.mean()
tickers = returns.columns
sharpe_1 = {}
std_1 = {}
for x in tickers:
    stock = returns[x].loc[start_date_1:end_date_1].dropna(axis=0)
    mean_returns_1 = stock.mean()
    std_returns_1 = stock.std()
```

```

    excess_returns_1 = mean_returns_1 - risk_free_rate_1
    sharpe_ratio_1 = excess_returns_1 / std_returns_1
    sharpe_1[x] = sharpe_ratio_1
    std_1[x] = std_returns_1

start_date_2 = '2021-01-01'
end_date_2 = '2022-01-01'
risk_free_rate = ff.loc[start_date_2:end_date_2].dropna(axis=0)
risk_free_rate_2 = risk_free_rate.RF.mean()
sharpe_2 = {}
std_2 = {}
for x in tickers:
    stock = returns[x].loc[start_date_2:end_date_2].dropna(axis=0)
    mean_returns_2 = stock.mean()
    std_returns_2 = stock.std()
    excess_returns_2 = mean_returns_2 - risk_free_rate_2
    sharpe_ratio_2 = excess_returns_2 / std_returns_2
    sharpe_2[x] = sharpe_ratio_2
    std_2[x] = std_returns_2

sharpe_array_1 = np.array(list(sharpe_1.values()))
sharpe_array_2 = np.array(list(sharpe_2.values()))
print('Sharpe Ratio 2020:', sharpe_array_1)
print('Sharpe Ratio 2021:', sharpe_array_2)

std_returns_array_1 = np.array(list(std_1.values()))
std_returns_array_2 = np.array(list(std_2.values()))

mask = np.logical_not(np.logical_or(np.isnan(sharpe_array_1), np.
    ↪isnan(sharpe_array_2)))
sharpe_array_1 = sharpe_array_1[mask]
sharpe_array_2 = sharpe_array_2[mask]
std_returns_array_1 = std_returns_array_1[mask]
std_returns_array_2 = std_returns_array_2[mask]

correlation = np.corrcoef(sharpe_array_1, sharpe_array_2)[0, 1]
print("Correlation between Sharpe Ratio 1 and Sharpe Ratio 2: {:.4f}".
    ↪format(correlation))

```

```

Sharpe Ratio 2020: [ 0.0683  0.0306 -0.0048 ...  0.143   0.1527  0.0486]
Sharpe Ratio 2021: [ 0.0993  0.115   0.032  ... -0.0583  0.0808  0.1312]
Correlation between Sharpe Ratio 1 and Sharpe Ratio 2: -0.1635

```

The Sharpe ratio is a metric used to assess the performance of an investment by adjusting the return earned for the amount of risk taken on. By subtracting the risk-free return from the return on the stock, the Sharpe ratio measures the return per unit of risk.

The sharp ratio is:

Sharpe ratio = (Return of the investment - Risk-free rate of return) / Standard deviation of the investment's return

Year t = 01/01/20 to 01/01/21 Year $t + 1$ = 01/01/21 to 01/01/22

Sharpe Ratio 2020: [0.0683 0.0306 -0.0048 ... 0.143 0.1527 0.0486] Sharpe Ratio 2021: [0.0993 0.115 0.032 ... -0.0583 0.0808 0.1312] Correlation between Sharpe Ratio 1 and Sharpe Ratio 2: -0.1635

A higher Sharpe ratio suggests higher return per unit of risk, while a lower Sharpe ratio suggests lower return per unit of risk. It is an important tool for comparing the risk-adjusted returns of different investments and evaluating investment performance over time. However, it should be used in conjunction with other metrics and analysis.

An increasing Sharpe ratio is generally considered better as it indicates that the investment is generating a higher return per unit of risk. Conversely, a negative Sharpe ratio suggests a decrease in the company's share value. It is important to note that the Sharpe ratio is just one of many metrics used to evaluate investment performance and should be interpreted in light of other relevant factors.

2.3.4 Task 4: Do CAPM betas in year t predict CAPM betas in year $t + 1$?

```
[15]: a = returns.loc['2020':'2021'].dropna(axis=1)
a
```

```
[15]:
```

	A	AA	AAL	AAP	...	ZION	ZM	ZS	ZTS
Date					...				
2020-01-02	0.0075	-0.0042	0.0143	-0.0047	...	0.0100	0.0100	0.0178	0.0135
2020-01-03	-0.0161	0.0037	-0.0495	0.0001	...	-0.0141	-0.0210	0.0011	0.0001
2020-01-06	0.0030	-0.0233	-0.0119	-0.0164	...	-0.0122	0.0452	0.0279	-0.0077
2020-01-07	0.0031	0.0152	-0.0037	-0.0119	...	-0.0061	0.0225	-0.0062	0.0034
2020-01-08	0.0099	-0.0403	0.0228	-0.0115	...	0.0099	0.0090	0.0486	-0.0022
...
2021-12-27	0.0060	0.0079	-0.0049	0.0188	...	0.0104	-0.0220	0.0213	0.0165
2021-12-28	0.0028	-0.0107	0.0204	0.0069	...	0.0016	-0.0196	-0.0159	-0.0092
2021-12-29	0.0092	0.0074	-0.0264	0.0122	...	0.0054	-0.0107	-0.0046	0.0114
2021-12-30	0.0014	-0.0070	0.0011	-0.0146	...	-0.0050	0.0479	0.0044	-0.0076
2021-12-31	-0.0076	0.0062	-0.0061	0.0099	...	0.0005	-0.0347	-0.0100	-0.0046

[505 rows x 925 columns]

```
[16]: returns_1 = a.loc['2020']
returns_1
```

```
[16]:
```

	A	AA	AAL	AAP	...	ZION	ZM	ZS	ZTS
Date					...				
2020-01-02	0.0075	-0.0042	0.0143	-0.0047	...	0.0100	0.0100	0.0178	0.0135
2020-01-03	-0.0161	0.0037	-0.0495	0.0001	...	-0.0141	-0.0210	0.0011	0.0001
2020-01-06	0.0030	-0.0233	-0.0119	-0.0164	...	-0.0122	0.0452	0.0279	-0.0077
2020-01-07	0.0031	0.0152	-0.0037	-0.0119	...	-0.0061	0.0225	-0.0062	0.0034


```

2020-01-08  0.0099 -0.0403  0.0228 -0.0115 ...  0.0099  0.0090  0.0486 -0.0022
...
2020-12-24  0.0001 -0.0117 -0.0145  0.0087 ... -0.0039 -0.0227 -0.0106  0.0054
2020-12-28  0.0044  0.0128  0.0255 -0.0117 ...  0.0005 -0.0634 -0.0287  0.0104
2020-12-29 -0.0051 -0.0090 -0.0125 -0.0133 ... -0.0136  0.0067 -0.0077  0.0045
2020-12-30  0.0014  0.0413  0.0183  0.0062 ...  0.0105 -0.0010  0.0175  0.0071
2020-12-31  0.0094  0.0044 -0.0235 -0.0010 ...  0.0051 -0.0455 -0.0079  0.0075

```

[253 rows x 925 columns]

```
[17]: returns_2 = a.loc['2021']
      returns_2
```

```

[17]:
           A      AA      AAL      AAP ...  ZION      ZM      ZS      ZTS
Date
2021-01-04  0.0029  0.0087 -0.0406 -0.0011 ... -0.0117  0.0672 -0.0181 -0.0115
2021-01-05  0.0082  0.0181  0.0198 -0.0011 ...  0.0158  0.0024 -0.0133  0.0070
2021-01-06  0.0274  0.0651  0.0058  0.0578 ...  0.1124 -0.0455 -0.0468  0.0147
2021-01-07  0.0266  0.0008 -0.0090  0.0085 ...  0.0305 -0.0055  0.0468 -0.0009
2021-01-08  0.0071 -0.0095 -0.0163  0.0143 ... -0.0254  0.0208  0.0224  0.0066
...
2021-12-27  0.0060  0.0079 -0.0049  0.0188 ...  0.0104 -0.0220  0.0213  0.0165
2021-12-28  0.0028 -0.0107  0.0204  0.0069 ...  0.0016 -0.0196 -0.0159 -0.0092
2021-12-29  0.0092  0.0074 -0.0264  0.0122 ...  0.0054 -0.0107 -0.0046  0.0114
2021-12-30  0.0014 -0.0070  0.0011 -0.0146 ... -0.0050  0.0479  0.0044 -0.0076
2021-12-31 -0.0076  0.0062 -0.0061  0.0099 ...  0.0005 -0.0347 -0.0100 -0.0046

```

[252 rows x 925 columns]

```

[18]: def beta(ri, rf=ff['RF'], rm_rf=ff['Mkt-RF']):
      ri_rf = ri.sub(rf).dropna(axis=0)
      return ri_rf.cov(rm_rf) / rm_rf.loc[ri_rf.index].var()

      beta_2020 = returns_1.apply(beta)
      print('Beta 2020:', beta_2020)

```

```

Beta 2020: A      0.8770
AA      1.5221
AAL      1.3442
AAP      0.9627
AAPL     1.1174
...
ZG      1.3130
ZION     1.0313
ZM     -0.1166
ZS      0.6140
ZTS      0.9147

```

Length: 925, dtype: float64

```
[19]: beta_2021 = returns_2.apply(beta)
      print('Beta 2021:', beta_2021)
```

Beta 2021: A 0.9428

AA 1.7329

AAL 1.1604

AAP 0.7107

AAPL 1.1956

...

ZG 1.9377

ZION 1.2571

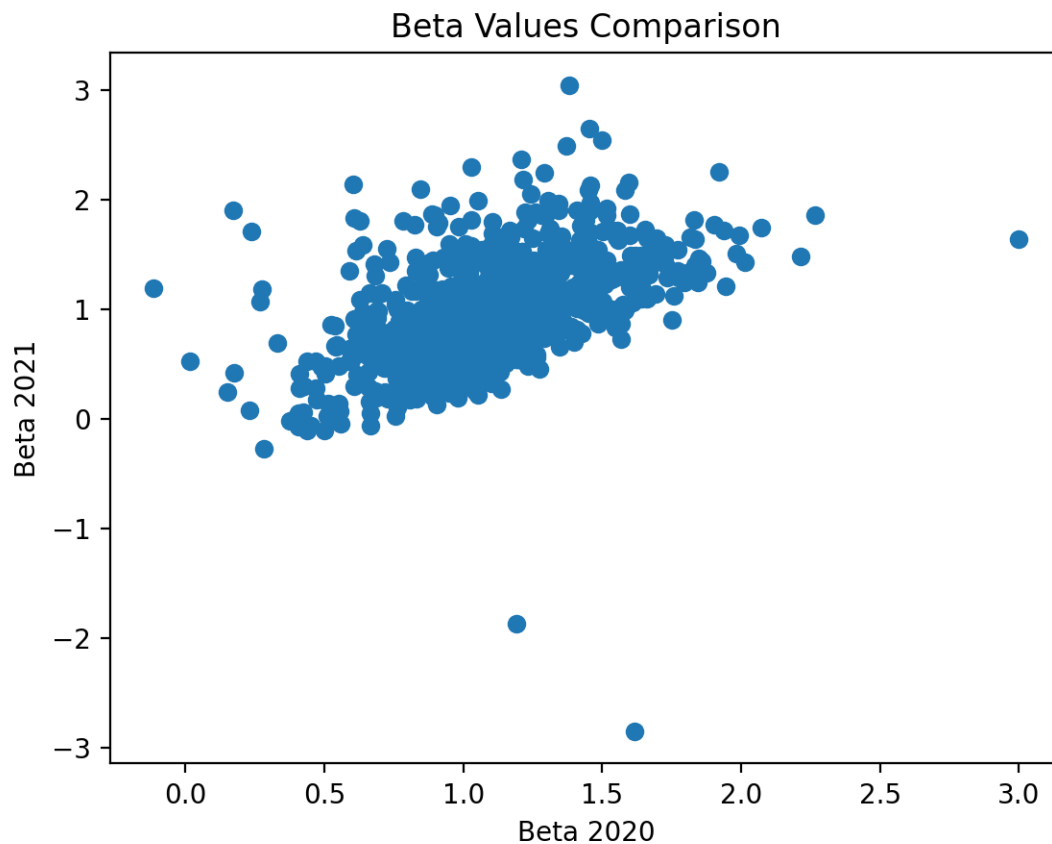
ZM 1.1930

ZS 1.5391

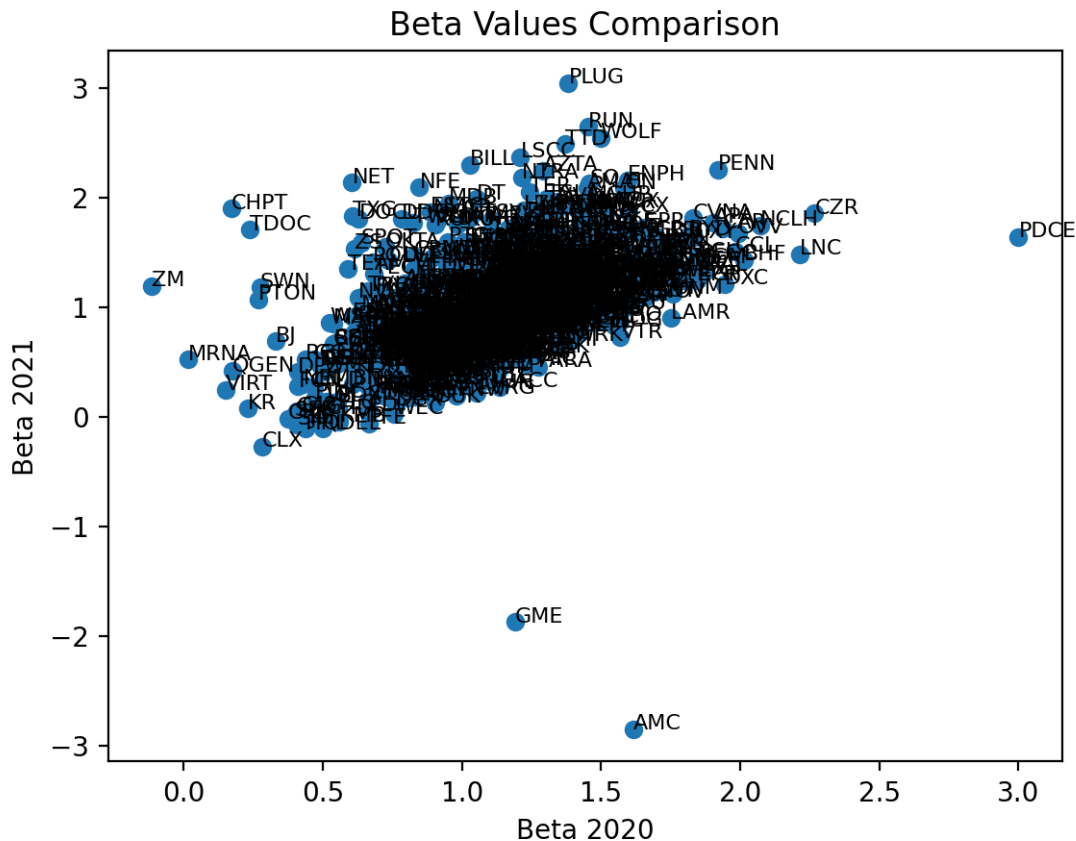
ZTS 0.7322

Length: 925, dtype: float64

```
[20]: plt.scatter(beta_2020, beta_2021)
      plt.title('Beta Values Comparison')
      plt.xlabel('Beta 2020')
      plt.ylabel('Beta 2021')
      plt.show()
```



```
[21]: plt.scatter(beta_2020, beta_2021)
plt.title('Beta Values Comparison')
plt.xlabel('Beta 2020')
plt.ylabel('Beta 2021')
for i in returns:
    if i in beta_2020 and i in beta_2021:
        plt.text(x=beta_2020[i], y=beta_2021[i], s=i, fontsize= 8)
plt.show()
```



```
[22]: print('Correlation between Beta 2020 and Beta 2021: {:.4f}'.format(np.
↪corrcoef(beta_2020, beta_2021)[0,1]))
```

Correlation between Beta 2020 and Beta 2021: 0.5062

Beta is a metric that measures the systematic risk associated with a security or portfolio in relation to the market. It is also known as a sensitivity factor because it reflects how much a security's return changes in response to changes in the market's beta, which is set at 1.

$$\text{CAPM} = R_f + \text{Beta} \cdot (R_m - R_f)$$

Year $t = 01/01/20$ to $01/01/21$ Year $t + 1 = 01/01/21$ to $01/01/22$

Upon examining the given data, it can be observed that some betas are positive while others are negative. A beta greater than 1 suggests that the stock's volatility is higher than that of the market, and vice versa. On the other hand, a beta of 0 indicates a risk-free security.

If there is a positive correlation between the betas in year t and year $t+1$, then the past betas can be a valuable predictor of future betas. However, if the correlation is low or negative, then the past betas cannot be relied upon to predict future betas, and other factors such as unsystematic risk may be more significant in determining a company's beta. Therefore, predicting CAPM betas in year $t+1$ may not always be feasible due to the presence of other factors, as evidenced by the high variability in ZM beta.

2.3.5 Task 5: Does volatility in year t predict *mean returns* in year $t + 1$?

```
[23]: start_date_1 = '2020-01-01'
end_date_1 = '2021-01-01'
start_date_2 = '2021-01-01'
end_date_2 = '2022-01-01'

volatility_1 = {}
mean_returns_2 = {}

for x in tickers:
    stock = returns[x].loc[start_date_1:end_date_1].dropna()
    volatility_1[x] = stock.std()
    stock_2 = returns[x].loc[start_date_2:end_date_2].dropna()
    mean_returns_2[x] = stock_2.mean()

volatility_array_1 = np.array(list(volatility_1.values()))
mean_returns_array_2 = np.array(list(mean_returns_2.values()))

mask = np.logical_not(np.logical_or(np.isnan(volatility_array_1), np.
    ↪ isnan(mean_returns_array_2)))
volatility_array_1 = volatility_array_1[mask]
mean_returns_array_2 = mean_returns_array_2[mask]
print('Volatility 2020:', volatility_array_1)
print('Mean Returns 2021:', mean_returns_array_2)

correlation = np.corrcoef(volatility_array_1, mean_returns_array_2)[0, 1]
print("Correlation between volatility in 2020 and mean returns in year 2020: {:.
    ↪ 4f}".format(correlation))
```

```
Volatility 2020: [0.023  0.0513 0.0656 0.0292 0.0294 0.022  0.0262 0.0497 0.0247
0.0361
0.0526 0.0193 0.0349 0.0263 0.0302 0.0315 0.0252 0.028  0.0317 0.0516
0.0272 0.0243 0.0366 0.0441 0.0366 0.0356 0.0305 0.0475 0.0277 0.0447
0.0271 0.0305 0.0254 0.0239 0.0668 0.0387 0.051  0.045  0.0501 0.027
0.0288 0.0475 0.0282 0.0283 0.0503 0.0371 0.0882 0.0299 0.0385 0.029
```

0.0314	0.0366	0.0241	0.0269	0.0434	0.0276	0.0243	0.0383	0.0308	0.029
0.0251	0.0239	0.0767	0.0277	0.0257	0.0415	0.0452	0.0755	0.0264	0.0321
0.0531	0.0302	0.0297	0.0262	0.0211	0.0294	0.0244	0.0318	0.0323	0.0345
0.0393	0.0306	0.0341	0.027	0.0417	0.0404	0.0303	0.0343	0.0378	0.0514
0.024	0.026	0.0343	0.0387	0.0551	0.0369	0.0223	0.025	0.0233	0.0613
0.0325	0.0434	0.0229	0.0341	0.028	0.0281	0.0267	0.0251	0.0396	0.0301
0.0562	0.0435	0.0502	0.0258	0.0324	0.0307	0.0221	0.0329	0.0443	0.0461
0.0513	0.0301	0.0353	0.0187	0.0367	0.0443	0.0393	0.0228	0.022	0.0307
0.0239	0.0502	0.0279	0.0344	0.0378	0.0319	0.025	0.0329	0.0367	0.0592
0.0424	0.0288	0.0411	0.0275	0.0213	0.0289	0.0774	0.0405	0.0276	0.0283
0.0304	0.0273	0.0393	0.0312	0.0556	0.0204	0.0269	0.0311	0.0761	0.0381
0.0291	0.0313	0.0337	0.0691	0.0368	0.048	0.0403	0.0354	0.0359	0.0207
0.0492	0.0263	0.0336	0.0435	0.0207	0.022	0.0336	0.0311	0.0373	0.02
0.0515	0.0459	0.0317	0.0203	0.0478	0.0241	0.0298	0.0313	0.0275	0.0244
0.0306	0.0337	0.0369	0.0747	0.0455	0.0425	0.0287	0.0331	0.025	0.0457
0.0184	0.0672	0.0392	0.0585	0.0203	0.0655	0.0276	0.0294	0.0369	0.0337
0.0313	0.0333	0.0369	0.0412	0.0264	0.0282	0.0295	0.0289	0.0327	0.0329
0.0333	0.0303	0.032	0.0254	0.0362	0.0715	0.0249	0.0384	0.0356	0.081
0.0283	0.0507	0.0364	0.0396	0.0333	0.0275	0.0322	0.0415	0.0287	0.0366
0.0328	0.0318	0.0529	0.0196	0.026	0.0374	0.0211	0.0507	0.0309	0.0399
0.051	0.0427	0.0272	0.0273	0.0299	0.0219	0.0381	0.0291	0.039	0.0219
0.0274	0.0521	0.0397	0.03	0.026	0.0261	0.0608	0.0606	0.0348	0.0229
0.024	0.0306	0.0259	0.0399	0.0264	0.034	0.0275	0.0285	0.0257	0.0352
0.03	0.0345	0.0323	0.0339	0.0477	0.0647	0.033	0.047	0.0342	0.0704
0.0449	0.0255	0.032	0.0543	0.0306	0.0285	0.034	0.0316	0.0364	0.0325
0.0295	0.045	0.0256	0.0387	0.031	0.0279	0.042	0.0495	0.0308	0.0349
0.0403	0.0203	0.0446	0.026	0.0355	0.0339	0.065	0.0245	0.0361	0.0281
0.036	0.0452	0.0284	0.033	0.0333	0.026	0.0394	0.0478	0.0369	0.0284
0.0294	0.0463	0.0422	0.0316	0.0215	0.0398	0.034	0.0323	0.0474	0.0406
0.0339	0.041	0.0304	0.0308	0.0288	0.0301	0.0414	0.0424	0.0386	0.0346
0.0291	0.0371	0.0376	0.0299	0.0254	0.033	0.0398	0.0237	0.0255	0.0382
0.0236	0.0194	0.0333	0.0398	0.0461	0.032	0.0384	0.0745	0.0306	0.0331
0.0241	0.0266	0.0241	0.0242	0.0327	0.0254	0.0346	0.059	0.0236	0.0329
0.039	0.0271	0.0267	0.0419	0.0586	0.0343	0.0412	0.0406	0.0383	0.0274
0.0294	0.0353	0.0348	0.0502	0.0422	0.0409	0.0286	0.0373	0.0324	0.049
0.0293	0.0285	0.0346	0.0402	0.0344	0.0279	0.0382	0.019	0.0279	0.0435
0.0235	0.0288	0.0384	0.032	0.0352	0.0487	0.0488	0.0343	0.0336	0.0334
0.0277	0.0294	0.0257	0.024	0.0258	0.0265	0.026	0.0242	0.0255	0.029
0.0268	0.0289	0.0336	0.0298	0.0309	0.0273	0.0327	0.036	0.0333	0.0312
0.0322	0.0282	0.0287	0.0309	0.0337	0.0269	0.0469	0.0268	0.0298	0.0286
0.0334	0.0259	0.0364	0.0561	0.0267	0.0347	0.0381	0.025	0.0395	0.0191
0.0232	0.0342	0.0597	0.0199	0.0421	0.0241	0.0398	0.0478	0.0277	0.0272
0.0479	0.0337	0.0379	0.0197	0.0351	0.0305	0.0365	0.0247	0.0218	0.0201
0.0333	0.0616	0.0369	0.0431	0.0515	0.0347	0.0235	0.0236	0.0033	0.0276
0.0365	0.0268	0.0421	0.043	0.0445	0.0402	0.0332	0.0325	0.026	0.0247
0.0246	0.0354	0.0414	0.0268	0.0259	0.0604	0.0335	0.0243	0.0274	0.032
0.0413	0.0443	0.04	0.0358	0.0269	0.0251	0.038	0.0357	0.0322	0.0331
0.0393	0.0369	0.0367	0.0442	0.0548	0.0458	0.0584	0.0308	0.0291	0.0339

0.0404	0.042	0.0264	0.0238	0.0334	0.0252	0.0386	0.0288	0.0317	0.0393
0.0215	0.026	0.0364	0.0379	0.0289	0.0599	0.0468	0.0437	0.0241	0.0321
0.038	0.0296	0.0349	0.0229	0.0235	0.0226	0.0229	0.0344	0.0212	0.0495
0.0495	0.0526	0.0348	0.0389	0.0344	0.0201	0.0639	0.0594	0.0374	0.0408
0.034	0.0362	0.0323	0.0329	0.0276	0.0285	0.0277	0.0254	0.0405	0.0349
0.0257	0.0541	0.0321	0.0423	0.0362	0.0338	0.0305	0.0829	0.041	0.0542
0.0267	0.0317	0.0262	0.029	0.0436	0.0227	0.0388	0.0464	0.0262	0.0291
0.0283	0.0261	0.0385	0.0416	0.0251	0.0552	0.0315	0.0302	0.0317	0.0302
0.0329	0.0486	0.0518	0.0331	0.0313	0.1059	0.0388	0.0364	0.0383	0.0375
0.0375	0.0358	0.0316	0.031	0.0478	0.0316	0.0259	0.0367	0.0363	0.0264
0.0279	0.0522	0.0589	0.0322	0.033	0.0359	0.051	0.0307	0.0547	0.0488
0.0591	0.0256	0.0333	0.0264	0.0379	0.0318	0.0257	0.081	0.0375	0.069
0.0418	0.0496	0.0411	0.0274	0.0451	0.041	0.0409	0.0304	0.0381	0.0228
0.0465	0.0371	0.1225	0.0367	0.0255	0.0308	0.0332	0.0813	0.023	0.0225
0.0413	0.0712	0.0204	0.0233	0.0377	0.0417	0.0412	0.0253	0.0525	0.0654
0.0287	0.0237	0.029	0.0526	0.0708	0.0613	0.0246	0.0363	0.0428	0.0304
0.0278	0.0306	0.0297	0.0227	0.0313	0.0274	0.0295	0.0295	0.0344	0.0425
0.023	0.0407	0.044	0.0284	0.0472	0.0567	0.0308	0.0494	0.033	0.0332
0.0547	0.0197	0.0359	0.1469	0.0395	0.0434	0.0715	0.0311	0.0441	0.0272
0.0292	0.0226	0.0444	0.0462	0.0309	0.0347	0.0512	0.0325	0.0652	0.0363
0.0464	0.0394	0.0307	0.0409	0.0272	0.0309	0.0463	0.0238	0.0258	0.0362
0.0277	0.0256	0.0607	0.0329	0.0289	0.0219	0.0362	0.0538	0.0359	0.0325
0.0367	0.0268	0.0435	0.0287	0.0305	0.0336	0.0267	0.0248	0.0342	0.0287
0.0403	0.03	0.0305	0.027	0.0269	0.0407	0.0405	0.06	0.0206	0.0384
0.0488	0.0509	0.019	0.035	0.0401	0.0333	0.0307	0.0227	0.0511	0.0268
0.054	0.0366	0.029	0.029	0.0414	0.0577	0.0293	0.0382	0.0347	0.0676
0.0459	0.0472	0.0342	0.0296	0.0319	0.0281	0.0413	0.0342	0.0241	0.0386
0.0369	0.046	0.029	0.0306	0.0391	0.0353	0.0523	0.047	0.0309	0.0404
0.0439	0.0224	0.029	0.0302	0.0443	0.0448	0.032	0.0284	0.0244	0.0334
0.0418	0.027	0.0281	0.0236	0.0627	0.0275	0.0469	0.0324	0.0393	0.0234
0.0257	0.0355	0.0548	0.0525	0.045	0.0516	0.0541	0.0402	0.0718	0.0476
0.034	0.0303	0.0292	0.0304	0.0249	0.0563	0.0312	0.0281	0.0227	0.0484
0.0301	0.0264	0.0272	0.0438	0.0327	0.0272	0.0425	0.0223	0.0561	0.0419
0.0438	0.0651	0.0472	0.0321	0.0325	0.0285	0.0415	0.0367	0.0411	0.0405
0.0303	0.0501	0.0264	0.0456	0.0259	0.1189	0.0429	0.0368	0.0569	0.0251
0.0157	0.0269	0.0556	0.0301	0.0363	0.0397	0.0276	0.0504	0.0336	0.0292
0.0281	0.0444	0.0315	0.0302	0.0243	0.0251	0.0391	0.029	0.0438	0.0324
0.0531	0.0293	0.0388	0.0155	0.0699	0.0346	0.0484	0.0253	0.0305	0.0323
0.0484	0.0498	0.0326	0.0433	0.0269	0.0472	0.0489	0.0507	0.0386	0.0423
0.0393	0.0435	0.0424	0.0219	0.0404	0.0398	0.0198	0.0448	0.037	0.0307
0.0418	0.0451	0.0419	0.0235	0.0248	0.0488	0.0263	0.0307	0.0257	0.0273
0.043	0.0336	0.0437	0.0542	0.0495	0.0246	0.0333	0.0436	0.0304	0.029
0.0428	0.0278	0.0469	0.0315	0.0312	0.0478	0.045	0.0377	0.0539	0.0437
0.0246]									

Mean Returns 2021: [1.2911e-03 4.5601e-03 9.5224e-04 1.8645e-03 1.3057e-03 1.1959e-03

1.3916e-03	1.0520e-03	1.1475e-03	9.3147e-04	9.5375e-04	2.6401e-03
1.9030e-03	1.9598e-03	6.7134e-04	9.0145e-04	1.3453e-03	1.4824e-03

-8.8907e-05	8.1292e-04	6.9026e-04	4.5679e-04	4.0147e-04	2.8077e-03
1.2621e-03	8.4020e-04	2.5808e-04	2.1022e-03	5.8387e-04	1.8846e-03
1.6526e-03	6.8864e-04	1.3778e-03	5.6116e-04	3.5385e-04	2.2453e-03
1.6005e-03	1.1044e-03	2.7987e-04	4.5928e-04	6.6210e-04	1.4181e-03
1.5223e-03	-4.2266e-04	1.6112e-03	2.7938e-03	2.2979e-02	3.1603e-04
2.1447e-03	8.7304e-04	-1.9874e-03	2.2005e-03	1.1416e-04	1.6064e-03
1.9491e-03	1.2102e-03	2.0832e-04	2.3483e-03	2.9302e-03	5.8752e-04
1.5295e-03	2.0007e-03	3.2161e-03	5.9557e-04	1.2753e-03	1.8715e-03
1.1515e-03	5.4548e-03	1.0502e-03	2.4313e-03	5.5230e-05	1.3931e-03
1.3855e-03	5.5441e-04	-3.0677e-04	-3.0595e-03	-1.1062e-03	1.9920e-03
1.9390e-03	8.6283e-04	1.7723e-03	1.4933e-03	1.9538e-03	9.6631e-04
1.3794e-03	1.4017e-03	5.7394e-04	7.0611e-04	2.4846e-03	-2.3405e-03
9.6668e-04	2.3675e-03	8.5373e-04	2.2076e-03	9.7023e-06	1.7286e-03
6.7746e-05	2.5928e-04	3.9051e-04	3.7313e-03	3.9769e-04	1.3683e-03
1.4058e-04	1.5576e-03	-1.4970e-03	1.2126e-03	-1.3171e-04	-1.6952e-04
-1.0142e-03	1.6430e-03	1.6991e-03	3.3822e-04	3.3605e-03	1.1602e-03
2.6280e-03	1.4826e-03	-1.3423e-04	5.1402e-04	9.7067e-04	1.8932e-03
3.2309e-03	1.1240e-03	2.1389e-04	1.8145e-04	6.3325e-04	1.9827e-03
1.7668e-03	8.4071e-04	1.0564e-03	1.8897e-03	1.6710e-03	2.0390e-03
7.6768e-04	1.0480e-03	6.8493e-04	8.7868e-04	-7.3693e-04	3.0649e-03
1.0614e-03	2.0282e-03	1.6725e-04	-7.5938e-04	3.0867e-03	3.8832e-04
-2.0929e-05	1.2527e-04	9.0808e-03	1.6318e-03	5.3881e-04	7.1603e-04
1.0867e-03	1.4741e-03	2.3260e-03	5.4580e-04	1.6944e-03	-3.0918e-04
1.2727e-03	5.4591e-04	2.2883e-04	1.8316e-04	1.4545e-03	1.9076e-03
1.2343e-03	-2.9601e-05	2.7598e-03	1.4634e-03	1.7157e-03	2.4582e-03
9.2819e-05	7.4598e-04	1.0896e-03	9.6068e-05	1.6346e-03	-1.8684e-03
7.5494e-04	6.2156e-05	5.9329e-04	1.6828e-03	1.2676e-03	1.2647e-04
2.4252e-03	1.2301e-03	-4.6657e-04	-3.7061e-04	2.1302e-03	2.9826e-05
1.1152e-03	1.0612e-03	4.3070e-05	4.3313e-04	7.9250e-04	1.4437e-03
1.2099e-03	2.5790e-03	1.7866e-03	-5.0202e-05	-2.8302e-04	6.3673e-04
6.6418e-04	2.7297e-03	1.7287e-03	2.2106e-03	-2.5684e-03	5.6331e-04
-2.0009e-04	2.1493e-03	8.1743e-04	2.4770e-03	1.3042e-03	5.7091e-04
1.7905e-03	6.8584e-04	6.7672e-04	3.2668e-04	1.5689e-03	-4.6211e-04
1.9778e-03	1.0035e-03	1.0397e-03	9.9826e-04	1.1162e-03	4.6373e-04
9.8871e-04	2.2973e-03	9.2842e-04	3.9190e-04	1.8244e-03	1.6282e-03
8.6010e-04	1.3726e-03	3.7825e-04	1.6178e-04	1.0760e-03	1.0090e-03
6.1213e-04	3.8861e-04	7.3967e-04	2.8665e-03	1.1820e-03	1.2500e-03
8.3894e-04	1.7803e-03	1.2569e-03	5.7044e-04	1.6394e-03	2.0408e-03
1.6814e-03	1.3436e-03	-5.0024e-04	2.8122e-04	-1.4702e-03	3.4485e-03
5.2722e-05	1.1572e-03	1.2929e-03	-5.7432e-04	-5.3516e-04	1.5777e-03
4.2626e-04	3.8237e-04	1.6930e-03	1.2184e-03	1.7009e-03	7.5862e-04
7.4603e-04	2.5647e-05	4.8439e-03	1.2027e-03	1.7579e-03	-1.9328e-04
1.3713e-03	4.3784e-04	8.7937e-04	-5.3203e-04	1.8482e-03	2.1532e-03
-7.6819e-04	5.8617e-04	1.4767e-03	-9.6894e-05	1.4390e-03	1.6268e-03
1.0030e-03	7.6361e-04	9.1517e-04	1.0523e-03	1.7594e-03	2.9127e-03
2.7283e-03	1.9213e-03	1.2477e-03	8.5740e-04	1.8799e-03	2.7246e-03
-7.7375e-04	3.9154e-04	1.4934e-03	1.7718e-03	-1.1619e-04	1.6156e-03
7.0892e-04	1.4893e-03	2.1022e-03	1.1230e-03	1.0449e-03	1.5095e-03

2.0392e-03	-1.6603e-03	1.4449e-03	9.3207e-06	2.1904e-03	1.5061e-03
1.5544e-03	2.8606e-03	3.7780e-03	1.8696e-03	3.8227e-03	1.2447e-03
1.0548e-03	1.3331e-03	1.7092e-03	2.4137e-03	1.6285e-03	1.7106e-04
1.4620e-03	1.4506e-03	9.2515e-04	1.3321e-03	-4.6600e-04	-8.3532e-04
-2.3881e-04	2.1205e-03	9.6076e-04	-4.7605e-04	9.6524e-04	-4.4857e-04
-6.4667e-04	5.6946e-05	1.3428e-03	1.6142e-03	1.4001e-03	-3.6365e-04
9.3958e-04	1.2280e-03	1.9361e-03	1.4991e-03	-1.2115e-03	2.1419e-03
-9.3115e-05	3.7597e-03	3.9678e-04	1.8902e-03	1.6817e-03	1.1266e-03
1.5033e-03	3.1336e-04	5.7543e-04	1.1184e-03	5.5744e-04	-4.6449e-04
1.1119e-03	7.4957e-04	9.9387e-05	1.8201e-03	8.7701e-04	3.5955e-04
1.6519e-03	1.9736e-02	5.3427e-04	2.1096e-03	2.6909e-04	-9.9218e-04
2.1037e-03	2.1125e-03	1.5333e-03	7.3531e-04	-1.6229e-03	9.2947e-05
6.8629e-04	1.6716e-03	1.0993e-03	-3.4948e-04	1.1057e-03	1.2482e-03
1.1740e-03	5.6388e-04	1.1449e-03	1.0245e-03	1.9484e-03	1.9343e-03
8.6095e-04	4.8313e-04	5.3507e-04	1.7626e-03	1.1838e-03	1.6251e-03
5.6068e-04	7.5845e-04	1.5168e-03	5.1857e-04	3.4525e-04	5.9720e-05
1.4202e-03	4.1687e-04	1.9894e-03	1.0345e-03	1.9138e-03	3.5138e-04
7.1772e-04	9.0039e-04	1.0716e-03	1.3097e-03	2.5223e-03	6.0681e-04
1.5879e-03	6.6615e-04	5.7004e-04	1.8058e-03	-7.9378e-04	4.6485e-04
2.6520e-04	1.2215e-03	7.1725e-04	7.8014e-04	6.1842e-04	8.5293e-04
1.2428e-03	8.0098e-04	1.5448e-03	3.3427e-04	-4.8395e-04	1.0263e-03
4.3131e-04	2.2852e-03	1.8251e-03	-1.9987e-03	2.5441e-04	2.1495e-03
-7.0727e-04	1.8930e-03	1.3678e-03	2.6816e-03	1.2461e-03	3.1090e-03
1.2843e-03	8.9618e-04	1.4708e-03	1.1148e-03	1.4295e-03	-8.4153e-04
-1.2177e-04	1.7612e-03	2.1949e-03	2.5746e-04	2.3709e-03	2.0924e-03
1.3710e-03	2.6523e-04	2.5577e-03	4.7145e-04	2.0773e-03	1.0623e-03
-4.9561e-04	3.5613e-04	1.9122e-03	7.0073e-04	7.6958e-04	1.6875e-03
1.8841e-03	3.9701e-04	2.2700e-03	2.6095e-03	2.3914e-03	4.2259e-04
9.6896e-04	-8.3573e-04	1.5228e-03	1.6577e-03	4.7347e-04	1.6857e-03
8.1993e-04	1.3072e-03	1.1000e-03	3.9066e-04	1.7732e-03	4.5500e-04
1.9476e-04	1.8455e-04	8.1597e-03	-4.7608e-04	8.2150e-04	8.7995e-04
2.9358e-05	1.9622e-03	2.0696e-03	-1.8815e-04	1.0367e-03	1.8216e-03
6.3583e-04	8.3538e-04	1.2155e-03	7.2290e-04	2.2639e-03	2.2096e-03
2.0284e-04	1.5883e-03	2.2632e-03	8.8859e-04	-7.8827e-05	2.0633e-03
1.9255e-03	3.3445e-03	2.0540e-03	2.5191e-03	2.8009e-03	1.3163e-03
7.6759e-04	7.3877e-04	6.4881e-04	1.8118e-03	-1.1646e-04	-1.4838e-03
-6.1694e-04	3.7744e-04	-9.6066e-05	2.2596e-03	4.2913e-03	2.0617e-04
2.5334e-03	5.4532e-04	1.7738e-03	1.0894e-03	1.1291e-03	4.8535e-04
1.0090e-03	1.0198e-03	1.2373e-03	1.5475e-03	1.2877e-03	2.2683e-03
6.3367e-04	-3.2128e-04	8.3906e-04	1.4002e-03	9.9872e-04	1.7318e-03
1.2469e-03	1.8246e-03	1.5717e-04	7.9951e-04	9.3952e-04	-1.0796e-03
1.9142e-03	1.6858e-03	2.5622e-04	2.3773e-04	9.4909e-04	1.7638e-03
1.6857e-03	2.5096e-03	2.5441e-03	2.0942e-03	6.2872e-04	1.5214e-03
-1.5508e-03	1.7897e-04	4.8088e-03	4.2407e-03	-1.1451e-03	2.3405e-03
2.8104e-03	1.6552e-03	1.8438e-04	1.4278e-03	1.7628e-03	-1.0730e-04
1.9899e-03	2.1787e-04	1.0622e-03	-1.6860e-04	1.6863e-03	8.0003e-04
8.3397e-04	1.4674e-03	1.1733e-03	2.1806e-04	-2.1874e-04	-1.9061e-04
-6.3006e-04	5.6952e-04	1.9468e-03	1.0810e-03	9.3034e-04	4.3097e-04

2.9039e-03	-3.7500e-04	2.6698e-03	-2.1825e-03	1.9755e-03	6.2735e-04
9.4475e-04	8.3106e-04	1.6359e-04	9.1911e-04	1.0954e-03	4.4087e-04
9.0520e-04	9.6435e-04	2.8132e-03	1.0528e-03	1.5862e-03	3.4883e-04
3.4350e-04	1.2217e-03	3.4467e-03	3.7468e-03	-2.3617e-03	3.6283e-03
1.5987e-03	1.3194e-03	2.2098e-03	4.4033e-04	1.1297e-03	1.0449e-03
1.5857e-03	9.7096e-04	-6.5094e-05	9.1665e-04	9.3791e-04	2.5406e-03
1.0055e-03	-4.0273e-04	2.1652e-03	-1.0479e-04	-9.9304e-04	-1.3946e-03
3.8896e-03	9.0442e-04	1.0721e-03	3.3090e-03	-4.5703e-04	1.4121e-03
1.5881e-03	1.8498e-03	-1.7678e-03	1.3033e-03	1.1452e-03	4.0284e-03
1.4616e-03	2.6984e-03	1.8978e-03	2.6819e-03	2.7189e-03	2.0134e-03
-1.4716e-05	2.6931e-04	-6.5484e-05	1.6858e-03	3.9698e-04	3.3672e-04
1.0971e-04	8.3837e-04	4.1553e-03	9.3174e-04	7.3850e-04	-4.8826e-04
2.2215e-03	-1.2297e-03	7.8529e-04	2.1620e-03	1.8044e-03	1.7882e-04
7.8212e-04	4.9040e-04	8.0418e-04	1.3834e-03	8.6324e-04	7.9605e-04
-1.6989e-03	7.3842e-04	1.4491e-04	1.5023e-03	2.2349e-03	8.9256e-04
-1.9996e-04	9.2321e-04	8.0964e-04	1.4164e-03	1.8166e-03	1.4321e-03
-2.2232e-04	4.4954e-04	1.8251e-03	5.3683e-04	1.6329e-03	8.7387e-04
5.3336e-04	-2.5394e-04	7.2303e-04	1.6144e-03	2.0974e-03	1.8272e-03
5.7143e-04	3.4035e-04	-4.5436e-03	8.9857e-04	2.0577e-03	2.2978e-03
-5.9480e-04	1.0275e-03	-3.4190e-04	2.9987e-04	3.3408e-05	-3.1150e-03
1.4747e-03	-1.5370e-03	5.6506e-04	8.3506e-04	2.2548e-03	1.1985e-03
2.1386e-03	3.7527e-04	1.5207e-03	7.7374e-05	1.6543e-03	1.2567e-04
1.0626e-03	2.4796e-03	7.6998e-04	1.9727e-03	1.2996e-04	8.6545e-04
9.5918e-04	-2.3011e-03	2.4019e-04	1.4715e-03	-7.7147e-04	-3.4137e-04
6.1777e-04	-6.7884e-05	5.7420e-04	-6.3886e-04	4.7027e-03	1.6869e-03
1.4366e-03	1.5899e-03	9.3435e-04	-1.6081e-03	1.4952e-03	-2.6807e-04
-2.2009e-03	1.3949e-03	3.8121e-03	5.2044e-04	2.5566e-04	2.0550e-03
1.6302e-03	1.1983e-03	1.7130e-03	4.1736e-04	1.5373e-03	-2.4843e-04
-3.4093e-04	1.5381e-03	1.8396e-04	1.9307e-03	2.5088e-03	1.3010e-03
8.4820e-04	1.0211e-03	1.6540e-03	1.1571e-03	7.0756e-04	2.1085e-03
9.1583e-04	-5.4601e-04	1.1355e-03	1.2126e-03	1.2885e-03	1.5875e-03
1.9019e-03	1.5592e-03	6.5214e-04	9.8830e-05	1.2734e-03	2.8646e-03
1.5547e-03	-1.1531e-03	-7.6230e-04	8.7403e-04	-6.7628e-04	1.0367e-03
-4.8008e-04	3.6094e-04	-1.2965e-03	5.9565e-04	-1.2182e-04	7.7218e-04
1.1236e-03	2.4561e-03	1.2619e-03	1.3224e-03	6.6957e-04	1.4423e-03
3.9350e-04	3.6606e-04	2.6006e-03	1.4629e-03	4.7450e-04	1.7905e-03
4.4894e-04	-1.6790e-04	3.3928e-04	3.5191e-03	2.9048e-04	-2.5496e-03
5.5436e-04	2.3432e-03	2.1571e-03	1.5993e-03	1.0773e-03	4.0326e-04
-7.2151e-04	1.2399e-03	3.1382e-03	6.2651e-04	7.9955e-04	6.0586e-04
-1.7149e-04	1.5468e-03	-4.8557e-04	2.1157e-03	1.1938e-03	2.3115e-03
2.6705e-03	1.4050e-03	2.4962e-03	2.1776e-03	3.0228e-03	4.1876e-04
1.2254e-03	1.3145e-03	8.3821e-04	6.1233e-04	2.2717e-03	2.1884e-03
1.3772e-03	1.4725e-03	3.4636e-04	1.5163e-03	1.7494e-03	-4.4837e-04
1.9866e-03	-4.1845e-04	9.0757e-04	7.8164e-04	2.0326e-03	9.8796e-04
3.0514e-04	1.0588e-03	1.1690e-03	4.4790e-04	-3.4919e-04	1.9794e-03
1.2927e-03	1.9993e-03	-7.5188e-05	7.9771e-04	1.6395e-03	1.3221e-03
1.5532e-03	6.9964e-04	9.1529e-04	1.7854e-03	1.1606e-03	8.6238e-03
1.6815e-03	1.0022e-03	4.2102e-04	1.6299e-03	-2.3792e-03	1.0325e-04

```

1.1177e-03 -3.2007e-05 -3.3470e-04  9.6069e-04  8.7630e-04  1.6214e-03
1.5062e-03  1.6317e-03  1.7708e-04  8.5100e-04 -1.9966e-04  6.3555e-04
5.0655e-04  7.1413e-04  1.3279e-03 -1.5537e-04  1.6623e-03  1.0651e-03
4.2376e-04 -1.0015e-03  2.0876e-03 -2.7135e-04 -4.6764e-05  1.0785e-03
2.6426e-03  1.7326e-03  1.3654e-03 -3.8131e-04  1.5050e-03  2.3990e-03
7.1615e-04  1.0097e-03  4.0517e-04  1.3945e-03  6.8085e-04 -1.2106e-03
2.1192e-03  1.8322e-03  1.2946e-03 -1.2221e-03  9.6920e-04  1.4951e-03
1.3914e-03  2.2841e-03  1.3310e-04  9.8811e-04  8.7982e-04  1.0527e-03
3.4195e-04  2.4339e-03  2.4530e-03  1.5076e-03  2.1239e-03  1.8580e-03
1.5176e-04  6.6919e-04  6.5211e-04 -5.1821e-04 -2.2380e-04  3.5982e-04
1.0934e-03 -7.7210e-04  2.2407e-03  2.4322e-04  1.9773e-03  6.8889e-04
4.3166e-04  7.8177e-04  1.0957e-03  1.1085e-03 -2.0059e-03 -6.2141e-04
1.8904e-03 -2.3131e-03  1.6828e-03  1.8286e-03 -1.8779e-03  2.2910e-03
1.6425e-03]

```

Correlation between volatility in 2020 and mean returns in year 2020: 0.2398

The given data shows a positive correlation between the volatility in 2020 and the mean returns in the same year. This implies that the level of volatility in one year can be used to predict the mean returns in the following year. In other words, high volatility in one year is likely to result in high mean returns in the next year, and vice versa.

However, it is important to note that the correlation between volatility and mean returns is not the only factor to consider when assessing investment performance. Other factors such as market risk, industry risk, regulatory risk, company reports and results, and economic and geographic factors should also be taken into account.

2.3.6 Task 6: Does CAPM beta in year t predict *mean returns* in year $t + 1$?

```

[24]: beta_2020 = returns_1.apply(beta)
      print('Beta 2020:',beta_2020)

```

```

Beta 2020: A          0.8770
AA           1.5221
AAL          1.3442
AAP          0.9627
AAPL         1.1174
...
ZG           1.3130
ZION         1.0313
ZM          -0.1166
ZS           0.6140
ZTS          0.9147
Length: 925, dtype: float64

```

```

[25]: mean_returns = returns_2.mean()
      print('Mean Returns 2021:',mean_returns)

```

```

Mean Returns 2021: A          0.0013
AA           0.0046

```

```

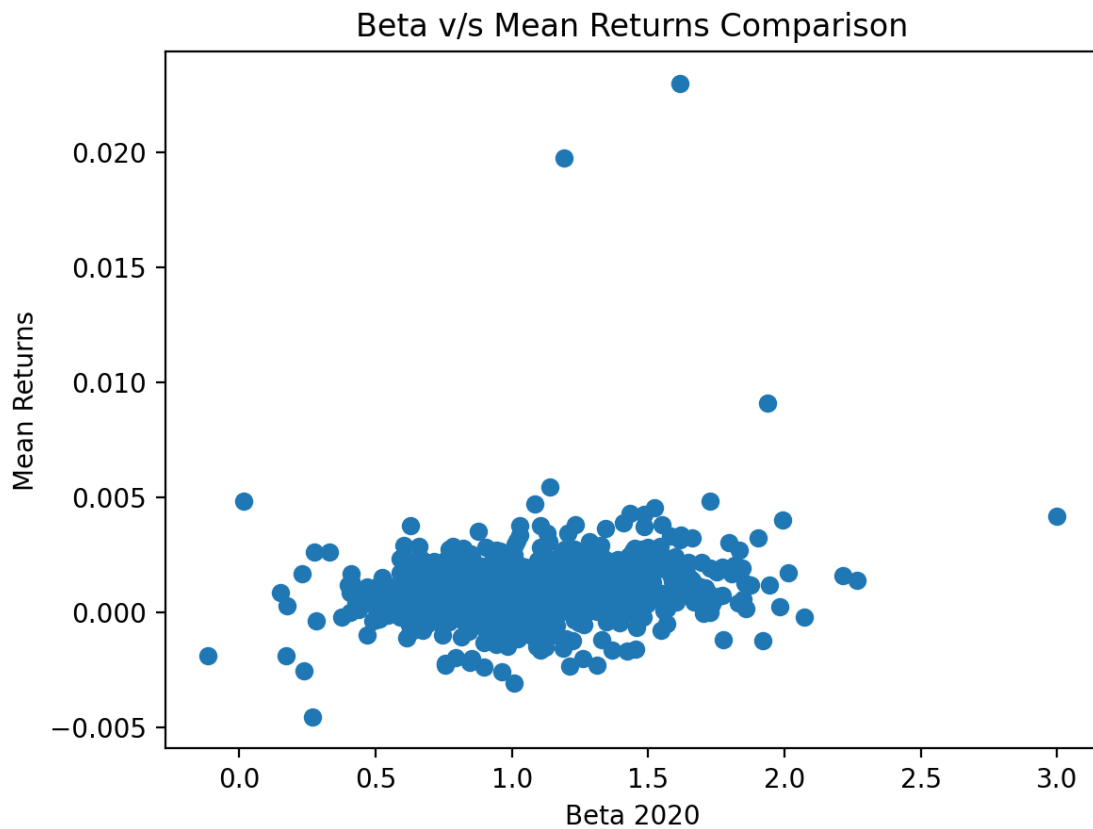
AAL      0.0010
AAP      0.0019
AAPL     0.0013
...
ZG       -0.0023
ZION     0.0018
ZM       -0.0019
ZS       0.0023
ZTS      0.0016
Length: 925, dtype: float64

```

```

[26]: plt.scatter(beta_2020, mean_returns)
plt.title('Beta v/s Mean Returns Comparison')
plt.xlabel('Beta 2020')
plt.ylabel('Mean Returns')
plt.show()

```



```

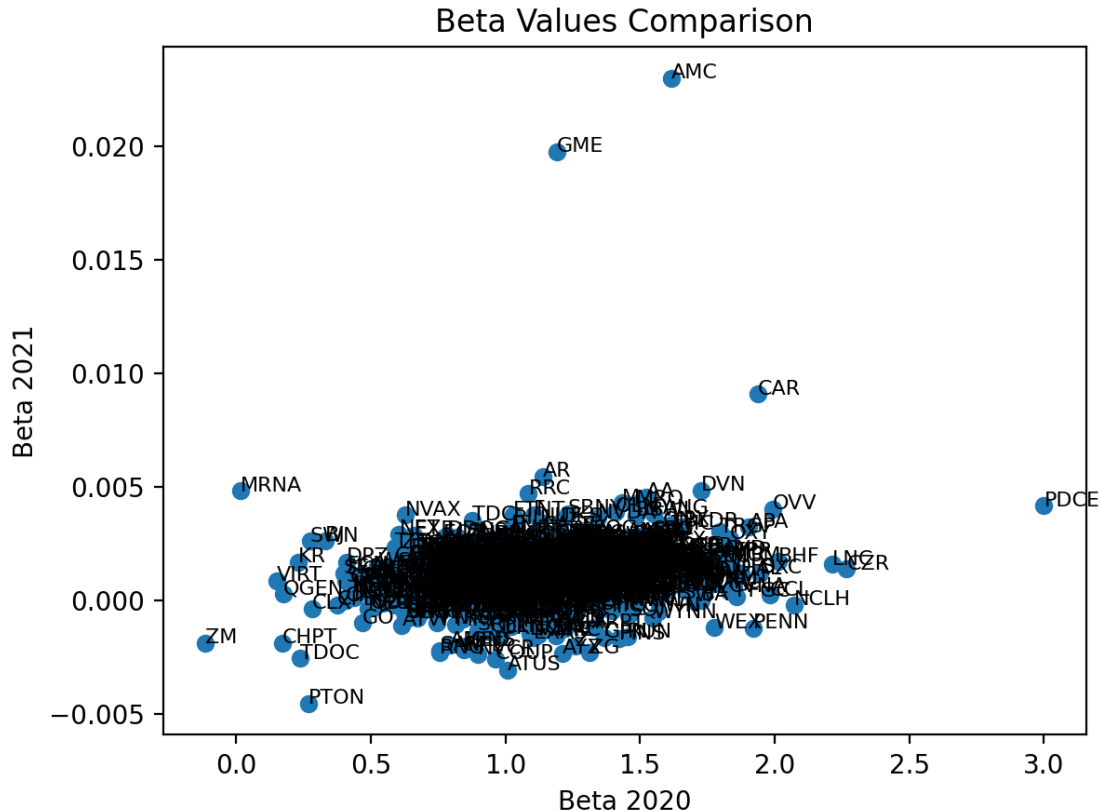
[27]: plt.scatter(beta_2020, mean_returns)
plt.title('Beta Values Comparison')
plt.xlabel('Beta 2020')
plt.ylabel('Beta 2021')

```

```

for i in returns:
    if i in beta_2020 and i in mean_returns:
        plt.text(x=beta_2020[i], y=mean_returns[i], s=i, fontsize= 8)
plt.show()

```



```

[28]: print('Correlation between Beta 2020 and Mean Returns 2021: {:.4f}'.format(np.
        ↳corrcoef(beta_2020, mean_returns)[0,1]))

```

Correlation between Beta 2020 and Mean Returns 2021: 0.2219

The CAPM beta is a measure of the volatility of a stock or portfolio in relation to the market as a whole. #It is a matter of empirical research & cannot be answered a single line of code. #The CAPM model suggests that the expected return of the stock or a portfolio is linked to the beta & the market return. #A higher beta may result in a higher return of the stock or the portfolio, having all the other factors constant. There may be a possibility that the beta for year 2020 & the mean return of 2021 may be related, but the stock or the portfolio returns also depends on various other factors such as the overall performance of the market & any unforeseen event that may affect the returns of the stock or the portfolio.

Two graphs have been presented above through which we can infer that GME & AMC have the highest return with a significant amount of beta while all the other stocks have the same or a higher beta but lesser returns which satisfies our explanation on the top. Many more factors may affect

the return of the stock apart from the Beat itself.

Therefore, to only conclude that CAPM beta in year t predicts the mean return in year $t+1$ may not be significant as all the other factors are not accounted for & remain unexplained.

Correlation coefficient is a linear relationship between two variables. the correlation coefficient ranges from -1 to +1. Where -1 depicts a perfect negative correlation, +1 depicts a perfect positive correlation & zero depicts no correlation among the variables.

A correlation coefficient of 0.2219 represent a weak positive linear relationship among the Beta values for year 2020 & mean returns for year 2021. We also need to understand that correlation doesn't mean that there is causation , & there may be other factors such as company specific factors, economy trends & many more that are influencing the relationship between these variables. The relationship also be influenced by the data anomalies that are not accounted for. Additional statistical test may be needed to understand the nature & The strength of the relationship between these variables.

2.4 Portfolios I

For this section, create 100 random portfolios of 50 stocks each from the daily returns in `returns`. Equally weight these portfolios and rebalance them daily. Use the same stocks and years t and $t+1$ as the previous section.

```
[29]: np.random.seed(100)
num_portfolio= 100
num_stocks= 50
returuns= returns.loc['2020-01-01':'2021-01-01']
stocks = returns.columns.tolist()
portfolio_returns_dict = {}

for i in range (num_portfolio):
    selected_stocks = np.random.choice(stocks, num_stocks, replace = False)
    portfolio= returns[selected_stocks]
    weights = pd.Series(1/num_portfolio, index= selected_stocks)
    portfolio_returns = portfolio.multiply(weights, axis=1)
    portfolio_returns_mean = portfolio_returns.mean(axis=1)
    daily_portfolio_return = portfolio_returns_mean.dropna()
    portfolio_returns_dict[f"Portfolio {i+1}: {' '.join(selected_stocks)}"] =
    ↪daily_portfolio_return.loc['2020-01-01':'2021-01-01']

print(portfolio_returns_dict)
```

```
{'Portfolio 1: DEI, MRO, LRCX, UAA, JBLU, BLDR, KEY, JAMF, WYNN, OKE, NSA, RRC,
CACC, WEX, PRU, TTEK, EXR, VIRT, ESTC, SIVB, WFC, CPT, VRSK, ALNY, BILL, UGI,
TSCO, AMBP, STT, SJM, WDAY, CHH, CNA, DNB, ESAB, ROP, WMT, TER, CDNS, PPC, CFLT,
CBOE, CRUS, LYV, OLED, CTRA, MMM, BJ, TWKS, JHG': Date
2020-01-02    0.0001
2020-01-03   -0.0000
2020-01-06   -0.0000
2020-01-07   -0.0000
```

```

2020-01-08    0.0000
...
2020-12-24   -0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 2: ARW, TSLA, BRK-B, CAH, SEIC, CE, RHI,
WSM, FLT, ABNB, FND, TEAM, IT, ODFL, DTM, AFG, GIS, CI, AKAM, META, V, IAA, DOX,
PLTR, DASH, EFX, WMS, ON, FTV, CMA, BRO, SYNH, SSNC, BIIB, COO, JEF, FTNT, ORCL,
UI, DXCM, EXAS, LSXMA, CHDN, FG, UPS, IPG, PGR, AGL, EVRG, UAL': Date
2020-01-02    0.0001
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07    0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0000
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 3: AGO, GE, GPC, AMT, EQT, U, TFC, LPX,
SPLK, FFIV, WH, ASH, ETN, AEP, VMC, HII, AVT, SUI, SWKS, LSI, ZG, JNPR, PPC,
SNDR, TEAM, BA, CIEN, CSGP, ZION, KRC, HES, SCCO, INTU, AFG, DOCU, WDAY, HCA,
GPK, FOUR, CRL, SMAR, PVH, FAST, NFE, VST, PII, W, ALGN, EMR, BLK': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 4: MTZ, OC, PSA, CPRI, NSA, SITE, MCO,
GM, RYN, W, CHPT, GME, SYU, FANG, FG, UDR, PAYX, LECO, SLM, AOS, UHS, MSA, NNN,
AN, DFS, CDNS, SLB, UGI, FOX, SPLK, SEE, MPC, FCNCA, META, G, BFAM, GGG, ELS,
CFG, CASH, VMC, SGEN, FSLR, TDOC, BRKR, AZPN, PPG, CBRE, BK, TOST': Date
2020-01-02    0.0000
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000

```

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2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 5: HR, BOH, SEE, HAL, INCY, AMCR, SQ,
EXP, J, VAC, PFGC, CHDN, QRVO, CASY, ANET, DIS, IONS, KBR, LYB, C, WFC, TFC,
PENN, URI, TDG, PVH, GTES, ALL, EW, VSCO, MS, TAP, ALB, DKS, ACHC, TKR, CAT,
CHTR, ROKU, OC, ITT, HSY, BF-A, BBY, PAG, ARMK, QS, BX, COUP, ITW': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000

...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31    -0.0000
Length: 253, dtype: float64, 'Portfolio 6: DDOG, ARW, OGE, RUN, IRM, GPC, TRIP,
MCD, NRG, BSY, KD, MGM, MRVL, WEC, RTX, HRB, CTSH, RGLD, ANSS, KHC, SQ, RH, WTM,
URI, KKR, AEP, CCL, EGP, AME, VNT, ROP, USFD, NI, CAT, ADSK, HOLX, APA, WWE,
CMA, ARE, V, MTG, CFG, PG, LULU, SON, TDG, LEA, WYNN, MAN': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06    -0.0000
2020-01-07     0.0001
2020-01-08     0.0000

...
2020-12-24    -0.0000
2020-12-28     0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0001
Length: 253, dtype: float64, 'Portfolio 7: DBX, EBAY, LIN, CACC, FDX, MPC, PB,
PCAR, BK, TEAM, UAL, BWA, TKR, SWKS, EXPD, FR, OKE, MORN, QRVO, WAB, TJX, VST,
WRK, JAMF, TOL, HHC, SJM, LULU, SPR, DASH, HSIC, DV, WSC, WDAY, PXD, CFG, ZG,
SWK, CRWD, TSN, VLO, WAT, FCNCA, BA, AGR, UI, BIIB, PNC, ANET, ETSY': Date
2020-01-02     0.0001
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07     0.0000
2020-01-08     0.0000

...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001

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2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 8: CSX, HSY, DNB, CTAS, AMZN, XPO, MAR,
ACGL, BAX, BK, ARE, KRC, RPM, MS, ESS, LFUS, AXTA, KEYS, H, UBER, UNH, WBD, LNG,
SMG, ELAN, PRGO, EMN, VZ, BXP, SNOW, QDEL, R, AMD, CTLT, CFR, G, FLS, DIS, IPG,
HSIC, WLK, CSL, HR, DGX, EGP, DASH, FIVE, IEX, COST, EQR': Date
2020-01-02    0.0000
2020-01-03   -0.0001
2020-01-06   -0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28    0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 9: BSX, NDAQ, TSLA, AMAT, TTC, XEL, BAX,
KKR, IBKR, NVAX, SF, MRK, FTV, BF-A, FHB, FFIV, AES, INFA, PKG, ABT, HAS, FDS,
AIZ, J, PSA, L, GLOB, MAR, SON, MPW, SNDR, NVST, CTVA, PWR, ROKU, AZTA, ABNB,
WWE, TRV, GO, CCK, LEA, DLTR, GIS, PSTG, WAT, TDOC, ESTC, JNPR, THC': Date
2020-01-02    0.0001
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0000
2020-12-30    0.0000
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 10: CDNS, BRO, LKQ, CASY, MU, BSX, ACI,
CHDN, CCL, AA, PRI, GPC, DRVN, TNDM, TDC, TMO, J, ECL, ULTA, ELV, SOFI, LEN,
UNH, TER, CDW, AWI, WCC, NI, GEHC, MOH, RRX, RL, VOYA, AMCR, CLX, PSX, SEB,
SGFY, SGEN, CNA, BHF, TOST, COTY, GS, CHH, WBA, CZR, RPM, SBNY, VSAT': Date
2020-01-02    0.0000
2020-01-03   -0.0001
2020-01-06   -0.0000
2020-01-07    0.0000
2020-01-08   -0.0000
...
2020-12-24    0.0000
2020-12-28    0.0000
2020-12-29   -0.0000
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 11: ROKU, ALLE, UPST, REXR, CERT, ENTG,
BIIB, FCX, SRC, NVST, LAD, EFX, BOH, U, BSY, TAP, WLK, OSK, SMG, AGL, ETSY, AON,

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LUV, ANSS, MCO, AMC, YUM, HOOD, QDEL, LPX, CLF, MDLZ, USB, WELL, CPB, FOUR, TTEK, DXC, ZG, PEGA, OTIS, ETR, ALSN, DT, RITM, PGR, LESL, TXN, CPT, DPZ': Date

2020-01-02	0.0000
2020-01-03	-0.0000
2020-01-06	0.0000
2020-01-07	0.0000
2020-01-08	0.0000
...	
2020-12-24	-0.0000
2020-12-28	-0.0001
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 12: ELS, ABBV, FWONA, WH, PWR, OMF, ADBE, PG, TNL, RGLD, GLW, LAMR, PSTG, AEP, HD, WEN, JLL, JBL, TFC, SMAR, SCCO, MCK, DRVN, AIG, DLR, AGNC, BKNG, EXP, URI, PAYC, QS, SPG, J, AYX, AN, NCLH, DKS, CTSH, SBUX, G, HBAN, IART, ORLY, SLG, TSN, UDR, XOM, MHK, BKR, CVS': Date

2020-01-02	0.0000
2020-01-03	-0.0001
2020-01-06	-0.0000
2020-01-07	-0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 13: KD, EQT, PEGA, ABBV, TWLO, MAS, UTHR, GRMN, WLK, RH, RIVN, DE, MSA, CMI, CNM, PLD, AZO, DVN, HAYW, CSCO, TJX, MDT, TOST, SWK, TGT, AAL, VRT, NWL, SYK, PCAR, SKX, AMD, LYB, PKI, GNTX, WMB, PNFP, JAMF, HXL, OSH, FOXA, AMT, BRX, PATH, TYL, NWS, SYNH, JBGS, ALGN, KBR': Date

2020-01-02	0.0001
2020-01-03	-0.0001
2020-01-06	0.0000
2020-01-07	-0.0000
2020-01-08	-0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 14: FND, MDT, AFG, CNXC, VRSK, TPX, EFX, PAG, VIRT, FAST, WRB, GEN, PANW, TSCO, GDDY, SPB, CAT, ALK, ADP, BWXT, BURL, GO, SNX, UNM, EQH, CSL, ARES, LESL, SLGN, QRVO, BX, PTC, CVS, CPT, MAT, SLG, ELV, PEAK, MKC, MS, ATR, TTEK, VVV, ESI, CE, V, NDSN, MAA, COLM, LOW': Date

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2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0000
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 15: RYN, COTY, CLVT, TNDM, CDNS, MTB,
MDT, FWONK, EXC, TPX, EWBC, TTD, COUP, NDAQ, OMF, AFRM, ED, PEP, MTZ, HBI, VMW,
ILMN, DVA, ITT, TFC, ZI, JWN, HON, CMCSA, ALGM, ETSY, KR, PEGA, CC, RHI, RH,
ULTA, RIVN, AN, WAT, UPST, GNTX, COP, NVR, SBAC, NTRS, MSFT, HTZ, VSCO, HIG':
Date
2020-01-02    0.0001
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24   -0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 16: CAT, TPR, CR, VST, AVB, GPS, MTCH,
VZ, ELAN, PCAR, TW, OXY, SPG, GH, WTW, PEP, COO, NEM, FCX, MDB, ORCL, GDDY, OKE,
REXR, ESTC, SYF, EQR, DG, HE, DLR, GNRC, CMI, PII, OZK, HBI, MRNA, HXL, PEN,
ICE, ALL, GMED, ZS, GTES, APH, CHD, UNP, PGR, CSCO, VSCO, JAZZ': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 17: APH, CRL, KEX, IEX, HAYW, ESS, VRSK,
AVTR, DELL, PFG, BMY, FIVN, ALB, SBAC, TKR, HII, SGFY, HST, AON, PYCR, MTCH,
BLK, AN, CMCSA, GWW, HSIC, RJF, CCI, HSY, PGR, RXO, JBL, MAA, AMBP, NVCR, PM,
AMED, MKL, UHS, ARMK, EIX, ALGM, EW, OSK, MA, CACC, TMUS, GH, LSI, EPR': Date
2020-01-02    0.0000
2020-01-03   -0.0000

```

2020-01-06 0.0000
2020-01-07 0.0000
2020-01-08 0.0001

...

2020-12-24 0.0000
2020-12-28 0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0001

Length: 253, dtype: float64, 'Portfolio 18: HEI, DISH, KD, TXT, FND, AES, CTVA, CLVT, APD, ETSY, GGG, XEL, AXTA, PEG, VMW, MP, JHG, HON, ARES, ST, ROL, FE, TRV, BBY, BC, MRO, JLL, WBD, PM, DASH, GTS, JBL, T, TNDM, DVA, UNM, DINO, OMF, ORI, LPX, SLM, HES, EL, DV, RGLD, SPOT, BF-A, WRK, DGX, XRAY': Date

2020-01-02 0.0000
2020-01-03 -0.0001
2020-01-06 0.0000
2020-01-07 -0.0000
2020-01-08 -0.0000

...

2020-12-24 0.0000
2020-12-28 -0.0001
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 19: ELV, MTD, RUN, WRB, KIM, VMI, CHTR, CW, HII, MRNA, LFUS, TNDM, AMAT, BSX, FITB, AMG, IRM, FOXA, AMZN, IQV, BAX, PCAR, ED, UNH, SYU, TNL, SRCL, MDLZ, AFRM, K, DISH, BLD, ORCL, DVA, PLD, TT, CE, CHH, LOW, CLX, OGE, HIW, ES, MBC, GXO, GLPI, RPM, AVGO, M, HOG': Date

2020-01-02 -0.0000
2020-01-03 -0.0000
2020-01-06 0.0000
2020-01-07 -0.0000
2020-01-08 0.0000

...

2020-12-24 0.0000
2020-12-28 0.0000
2020-12-29 -0.0000
2020-12-30 0.0001
2020-12-31 0.0001

Length: 253, dtype: float64, 'Portfolio 20: LRCX, JNJ, PRI, CAH, ARW, YETI, ROKU, PVH, SYNH, AMED, ANET, DNA, MSCI, ZTS, BKR, HEI, SPR, JAZZ, EIX, PNW, EPR, DAR, REXR, WTW, LSCC, FCNCA, KEY, BOKF, AKAM, DHR, ISRG, RGLD, DVN, MCD, SQ, MSFT, DISH, MP, LITE, ALSN, PLNT, DD, NSC, PINS, PH, GM, NWSA, KLAC, LAMR, UNVR': Date

2020-01-02 0.0001
2020-01-03 -0.0001
2020-01-06 -0.0000
2020-01-07 0.0000

```

2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 21: O, DASH, SRC, AL, SIRI, AGL, SNX,
HR, PLUG, BALL, OMC, FLT, ALLY, PM, CERT, INFA, CZR, CPB, WE, ATUS, JHG, RNG,
CRWD, IEX, ALGN, MAA, SQ, WIX, LSCC, WMS, RH, MMC, ILMN, CUZ, BAX, LKQ, BILL,
RITM, CMG, MCD, RMD, PEP, MNST, MET, ZI, J, EPAM, LOPE, RJF, CHE': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0001
2020-01-07   -0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 22: VEEV, EQIX, DH, OLN, AAP, LFUS, DUK,
TNL, CCL, KBR, ANSS, CHD, PSA, WY, MSI, QRVO, SRC, HBAN, LCID, AON, NYT, NEU,
NEWR, ZG, OLPX, EEFT, DNB, BRKR, GIS, MAN, ISRG, VTRS, WWD, EHC, BHF, LYFT, WRB,
CABO, MCW, WBS, VTS, TKR, DV, TXN, MORN, MRCY, AVB, SAIC, VNT, VRT': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06   -0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 23: NEM, COLD, SIVB, MKSI, SIX, RF,
ESTC, LOPE, NNN, CPB, C, PCOR, FCN, SEB, FFIV, CTRA, AMBP, AMGN, FDX, PLTK, PKI,
APP, ABT, EMN, EIX, MDT, SMG, MBC, PEG, ULTA, PARA, BURL, UHAL, EFX, AFG, HOLX,
PAYX, LW, LHX, NDAQ, CASY, PLUG, FRC, CRL, SO, ROP, DHI, CAR, RRC, FWONK': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07    0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000

```

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2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0001
Length: 253, dtype: float64, 'Portfolio 24: DD, TECH, EXPD, SLGN, RS, VMW, NVCR,
GPN, ILMN, DFS, SRE, AZEK, J, TREX, NATI, IAC, RE, ATVI, AES, PLUG, KO, GLW, UA,
MHK, OKTA, EVA, SMAR, CR, RGEN, ON, UHAL, AGO, WTEC, SNDR, UMPQ, WSM, RTX, DEI,
LSI, DRI, UNP, WAB, PAYX, ELAN, PEN, DLR, FOUR, LYFT, FCX, DOCS': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 25: X, OGE, WTW, POST, CNC, DINO, YETI,
BBWI, OC, FCX, J, MTB, NOC, ESS, PCG, CINF, NET, CMA, IAC, AN, GPK, BDX, ACM, G,
VOYA, NVDA, CTLT, COO, HUBB, COLD, PTC, PCAR, GOOG, CUZ, LAMR, AKAM, CNP, NEWR,
BKNG, AMD, ELAN, TDC, QRVO, BMY, MKTX, BAC, OKTA, MCD, HHC, UNP': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06    -0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 26: SF, XYL, BURL, BRKR, DAL, GILD,
LAMR, RF, GPK, LITE, FND, SRC, IPG, TDOC, AZTA, HAS, DHI, PNR, FFIV, OC, DG,
ALL, KKR, WAT, CPRI, AZO, STE, AEP, SLG, PEGA, FLO, EIX, IART, PRU, WBS, ROP,
OLED, IRM, VIRT, GLPI, IPGP, TXT, HIW, GTES, PAG, UHS, AZPN, CLX, NTRA, ALB':
Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001

```

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2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 27: IVZ, CRI, EXR, MOH, LAMR, VMW, SSNC,
VAC, CAR, HAYW, ENOV, RHI, INTU, BC, CHDN, ACGL, JBLU, COHR, WFC, HON, SRCL,
KEY, MCW, ULTA, CACI, HST, HRL, UA, WH, GME, IAC, AXON, ETSY, VSAT, HOG, ADSK,
BSY, X, KIM, BERY, TPR, APH, NEWR, SYF, LUMN, ROK, COUP, SSRM, PTON, SPG': Date
2020-01-02    0.0001
2020-01-03   -0.0001
2020-01-06   -0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 28: NEE, CPRT, SITE, DIS, EQR, UA, DLB,
HUBS, AON, GLOB, MSCI, ELV, PAYX, SSNC, MA, EFX, GRMN, NI, LITE, CE, SQ, S, FLO,
CASY, OGE, NTRA, NSA, DXCM, SGFY, ACHC, GDDY, LBRDA, KR, SMG, HUN, NYCB, MDB,
SYY, PATH, CHRW, FNF, BKR, MNST, WAT, META, KSS, VSCO, NSC, JCI, MHK': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07    0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28    0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 29: DKS, CHK, WCC, PRI, TW, BRKR, USB,
EL, D, WBS, WWD, UAA, HBI, GS, PCG, CSL, CLH, WRB, HUM, DTM, CARR, BG, BWXT,
KMI, SF, MMC, JKHY, APP, MCHP, EXC, CLF, APD, BBY, ROKU, DTE, CEG, CCK, W, ZI,
QRVO, BJ, CHE, JBGS, CHTR, CE, EQT, WBD, CAR, QDEL, ADI': Date
2020-01-02   -0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07    0.0000
2020-01-08   -0.0000
...
2020-12-24   -0.0000
2020-12-28   -0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 30: MORN, AEE, NXST, WEC, OWL, AZTA,

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BRO, VRSN, VRSK, BSX, PRU, HEI-A, DTM, CMA, GILD, FCN, MSFT, ROP, HSIC, CME,
 AMG, JBHT, ALGM, BRK-B, PDCE, PFG, ACGL, CPT, ITT, RGA, ARMK, SNA, NKE, CUBE,
 COLM, PTON, DAL, LITE, EEFT, DLTR, GD, DBX, XEL, DELL, GNTX, AAL, PYPL, MASI,
 CLX, TTC': Date
 2020-01-02 0.0001
 2020-01-03 -0.0000
 2020-01-06 0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0000
 2020-12-31 0.0001
 Length: 253, dtype: float64, 'Portfolio 31: EQIX, TRGP, DELL, SGEN, HEI, VFC,
 MP, CSL, SJM, TT, WSC, FTNT, HSY, NEU, PCOR, EXEL, WYNN, FCN, NDAQ, PNR, SOFI,
 RMD, EHAB, GL, RRX, ON, MAN, MTZ, HRL, WST, IPG, TW, AOS, ZG, SAM, SEIC, EPAM,
 UMPQ, ADI, VICI, AMT, DUK, THG, RGLD, BXP, WBA, OLLI, O, HES, JNPR': Date
 2020-01-02 0.0000
 2020-01-03 -0.0000
 2020-01-06 0.0000
 2020-01-07 -0.0000
 2020-01-08 -0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 32: AVT, GEHC, CHK, AMP, MPW, ESTC,
 NVCR, KEY, TPX, BKI, H, PPG, EL, NBIX, HBI, DV, ENOV, UA, LH, CVNA, NEE, GNTX,
 MRK, NYT, CUBE, HZNP, RRC, WE, FRPT, SYF, MTCH, CBSH, OZK, CTLT, FWONK, HOLX,
 PINC, FLO, SBAC, CLF, MIDD, MKL, AYI, AMG, EMR, CRM, GIS, WDAY, BRKR, NI': Date
 2020-01-02 -0.0000
 2020-01-03 -0.0000
 2020-01-06 0.0000
 2020-01-07 0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 -0.0001
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 33: DIS, CDAY, ADP, VRT, CLH, VRTX,
 MRCY, PG, DELL, BYD, AWK, MRVI, UNP, COP, ETSY, STLD, TNL, DPZ, SITE, ZI, AMED,
 VFC, ETN, NTAP, SHW, SMG, RNG, DOW, LW, LRCX, YETI, CVS, RCL, ELS, KR, DRVN,

HEI, GOOGL, ST, LYFT, VTR, MRTX, ABT, LOPE, APH, LSXMA, TDG, ACM, EXAS, GNTX':
Date
2020-01-02 0.0000
2020-01-03 -0.0000
2020-01-06 0.0000
2020-01-07 -0.0000
2020-01-08 0.0000
...
2020-12-24 -0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000
Length: 253, dtype: float64, 'Portfolio 34: SITE, SRPT, BDX, NUE, REXR, F, A, CCCS, FTNT, AXON, ACGL, LAMR, CF, LYV, MMM, CDAY, PAG, WMB, AGL, ANSS, MKL, NDSN, GWW, RF, FCX, OHI, TAP, CCI, ZM, TROW, TECH, MU, PINS, CNP, COLD, HR, ACN, TXG, JNJ, CAR, ZI, AMT, NKE, CRWD, KSS, FNF, ZION, BKR, AA, FOX': Date
2020-01-02 0.0000
2020-01-03 -0.0000
2020-01-06 0.0000
2020-01-07 0.0000
2020-01-08 0.0000
...
2020-12-24 -0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000
Length: 253, dtype: float64, 'Portfolio 35: VSCO, ISRG, LITE, TPR, SF, BAX, BKR, PKI, NDSN, WSO, RTX, LIN, GWW, FISV, WWD, JBL, RNR, ALSN, SCI, SPR, TTD, BHF, NET, PANW, CPB, PNR, DXCM, OMC, AOS, FDX, XRAY, AAP, CRI, EA, SOFI, PFG, HIW, THC, CARR, CNC, WPC, MPWR, VNO, UMPQ, ZS, EEFT, AMGN, COF, PODD, CDAY': Date
2020-01-02 0.0001
2020-01-03 -0.0000
2020-01-06 0.0000
2020-01-07 -0.0000
2020-01-08 0.0000
...
2020-12-24 0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000
Length: 253, dtype: float64, 'Portfolio 36: EPR, ZS, PK, SNV, ADBE, CLF, SAM, NVT, CHE, IVZ, YUM, PSTG, CFG, SRCL, URI, BF-A, BEPC, APH, MORN, PRI, PCTY, SCCO, CRM, DFS, ARE, MAT, BAC, PCOR, TT, XYL, ACN, GPS, PFE, GNTX, PYPL, NTRA, VTRS, FG, AGR, AEE, TOL, CF, GO, COLM, DT, AME, FCN, NET, AVT, IBKR': Date
2020-01-02 0.0000


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2020-01-03    -0.0000
2020-01-06     0.0001
2020-01-07    -0.0000
2020-01-08     0.0001
...
2020-12-24     0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 37: PAYC, PCAR, TOL, CVNA, MPW, BAX,
WMS, CMG, BIO, RJF, TRMB, SRCL, JHG, V, SBUX, RH, FWONA, CSCO, SF, SMG, ALB,
WELL, FYBR, EEF, PRU, AEP, AMT, CW, CFG, ELS, DT, LSTR, CCK, ALL, HIG, ENOV,
DLR, HR, FCX, SIVB, HWM, TJX, IONS, CHRW, WCC, PB, SBAC, FAF, PLNT, GME': Date
2020-01-02     0.0001
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 38: SPLK, CE, TW, VMW, ESAB, FIS, DIS,
MRO, OLPX, DOCU, ACM, SEIC, DE, CVS, WAB, IPGP, AMG, ARMK, HD, HOOD, LHX, ATO,
MRK, HIW, UNVR, FR, LSTR, PH, SWN, SMG, MSFT, LEG, IBM, JKHY, ZG, VNT, UBER,
NCNO, GLW, SYK, NDAQ, BMY, OZK, SPB, BALL, AVY, FCX, KEX, PG, DNA': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 39: ETR, LW, AMC, INTU, MRTX, OVV, ALB,
NDAQ, MTCH, JAZZ, DBX, AMAT, MRVI, PM, WFC, CNP, SCI, CLVT, USB, BDX, RGLD, PPL,
CDNS, BBY, DHR, LLY, WTRG, BERY, MOH, GWRE, DFS, RITM, GE, LECO, PNC, AAL, AGNC,
WRK, MCO, AVY, NNN, MP, AL, SPOT, PSA, BF-A, PVH, SJM, LAMR, ROKU': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000

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2020-01-08    -0.0000
...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 40: GLW, KMB, CMS, SEE, CHK, GPC, MAR,
DOV, ABC, AIZ, PYPL, EXEL, ADI, MMM, DECK, AJG, AVB, TSCO, JCI, THC, NWS, KEY,
GEHC, CPB, FBIN, RTX, WMB, VLO, AGNC, ALLE, VRSK, FDX, NWL, ADT, FG, MDB, PCAR,
WWD, TREX, SBUX, BAC, ENTG, FIVE, THG, MET, MLM, MP, UPST, BRX, SLM': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0001
Length: 253, dtype: float64, 'Portfolio 41: IDXX, DOX, AGR, GLW, SIRI, HEI-A,
SCI, VZ, DOCU, MTCH, LRCX, NUE, ZM, MDT, APO, CFR, ACM, M, FWONA, TGT, CACI,
LSI, HES, FRT, AL, GFS, QDEL, LMT, ROL, TAP, RPRX, SLM, AIG, SWKS, AVY, BYD,
ESAB, BXP, ALL, SRCL, DAL, APA, THC, AXTA, JBGS, CPA, ALK, SLB, MRVL, AWK': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07     0.0001
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31    -0.0000
Length: 253, dtype: float64, 'Portfolio 42: SCI, IRM, ERIE, HIG, GXO, VFC, VZ,
AWK, RUN, SNOW, PYCR, TXN, STWD, ENPH, GE, AZPN, FTNT, CFG, SEE, EQH, SO, SGEN,
SMAR, MLM, SEB, KSS, PG, RKT, LSXMK, ZM, ITW, FNB, LH, CDW, SBUX, DBX, MAA,
LULU, SBAC, GIS, APP, TAP, PYPL, BKR, RSG, FDS, XRAY, IDA, MHK, SIX': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24    -0.0000

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2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 43: OZK, TDY, SIX, COUP, SRC, CMI, FND,
GRMN, WSM, INCY, ZBRA, HIG, TYL, GNTX, MET, MRNA, FNF, ESAB, GD, HUBS, BILL,
HEI-A, AVTR, URI, LITE, HAL, EQT, ACM, MTB, UHAL-B, WDC, CVS, AAP, WAT, LUMN,
CHDN, TFX, HOG, WLK, PLD, VTRS, BEPC, RRX, WBA, ITW, FICO, AMED, NEM, CHE,
PENN': Date
2020-01-02     0.0001
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08    -0.0000
...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 44: JKHY, MTN, ELS, BOKF, BKR, DH, INTC,
CC, PCTY, IPG, LDOS, WM, UHS, SQ, DD, FAST, LUMN, DE, MCW, EQH, EMR, BWXT, SYNH,
INVH, PFE, WPC, ADT, HBAN, THG, COST, IDA, ES, MAA, ALGM, KMX, LEN, ITW, EA,
SLM, CSCQ, WEC, UMPQ, ECL, OMF, TSCO, EQIX, WTRG, IART, CERT, DV': Date
2020-01-02    -0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 45: USB, RNR, TFSL, CIEN, IPGP, SSNC,
WRB, UHAL-B, HTZ, ACGL, IRM, NATI, FFIV, OSK, NWS, MET, KMX, IVZ, LAD, OLLI,
CTRA, MO, RGEN, PDCE, ROP, IONS, SMAR, RYN, KEY, PPG, RPM, WCC, PLTK, UNP, AJG,
CNP, WPC, AYI, ZBH, CF, LHX, DLTR, COUP, DAL, REG, HBAN, TMUS, WMB, AMGN, SNA':
Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06    -0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000

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2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 46: GFS, UPS, TTWO, LVS, BLK, SITE,
FBIN, IPG, AMG, DOW, AMGN, PTON, AMCR, AYX, BKNG, DELL, IDXX, UDR, URI, MP,
MTCH, YETI, C, HD, PCOR, PANW, LEN, SRPT, WTW, LSXMK, NEU, UMPQ, EXC, BSY, PAYX,
MDLZ, SYNH, VST, MTG, LSXMA, ELV, KD, MBC, DBX, CSCO, BC, ILMN, RJF, TECH,
EBAY': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0001
...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 47: CRI, AIZ, BERY, AMP, FE, IT, AVT,
CCCS, PNFP, INCY, FIVE, INTU, UNH, AXS, PINS, LEN-B, SWKS, VNO, EQH, AON, IAC,
MRO, CG, HXL, VST, FOUR, AGL, MMM, NNN, ATO, NOC, IPGP, AFL, PLNT, FIS, AGO,
TPL, MTCH, WELL, LII, KEY, FCNCA, FTV, MOS, CRL, PLUG, GH, CACC, HPQ, PSA': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0001
2020-01-07    -0.0000
2020-01-08     0.0001
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0001
Length: 253, dtype: float64, 'Portfolio 48: THC, CNC, AA, CSCO, SNV, CINF, RGEN,
NWS, ATUS, NTRS, NTRA, AMED, BKR, EL, IBKR, ST, ROK, DIS, BYD, SGFY, ATVI, LII,
ENTG, AES, GH, DVN, CDAY, EQR, FR, TTWO, MSI, UTHR, CAT, OSK, APD, DUK, CHDN,
AFRM, TRGP, VFC, LAMR, SNDR, OMF, LITE, ACN, GME, FAST, MBC, CRL, LULU': Date
2020-01-02     0.0001
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24    -0.0000
2020-12-28     0.0000
2020-12-29    -0.0001
2020-12-30     0.0001

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2020-12-31 0.0001
 Length: 253, dtype: float64, 'Portfolio 49: PEN, SHW, J, MIDD, AA, SPB, UPS, V, ON, VRSN, SEB, H, RNR, KKR, GLOB, CRI, ACN, CF, SAM, CSL, HWM, GH, BPOP, CGNX, PARAA, COTY, CHRW, PNC, SOFI, ALSN, UBER, ASH, CE, ZG, TREX, SIRI, ALNY, KMB, A, CNA, MTB, CTAS, CERT, RGA, FDS, GNTX, MOS, FOXA, VSCO, LHX': Date
 2020-01-02 0.0000
 2020-01-03 -0.0001
 2020-01-06 -0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 -0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 50: LPX, CCI, ES, MTN, GEHC, AKAM, TW, APTV, NEE, UAL, ERIE, CGNX, PAYC, NI, SGFY, TSCO, WEX, NRG, AEE, BRX, BERY, HHC, ADSK, VICI, FLT, CBSH, SCCO, MTCH, TOL, NDAQ, GFS, ESTC, BOKF, MOS, TROW, NVDA, RE, LMT, SRCL, ENTG, CDW, PKG, TXN, MAA, SSRM, FIVE, INVH, GIS, CPA, SBUX': Date
 2020-01-02 0.0000
 2020-01-03 -0.0000
 2020-01-06 -0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0001
 ...
 2020-12-24 0.0000
 2020-12-28 0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 51: WST, AMG, SYK, AIG, GRMN, REXR, LHX, EHAB, SYF, NYT, NCNO, ATO, GNRC, FLO, LITE, ANET, MMM, KMPR, MSA, THC, KR, SCCO, UWMC, DOW, COP, W, AAL, CTLT, IBKR, TPX, J, CLVT, SBUX, KMI, NEWR, PEGA, CMA, DOCS, CFG, WWE, CIEN, SYNH, BILL, DOCU, ZION, BURL, VMC, SOFI, ZS, SLB': Date
 2020-01-02 0.0001
 2020-01-03 -0.0001
 2020-01-06 0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 52: CZR, AJG, LDOS, SKX, CDNS, AGR, MSGS, RNG, PII, PRU, AEE, ON, LNT, DISH, CPRT, CPB, IFF, AXON, AZPN, RE, HIG,

VFC, ENTG, DH, ADM, AMED, SPR, SYK, CAH, BPOP, AZTA, CLH, SRC, HR, MSA, EQR, ROL, LYB, CLF, UBER, VTRS, MAT, PEG, CC, CHRW, SNOW, ROST, ESS, WOOF, SLB': Date

2020-01-02	0.0000
2020-01-03	-0.0000
2020-01-06	0.0000
2020-01-07	0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 53: RNR, SLB, COST, CERT, ACGL, AEE, CLX, LYB, EEFT, GNTX, TAP, VIRT, CMS, CHPT, REYN, KMX, MSGS, FCN, ENPH, SGFY, NNN, MP, TPX, RL, BBWI, PWR, XRAY, KEY, GO, ARE, M, CMCSA, IDXX, ERIE, UMPQ, ALL, BXP, MGM, DRVN, REXR, BOKF, SEIC, DH, PEG, AMZN, UNH, AR, FG, AMD, HUM': Date

2020-01-02	0.0000
2020-01-03	0.0000
2020-01-06	0.0000
2020-01-07	-0.0000
2020-01-08	0.0000
...	
2020-12-24	-0.0000
2020-12-28	0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 54: EXPD, PPL, HII, VST, CIEN, OGN, LAD, ABC, FTNT, ITW, BA, COP, UMPQ, GPS, CTSH, CME, LSI, UNM, EXC, AMD, SCCO, MSM, SUI, LVS, VSAT, TROW, NVCR, EL, NFE, DEI, DDOG, SNDR, JBLU, MBC, EVR, IT, UHAL, PWR, EHAB, NKE, FRT, SWN, RGEN, CR, ADSK, BWXT, CNM, LSCC, GS, KEYS': Date

2020-01-02	0.0000
2020-01-03	-0.0000
2020-01-06	0.0000
2020-01-07	0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 55: EQR, SWK, JNJ, MET, ALGN, CTSH, LYV, EHC, OKE, UTHR, TREX, ALB, MRCY, LAD, IRM, DTM, LSI, VSAT, NTRA, AZEK, KIM, CBSH, CG, PAG, CSGP, EIX, D, LLY, AVB, MAA, MDB, MU, CMG, TYL, SNPS, HUBS, EQT, ABT, ZS, BMRN, LULU, DBX, ABBV, EW, AMGN, PXD, AZPN, HE, FRT, DCI': Date

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2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0001
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 56: CMS, RBLX, VTRS, JBLU, DCI, PPC,
KIM, WST, VRT, MIDD, NFLX, PNC, GOOG, AMP, R, FWONK, ARES, INFA, MOS, WDC, DHI,
LKQ, OMF, SPG, CTLT, CSX, PEAK, HCA, CARR, GS, NTRA, SWK, ZION, PARAA, CRWD,
CINF, WWD, DVA, XPO, UBER, SGFY, KEYS, FWONA, SNDR, WBS, DGX, SQ, NTRS, HBI,
RXO': Date
2020-01-02    0.0000
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07    0.0000
2020-01-08    0.0000
...
2020-12-24   -0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 57: ISRG, PII, GGG, ARE, ZS, LCID, PPL,
VUV, FOX, IP, GLPI, UA, ASH, MMC, KRC, GTES, YUM, EVA, SPLK, CPT, GNRC, MDB,
JPM, MAA, MKSI, HRB, FITB, NLY, DPZ, RITM, NFE, DXCM, CAT, RF, NTAP, ETR, X,
PCTY, GIS, CCI, JNPR, EXAS, FOUR, WCC, ERIE, ENTG, AFL, UPST, MET, KLAC': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 58: CAG, PK, UWMC, MTZ, PKI, FIS, X,
NWL, EVR, INCY, C, LOPE, FMC, ACHC, PEP, HII, TXG, EHC, AR, ZTS, OLPX, WMS, IAC,
FE, AVY, LSCC, UPST, VMC, MTN, COLM, BG, MAS, COST, D, MTD, ABT, DKNG, CE, RYN,
KRC, WST, TJX, CAT, AMGN, DASH, HE, BBY, MSFT, MU, FICO': Date
2020-01-02   -0.0000
2020-01-03   -0.0000

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2020-01-06	0.0000
2020-01-07	0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0001

Length: 253, dtype: float64, 'Portfolio 59: AYX, FCN, CPRI, RMD, WRB, DASH, FFIV, TKR, TER, PLTK, FDX, SF, IART, MORN, DAL, TYL, NSC, TXT, EL, DECK, ETN, VSAT, V, QRVO, AJG, MS, DKS, JAZZ, FRC, CABO, MDU, MDT, DNA, PATH, TSLA, ENPH, VEEV, CHK, INCY, ABT, EHC, ADP, GEN, EQH, LSI, CCL, MSFT, CAH, SON, WTRG': Date

2020-01-02	0.0001
2020-01-03	-0.0001
2020-01-06	0.0000
2020-01-07	-0.0000
2020-01-08	0.0001
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 60: ELV, DHI, MET, FCX, CW, EQH, ZTS, WAL, NVAX, ADT, U, KEY, AMC, SIX, MPC, HTZ, ADBE, LAZ, ALNY, LSTR, L, FBIN, TTEK, FAF, MA, JAZZ, IPG, OPEN, AEE, RE, AGNC, FSLR, HZNP, SEE, UNM, MDLZ, TFSL, AMG, HRL, PAYX, FLS, BIO, MTN, PLTR, THC, SHW, FLO, DECK, CI, TROW': Date

2020-01-02	0.0001
2020-01-03	-0.0001
2020-01-06	0.0000
2020-01-07	-0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0001
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	-0.0000

Length: 253, dtype: float64, 'Portfolio 61: IRM, OGE, FTV, MASI, ADM, RRX, DHI, ALLE, HIG, TTD, GO, HLT, AES, SOFI, AFG, NSA, IFF, DPZ, STT, AWI, WFC, DD, TDY, IR, AZTA, NBIX, PH, SNV, IDA, IQV, WMT, CI, FIS, HAYW, AGL, AEE, SBNY, DLR, OPEN, SEE, USFD, ANSS, ALLY, F, PB, XOM, TNL, CBRE, INCY, RRC': Date

2020-01-02	0.0000
2020-01-03	-0.0001
2020-01-06	-0.0000
2020-01-07	-0.0000
2020-01-08	0.0000


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...
2020-12-24    0.0000
2020-12-28   -0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 62: BILL, WLK, MCHP, AFL, AMG, SCI, GWW,
OMF, DT, KRC, FG, SEB, WST, SLG, LDOS, HXL, SPOT, SYK, JBHT, LITE, SLB, ELAN,
RRX, CNA, EVRG, MA, TSN, ABT, OLPX, HUN, INFA, ZS, CF, PCG, NTRS, GTES, META,
GFS, MET, MAA, RJF, TPL, ADBE, LOW, INTU, TNDM, MS, MSI, DBX, CSCO': Date
2020-01-02    0.0001
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 63: MSI, A, OLPX, RNR, PPG, UHS, AMAT,
TDC, JEF, SRE, PINC, REYN, ALL, GDDY, UGI, PH, SSRM, CPB, IPG, ENTG, ELV, DNB,
FAF, ANET, IBKR, SEIC, SF, TMO, LH, ELAN, TAP, MA, PFGC, ERIE, SPB, AXP, LBRDA,
OKE, CACI, AN, FWONK, TTWO, USFD, CFG, SNA, DXC, ES, LEN, TYL, CHD': Date
2020-01-02   -0.0000
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28    0.0000
2020-12-29   -0.0000
2020-12-30    0.0000
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 64: ITW, MSFT, EMR, MMC, BDX, EA, AL,
LUV, BOH, SJM, MORN, MSGS, NTN, CDW, CPRI, FTV, NWSA, RPRX, BBY, RMD, TEAM,
PLTR, KMX, NRG, ALL, DEI, CPB, IDA, LOW, EVRG, PSTG, FIS, CHD, IFF, SUI, APO,
GEN, ZS, COHR, G, AEE, POOL, PRI, KBR, AMP, BFAM, PEG, TRV, SGFY, LYV': Date
2020-01-02    0.0001
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0000

```

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2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 65: EXPE, IART, FIVE, APD, WM, CMCSA,
SNV, FDS, WMB, REG, SBNY, CGNX, VRSN, XPO, ZION, ESS, UAA, INFA, BERY, IT, VTS,
AGNC, TPX, LH, NTAP, GIS, KR, ALSN, ANET, MANH, MTCH, AMGN, SNA, WPC, LHX, CCL,
RPRX, HAL, TNDM, CABO, AL, TDG, TTD, PAYC, KMPR, DH, FND, SCI, ACM, VNO': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0001
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 66: LOPE, VEEV, TROW, POST, USB, WWD,
NDSN, PSA, GFS, MGM, FOXA, ANSS, NCR, GWRE, TWKS, ICUI, DASH, WTFC, RTX, OGE,
HBAN, SMAR, UPS, APO, BJ, CLVT, CC, TFSL, AVB, CG, CNP, GS, TW, AM, UWMC, AXTA,
HZNP, IT, X, ORLY, BOH, PODD, EMR, ACM, ECL, SYU, TTWO, APP, AMAT, TYL': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 67: J, SGEN, WMS, WM, SNA, NVST, AZO,
ANSS, RH, D, WTFC, JNJ, DNA, MSFT, BURL, BWXT, ALLE, M, RE, ORI, CTAS, DVN, DOX,
PWR, CMS, ACGL, MTG, AAP, FR, WSM, FLS, MBC, GNRC, DASH, AWK, AXON, ATO, IONS,
RNG, KSS, GEN, PLTK, PCOR, AMED, MKTX, UNVR, RMD, TRGP, FRPT, KEY': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07     0.0000
2020-01-08    -0.0000
...
2020-12-24     0.0000
2020-12-28     0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000

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Length: 253, dtype: float64, 'Portfolio 68: MS, SRCL, SO, APH, FRT, ROL, XRAY, GS, L, BOH, CHPT, ACI, IRM, EEFT, ENTG, MRTX, KLAC, COP, MCD, CSGP, BOKF, LW, APO, SNOW, PCTY, SYF, U, UNM, MKTX, MPWR, NOW, KRC, WOOF, TROW, WY, APTV, AXON, ETSY, FOX, PTC, AGR, WAB, LBRDA, TWLO, CRM, HTZ, MCO, IDA, CMA, AIG': Date

2020-01-02	0.0001
2020-01-03	-0.0000
2020-01-06	-0.0000
2020-01-07	-0.0000
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0001
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 69: BBWI, PXD, PKG, RIVN, GME, HBI, NWS, MRTX, CME, PM, GWRE, FRC, AXP, LPLA, SPLK, PCOR, NTRA, PCAR, EEFT, ETSY, VTS, KD, DBX, INCY, KMI, NOV, MO, LII, SRPT, RGLD, CBOE, SBNY, VTRS, ALK, NVT, STZ, UNVR, SNA, BHF, COIN, LEG, ROL, CNXC, DTM, TFX, ZBRA, IR, UAL, SBAC, SJM': Date

2020-01-02	0.0000
2020-01-03	-0.0001
2020-01-06	0.0000
2020-01-07	-0.0001
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 70: SRPT, SPGI, TSCO, FIS, GNTX, STT, CTVA, DLR, IEX, JHG, ZG, RF, TDG, GPN, BALL, PINC, EPAM, BHF, PARA, FLT, CLH, GME, WTRG, APD, ETSY, PKI, MHK, WIX, ELAN, DT, MANH, SGFY, WAT, WRK, AVB, JCI, CNXC, OMF, FITB, SKX, TOST, EEFT, PII, CBOE, APP, TPX, LEN, QRVO, KMX, GOOGL': Date

2020-01-02	0.0000
2020-01-03	-0.0001
2020-01-06	0.0000
2020-01-07	-0.0001
2020-01-08	0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 71: CVNA, XPO, NRG, FITB, NTRS, HPQ, DNB, BSY, MANH, AZTA, A, G, BXP, CGNX, FE, RGEN, NVST, CTVA, ZS, AMG, UHAL, GWW,

DRVN, ATUS, OC, FCX, EXPD, MS, FICO, CLF, V, KKR, SBAC, SCI, NCLH, NCNO, CC,
 AVTR, PINS, AGL, CCCS, ACM, CHTR, CVS, IR, ABT, WST, GEN, MSM, PSX': Date
 2020-01-02 0.0001
 2020-01-03 -0.0001
 2020-01-06 0.0000
 2020-01-07 0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 -0.0001
 2020-12-29 -0.0000
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 72: CDW, FCX, HUM, PPL, CNA, OVV, EMR,
 CNXC, BKNG, GD, DVN, LULU, EHAB, DD, PKG, RPM, LSCC, REYN, CPB, CTSH, HEI-A,
 PNFP, BYD, DH, AWK, NRG, MRCY, ARES, WMT, CHPT, EBAY, MOH, ARE, SIRI, BEPC, DVA,
 AXON, WWD, REG, MSCI, NTRS, RJF, INGR, CTLT, BERY, HPE, LYB, FNF, ACN, AFG':
 Date
 2020-01-02 0.0000
 2020-01-03 -0.0001
 2020-01-06 -0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0000
 ...
 2020-12-24 0.0000
 2020-12-28 0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0001
 Length: 253, dtype: float64, 'Portfolio 73: GPC, MKTX, WBA, BLDR, ESAB, PARA,
 ANET, IRM, CEG, BSY, AVTR, TRGP, CMS, GO, GPK, MOS, WWD, CZR, CINF, MTCH, H,
 MASI, RPM, SF, TOST, PB, FISV, UBER, AMC, EPR, VLO, TWLO, ZBRA, RS, KRC, BBY,
 NTAP, UTHR, TROW, V, NVT, TKR, DT, ESTC, QCOM, KMPR, ZS, COIN, SON, O': Date
 2020-01-02 0.0000
 2020-01-03 -0.0000
 2020-01-06 0.0000
 2020-01-07 0.0000
 2020-01-08 -0.0000
 ...
 2020-12-24 -0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000
 Length: 253, dtype: float64, 'Portfolio 74: RJF, LPX, CDAY, SYNH, CHH, AFL, FNF,
 NXST, HLT, APH, GE, COTY, EHC, WPC, CTAS, ZS, IAC, MTN, SPLK, SLGN, ALL, EXPD,
 AR, RRC, FR, FOX, CE, SAM, NDAQ, LEN, SMG, OTIS, FHN, TMO, PG, TRMB, CVNA, TTD,
 Z, LUMN, DLTR, AMCR, CRL, CW, EL, VIRT, KR, GLPI, BURL, SGEN': Date

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2020-01-02    -0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07     0.0000
2020-01-08     0.0000

...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 75: CRL, CRM, OGE, BSY, TREX, TWKS, STZ,
LBRDA, CGNX, GL, SLM, ALGM, SIRI, CBRE, BSX, HUBS, COHR, CMS, FNB, NCNO, IRM,
ABNB, ELV, NOV, GPN, DRI, CHDN, SNV, CTRA, UGI, TMO, PKI, ORCL, AMED, DECK,
DDOG, THG, NEU, RSG, CDNS, EWBC, TXN, WEN, HPE, MBC, GEHC, AL, UNP, EL, MDLZ':
Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0001
2020-01-07    -0.0000
2020-01-08     0.0000

...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0000
2020-12-31     0.0001
Length: 253, dtype: float64, 'Portfolio 76: LNG, SKX, LEA, CNXC, ICUI, X, GEHC,
TSN, ADP, RIVN, WEC, F, CG, MORN, FWONK, NWS, RCL, GD, K, NFLX, ORLY, URI, PEN,
LESL, RXO, CHD, EXC, LLY, TXG, FCNCA, FMC, OSH, JAMF, MPW, AFRM, ESTC, COF,
OLLI, RSG, MTG, LSTR, ZM, IVZ, FHB, COST, NYCB, CTVA, FISV, VICI, TWKS': Date
2020-01-02    -0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000

...
2020-12-24    -0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0000
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 77: DRVN, VLO, PTON, IFF, AVY, AMT, TPL,
KEYS, SWKS, ALLY, LYV, TTD, COF, MS, VNO, CDAY, VIRT, PRI, KKR, MTN, LBRDA,
AMCR, ETR, AAPL, EPAM, EXR, AZO, CSX, ULTA, MPWR, PINS, ICUI, ZBH, UNM, IRM,
ELS, IP, GNRC, SWK, MCHP, TSLA, OTIS, SF, CRI, AFL, NI, SHW, FWONK, ACHC, VSAT':
Date
2020-01-02     0.0001

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2020-01-03    -0.0000
2020-01-06    -0.0000
2020-01-07     0.0000
2020-01-08     0.0001
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 78: LSTR, UBER, AXON, PEGA, LCID, PODD,
VLO, QDEL, TGT, SYX, DIS, HBI, NTAP, GEHC, BK, BAX, DKS, F, PENN, NCR, STE,
PLUG, CLF, CNC, MTD, ORLY, DNA, UAL, WOLF, BSY, HSY, VEEV, MAR, RITM, SSNC, EGP,
CI, ETSY, AXP, ILMN, GO, PK, YETI, CPT, XOM, QRVO, EOG, UWMC, FWONK, ODFL': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07     0.0000
2020-01-08     0.0001
...
2020-12-24    -0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 79: MRVI, EGP, LSTR, ROKU, LPLA, TFSL,
DOCS, FTV, K, ALB, VSAT, MRTX, TWLO, SLM, ULTA, NXST, VRSK, ITW, GILD, PPL, MAN,
WIX, LII, CVNA, BRX, PATH, DOW, CNM, DH, JEF, DHR, GWW, HWM, MKSI, HD, CHK,
MIDD, AMZN, J, WOOF, WMS, APTV, CF, WM, SNDR, INGR, AIG, WDC, USFD, WEN': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 80: LKQ, TT, MRTX, AMAT, VAC, LYV, SNA,
CPT, MCHP, SEE, NEE, DOV, SSRM, TSLA, FND, LAMR, DEI, KDP, WMS, CARR, PH, MGM,
CACI, KRC, BKNG, LBRDA, PRI, HES, OKE, TW, PCOR, AIRC, TTWO, PTON, EMR, R, EQH,
BSX, APP, DE, EXP, NDAQ, HOOD, IT, SSNC, FOX, BK, IONS, AZO, XEL': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000

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2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 81: LSCC, SHW, AAP, CABO, EL, FDX, KMI,
USB, MET, PPL, ERIE, DBX, PAYC, WAB, UHAL, TFX, ABBV, AL, RTX, J, ORLY, LVS,
PSTG, BMRN, HUBB, EW, KEX, SGEN, CCCS, FLO, KDP, WPC, LEA, XEL, NCR, IT, HBI,
UI, HUBS, FNB, IEX, TRMB, HBAN, MAT, FTNT, UNM, RARE, MCW, AFRM, APD': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0000
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 82: NTAP, HWM, VRSK, ETR, ERIE, FNF,
POOL, ELS, DXC, GE, WE, UTHR, ADBE, EXR, WST, PSX, DOCS, CLVT, SCI, LOPE, WOLF,
CRM, NTRS, DECK, PEP, PM, UNH, LAMR, SNA, HBI, TT, ICE, VIRT, MCHP, ALLY, MDU,
WBS, FFIV, SBNY, GLPI, GEHC, RGA, LAZ, LIN, FRC, AVB, EHC, AFL, SRE, WELL': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28    0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 83: HPQ, KIM, INVH, RNG, VOYA, IONS,
IEX, GWRE, DNB, TFX, CTAS, BG, DHI, BAX, NVCR, MTZ, PNC, OLN, TMO, JAMF, TRMB,
PKI, CTLT, OVV, BILL, MLM, REYN, LPLA, UNH, ABT, TRU, KKR, EQH, ICUI, PK, REXR,
AVGO, CRUS, HE, WAL, AES, AIG, LEG, GM, REGN, CCL, PEG, PARA, HOOD, TKR': Date
2020-01-02    0.0000
2020-01-03   -0.0001
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000

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2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 84: IR, PLD, PWR, CLH, KO, AR, UNVR, AL,
NKE, ATVI, SAIC, OXY, EPAM, PEG, PYPL, SCCO, ARES, EQT, GL, ICUI, PEAK, DNB,
FRPT, EVA, JPM, LULU, RF, ROKU, AEE, ZBH, ORLY, PTC, HBI, ALGN, CHK, WU, D, W,
BLDR, SKX, ARW, HON, WDAY, BKI, PNC, DOCS, NVAX, GPN, PAG, LSXMK': Date
2020-01-02     0.0000
2020-01-03    -0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08    -0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 85: H, LEN-B, UAA, BMY, LNG, EPAM, THG,
JPM, HEI, HHC, NSA, MRVI, JLL, HST, ED, LSTR, NOV, MO, BBWI, OTIS, HRB, HOOD,
SKX, FAF, HCA, SRPT, FR, SHC, PG, LBRDA, GILD, KNX, RMD, USB, HAL, SGFY, GDDY,
AZPN, PARA, BAH, CVX, ABC, PAYC, KMB, AAL, LYV, NEU, WLK, EQIX, REGN': Date
2020-01-02     0.0000
2020-01-03     0.0000
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24    -0.0000
2020-12-28     0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 86: LSXMA, NVDA, MIDD, AVT, OSH, NYCB,
BWA, MCHP, ODFL, MOS, ASH, NRG, META, CHPT, EA, AXP, BC, AEE, PAYC, KRC, PWR,
LIN, CACI, RSG, LPX, BMY, JBL, HPE, AMGN, MRNA, KHC, GS, ROK, ROST, SPB, VFC,
FLT, MRO, AR, DXC, BILL, RH, T, MSFT, MTZ, ACHC, MKC, PM, NTRA, POST': Date
2020-01-02    -0.0000
2020-01-03    -0.0001
2020-01-06     0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001

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2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 87: CAR, SBUX, DOW, COTY, RRC, PCOR,
EMN, VIRT, BK, MIDD, VNT, PANW, KRC, NVST, COUP, SYK, BRX, GLOB, SRE, BMY, FIS,
SCI, DPZ, UHAL-B, T, INCY, LOPE, AMG, NSC, FNB, EXR, FAF, STWD, CCI, ARMK, UGI,
SEIC, HR, RNG, WM, IBKR, FTNT, AGNC, CTAS, PSTG, ABBV, DIS, UBER, WU, SBNY':
Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24   -0.0000
2020-12-28   -0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0001
Length: 253, dtype: float64, 'Portfolio 88: PAYC, ALL, PH, BALL, ALK, CMA, PGR,
BJ, ARMK, LECO, SEIC, BBWI, LYFT, ROL, GMED, OHI, CL, TTWO, DELL, CMS, HE, HEI,
EXP, CTLT, PM, AAL, FND, MANH, ABNB, BPOP, LW, KRC, ISRG, WIX, A, W, GXO, HD,
RGA, TFX, CDW, URI, TEAM, YUM, NET, DISH, MNST, TTD, AXON, BOH': Date
2020-01-02    0.0001
2020-01-03   -0.0000
2020-01-06    0.0000
2020-01-07   -0.0000
2020-01-08    0.0001
...
2020-12-24    0.0000
2020-12-28   -0.0001
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 89: MNST, GMED, HPP, VFC, DLR, WTM,
WELL, MCD, FCNCA, L, SEB, EIX, CR, NVAX, CSX, KSS, AXS, CPB, AGL, CL, JBL, TOL,
CVS, CAH, AZPN, VIRT, GLOB, PEG, CACI, ZION, LPLA, ECL, RE, CCCS, SUI, SPB,
PYCR, SYK, HCA, PCG, BF-A, NEU, CFG, BF-B, ADM, WTFC, JWN, ROK, SNA, HUN': Date
2020-01-02    0.0000
2020-01-03   -0.0000
2020-01-06   -0.0000
2020-01-07   -0.0000
2020-01-08    0.0000
...
2020-12-24    0.0000
2020-12-28    0.0000
2020-12-29   -0.0001
2020-12-30    0.0001
2020-12-31    0.0000
Length: 253, dtype: float64, 'Portfolio 90: FTV, TDG, ARE, CVS, JHG, JNPR, WMS,

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POOL, PLUG, WOLF, AGL, MRO, EHC, CLVT, ISRG, MDB, PPC, GRMN, META, MLM, OGN, EQH, NI, DVA, PCTY, TDOC, RNR, ADP, PII, GIS, SEIC, CPRI, TTC, KEX, WM, AWI, RITM, MSM, BX, APTV, IPG, BALL, CTVA, DECK, K, T, DAL, AMCR, TWLO, RPM': Date

2020-01-02 0.0000
2020-01-03 -0.0000
2020-01-06 0.0001
2020-01-07 -0.0000
2020-01-08 0.0001

...

2020-12-24 -0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 91: VOYA, EW, ADI, DE, INTU, R, EWBC, GO, MKL, TOL, LEA, KHC, KRC, CTLT, WAT, WTRG, BAH, SPLK, MU, OLPX, CG, FE, HAL, ENPH, FHB, FHN, DHI, TGT, OHI, O, EA, TDG, SIRI, KSS, FFIV, PVH, MRVL, ASH, EBAY, BWXT, MPWR, UAA, MAA, MAS, OXY, CHK, ACM, PYCR, MDB, EGP': Date

2020-01-02 0.0001
2020-01-03 -0.0000
2020-01-06 -0.0000
2020-01-07 0.0000
2020-01-08 0.0000

...

2020-12-24 0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 92: SBUX, LOPE, ACGL, PPG, TXN, BSY, TW, ARMK, NBIX, BLD, MCW, BKI, CTRA, AIRC, HHC, R, BEPC, DCI, PPC, LBRDK, PEG, AWK, ROL, WBA, CHDN, MSGS, BALL, FE, WCC, RCL, VTR, STLD, ABT, INFA, BDX, HEI-A, AR, DLTR, GEHC, PEP, TSN, RUN, LMT, DNB, TDG, ISRG, HOLX, MRK, WST, TRV': Date

2020-01-02 -0.0000
2020-01-03 0.0000
2020-01-06 -0.0000
2020-01-07 -0.0000
2020-01-08 -0.0000

...

2020-12-24 -0.0000
2020-12-28 -0.0000
2020-12-29 -0.0001
2020-12-30 0.0001
2020-12-31 0.0001

Length: 253, dtype: float64, 'Portfolio 93: OMF, AMCR, CPT, BSY, GNTX, CRL, U, SMG, KMPR, EL, BILL, TFSL, FTV, ELV, APH, PEGA, DOCS, PLTR, WAL, BC, HBAN, PAYX, LOW, FDS, PII, AFG, GEN, NOC, BOH, PEG, VMW, ES, TDG, LVS, VEEV, VOYA, LPX, HSIC, EXC, TRU, F, FNB, MMM, KRC, UMPQ, QRVO, RKT, BIIB, NBIX, NXST': Date

2020-01-02	0.0001
2020-01-03	-0.0000
2020-01-06	-0.0000
2020-01-07	-0.0000
2020-01-08	0.0001
...	
2020-12-24	-0.0000
2020-12-28	-0.0001
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 94: BRKR, CAR, NTAP, OSK, TAP, TREX, FSLR, WBA, CDW, SLB, DECK, ITT, ARW, REXR, HZNP, PTON, SPG, VTS, MA, AM, NNN, CF, WM, ALB, KMB, WAL, PARA, AVTR, MMC, FISV, PDCE, PSA, WPC, TSLA, BBWI, LYB, CVX, KNX, FTNT, AL, BWXT, CNA, ODFL, NSC, PEAK, DBX, UWMC, ANET, WIX, THG': Date

2020-01-02	0.0000
2020-01-03	0.0000
2020-01-06	0.0000
2020-01-07	0.0000
2020-01-08	-0.0000
...	
2020-12-24	0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 95: EL, TWKS, SBNY, SNA, ADP, LPX, APH, VFC, FYBR, PKI, COP, HEI-A, UHAL, CHH, SF, AXON, ICE, PDCE, WRK, GWRE, ETR, MLM, GD, STT, CB, SRPT, FDS, IRM, VTS, SEB, AMCR, DKN, SMAR, AZTA, GILD, ZTS, CI, NUE, ULTA, NVST, UAA, HSY, EVR, DVA, OSK, CBOE, BKNG, FIVN, PHM, SNOW': Date

2020-01-02	0.0001
2020-01-03	-0.0000
2020-01-06	-0.0000
2020-01-07	-0.0000
2020-01-08	0.0000
...	
2020-12-24	-0.0000
2020-12-28	-0.0000
2020-12-29	-0.0001
2020-12-30	0.0001
2020-12-31	0.0000

Length: 253, dtype: float64, 'Portfolio 96: CHH, INTC, PSA, HES, LPLA, TECH, ZM, BWA, OKE, CASY, HAS, GWRE, HXL, MCD, TXG, PKI, MORN, CNC, NKE, AXTA, MPWR, AME, OGE, ZG, EFX, HEI-A, SBUX, CGNX, SBAC, CDAY, FITB, QS, ABNB, PRU, JAZZ, FCX, VSAT, HPP, APP, WPC, PEP, WCC, SCI, THG, FICO, SOFI, CTRA, RGA, SAIC, COLD': Date

2020-01-02	0.0000
2020-01-03	-0.0000

2020-01-06 0.0000
 2020-01-07 -0.0000
 2020-01-08 -0.0000

...

2020-12-24 0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 97: ENTG, LFUS, STT, WTFC, NCNO, SWN, CPRT, CTSB, MRNA, SPB, EXPD, PII, TNL, ATO, ADT, VSAT, WAL, DFS, CVX, TPL, PCTY, MMC, DVA, DKS, O, AMCR, COHR, SEIC, NET, CBSH, LVS, BF-A, TDOC, FRC, VAC, LSXMA, MDLZ, SWKS, WTW, LESL, AZEK, VFC, CNP, HON, MTZ, W, MAA, HPP, AOS, KEYS': Date

2020-01-02 0.0000
 2020-01-03 -0.0001
 2020-01-06 -0.0000
 2020-01-07 -0.0000
 2020-01-08 -0.0000

...

2020-12-24 -0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 98: DISH, HPP, DIS, CMA, DOCU, UNH, GME, DOX, RYAN, HTZ, EVR, WCC, PCG, STWD, NOV, MKC, FMC, SAM, MO, MDT, IT, SPGI, FTNT, ATVI, WM, AMP, UHS, O, GDDY, NSA, NSC, SHW, WBS, LAD, MMM, CC, SRPT, ALB, UTHR, KR, NVR, IART, MRO, BLD, IDA, FCN, INTC, JAZZ, COHR, TEAM': Date

2020-01-02 0.0000
 2020-01-03 -0.0001
 2020-01-06 0.0000
 2020-01-07 -0.0000
 2020-01-08 0.0000

...

2020-12-24 0.0000
 2020-12-28 -0.0000
 2020-12-29 -0.0001
 2020-12-30 0.0001
 2020-12-31 0.0000

Length: 253, dtype: float64, 'Portfolio 99: DBX, ESTC, VSCO, LKQ, CHPT, AKAM, WOLF, MAR, PHM, WRB, BIIB, THC, GFS, MORN, NTNX, EA, PSX, TTC, XPO, CW, SPOT, COHR, PRU, MTD, OLN, BOH, WPC, GWRE, PLUG, HTZ, OXY, DHI, EOG, NRG, NFLX, SBUX, SEIC, TPR, FRC, LW, STWD, AFG, LULU, UDR, VIRT, ARE, AZPN, RYN, CARR, RMD': Date

2020-01-02 0.0001
 2020-01-03 -0.0000
 2020-01-06 0.0001
 2020-01-07 -0.0000
 2020-01-08 0.0001

```

...
2020-12-24    -0.0000
2020-12-28    -0.0001
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64, 'Portfolio 100: KBR, ARES, JNPR, MBC, CSL, ZBH, FR,
ITT, OLLI, UNP, ED, AXON, PII, JLL, BXP, HSY, PPC, JBHT, ROK, CB, HIG, CRUS,
CPRI, COHR, JPM, Z, AGNC, AMG, LIN, CLX, RPM, CTAS, AVT, TNDM, TRGP, LOPE, SPGI,
FLO, APTV, LUV, WIX, ETR, GGG, FCN, CFG, CSX, VIRT, POOL, CCK, WHR': Date
2020-01-02     0.0000
2020-01-03    -0.0001
2020-01-06    -0.0000
2020-01-07    -0.0000
2020-01-08     0.0000
...
2020-12-24     0.0000
2020-12-28    -0.0000
2020-12-29    -0.0001
2020-12-30     0.0001
2020-12-31     0.0000
Length: 253, dtype: float64}

```

```

[30]: portfolio_returns_df = pd.DataFrame.from_dict(portfolio_returns_dict,
    ↳ orient='index', columns=None).transpose()
portfolio_returns_df.columns = [f'Portfolio {i+1}' for i in
    ↳ range(num_portfolio)]
portfolio_returns_df.index = pd.to_datetime(portfolio_returns_df.index)
portfolio_returns_df

```

```

[30]:
Portfolio 1  Portfolio 2  ...  Portfolio 99  Portfolio 100
2020-01-02    0.0001    0.0001  ...    0.0001    0.0000
2020-01-03   -0.0000   -0.0000  ...   -0.0000   -0.0001
2020-01-06   -0.0000    0.0000  ...    0.0001   -0.0000
2020-01-07   -0.0000    0.0000  ...   -0.0000   -0.0000
2020-01-08    0.0000    0.0001  ...    0.0001    0.0000
...
2020-12-24   -0.0000    0.0000  ...   -0.0000    0.0000
2020-12-28   -0.0000   -0.0000  ...   -0.0001   -0.0000
2020-12-29   -0.0001   -0.0001  ...   -0.0001   -0.0001
2020-12-30    0.0001    0.0000  ...    0.0001    0.0001
2020-12-31    0.0000    0.0000  ...    0.0000    0.0000

```

[253 rows x 100 columns]

```

[31]: np.random.seed(100)
num_portfolio= 100

```

```

num_stocks= 50
returuns= returns.loc['2021-01-01':'2022-01-01']
stocks = returns.columns.tolist()
portfolio_returns_dict_1 = {}

for i in range (num_portfolio):
    selected_stocks = np.random.choice(stocks, num_stocks, replace = False)
    portfolio= returns[selected_stocks]
    weights = pd.Series(1/num_portfolio, index= selected_stocks)
    portfolio_returns = portfolio.multiply(weights, axis=1)
    portfolio_returns_mean = portfolio_returns.mean(axis=1)
    daily_portfolio_return = portfolio_returns_mean.dropna()
    portfolio_returns_dict_1[f"Portfolio {i+1}: {' '.join(selected_stocks)}"] =
    ↪ daily_portfolio_return.loc['2021-01-01':'2022-01-01']

print(portfolio_returns_dict_1)

```

```

{'Portfolio 1: DEI, MRO, LRCX, UAA, JBLU, BLDR, KEY, JAMF, WYNN, OKE, NSA, RRC,
CACC, WEX, PRU, TTEK, EXR, VIRT, ESTC, SIVB, WFC, CPT, VRSK, ALNY, BILL, UGI,
TSCO, AMBP, STT, SJM, WDAY, CHH, CNA, DNB, ESAB, ROP, WMT, TER, CDNS, PPC, CFLT,
CBOE, CRUS, LYV, OLED, CTRA, MMM, BJ, TWKS, JHG': Date
2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08    -0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 2: ARW, TSLA, BRK-B, CAH, SEIC, CE, RHI,
WSM, FLT, ABNB, FND, TEAM, IT, ODFL, DTM, AFG, GIS, CI, AKAM, META, V, IAA, DOX,
PLTR, DASH, EFX, WMS, ON, FTV, CMA, BRO, SYNH, SSNC, BIIB, COO, JEF, FTNT, ORCL,
UI, DXCM, EXAS, LSXMA, CHDN, FG, UPS, IPG, PGR, AGL, EVRG, UAL': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0002
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000

```

Length: 252, dtype: float64, 'Portfolio 3: AGO, GE, GPC, AMT, EQT, U, TFC, LPX, SPLK, FFIV, WH, ASH, ETN, AEP, VMC, HII, AVT, SUI, SWKS, LSI, ZG, JNPR, PPC, SNDR, TEAM, BA, CIEN, CSGP, ZION, KRC, HES, SCCO, INTU, AFG, DOCU, WDAY, HCA, GPK, FOUR, CRL, SMAR, PVH, FAST, NFE, VST, PII, W, ALGN, EMR, BLK': Date

2021-01-04	-0.0001
2021-01-05	0.0002
2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 4: MTZ, OC, PSA, CPRI, NSA, SITE, MCO, GM, RYN, W, CHPT, GME, SYU, FANG, FG, UDR, PAYX, LECO, SLM, AOS, UHS, MSA, NNN, AN, DFS, CDNS, SLB, UGI, FOX, SPLK, SEE, MPC, FCNCA, META, G, BFAM, GGG, ELS, CFG, CASH, VMC, SGEN, FSLR, TDOC, BRKR, AZPN, PPG, CBRE, BK, TOST': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0002
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 5: HR, BOH, SEE, HAL, INCY, AMCR, SQ, EXP, J, VAC, PFGC, CHDN, QRV0, CASH, ANET, DIS, IONS, KBR, LYB, C, WFC, TFC, PENN, URI, TDG, PVH, GTES, ALL, EW, VSCO, MS, TAP, ALB, DKS, ACHC, TKR, CAT, CHTR, ROKU, OC, ITT, HSY, BF-A, BBY, PAG, ARMK, QS, BX, COUP, ITW': Date

2021-01-04	-0.0002
2021-01-05	0.0002
2021-01-06	0.0003
2021-01-07	0.0002
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 6: DDOG, ARW, OGE, RUN, IRM, GPC, TRIP, MCD, NRG, BSY, KD, MGM, MRVL, WEC, RTX, HRB, CTSH, RGLD, ANSS, KHC, SQ, RH, WTM, URI, KKR, AEP, CCL, EGP, AME, VNT, ROP, USFD, NI, CAT, ADSK, HOLX, APA, WWE,

CMA, ARE, V, MTG, CFG, PG, LULU, SON, TDG, LEA, WYNN, MAN': Date

2021-01-04	-0.0002
2021-01-05	0.0002
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 7: DBX, EBAY, LIN, CACC, FDX, MPC, PB, PCAR, BK, TEAM, UAL, BWA, TKR, SWKS, EXPD, FR, OKE, MORN, QRVO, WAB, TJX, VST, WRK, JAMF, TOL, HHC, SJM, LULU, SPR, DASH, HSIC, DV, WSC, WDAY, PXD, CFG, ZG, SWK, CRWD, TSN, VLO, WAT, FCNCA, BA, AGR, UI, BIIB, PNC, ANET, ETSY': Date

2021-01-04	-0.0002
2021-01-05	0.0002
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 8: CSX, HSY, DNB, CTAS, AMZN, XPO, MAR, AGL, BAX, BK, ARE, KRC, RPM, MS, ESS, LFUS, AXTA, KEYS, H, UBER, UNH, WBD, LNG, SMG, ELAN, PRGO, EMN, VZ, BXP, SNOW, QDEL, R, AMD, CTLT, CFR, G, FLS, DIS, IPG, HSIC, WLK, CSL, HR, DGX, EGP, DASH, FIVE, IEX, COST, EQR': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 9: BSX, NDAQ, TSLA, AMAT, TTC, XEL, BAX, KKR, IBKR, NVAX, SF, MRK, FTV, BF-A, FHB, FFIV, AES, INFA, PKG, ABT, HAS, FDS, AIZ, J, PSA, L, GLOB, MAR, SON, MPW, SNDR, NVST, CTVA, PWR, ROKU, AZTA, ABNB, WWE, TRV, GO, CCK, LEA, DLTR, GIS, PSTG, WAT, TDOC, ESTC, JNPR, THC': Date

2021-01-04	-0.0001
2021-01-05	0.0001

2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	0.0000

...

2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 10: CDNS, BRO, LKQ, CASY, MU, BSX, ACI, CHDN, CCL, AA, PRI, GPC, DRVN, TNDM, TDC, TMO, J, ECL, ULTA, ELV, SOFI, LEN, UNH, TER, CDW, AWI, WCC, NI, GEHC, MOH, RRX, RL, VOYA, AMCR, CLX, PSX, SEB, SGFY, SGEN, CNA, BHF, TOST, COTY, GS, CHH, WBA, CZR, RPM, SBNY, VSAT': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0003
2021-01-08	-0.0000

...

2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 11: ROKU, ALLE, UPST, REXR, CERT, ENTG, BIIB, FCX, SRC, NVST, LAD, EFX, BOH, U, BSY, TAP, WLK, OSK, SMG, AGL, ETSY, AON, LUV, ANSS, MCO, AMC, YUM, HOOD, QDEL, LPX, CLF, MDLZ, USB, WELL, CPB, FOUR, TTEK, DXC, ZG, PEGA, OTIS, ETR, ALSN, DT, RITM, PGR, LESL, TXN, CPT, DPZ': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0001

...

2021-12-27	0.0001
2021-12-28	-0.0001
2021-12-29	0.0000
2021-12-30	0.0001
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 12: ELS, ABBV, FWONA, WH, PWR, OMF, ADBE, PG, TNL, RGLD, GLW, LAMR, PSTG, AEP, HD, WEN, JLL, JBL, TFC, SMAR, SCCO, MCK, DRVN, AIG, DLR, AGNC, BKNG, EXP, URI, PAYC, QS, SPG, J, AYX, AN, NCLH, DKS, CTSH, SBUX, G, HBAN, IART, ORLY, SLG, TSN, UDR, XOM, MHK, BKR, CVS': Date

2021-01-04	-0.0003
2021-01-05	0.0002
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000

```

...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 13: KD, EQT, PEGA, ABBV, TWLO, MAS,
UTHR, GRMN, WLK, RH, RIVN, DE, MSA, CMI, CNM, PLD, AZO, DVN, HAYW, CSCO, TJX,
MDT, TOST, SWK, TGT, AAL, VRT, NWL, SYK, PCAR, SKX, AMD, LYB, PKI, GNTX, WMB,
PNFP, JAMF, HXL, OSH, FOXA, AMT, BRX, PATH, TYL, NWS, SYNH, JBGS, ALGN, KBR':
Date
2021-01-04   -0.0001
2021-01-05    0.0002
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08   -0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 14: FND, MDT, AFG, CNXC, VRSK, TPX, EFX,
PAG, VIRT, FAST, WRB, GEN, PANW, TSCO, GDDY, SPB, CAT, ALK, ADP, BWXT, BURL, GO,
SNX, UNM, EQH, CSL, ARES, LESL, SLGN, QRVO, BX, PTC, CVS, CPT, MAT, SLG, ELV,
PEAK, MKC, MS, ATR, TTEK, VVV, ESI, CE, V, NDSN, MAA, COLM, LOW': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28    0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 15: RYN, COTY, CLVT, TNDM, CDNS, MTB,
MDT, FWONK, EXC, TPX, EWBC, TTD, COUP, NDAQ, OMF, AFRM, ED, PEP, MTZ, HBI, VMW,
ILMN, DVA, ITT, TFC, ZI, JWN, HON, CMCSA, ALGM, ETSY, KR, PEGA, CC, RHI, RH,
ULTA, RIVN, AN, WAT, UPST, GNTX, COP, NVR, SBAC, NTRS, MSFT, HTZ, VSCO, HIG':
Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08   -0.0000
...

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2021-12-27 0.0002
 2021-12-28 -0.0001
 2021-12-29 0.0000
 2021-12-30 0.0000
 2021-12-31 -0.0000
 Length: 252, dtype: float64, 'Portfolio 16: CAT, TPR, CR, VST, AVB, GPS, MTCH, VZ, ELAN, PCAR, TW, OXY, SPG, GH, WTW, PEP, COO, NEM, FCX, MDB, ORCL, GDDY, OKE, REXR, ESTC, SYF, EQR, DG, HE, DLR, GNRC, CMI, PII, OZK, HBI, MRNA, HXL, PEN, ICE, ALL, GMED, ZS, GTES, APH, CHD, UNP, PGR, CSCO, VSCO, JAZZ': Date
 2021-01-04 -0.0001
 2021-01-05 0.0001
 2021-01-06 0.0003
 2021-01-07 0.0001
 2021-01-08 -0.0000
 ...
 2021-12-27 0.0001
 2021-12-28 -0.0000
 2021-12-29 0.0001
 2021-12-30 0.0000
 2021-12-31 0.0000
 Length: 252, dtype: float64, 'Portfolio 17: APH, CRL, KEX, IEX, HAYW, ESS, VRSK, AVTR, DELL, PFG, BMY, FIVN, ALB, SBAC, TKR, HII, SGFY, HST, AON, PYCR, MTCH, BLK, AN, CMCSA, GWW, HSIC, RJF, CCI, HSY, PGR, RXO, JBL, MAA, AMBP, NVCR, PM, AMED, MKL, UHS, ARMK, EIX, ALGM, EW, OSK, MA, CACC, TMUS, GH, LSI, EPR': Date
 2021-01-04 -0.0002
 2021-01-05 0.0001
 2021-01-06 0.0002
 2021-01-07 0.0002
 2021-01-08 0.0000
 ...
 2021-12-27 0.0001
 2021-12-28 0.0000
 2021-12-29 0.0000
 2021-12-30 0.0000
 2021-12-31 -0.0000
 Length: 252, dtype: float64, 'Portfolio 18: HEI, DISH, KD, TXT, FND, AES, CTVA, CLVT, APD, ETSY, GGG, XEL, AXTA, PEG, VMW, MP, JHG, HON, ARES, ST, ROL, FE, TRV, BBY, BC, MRO, JLL, WBD, PM, DASH, GTES, JBL, T, TNDM, DVA, UNM, DINO, OMF, ORI, LPX, SLM, HES, EL, DV, RGLD, SPOT, BF-A, WRK, DGX, XRAY': Date
 2021-01-04 -0.0002
 2021-01-05 0.0002
 2021-01-06 0.0002
 2021-01-07 0.0001
 2021-01-08 0.0000
 ...
 2021-12-27 0.0001
 2021-12-28 -0.0000
 2021-12-29 0.0000

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2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 19: ELV, MTD, RUN, WRB, KIM, VMI, CHTR,
CW, HII, MRNA, LFUS, TNDM, AMAT, BSX, FITB, AMG, IRM, FOXA, AMZN, IQV, BAX,
PCAR, ED, UNH, SYU, TNL, SRCL, MDLZ, AFRM, K, DISH, BLD, ORCL, DVA, PLD, TT, CE,
CHH, LOW, CLX, OGE, HIW, ES, MBC, GXO, GLPI, RPM, AVGO, M, HOG': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28    0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 20: LRCX, JNJ, PRI, CAH, ARW, YETI,
ROKU, PVH, SYNH, AMED, ANET, DNA, MSCI, ZTS, BKR, HEI, SPR, JAZZ, EIX, PNW, EPR,
DAR, REXR, WTW, LSCC, FCNCA, KEY, BOKF, AKAM, DHR, ISRG, RGLD, DVN, MCD, SQ,
MSFT, DISH, MP, LITE, ALSN, PLNT, DD, NSC, PINS, PH, GM, NWSA, KLAC, LAMR,
UNVR': Date
2021-01-04   -0.0001
2021-01-05    0.0002
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 21: O, DASH, SRC, AL, SIRI, AGL, SNX,
HR, PLUG, BALL, OMC, FLT, ALLY, PM, CERT, INFA, CZR, CPB, WE, ATUS, JHG, RNG,
CRWD, IEX, ALGN, MAA, SQ, WIX, LSCC, WMS, RH, MMC, ILMN, CUZ, BAX, LKQ, BILL,
RITM, CMG, MCD, RMD, PEP, MNST, MET, ZI, J, EPAM, LOPE, RJF, CHE': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0001
2021-01-07    0.0002
2021-01-08    0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000

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Length: 252, dtype: float64, 'Portfolio 22: VEEV, EQIX, DH, OLN, AAP, LFUS, DUK, TNL, CCL, KBR, ANSS, CHD, PSA, WY, MSI, QRVO, SRC, HBAN, LCID, AON, NYT, NEU, NEWR, ZG, OLPX, EEFT, DNB, BRKR, GIS, MAN, ISRG, VTRS, WWD, EHC, BHF, LYFT, WRB, CABO, MCW, WBS, VTS, TKR, DV, TXN, MORN, MRCY, AVB, SAIC, VNT, VRT': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0001

...

2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 23: NEM, COLD, SIVB, MKSI, SIX, RF, ESTC, LOPE, NNN, CPB, C, PCOR, FCN, SEB, FFIV, CTRA, AMBP, AMGN, FDX, PLTK, PKI, APP, ABT, EMN, EIX, MDT, SMG, MBC, PEG, ULTA, PARA, BURL, UHAL, EFX, AFG, HOLX, PAYX, LW, LHX, NDAQ, CASY, PLUG, FRC, CRL, SO, ROP, DHI, CAR, RRC, FWONK': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0002
2021-01-08	0.0001

...

2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 24: DD, TECH, EXPD, SLGN, RS, VMW, NVCR, GPN, ILMN, DFS, SRE, AZEK, J, TREX, NATI, IAC, RE, ATVI, AES, PLUG, KO, GLW, UA, MHK, OKTA, EVA, SMAR, CR, RGEN, ON, UHAL, AGO, WTEC, SNDR, UMPQ, WSM, RTX, DEI, LSI, DRI, UNP, WAB, PAYX, ELAN, PEN, DLR, FOUR, LYFT, FCX, DOCS': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	0.0000

...

2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 25: X, OGE, WTW, POST, CNC, DINO, YETI, BBWI, OC, FCX, J, MTB, NOC, ESS, PCG, CINF, NET, CMA, IAC, AN, GPK, BDX, ACM, G, VOYA, NVDA, CTLT, COO, HUBB, COLD, PTC, PCAR, GOOG, CUZ, LAMR, AKAM, CNP, NEWR,

BKNG, AMD, ELAN, TDC, QRV0, BMY, MKTX, BAC, OKTA, MCD, HHC, UNP': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 26: SF, XYL, BURL, BRKR, DAL, GILD, LAMR, RF, GPK, LITE, FND, SRC, IPG, TDOC, AZTA, HAS, DHI, PNR, FFIV, OC, DG, ALL, KKR, WAT, CPRI, AZO, STE, AEP, SLG, PEGA, FLO, EIX, IART, PRU, WBS, ROP, OLED, IRM, VIRT, GLPI, IPGP, TXT, HIW, GTES, PAG, UHS, AZPN, CLX, NTRA, ALB': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0002
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 27: IVZ, CRI, EXR, MOH, LAMR, VMW, SSNC, VAC, CAR, HAYW, ENOV, RHI, INTU, BC, CHDN, ACGL, JBLU, COHR, WFC, HON, SRCL, KEY, MCW, ULTA, CACI, HST, HRL, UA, WH, GME, IAC, AXON, ETSY, VSAT, HOG, ADSK, BSY, X, KIM, BERY, TPR, APH, NEWR, SYF, LUMN, ROK, COUP, SSRM, PTON, SPG': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 28: NEE, CPRT, SITE, DIS, EQR, UA, DLB, HUBS, AON, GLOB, MSCI, ELV, PAYX, SSNC, MA, EFX, GRMN, NI, LITE, CE, SQ, S, FLO, CASY, OGE, NTRA, NSA, DXCM, SGFY, ACHC, GDDY, LBRDA, KR, SMG, HUN, NYCB, MDB, SYY, PATH, CHRW, FNF, BKR, MNST, WAT, META, KSS, VSCO, NSC, JCI, MHK': Date

2021-01-04	-0.0002
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2021-01-05    0.0001
2021-01-06    0.0001
2021-01-07    0.0002
2021-01-08    0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0001
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 29: DKS, CHK, WCC, PRI, TW, BRKR, USB,
EL, D, WBS, WWD, UAA, HBI, GS, PCG, CSL, CLH, WRB, HUM, DTM, CARR, BG, BWXT,
KMI, SF, MMC, JKHY, APP, MCHP, EXC, CLF, APD, BBY, ROKU, DTE, CEG, CCK, W, ZI,
QRVO, BJ, CHE, JBGS, CHTR, CE, EQT, WBD, CAR, QDEL, ADI': Date
2021-01-04   -0.0001
2021-01-05    0.0002
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 30: MORN, AEE, NXST, WEC, OWL, AZTA,
BRQ, VRSN, VRSK, BSX, PRU, HEI-A, DTM, CMA, GILD, FCN, MSFT, ROP, HSIC, CME,
AMG, JBHT, ALGM, BRK-B, PDCE, PFG, ACGL, CPT, ITT, RGA, ARMK, SNA, NKE, CUBE,
COLM, PTON, DAL, LITE, EEFT, DLTR, GD, DBX, XEL, DELL, GNTX, AAL, PYPL, MASI,
CLX, TTC': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28    0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 31: EQIX, TRGP, DELL, SGEN, HEI, VFC,
MP, CSL, SJM, TT, WSC, FTNT, HSY, NEU, PCOR, EXEL, WYNN, FCN, NDAQ, PNR, SOFI,
RMD, EHAB, GL, RRX, ON, MAN, MTZ, HRL, WST, IPG, TW, AOS, ZG, SAM, SEIC, EPAM,
UMPQ, ADI, VICI, AMT, DUK, THG, RGLD, BXP, WBA, OLLI, O, HES, JNPR': Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0002

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2021-01-07    0.0003
2021-01-08    0.0000
...
2021-12-27    0.0002
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 32: AVT, GEHC, CHK, AMP, MPW, ESTC,
NVCR, KEY, TPX, BKI, H, PPG, EL, NBIX, HBI, DV, ENOV, UA, LH, CVNA, NEE, GNTX,
MRK, NYT, CUBE, HZNP, RRC, WE, FRPT, SYF, MTCH, CBSH, OZK, CTLT, FWONK, HOLX,
PINC, FLO, SBAC, CLF, MIDD, MKL, AYI, AMG, EMR, CRM, GIS, WDAY, BRKR, NI': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 33: DIS, CDAY, ADP, VRT, CLH, VRTX,
MRCY, PG, DELL, BYD, AWK, MRVI, UNP, COP, ETSY, STLD, TNL, DPZ, SITE, ZI, AMED,
VFC, ETN, NTAP, SHW, SMG, RNG, DOW, LW, LRCX, YETI, CVS, RCL, ELS, KR, DRVN,
HEI, GOOGL, ST, LYFT, VTR, MRTX, ABT, LOPE, APH, LSXMA, TDG, ACM, EXAS, GNTX':
Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0001
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 34: SITE, SRPT, BDX, NUE, REXR, F, A,
CCCS, FTNT, AXON, AGL, LAMR, CF, LYV, MMM, CDAY, PAG, WMB, AGL, ANSS, MKL,
NDSN, GWW, RF, FCX, OHI, TAP, CCI, ZM, TROW, TECH, MU, PINS, CNP, COLD, HR, ACN,
TXG, JNJ, CAR, ZI, AMT, NKE, CRWD, KSS, FNF, ZION, BKR, AA, FOX': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08   -0.0001

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...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 35: VSCO, ISRG, LITE, TPR, SF, BAX, BKR,
PKI, NDSN, WSO, RTX, LIN, GWW, FISV, WWD, JBL, RNR, ALSN, SCI, SPR, TTD, BHF,
NET, PANW, CPB, PNR, DXCM, OMC, AOS, FDX, XRAY, AAP, CRI, EA, SOFI, PFG, HIW,
THC, CARR, CNC, WPC, MPWR, VNO, UMPQ, ZS, EEFT, AMGN, COF, PODD, CDAY': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 36: EPR, ZS, PK, SNV, ADBE, CLF, SAM,
NVT, CHE, IVZ, YUM, PSTG, CFG, SRCL, URI, BF-A, BEPC, APH, MORN, PRI, PCTY,
SCCO, CRM, DFS, ARE, MAT, BAC, PCOR, TT, XYL, ACN, GPS, PFE, GNTX, PYPL, NTRA,
VTRS, FG, AGR, AEE, TOL, CF, GO, COLM, DT, AME, FCN, NET, AVT, IBKR': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 37: PAYC, PCAR, TOL, CVNA, MPW, BAX,
WMS, CMG, BIO, RJF, TRMB, SRCL, JHG, V, SBUX, RH, FWONA, CSCO, SF, SMG, ALB,
WELL, FYBR, EEFT, PRU, AEP, AMT, CW, CFG, ELS, DT, LSTR, CCK, ALL, HIG, ENOV,
DLR, HR, FCX, SIVB, HWM, TJX, IONS, CHRW, WCC, PB, SBAC, FAF, PLNT, GME': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28    0.0000

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2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 38: SPLK, CE, TW, VMW, ESAB, FIS, DIS,
MRO, OLPX, DOCU, ACM, SEIC, DE, CVS, WAB, IPGP, AMG, ARMK, HD, HOOD, LHX, ATO,
MRK, HIW, UNVR, FR, LSTR, PH, SWN, SMG, MSFT, LEG, IBM, JKHY, ZG, VNT, UBER,
NCNO, GLW, SYK, NDAQ, BMY, OZK, SPB, BALL, AVY, FCX, KEX, PG, DNA': Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08   -0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 39: ETR, LW, AMC, INTU, MRTX, OVV, ALB,
NDAQ, MTCH, JAZZ, DBX, AMAT, MRVI, PM, WFC, CNP, SCI, CLVT, USB, BDX, RGLD, PPL,
CDNS, BBY, DHR, LLY, WTRG, BERY, MOH, GWRE, DFS, RITM, GE, LECO, PNC, AAL, AGNC,
WRK, MCO, AVY, NNN, MP, AL, SPOT, PSA, BF-A, PVH, SJM, LAMR, ROKU': Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 40: GLW, KMB, CMS, SEE, CHK, GPC, MAR,
DOV, ABC, AIZ, PYPL, EXEL, ADI, MMM, DECK, AJG, AVB, TSCO, JCI, THC, NWS, KEY,
GEHC, CPB, FBIN, RTX, WMB, VLO, AGNC, ALLE, VRSK, FDX, NWL, ADT, FG, MDB, PCAR,
WWD, TREX, SBUX, BAC, ENTG, FIVE, THG, MET, MLM, MP, UPST, BRX, SLM': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08   -0.0000
...
2021-12-27    0.0002
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31    0.0000

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Length: 252, dtype: float64, 'Portfolio 41: IDXX, DOX, AGR, GLW, SIRI, HEI-A, SCI, VZ, DOCU, MTCH, LRCX, NUE, ZM, MDT, APO, CFR, ACM, M, FWONA, TGT, CACI, LSI, HES, FRT, AL, GFS, QDEL, LMT, ROL, TAP, RPRX, SLM, AIG, SWKS, AVY, BYD, ESAB, BXP, ALL, SRCL, DAL, APA, THC, AXTA, JBGS, CPA, ALK, SLB, MRVL, AWK': Date

2021-01-04	-0.0002
2021-01-05	0.0002
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 42: SCI, IRM, ERIE, HIG, GXO, VFC, VZ, AWK, RUN, SNOW, PYCR, TXN, STWD, ENPH, GE, AZPN, FTNT, CFG, SEE, EQH, SO, SGEN, SMAR, MLM, SEB, KSS, PG, RKT, LSXMK, ZM, ITW, FNB, LH, CDW, SBUX, DBX, MAA, LULU, SBAC, GIS, APP, TAP, PYPL, BKR, RSG, FDS, XRAY, IDA, MHK, SIX': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 43: OZK, TDY, SIX, COUP, SRC, CMI, FND, GRMN, WSM, INCY, ZBRA, HIG, TYL, GNTX, MET, MRNA, FNF, ESAB, GD, HUBS, BILL, HEI-A, AVTR, URI, LITE, HAL, EQT, ACM, MTB, UHAL-B, WDC, CVS, AAP, WAT, LUMN, CHDN, TFX, HOG, WLK, PLD, VTRS, BEPC, RRX, WBA, ITW, FICO, AMED, NEM, CHE, PENN': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 44: JKHY, MTN, ELS, BOKF, BKR, DH, INTC, CC, PCTY, IPG, LDOS, WM, UHS, SQ, DD, FAST, LUMN, DE, MCW, EQH, EMR, BWXT, SYNH,

INVH, PFE, WPC, ADT, HBAN, THG, COST, IDA, ES, MAA, ALGM, KMX, LEN, ITW, EA,
 SLM, CSCO, WEC, UMPQ, ECL, OMF, TSCO, EQIX, WTRG, IART, CERT, DV': Date
 2021-01-04 -0.0002
 2021-01-05 0.0001
 2021-01-06 0.0003
 2021-01-07 0.0001
 2021-01-08 0.0000
 ...
 2021-12-27 0.0001
 2021-12-28 0.0000
 2021-12-29 0.0000
 2021-12-30 0.0000
 2021-12-31 -0.0000
 Length: 252, dtype: float64, 'Portfolio 45: USB, RNR, TFSL, CIEN, IPGP, SSNC,
 WRB, UHAL-B, HTZ, ACGL, IRM, NATI, FFIV, OSK, NWS, MET, KMX, IVZ, LAD, OLLI,
 CTRA, MO, RGEN, PDCE, ROP, IONS, SMAR, RYN, KEY, PPG, RPM, WCC, PLTK, UNP, AJG,
 CNP, WPC, AYI, ZBH, CF, LHX, DLTR, COUP, DAL, REG, HBAN, TMUS, WMB, AMGN, SNA':
 Date
 2021-01-04 -0.0002
 2021-01-05 0.0001
 2021-01-06 0.0003
 2021-01-07 0.0001
 2021-01-08 0.0000
 ...
 2021-12-27 0.0001
 2021-12-28 0.0000
 2021-12-29 0.0000
 2021-12-30 -0.0000
 2021-12-31 -0.0000
 Length: 252, dtype: float64, 'Portfolio 46: GFS, UPS, TTWO, LVS, BLK, SITE,
 FBIN, IPG, AMG, DOW, AMGN, PTON, AMCR, AYX, BKNG, DELL, IDXX, UDR, URI, MP,
 MTCH, YETI, C, HD, PCOR, PANW, LEN, SRPT, WTW, LSXMK, NEU, UMPQ, EXC, BSY, PAYX,
 MDLZ, SYNH, VST, MTG, LSXMA, ELV, KD, MBC, DBX, CSCO, BC, ILMN, RJF, TECH,
 EBAY': Date
 2021-01-04 -0.0002
 2021-01-05 0.0001
 2021-01-06 0.0002
 2021-01-07 0.0001
 2021-01-08 -0.0001
 ...
 2021-12-27 0.0001
 2021-12-28 -0.0000
 2021-12-29 0.0000
 2021-12-30 0.0000
 2021-12-31 -0.0000
 Length: 252, dtype: float64, 'Portfolio 47: CRI, AIZ, BERY, AMP, FE, IT, AVT,
 CCCS, PNFP, INCY, FIVE, INTU, UNH, AXS, PINS, LEN-B, SWKS, VNO, EQH, AON, IAC,
 MRO, CG, HXL, VST, FOUR, AGL, MMM, NNN, ATO, NOC, IPGP, AFL, PLNT, FIS, AGO,

TPL, MTCH, WELL, LII, KEY, FCNCA, FTV, MOS, CRL, PLUG, GH, CACC, HPQ, PSA': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 48: THC, CNC, AA, CSCO, SNV, CINF, RGEN, NWS, ATUS, NTRS, NTRA, AMED, BKR, EL, IBKR, ST, ROK, DIS, BYD, SGFY, ATVI, LII, ENTG, AES, GH, DVN, CDAY, EQR, FR, TTWO, MSI, UTHR, CAT, OSK, APD, DUK, CHDN, AFRM, TRGP, VFC, LAMR, SNDR, OMF, LITE, ACN, GME, FAST, MBC, CRL, LULU': Date

2021-01-04	-0.0001
2021-01-05	0.0002
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 49: PEN, SHW, J, MIDD, AA, SPB, UPS, V, ON, VRSN, SEB, H, RNR, KKR, GLOB, CRI, ACN, CF, SAM, CSL, HWM, GH, BPOP, CGNX, PARAA, COTY, CHRW, PNC, SOFI, ALSN, UBER, ASH, CE, ZG, TREX, SIRI, ALNY, KMB, A, CNA, MTB, CTAS, CERT, RGA, FDS, GNTX, MOS, FOXA, VSCO, LHX': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0003
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 50: LPX, CCI, ES, MTN, GEHC, AKAM, TW, APTV, NEE, UAL, ERIE, CGNX, PAYC, NI, SGFY, TSCO, WEX, NRG, AEE, BRX, BERY, HHC, ADSK, VICI, FLT, CBSH, SCCO, MTCH, TOL, NDAQ, GFS, ESTC, BOKF, MOS, TROW, NVDA, RE, LMT, SRCL, ENTG, CDW, PKG, TXN, MAA, SSRM, FIVE, INVH, GIS, CPA, SBUX': Date

2021-01-04	-0.0002
2021-01-05	0.0001

2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 51: WST, AMG, SYK, AIG, GRMN, REXR, LHX, EHAB, SYF, NYT, NCNO, ATO, GNRC, FLO, LITE, ANET, MMM, KMPR, MSA, THC, KR, SCCO, UUMC, DOW, COP, W, AAL, CTLT, IBKR, TPX, J, CLVT, SBUX, KMI, NEWR, PEGA, CMA, DOCS, CFG, WWE, CIEN, SYNH, BILL, DOCU, ZION, BURL, VMC, SOFI, ZS, SLB': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0003
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 52: CZR, AJG, LDOS, SKX, CDNS, AGR, MSGS, RNG, PII, PRU, AEE, ON, LNT, DISH, CPRT, CPB, IFF, AXON, AZPN, RE, HIG, VFC, ENTG, DH, ADM, AMED, SPR, SYK, CAH, BPOP, AZTA, CLH, SRC, HR, MSA, EQR, ROL, LYB, CLF, UBER, VTRS, MAT, PEG, CC, CHRW, SNOW, ROST, ESS, WOOF, SLB': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 53: RNR, SLB, COST, CERT, ACGL, AEE, CLX, LYB, EEFT, GNTX, TAP, VIRT, CMS, CHPT, REYN, KMX, MSGS, FCN, ENPH, SGFY, NNN, MP, TPX, RL, BBWI, PWR, XRAY, KEY, GO, ARE, M, CMCSA, IDXX, ERIE, UMPQ, ALL, BXP, MGM, DRVN, REXR, BOKF, SEIC, DH, PEG, AMZN, UNH, AR, FG, AMD, HUM': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001

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2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 54: EXPD, PPL, HII, VST, CIEN, OGN, LAD,
ABC, FTNT, ITW, BA, COP, UMPQ, GPS, CTSH, CME, LSI, UNM, EXC, AMD, SCCO, MSM,
SUI, LVS, VSAT, TROW, NVCR, EL, NFE, DEI, DDOG, SNDR, JBLU, MBC, EVR, IT, UHAL,
PWR, EHAB, NKE, FRT, SWN, RGEN, CR, ADSK, BWXT, CNM, LSCC, GS, KEYS': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 55: EQR, SWK, JNJ, MET, ALGN, CTSH, LYV,
EHC, OKE, UTHR, TREX, ALB, MRCY, LAD, IRM, DTM, LSI, VSAT, NTRA, AZEK, KIM,
CBSH, CG, PAG, CSGP, EIX, D, LLY, AVB, MAA, MDB, MU, CMG, TYL, SNPS, HUBS, EQT,
ABT, ZS, BMRN, LULU, DBX, ABBV, EW, AMGN, PXD, AZPN, HE, FRT, DCI': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 56: CMS, RBLX, VTRS, JBLU, DCI, PPC,
KIM, WST, VRT, MIDD, NFLX, PNC, GOOG, AMP, R, FWONK, ARES, INFA, MOS, WDC, DHI,
LKQ, OMF, SPG, CTLT, CSX, PEAK, HCA, CARR, GS, NTRA, SWK, ZION, PARAA, CRWD,
CINF, WWD, DVA, XPO, UBER, SGFY, KEYS, FWONA, SNDR, WBS, DGX, SQ, NTRS, HBI,
RXO': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0002
2021-01-08   -0.0000
...

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2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 57: ISRG, PII, GGG, ARE, ZS, LCID, PPL,
VVV, FOX, IP, GLPI, UA, ASH, MMC, KRC, GTES, YUM, EVA, SPLK, CPT, GNRC, MDB,
JPM, MAA, MKSI, HRB, FITB, NLY, DPZ, RITM, NFE, DXCM, CAT, RF, NTAP, ETR, X,
PCTY, GIS, CCI, JNPR, EXAS, FOUR, WCC, ERIE, ENTG, AFL, UPST, MET, KLAC': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 58: CAG, PK, UWMC, MTZ, PKI, FIS, X,
NWL, EVR, INCY, C, LOPE, FMC, ACHC, PEP, HII, TXG, EHC, AR, ZTS, OLPX, WMS, IAC,
FE, AVY, LSCC, UPST, VMC, MTN, COLM, BG, MAS, COST, D, MTD, ABT, DKNB, CE, RYN,
KRC, WST, TJX, CAT, AMGN, DASH, HE, BBY, MSFT, MU, FICO': Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08   -0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 59: AYX, FCN, CPRI, RMD, WRB, DASH,
FFIV, TKR, TER, PLTK, FDX, SF, IART, MORN, DAL, TYL, NSC, TXT, EL, DECK, ETN,
VSAT, V, QRVO, AJG, MS, DKS, JAZZ, FRC, CABO, MDU, MDT, DNA, PATH, TSLA, ENPH,
VEEV, CHK, INCY, ABT, EHC, ADP, GEN, EQH, LSI, CCL, MSFT, CAH, SON, WTRG': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000

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2021-12-30    -0.0000
2021-12-31    -0.0001
Length: 252, dtype: float64, 'Portfolio 60: ELV, DHI, MET, FCX, CW, EQH, ZTS,
WAL, NVAX, ADT, U, KEY, AMC, SIX, MPC, HTZ, ADBE, LAZ, ALNY, LSTR, L, FBIN,
TTEK, FAF, MA, JAZZ, IPG, OPEN, AEE, RE, AGNC, FSLR, HZNP, SEE, UNM, MDLZ, TFSL,
AMG, HRL, PAYX, FLS, BIO, MTN, PLTR, THC, SHW, FLO, DECK, CI, TROW': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0004
2021-01-07     0.0001
2021-01-08    -0.0000
...
2021-12-27     0.0001
2021-12-28     0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 61: IRM, OGE, FTV, MASI, ADM, RRX, DHI,
ALLE, HIG, TTD, GO, HLT, AES, SOFI, AFG, NSA, IFF, DPZ, STT, AWI, WFC, DD, TDY,
IR, AZTA, NBIX, PH, SNV, IDA, IQV, WMT, CI, FIS, HAYW, AGL, AEE, SBNY, DLR,
OPEN, SEE, USFD, ANSS, ALLY, F, PB, XOM, TNL, CBRE, INCY, RRC': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0003
2021-01-07     0.0002
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28     0.0000
2021-12-29     0.0000
2021-12-30     0.0000
2021-12-31     0.0000
Length: 252, dtype: float64, 'Portfolio 62: BILL, WLK, MCHP, AFL, AMG, SCI, GWW,
OMF, DT, KRC, FG, SEB, WST, SLG, LDOS, HXL, SPOT, SYK, JBHT, LITE, SLB, ELAN,
RRX, CNA, EVRG, MA, TSN, ABT, OLPX, HUN, INFA, ZS, CF, PCG, NTRS, GTES, META,
GFS, MET, MAA, RJF, TPL, ADBE, LOW, INTU, TNDM, MS, MSI, DBX, CSCO': Date
2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30     0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 63: MSI, A, OLPX, RNR, PPG, UHS, AMAT,

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TDC, JEF, SRE, PINC, REYN, ALL, GDDY, UGI, PH, SSRM, CPB, IPG, ENTG, ELV, DNB, FAF, ANET, IBKR, SEIC, SF, TMO, LH, ELAN, TAP, MA, PFGC, ERIE, SPB, AXP, LBRDA, OKE, CACI, AN, FWONK, TTWO, USFD, CFG, SNA, DXC, ES, LEN, TYL, CHD': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 64: ITW, MSFT, EMR, MMC, BDX, EA, AL, LUV, BOH, SJM, MORN, MSGS, NTN, CDW, CPRI, FTV, NWSA, RPRX, BBY, RMD, TEAM, PLTR, KMX, NRG, ALL, DEI, CPB, IDA, LOW, EVRG, PSTG, FIS, CHD, IFF, SUI, APO, GEN, ZS, COHR, G, AEE, POOL, PRI, KBR, AMP, BFAM, PEG, TRV, SGFY, LYV': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0001
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 65: EXPE, IART, FIVE, APD, WM, CMCSA, SNV, FDS, WMB, REG, SBNY, CGNX, VRSN, XPO, ZION, ESS, UAA, INFA, BERY, IT, VTS, AGNC, TPX, LH, NTAP, GIS, KR, ALSN, ANET, MANH, MTCH, AMGN, SNA, WPC, LHX, CCL, RPRX, HAL, TNDM, CABO, AL, TDG, TTD, PAYC, KMPR, DH, FND, SCI, ACM, VNO': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 66: LOPE, VEEV, TROW, POST, USB, WWD, NDSN, PSA, GFS, MGM, FOXA, ANSS, NCR, GWRE, TWKS, ICUI, DASH, WTFC, RTX, OGE, HBAN, SMAR, UPS, APO, BJ, CLVT, CC, TFSL, AVB, CG, CNP, GS, TW, AM, UWMC, AXTA, HZNP, IT, X, ORLY, BOH, PODD, EMR, ACM, ECL, SY, TTWO, APP, AMAT, TYL': Date

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2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29    -0.0000
2021-12-30     0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 67: J, SGEN, WMS, WM, SNA, NVST, AZO,
ANSS, RH, D, WFTC, JNJ, DNA, MSFT, BURL, BWXT, ALLE, M, RE, ORI, CTAS, DVN, DOX,
PWR, CMS, ACGL, MTG, AAP, FR, WSM, FLS, MBC, GNRC, DASH, AWK, AXON, ATO, IONS,
RNG, KSS, GEN, PLTK, PCOR, AMED, MKTX, UNVR, RMD, TRGP, FRPT, KEY': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0003
2021-01-07     0.0002
2021-01-08    -0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 68: MS, SRCL, SO, APH, FRT, ROL, XRAY,
GS, L, BOH, CHPT, ACI, IRM, EEFT, ENTG, MRTX, KLAC, COP, MCD, CSGP, BOKF, LW,
APO, SNOW, PCTY, SYF, U, UNM, MKTX, MPWR, NOW, KRC, WOOF, TROW, WY, APTV, AXON,
ETSY, FOX, PTC, AGR, WAB, LBRDA, TWLO, CRM, HTZ, MCO, IDA, CMA, AIG': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0001
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29    -0.0000
2021-12-30     0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 69: BBWI, PXD, PKG, RIVN, GME, HBI, NWS,
MRTX, CME, PM, GWRE, FRC, AXP, LPLA, SPLK, PCOR, NTRA, PCAR, EEFT, ETSY, VTS,
KD, DBX, INCY, KMI, NOV, MO, LII, SRPT, RGLD, CBOE, SBNY, VTRS, ALK, NVT, STZ,
UNVR, SNA, BHF, COIN, LEG, ROL, CNXC, DTM, TFX, ZBRA, IR, UAL, SBAC, SJM': Date
2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0003

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2021-01-07    0.0001
2021-01-08   -0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 70: SRPT, SPGI, TSCO, FIS, GNTX, STT,
CTVA, DLR, IEX, JHG, ZG, RF, TDG, GPN, BALL, PINC, EPAM, BHF, PARA, FLT, CLH,
GME, WTRG, APD, ETSY, PKI, MHK, WIX, ELAN, DT, MANH, SGFY, WAT, WRK, AVB, JCI,
CNXC, OMF, FITB, SKX, TOST, EEFT, PII, CBOE, APP, TPX, LEN, QRVO, KMX, GOOGL':
Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08   -0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 71: CVNA, XPO, NRG, FITB, NTRS, HPQ,
DNB, BSY, MANH, AZTA, A, G, BXP, CGNX, FE, RGEN, NVST, CTVA, ZS, AMG, UHAL, GWW,
DRVN, ATUS, OC, FCX, EXPD, MS, FICO, CLF, V, KKR, SBAC, SCI, NCLH, NCNO, CC,
AVTR, PINS, AGL, CCCS, ACM, CHTR, CVS, IR, ABT, WST, GEN, MSM, PSX': Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 72: CDW, FCX, HUM, PPL, CNA, OVV, EMR,
CNXC, BKNG, GD, DVN, LULU, EHAB, DD, PKG, RPM, LSCC, REYN, CPB, CTSH, HEI-A,
PNFP, BYD, DH, AWK, NRG, MRCY, ARES, WMT, CHPT, EBAY, MOH, ARE, SIRI, BEPC, DVA,
AXON, WWD, REG, MSCI, NTRS, RJF, INGR, CTLT, BERY, HPE, LYB, FNF, ACN, AFG':
Date
2021-01-04   -0.0001
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001

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2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28    0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31    0.0000
Length: 252, dtype: float64, 'Portfolio 73: GPC, MKTX, WBA, BLDR, ESAB, PARA,
ANET, IRM, CEG, BSY, AVTR, TRGP, CMS, GO, GPK, MOS, WWD, CZR, CINF, MTCH, H,
MASI, RPM, SF, TOST, PB, FISV, UBER, AMC, EPR, VLO, TWLO, ZBRA, RS, KRC, BBY,
NTAP, UTHR, TROW, V, NVT, TKR, DT, ESTC, QCOM, KMPR, ZS, COIN, SON, O': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08   -0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 74: RJF, LPX, CDAY, SYNH, CHH, AFL, FNF,
NXST, HLT, APH, GE, COTY, EHC, WPC, CTAS, ZS, IAC, MTN, SPLK, SLGN, ALL, EXPD,
AR, RRC, FR, FOX, CE, SAM, NDAQ, LEN, SMG, OTIS, FHN, TMO, PG, TRMB, CVNA, TTD,
Z, LUMN, DLTR, AMCR, CRL, CW, EL, VIRT, KR, GLPI, BURL, SGEN': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08   -0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 75: CRL, CRM, OGE, BSY, TREX, TWKS, STZ,
LBRDA, CGNX, GL, SLM, ALGM, SIRI, CBRE, BSX, HUBS, COHR, CMS, FNB, NCNO, IRM,
ABNB, ELV, NOV, GPN, DRI, CHDN, SNV, CTRA, UGI, TMO, PKI, ORCL, AMED, DECK,
DDOG, THG, NEU, RSG, CDNS, EWBC, TXN, WEN, HPE, MBC, GEHC, AL, UNP, EL, MDLZ':
Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0000
...

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2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 76: LNG, SKX, LEA, CNXC, ICUI, X, GEHC,
TSN, ADP, RIVN, WEC, F, CG, MORN, FWONK, NWS, RCL, GD, K, NFLX, ORLY, URI, PEN,
LESL, RXO, CHD, EXC, LLY, TXG, FCNCA, FMC, OSH, JAMF, MPW, AFRM, ESTC, COF,
OLLI, RSG, MTG, LSTR, ZM, IVZ, FHB, COST, NYCB, CTVA, FISV, VICI, TWKS': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29   -0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 77: DRVN, VLO, PTON, IFF, AVY, AMT, TPL,
KEYS, SWKS, ALLY, LYV, TTD, COF, MS, VNO, CDAY, VIRT, PRI, KKR, MTN, LBRDA,
AMCR, ETR, AAPL, EPAM, EXR, AZO, CSX, ULTA, MPWR, PINS, ICUI, ZBH, UNM, IRM,
ELS, IP, GNRC, SWK, MCHP, TSLA, OTIS, SF, CRI, AFL, NI, SHW, FWONK, ACHC, VSAT':
Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 78: LSTR, UBER, AXON, PEGA, LCID, PODD,
VLO, QDEL, TGT, SYU, DIS, HBI, NTAP, GEHC, BK, BAX, DKS, F, PENN, NCR, STE,
PLUG, CLF, CNC, MTD, ORLY, DNA, UAL, WOLF, BSY, HSY, VEEV, MAR, RITM, SSNC, EGP,
CI, ETSY, AXP, ILMN, GO, PK, YETI, CPT, XOM, QRVO, EOG, UWMC, FWONK, ODFL': Date
2021-01-04   -0.0001
2021-01-05    0.0002
2021-01-06    0.0002
2021-01-07    0.0002
2021-01-08    0.0001
...
2021-12-27    0.0001
2021-12-28   -0.0001

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2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 79: MRVI, EGP, LSTR, ROKU, LPLA, TFSL,
DOCS, FTV, K, ALB, VSAT, MRTX, TWLO, SLM, ULTA, NXST, VRSK, ITW, GILD, PPL, MAN,
WIX, LII, CVNA, BRX, PATH, DOW, CNM, DH, JEF, DHR, GWW, HWM, MKSI, HD, CHK,
MIDD, AMZN, J, WOOF, WMS, APTV, CF, WM, SNDR, INGR, AIG, WDC, USFD, WEN': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 80: LKQ, TT, MRTX, AMAT, VAC, LYV, SNA,
CPT, MCHP, SEE, NEE, DOV, SSRM, TSLA, FND, LAMR, DEI, KDP, WMS, CARR, PH, MGM,
CACI, KRC, BKNG, LBRDA, PRI, HES, OKE, TW, PCOR, AIRC, TTWO, PTON, EMR, R, EQH,
BSX, APP, DE, EXP, NDAQ, HOOD, IT, SSNC, FOX, BK, IONS, AZO, XEL': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0003
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30    0.0000
2021-12-31   -0.0000
Length: 252, dtype: float64, 'Portfolio 81: LSCC, SHW, AAP, CABO, EL, FDX, KMI,
USB, MET, PPL, ERIE, DBX, PAYC, WAB, UHAL, TFX, ABBV, AL, RTX, J, ORLY, LVS,
PSTG, BMRN, HUBB, EW, KEX, SGEN, CCCS, FLO, KDP, WPC, LEA, XEL, NCR, IT, HBI,
UI, HUBS, FNB, IEX, TRMB, HBAN, MAT, FTNT, UNM, RARE, MCW, AFRM, APD': Date
2021-01-04   -0.0002
2021-01-05    0.0001
2021-01-06    0.0002
2021-01-07    0.0001
2021-01-08    0.0000
...
2021-12-27    0.0001
2021-12-28   -0.0000
2021-12-29    0.0000
2021-12-30   -0.0000
2021-12-31   -0.0000

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Length: 252, dtype: float64, 'Portfolio 82: NTAP, HWM, VRSK, ETR, ERIE, FNF, POOL, ELS, DXC, GE, WE, UTHR, ADBE, EXR, WST, PSX, DOCS, CLVT, SCI, LOPE, WOLF, CRM, NTRS, DECK, PEP, PM, UNH, LAMR, SNA, HBI, TT, ICE, VIRT, MCHP, ALLY, MDU, WBS, FFIV, SBNY, GLPI, GEHC, RGA, LAZ, LIN, FRC, AVB, EHC, AFL, SRE, WELL': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	0.0000

Length: 252, dtype: float64, 'Portfolio 83: HPQ, KIM, INVH, RNG, VOYA, IONS, IEX, GWRE, DNB, TFX, CTAS, BG, DHI, BAX, NVCR, MTZ, PNC, OLN, TMO, JAMF, TRMB, PKI, CTLT, OVV, BILL, MLM, REYN, LPLA, UNH, ABT, TRU, KKR, EQH, ICUI, PK, REXR, AVGO, CRUS, HE, WAL, AES, AIG, LEG, GM, REGN, CCL, PEG, PARA, HOOD, TKR': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 84: IR, PLD, PWR, CLH, KO, AR, UNVR, AL, NKE, ATVI, SAIC, OXY, EPAM, PEG, PYPL, SCCO, ARES, EQT, GL, ICUI, PEAK, DNB, FRPT, EVA, JPM, LULU, RF, ROKU, AEE, ZBH, ORLY, PTC, HBI, ALGN, CHK, WU, D, W, BLDR, SKX, ARW, HON, WDAY, BKI, PNC, DOCS, NVAX, GPN, PAG, LSXMK': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 85: H, LEN-B, UAA, BMY, LNG, EPAM, THG, JPM, HEI, HHC, NSA, MRVI, JLL, HST, ED, LSTR, NOV, MO, BBWI, OTIS, HRB, HOOD, SKX, FAF, HCA, SRPT, FR, SHC, PG, LBRDA, GILD, KNX, RMD, USB, HAL, SGFY, GDDY,

AZPN, PARA, BAH, CVX, ABC, PAYC, KMB, AAL, LYV, NEU, WLK, EQIX, REGN': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	-0.0001
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 86: LSXMA, NVDA, MIDD, AVT, OSH, NYCB, BWA, MCHP, ODFL, MOS, ASH, NRG, META, CHPT, EA, AXP, BC, AEE, PAYC, KRC, PWR, LIN, CACI, RSG, LPX, BMY, JBL, HPE, AMGN, MRNA, KHC, GS, ROK, ROST, SPB, VFC, FLT, MRO, AR, DXC, BILL, RH, T, MSFT, MTZ, ACHC, MKC, PM, NTRA, POST': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 87: CAR, SBUX, DOW, COTY, RRC, PCOR, EMN, VIRT, BK, MIDD, VNT, PANW, KRC, NVST, COUP, SYK, BRX, GLOB, SRE, BMY, FIS, SCI, DPZ, UHAL-B, T, INCY, LOPE, AMG, NSC, FNB, EXR, FAF, STWD, CCI, ARMK, UGI, SEIC, HR, RNG, WM, IBKR, FTNT, AGNC, CTAS, PSTG, ABBV, DIS, UBER, WU, SBNY': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 88: PAYC, ALL, PH, BALL, ALK, CMA, PGR, BJ, ARMK, LECO, SEIC, BBWI, LYFT, ROL, GMED, OHI, CL, TTWO, DELL, CMS, HE, HEI, EXP, CTLT, PM, AAL, FND, MANH, ABNB, BPOP, LW, KRC, ISRG, WIX, A, W, GXO, HD, RGA, TFX, CDW, URI, TEAM, YUM, NET, DISH, MNST, TTD, AXON, BOH': Date

2021-01-04	-0.0002
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2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001
2021-01-08	0.0001
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 89: MNST, GMED, HPP, VFC, DLR, WTM, WELL, MCD, FCNCA, L, SEB, EIX, CR, NVAX, CSX, KSS, AXS, CPB, AGL, CL, JBL, TOL, CVS, CAH, AZPN, VIRT, GLOB, PEG, CACI, ZION, LPLA, ECL, RE, CCCS, SUI, SPB, PYCR, SYK, HCA, PCG, BF-A, NEU, CFG, BF-B, ADM, WTFC, JWN, ROK, SNA, HUN': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0003
2021-01-07	0.0001
2021-01-08	-0.0000
...	
2021-12-27	0.0001
2021-12-28	0.0000
2021-12-29	0.0000
2021-12-30	-0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 90: FTV, TDG, ARE, CVS, JHG, JNPR, WMS, POOL, PLUG, WOLF, AGL, MRO, EHC, CLVT, ISRG, MDB, PPC, GRMN, META, MLM, OGN, EQH, NI, DVA, PCTY, TDOC, RNR, ADP, PII, GIS, SEIC, CPRI, TTC, KEX, WM, AWI, RITM, MSM, BX, APTV, IPG, BALL, CTVA, DECK, K, T, DAL, AMCR, TWLO, RPM': Date

2021-01-04	-0.0002
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0002
2021-01-08	0.0000
...	
2021-12-27	0.0001
2021-12-28	-0.0000
2021-12-29	0.0000
2021-12-30	0.0000
2021-12-31	-0.0000

Length: 252, dtype: float64, 'Portfolio 91: VOYA, EW, ADI, DE, INTU, R, EWBC, GO, MKL, TOL, LEA, KHC, KRC, CTLT, WAT, WTRG, BAH, SPLK, MU, OLPX, CG, FE, HAL, ENPH, FHB, FHN, DHI, TGT, OHI, O, EA, TDG, SIRI, KSS, FFIV, PVH, MRVL, ASH, EBAY, BWXT, MPWR, UAA, MAA, MAS, OXY, CHK, ACM, PYCR, MDB, EGP': Date

2021-01-04	-0.0001
2021-01-05	0.0001
2021-01-06	0.0002
2021-01-07	0.0001

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2021-01-08    -0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0001
2021-12-30    -0.0000
2021-12-31     0.0000
Length: 252, dtype: float64, 'Portfolio 92: SBUX, LOPE, ACGL, PPG, TXN, BSY, TW,
ARMK, NBIX, BLD, MCW, BKI, CTRA, AIRC, HHC, R, BEPC, DCI, PPC, LBRDK, PEG, AWK,
ROL, WBA, CHDN, MSGS, BALL, FE, WCC, RCL, VTR, STLD, ABT, INFA, BDX, HEI-A, AR,
DLTR, GEHC, PEP, TSN, RUN, LMT, DNB, TDG, ISRG, HOLX, MRK, WST, TRV': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0001
...
2021-12-27     0.0001
2021-12-28     0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31     0.0000
Length: 252, dtype: float64, 'Portfolio 93: OMF, AMCR, CPT, BSY, GNTX, CRL, U,
SMG, KMPR, EL, BILL, TFSL, FTV, ELV, APH, PEGA, DOCS, PLTR, WAL, BC, HBAN, PAYX,
LOW, FDS, PII, AFG, GEN, NOC, BOH, PEG, VMW, ES, TDG, LVS, VEEV, VOYA, LPX,
HSIC, EXC, TRU, F, FNB, MMM, KRC, UMPQ, QRVO, RKT, BIIB, NBIX, NXST': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30     0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 94: BRKR, CAR, NTAP, OSK, TAP, TREX,
FSLR, WBA, CDW, SLB, DECK, ITT, ARW, REXR, HZNP, PTON, SPG, VTS, MA, AM, NNN,
CF, WM, ALB, KMB, WAL, PARA, AVTR, MMC, FISV, PDCE, PSA, WPC, TSLA, BBWI, LYB,
CVX, KNX, FTNT, AL, BWXT, CNA, ODFL, NSC, PEAK, DBX, UWMC, ANET, WIX, THG': Date
2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0003
2021-01-07     0.0002
2021-01-08     0.0000
...
2021-12-27     0.0001

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2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 95: EL, TWKS, SBNY, SNA, ADP, LPX, APH,
VFC, FYBR, PKI, COP, HEI-A, UHAL, CHH, SF, AXON, ICE, PDCE, WRK, GWRE, ETR, MLM,
GD, STT, CB, SRPT, FDS, IRM, VTS, SEB, AMCR, DKN, SMAR, AZTA, GILD, ZTS, CI,
NUE, ULTA, NVST, UAA, HSY, EVR, DVA, OSK, CBOE, BKNG, FIVN, PHM, SNOW': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08    -0.0001
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31     0.0000
Length: 252, dtype: float64, 'Portfolio 96: CHH, INTC, PSA, HES, LPLA, TECH, ZM,
BWA, OKE, CASH, HAS, GWRE, HXL, MCD, TXG, PKI, MORN, CNC, NKE, AXTA, MPWR, AME,
OGE, ZG, EFX, HEI-A, SBUX, CGNX, SBAC, CDAY, FITB, QS, ABNB, PRU, JAZZ, FCX,
VSAT, HPP, APP, WPC, PEP, WCC, SCI, THG, FICO, SOFI, CTRA, RGA, SAIC, COLD':
Date
2021-01-04    -0.0002
2021-01-05     0.0002
2021-01-06     0.0002
2021-01-07     0.0003
2021-01-08    -0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30     0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 97: ENTG, LFUS, STT, WTFC, NCNO, SWN,
CPRT, CTSH, MRNA, SPB, EXPD, PII, TNL, ATO, ADT, VSAT, WAL, DFS, CVX, TPL, PCTY,
MMC, DVA, DKS, O, AMCR, COHR, SEIC, NET, CBSH, LVS, BF-A, TDOC, FRC, VAC, LSXMA,
MDLZ, SWKS, WTW, LESL, AZEK, VFC, CNP, HON, MTZ, W, MAA, HPP, AOS, KEYS': Date
2021-01-04    -0.0001
2021-01-05     0.0001
2021-01-06     0.0003
2021-01-07     0.0001
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000

```

```

2021-12-30    -0.0000
2021-12-31     0.0000
Length: 252, dtype: float64, 'Portfolio 98: DISH, HPP, DIS, CMA, DOCU, UNH, GME,
DOX, RYAN, HTZ, EVR, WCC, PCG, STWD, NOV, MKC, FMC, SAM, MO, MDT, IT, SPGI,
FTNT, ATVI, WM, AMP, UHS, O, GDDY, NSA, NSC, SHW, WBS, LAD, MMM, CC, SRPT, ALB,
UTHR, KR, NVR, IART, MRO, BLD, IDA, FCN, INTC, JAZZ, COHR, TEAM': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08    -0.0001
...
2021-12-27     0.0001
2021-12-28     0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 99: DBX, ESTC, VSCO, LKQ, CHPT, AKAM,
WOLF, MAR, PHM, WRB, BIIB, THC, GFS, MORN, NTNX, EA, PSX, TTC, XPO, CW, SPOT,
COHR, PRU, MTD, OLN, BOH, WPC, GWRE, PLUG, HTZ, OXY, DHI, EOG, NRG, NFLX, SBUX,
SEIC, TPR, FRC, LW, STWD, AFG, LULU, UDR, VIRT, ARE, AZPN, RYN, CARR, RMD': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0002
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28    -0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31    -0.0000
Length: 252, dtype: float64, 'Portfolio 100: KBR, ARES, JNPR, MBC, CSL, ZBH, FR,
ITT, OLLI, UNP, ED, AXON, PII, JLL, BXP, HSY, PPC, JBHT, ROK, CB, HIG, CRUS,
CPRI, COHR, JPM, Z, AGNC, AMG, LIN, CLX, RPM, CTAS, AVT, TNDM, TRGP, LOPE, SPGI,
FLO, APTV, LUV, WIX, ETR, GGG, FCN, CFG, CSX, VIRT, POOL, CCK, WHR': Date
2021-01-04    -0.0002
2021-01-05     0.0001
2021-01-06     0.0002
2021-01-07     0.0001
2021-01-08     0.0000
...
2021-12-27     0.0001
2021-12-28     0.0000
2021-12-29     0.0000
2021-12-30    -0.0000
2021-12-31     0.0000
Length: 252, dtype: float64}

```

```
[32]: portfolio_returns_df_1 = pd.DataFrame.from_dict(portfolio_returns_dict_1,
    ↪orient='index', columns=None).transpose()
portfolio_returns_df_1.columns = [f'Portfolio {i+1}' for i in
    ↪range(num_portfolio)]
portfolio_returns_df_1.index = pd.to_datetime(portfolio_returns_df_1.index)
portfolio_returns_df_1
```

```
[32]:
```

	Portfolio 1	Portfolio 2	...	Portfolio 99	Portfolio 100
2021-01-04	-0.0001	-0.0002	...	-0.0002	-0.0002
2021-01-05	0.0001	0.0001	...	0.0001	0.0001
2021-01-06	0.0002	0.0002	...	0.0002	0.0002
2021-01-07	0.0001	0.0002	...	0.0002	0.0001
2021-01-08	-0.0000	0.0000	...	0.0000	0.0000
...
2021-12-27	0.0001	0.0001	...	0.0001	0.0001
2021-12-28	-0.0000	-0.0000	...	-0.0000	0.0000
2021-12-29	0.0000	0.0000	...	0.0000	0.0000
2021-12-30	-0.0000	-0.0000	...	-0.0000	-0.0000
2021-12-31	-0.0000	-0.0000	...	-0.0000	0.0000

[252 rows x 100 columns]

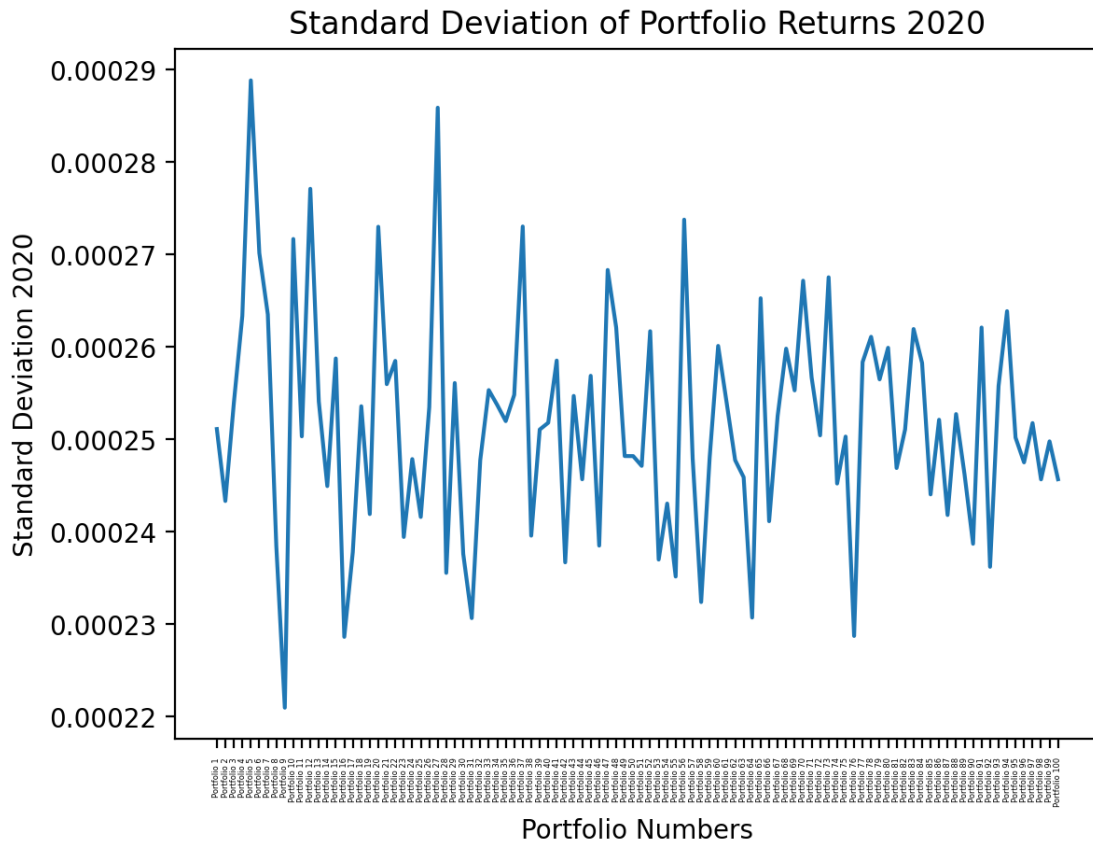
2.4.1 Task 7: Does volatility in year t predict *mean returns* in year $t + 1$?

```
[33]: y = portfolio_returns_df.std()
y
```

```
[33]: Portfolio 1    0.0003
Portfolio 2    0.0002
Portfolio 3    0.0003
Portfolio 4    0.0003
Portfolio 5    0.0003

...
Portfolio 96    0.0002
Portfolio 97    0.0003
Portfolio 98    0.0002
Portfolio 99    0.0002
Portfolio 100   0.0002
Length: 100, dtype: float64
```

```
[34]: plt.plot(y)
plt.xticks(range(0, len(y)), y.index, rotation = 90, fontsize = 3)
plt.title('Standard Deviation of Portfolio Returns 2020')
plt.xlabel('Portfolio Numbers')
plt.ylabel('Standard Deviation 2020')
plt.show()
```

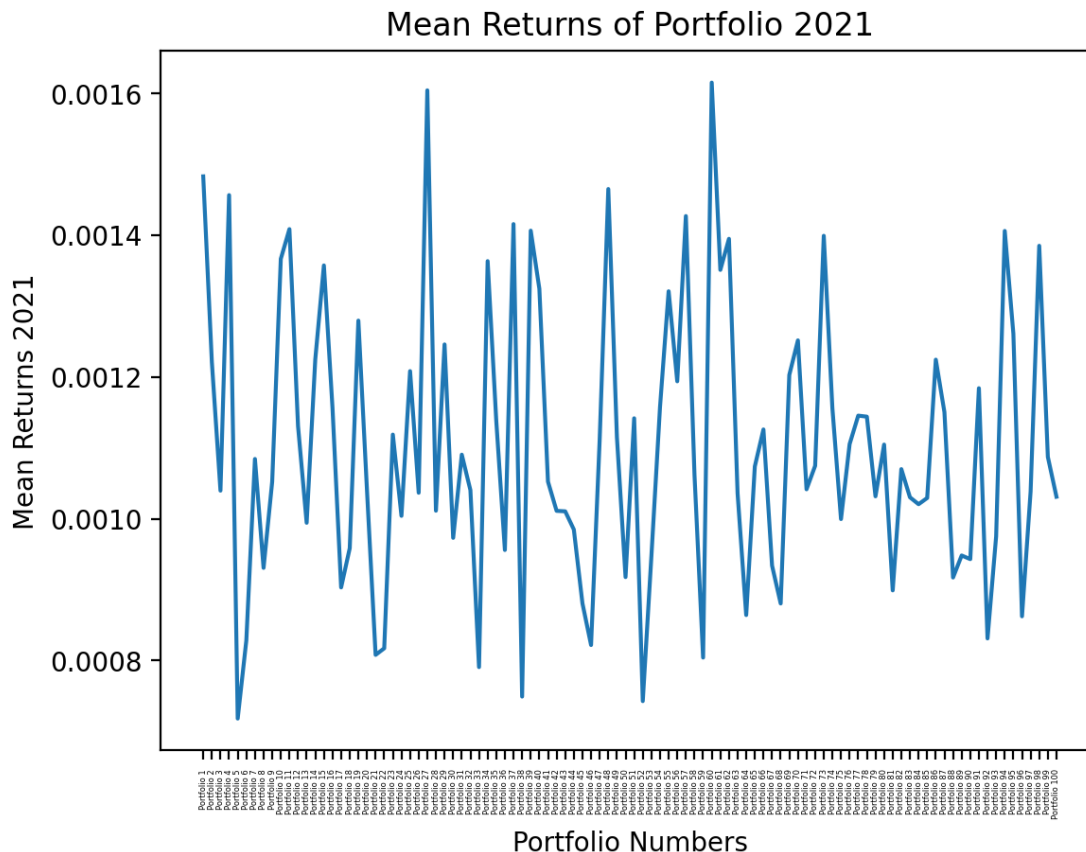


This plot can be useful for investors to evaluate the risk associated with different portfolios. If a portfolio has a high standard deviation, it means that its returns are more volatile and risky, while a portfolio with a low standard deviation is less risky.

```
[35]: x = portfolio_returns_df_1.mean().mul(100)
      x
```

```
[35]: Portfolio 1      0.0015
      Portfolio 2      0.0012
      Portfolio 3      0.0010
      Portfolio 4      0.0015
      Portfolio 5      0.0007
      ...
      Portfolio 96     0.0009
      Portfolio 97     0.0010
      Portfolio 98     0.0014
      Portfolio 99     0.0011
      Portfolio 100    0.0010
      Length: 100, dtype: float64
```

```
[36]: plt.plot(x)
plt.xticks(range(0, len(x)), x.index, rotation = 90, fontsize = 3)
plt.title('Mean Returns of Portfolio 2021')
plt.xlabel('Portfolio Numbers')
plt.ylabel('Mean Returns 2021')
plt.show()
```



```
[37]: print('Correlation between Standard Deviation 2020 and Mean Returns 2021:{:.4f}'.format(np.corrcoef(y,x)[0,1]))
```

Correlation between Standard Deviation 2020 and Mean Returns 2021:0.2027

This plot can be useful for investors to evaluate the performance of different portfolios. If a portfolio has a high average return, it means that it has performed well in terms of returns in 2021, while a portfolio with a low average return has underperformed.

In general there is a negative correlation between volatility & returns, which means that portfolio with higher volatility have lower returns & vice-versa. The point that we need to understand over here is that prior or past volatilities doesn't necessarily predict $t+1$ returns. there may be a relationship trend among these two variables, but there are many other factors as well that may affect returns of the portfolios such as market trends, economic conditions & many more unforeseen

events. Therefore, the standard deviation in year 2020 can give investors a tentative understanding of the risk with a portfolio but it may not necessarily predict the returns in year 2021.

In general the markets operate at semi-strong form of efficiency wherein the past information is already accounted for & no one can make a profit out of using the past information. If one is able to then the markets would be operating at weak form of efficiency.

As per the discussion provided above we can even see a practical example of it in the graphs presented above wherein Portfolio 5 has the highest volatility but on the other hand it has the lowest return among all the other portfolios. In portfolio 27 the case opposite as the portfolio has very high volatility but it even has a high return outcome which is totally opposite to the discussion provided.

Therefore it wouldn't be significant for us to conclude that volatility in year t predicts the return year $t+1$ as many of the other macroeconomic factors remain unaccountable & unexplained. This plot can be useful for investors to evaluate the performance of different portfolios. If a portfolio has a high average return, it means that it has performed well in terms of returns in 2021, while a portfolio with a low average return has underperformed.

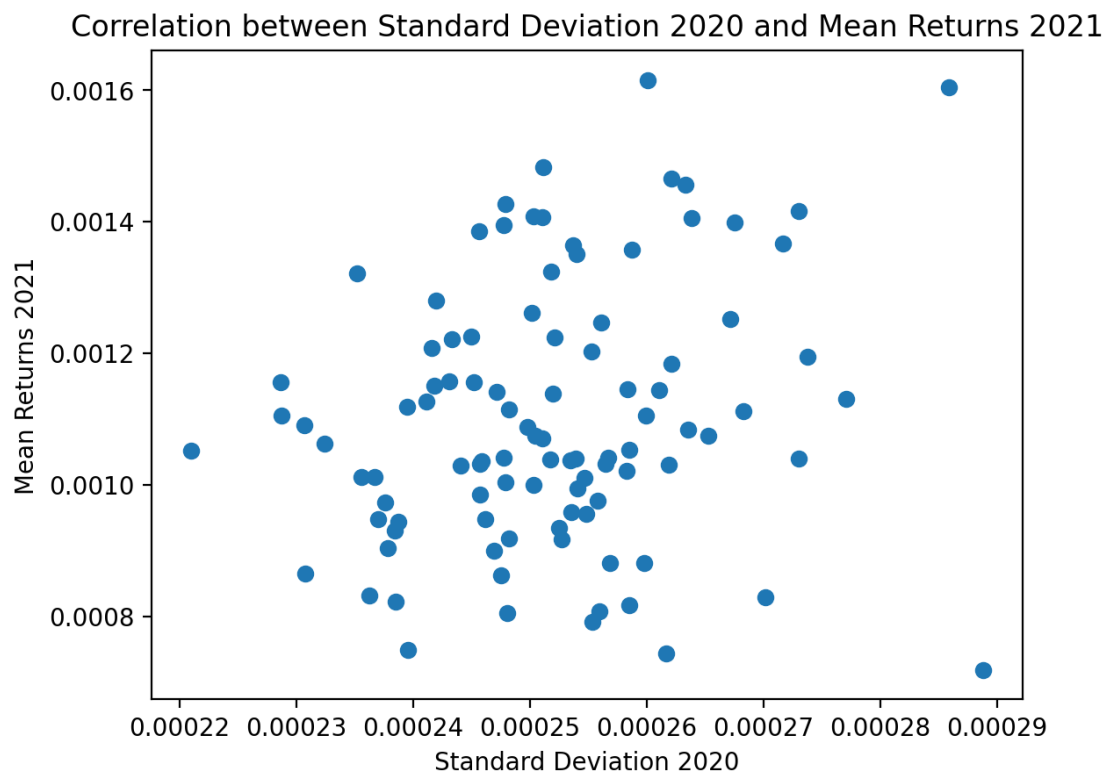
In general, there is a negative correlation between volatility & returns, which means that portfolio with higher volatility have lower returns & vice-versa. The point that we need to understand over here is that prior or past volatilities doesn't necessarily predict $t+1$ returns. there may be a relationship trend among these two variables, but there are many other factors as well that may affect returns of the portfolios such as market trends, economic conditions & many more unforeseen events. Therefore, the standard deviation in year 2020 can give investors a tentative understanding of the risk with a portfolio but it may not necessarily predict the returns in year 2021.

In general the markets operate at semi-strong form of efficiency wherein the past information is already accounted for & no one can make a profit out of using the past information. If one is able to then the markets would be operating at weak form of efficiency.

As per the discussion provided above we can even see a practical example of it in the graphs presented above wherein Portfolio 5 has the highest volatility but on the other hand it has the lowest return among all the other portfolios. In portfolio 271 the case opposite as the portfolio has extremely high volatility but it even has a high return outcome which is totally opposite to the discussion provided.

Therefore, it wouldn't be significant for us to conclude that volatility in year t predicts the return year $t+1$ as many of the other macroeconomic factors remain unaccountable & unexplained.

```
[38]: plt.scatter(y, x)
plt.title('Correlation between Standard Deviation 2020 and Mean Returns 2021')
plt.xlabel('Standard Deviation 2020')
plt.ylabel('Mean Returns 2021')
plt.show()
```



There is a weak positive linear relationship between standard deviation 2020 & mean returns 2021. It is quite unlikely that such a low correlation coefficient would have any significant impact on the decision making of the investors or the strategies.

0.2027 is a very low correlation coefficient between any two variables, therefore it's highly unlikely that volatility in year t can predict returns in year $t+1$. The correlation is not strong enough to make any prediction for future returns & also correlation doesn't imply causation.

From the graph presented above we can infer that certain portfolios that lie of the top side have higher return & volatility but the correlation coefficient is significantly low, & certain portfolios have a high standard deviation but low returns & significantly low correlation coefficient which helps us to justify our conclusion that volatility in year t cannot solely predict accurate returns in year $t+1$.

2.4.2 Task 8: Does CAPM beta in year t predict *mean returns* in year $t + 1$?

```
[39]: beta_2020 = portfolio_returns_df.apply(beta)
      print('Beta 2020:', beta_2020)
```

```
Beta 2020: Portfolio 1    0.0110
Portfolio 2    0.0109
Portfolio 3    0.0112
Portfolio 4    0.0113
```

```
Portfolio 5      0.0124
...
Portfolio 96     0.0109
Portfolio 97     0.0110
Portfolio 98     0.0110
Portfolio 99     0.0110
Portfolio 100    0.0108
Length: 100, dtype: float64
```

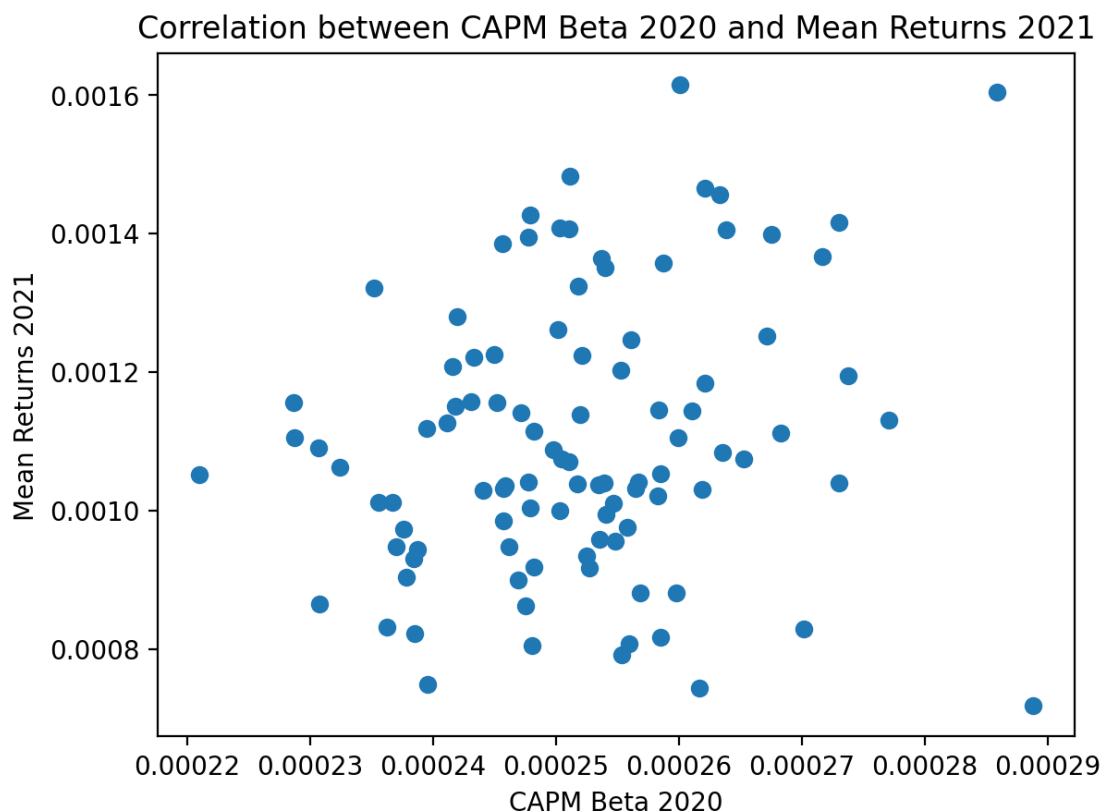
```
[40]: means = portfolio_returns_df_1.mean().mul(100)
      print('Mean Returns 2021:', means)
```

```
Mean Returns 2021: Portfolio 1      0.0015
Portfolio 2      0.0012
Portfolio 3      0.0010
Portfolio 4      0.0015
Portfolio 5      0.0007
...
Portfolio 96     0.0009
Portfolio 97     0.0010
Portfolio 98     0.0014
Portfolio 99     0.0011
Portfolio 100    0.0010
Length: 100, dtype: float64
```

```
[41]: print('Correlation between CAPM Beta 2020 and Mean Returns 2021: {:.4f}'.
      ↪ format(np.corrcoef(beta_2020, means)[0,1]))
```

```
Correlation between CAPM Beta 2020 and Mean Returns 2021: 0.1718
```

```
[42]: plt.scatter(y, x)
      plt.title('Correlation between CAPM Beta 2020 and Mean Returns 2021')
      plt.xlabel('CAPM Beta 2020')
      plt.ylabel('Mean Returns 2021')
      plt.show()
```



The CAPM beta is a measure of the volatility of a stock or portfolio in relation to the market as a whole. #It is a matter of empirical research & cannot be answered a single line of code. The CAPM model suggests that the expected return of the stock or a portfolio is linked to the beta & the market return. A higher beta may result in a higher return of the stock or the portfolio, having all the other factors constant. There may be a possibility that the beta for year 2020 & the mean return of 2021 may be related, but the stock or the portfolio return also depends on various other factors such as the overall performance of the market & any unforeseen event that may affect the returns of the stock or the portfolio.

A graph have been presented above through which we can infer that certain portfolios on the top side have the highest return with a significant amount of beta while all the other portfolios have the same or a higher beta but lesser returns which satisfies our explanation on the top that many more factors may affect the return of the stock apart from the Beat itself.

Therefore, to only conclude that CAPM beta in year t predicts the mean return in year $t+1$ may not be significant as all the other factors are not accounted for & remain unexplained.

A correlation coefficient of 0.1718 represent a weak positive linear relationship among the Beta values for year 2020 & mean returns for year 2021. We also need to understand that correlation doesn't mean that there is causation , & there may be other factors such as company specific factors, economy trends & many more that are influencing the relationship between these variables. The relationship also be influenced by the data anomalies that are not accounted for. Additional statistical test may be needed to understand the nature & the strength of the relationship between

these variables.

0.1718 is a very low correlation coefficient between any two variables, therefore it's highly unlikely that volatility in year t can predict returns in year $t+1$. The correlation is not strong enough to make any prediction for future returns.

In short we can say that CAPM beta in year t should predict mean returns in year $t+1$ as per the theory. However, the correlation between beta in 2020 and mean returns in 2021 is only 0.1718, which suggests that other factors may also be influencing the returns of these portfolios. CAPM is just a model and may not always provide us an accurate prediction of returns, as there may be other market factors and idiosyncratic risks that can affect returns.

2.5 Portfolios II

Calculate monthly volatility and total return for *every stock* and *every month* in **returns**. Drop stock-months with fewer than 15 returns. Each month, assign these stocks to one of five portfolios based on their volatility during the previous month. Equally weight these portfolios and rebalance them monthly.

```
[43]: returns_1= (
    returns
    .loc['1962-01-01':'2022-12-31']
    .groupby(pd.Grouper(freq='M'))
    .agg(['std'])
    .rename_axis(columns=['Ticker', 'Statistic'])
)

returns_1
```

```
[43]: Ticker      A      AA      AAL      AAP      ...      ZION      ZM      ZS      ZTS
Statistic      std      std      std      std      ...      std      std      std      std
Date
1962-01-31      NaN  0.0113      NaN      NaN      ...      NaN      NaN      NaN      NaN
1962-02-28      NaN  0.0093      NaN      NaN      ...      NaN      NaN      NaN      NaN
1962-03-31      NaN  0.0153      NaN      NaN      ...      NaN      NaN      NaN      NaN
1962-04-30      NaN  0.0113      NaN      NaN      ...      NaN      NaN      NaN      NaN
1962-05-31      NaN  0.0168      NaN      NaN      ...      NaN      NaN      NaN      NaN
...
2022-08-31  0.0232  0.0359  0.0263  0.0262      ...  0.0146  0.0489  0.0324  0.0152
2022-09-30  0.0172  0.0439  0.0327  0.0183      ...  0.0180  0.0198  0.0599  0.0169
2022-10-31  0.0223  0.0460  0.0282  0.0197      ...  0.0295  0.0271  0.0408  0.0179
2022-11-30  0.0282  0.0495  0.0260  0.0381      ...  0.0281  0.0510  0.0525  0.0365
2022-12-31  0.0144  0.0338  0.0275  0.0126      ...  0.0217  0.0247  0.0407  0.0156
```

[732 rows x 1010 columns]

2.5.1 Task 9: Do high volatility portfolios have high mean returns and Sharpe Ratios?

```
[44]: counts = returns_1.count(axis = 0)
      for x, count in counts.items():
          if count <=15:
              returns_1 = returns_1.drop(columns=x)
      returns_1
```

```
[44]: Ticker      A      AA      AAL      AAP ... ZION      ZM      ZS      ZTS
Statistic      std      std      std      std ...      std      std      std      std
Date
1962-01-31      NaN 0.0113      NaN      NaN ...      NaN      NaN      NaN      NaN
1962-02-28      NaN 0.0093      NaN      NaN ...      NaN      NaN      NaN      NaN
1962-03-31      NaN 0.0153      NaN      NaN ...      NaN      NaN      NaN      NaN
1962-04-30      NaN 0.0113      NaN      NaN ...      NaN      NaN      NaN      NaN
1962-05-31      NaN 0.0168      NaN      NaN ...      NaN      NaN      NaN      NaN
...
2022-08-31 0.0232 0.0359 0.0263 0.0262 ... 0.0146 0.0489 0.0324 0.0152
2022-09-30 0.0172 0.0439 0.0327 0.0183 ... 0.0180 0.0198 0.0599 0.0169
2022-10-31 0.0223 0.0460 0.0282 0.0197 ... 0.0295 0.0271 0.0408 0.0179
2022-11-30 0.0282 0.0495 0.0260 0.0381 ... 0.0281 0.0510 0.0525 0.0365
2022-12-31 0.0144 0.0338 0.0275 0.0126 ... 0.0217 0.0247 0.0407 0.0156
```

[732 rows x 995 columns]

```
[45]: returns_1 = returns_1.rename(columns={'0': 'Ticker', '1': 'Statistic'})
      returns_1['portfolio'] = pd.qcut(returns_1.iloc[:, 1], q=5, labels=['Portfolio_1', 'Portfolio 2', 'Portfolio 3', 'Portfolio 4', 'Portfolio 5'])
      returns_1
```

```
[45]: Ticker      A      AA      AAL      AAP ... ZM      ZS      ZTS      portfolio
Statistic      std      std      std      std ...      std      std      std
Date
1962-01-31      NaN 0.0113      NaN      NaN ...      NaN      NaN      NaN Portfolio 1
1962-02-28      NaN 0.0093      NaN      NaN ...      NaN      NaN      NaN Portfolio 1
1962-03-31      NaN 0.0153      NaN      NaN ...      NaN      NaN      NaN Portfolio 2
1962-04-30      NaN 0.0113      NaN      NaN ...      NaN      NaN      NaN Portfolio 1
1962-05-31      NaN 0.0168      NaN      NaN ...      NaN      NaN      NaN Portfolio 3
...
2022-08-31 0.0232 0.0359 0.0263 0.0262 ... 0.0489 0.0324 0.0152 Portfolio 5
2022-09-30 0.0172 0.0439 0.0327 0.0183 ... 0.0198 0.0599 0.0169 Portfolio 5
2022-10-31 0.0223 0.0460 0.0282 0.0197 ... 0.0271 0.0408 0.0179 Portfolio 5
2022-11-30 0.0282 0.0495 0.0260 0.0381 ... 0.0510 0.0525 0.0365 Portfolio 5
2022-12-31 0.0144 0.0338 0.0275 0.0126 ... 0.0247 0.0407 0.0156 Portfolio 5
```

[732 rows x 996 columns]

```
[46]: returns_2= (
        returns
        .loc['1962-01-01': '2022-12-31']
        .groupby(pd.Grouper(freq='M'))
        .agg(['mean'])
        .rename_axis(columns=['Ticker', 'Statistic'])
    )

returns_2
```

```
[46]: Ticker      A      AA      AAL      AAP  ...  ZION      ZM      ZS      ZTS
Statistic  mean    mean    mean    mean  ...  mean    mean    mean    mean
Date
1962-01-31    NaN -0.0042    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-02-28    NaN  0.0010    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-03-31    NaN  0.0026    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-04-30    NaN -0.0019    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-05-31    NaN -0.0047    NaN    NaN  ...    NaN    NaN    NaN    NaN
...
2022-08-31 -0.0017 -0.0005 -0.0020 -0.0056  ...  0.0008 -0.0099  0.0016 -0.0066
2022-09-30 -0.0024 -0.0172 -0.0031 -0.0030  ... -0.0036 -0.0040  0.0031 -0.0024
2022-10-31  0.0065  0.0082  0.0082  0.0095  ...  0.0014  0.0063 -0.0023  0.0010
2022-11-30  0.0058  0.0131  0.0012 -0.0101  ...  0.0006 -0.0036 -0.0056  0.0017
2022-12-31 -0.0015 -0.0041 -0.0056 -0.0007  ... -0.0023 -0.0048 -0.0076 -0.0023

[732 rows x 1010 columns]
```

```
[47]: counts = returns_2.count(axis = 0)
for x, count in counts.items():
    if count <=15:
        returns_2 = returns_2.drop(columns=x)
returns_2
```

```
[47]: Ticker      A      AA      AAL      AAP  ...  ZION      ZM      ZS      ZTS
Statistic  mean    mean    mean    mean  ...  mean    mean    mean    mean
Date
1962-01-31    NaN -0.0042    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-02-28    NaN  0.0010    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-03-31    NaN  0.0026    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-04-30    NaN -0.0019    NaN    NaN  ...    NaN    NaN    NaN    NaN
1962-05-31    NaN -0.0047    NaN    NaN  ...    NaN    NaN    NaN    NaN
...
2022-08-31 -0.0017 -0.0005 -0.0020 -0.0056  ...  0.0008 -0.0099  0.0016 -0.0066
2022-09-30 -0.0024 -0.0172 -0.0031 -0.0030  ... -0.0036 -0.0040  0.0031 -0.0024
2022-10-31  0.0065  0.0082  0.0082  0.0095  ...  0.0014  0.0063 -0.0023  0.0010
2022-11-30  0.0058  0.0131  0.0012 -0.0101  ...  0.0006 -0.0036 -0.0056  0.0017
2022-12-31 -0.0015 -0.0041 -0.0056 -0.0007  ... -0.0023 -0.0048 -0.0076 -0.0023
```

[732 rows x 995 columns]

```
[48]: returns_2 = returns_2.rename(columns={'0': 'Ticker', '1': 'Statistic'})
returns_2['Portfolio'] = pd.qcut(returns_1.iloc[:, 1], q=5, labels=['Portfolio_1', 'Portfolio 2', 'Portfolio 3', 'Portfolio 4', 'Portfolio 5'])
returns_2
```

```
[48]: Ticker      A      AA      AAL      AAP ...      ZM      ZS      ZTS
Portfolio
Statistic      mean      mean      mean      mean ...      mean      mean      mean
Date
1962-01-31      NaN -0.0042      NaN      NaN ...      NaN      NaN      NaN
Portfolio 1
1962-02-28      NaN  0.0010      NaN      NaN ...      NaN      NaN      NaN
Portfolio 1
1962-03-31      NaN  0.0026      NaN      NaN ...      NaN      NaN      NaN
Portfolio 2
1962-04-30      NaN -0.0019      NaN      NaN ...      NaN      NaN      NaN
Portfolio 1
1962-05-31      NaN -0.0047      NaN      NaN ...      NaN      NaN      NaN
Portfolio 3
...
...
2022-08-31 -0.0017 -0.0005 -0.0020 -0.0056 ... -0.0099  0.0016 -0.0066
Portfolio 5
2022-09-30 -0.0024 -0.0172 -0.0031 -0.0030 ... -0.0040  0.0031 -0.0024
Portfolio 5
2022-10-31  0.0065  0.0082  0.0082  0.0095 ...  0.0063 -0.0023  0.0010
Portfolio 5
2022-11-30  0.0058  0.0131  0.0012 -0.0101 ... -0.0036 -0.0056  0.0017
Portfolio 5
2022-12-31 -0.0015 -0.0041 -0.0056 -0.0007 ... -0.0048 -0.0076 -0.0023
Portfolio 5
```

[732 rows x 996 columns]

```
[49]: risk_free_rate = ff['RF'].mean()
tickers = returns.columns
sharpe_1 = {}
std_1 = {}
for x in tickers:
    stock = returns[x].dropna(axis=0)
    mean_returns_1 = stock.mean()
    std_returns_1 = stock.std()
    excess_returns_1 = mean_returns_1 - risk_free_rate
    sharpe_ratio_1 = excess_returns_1 / std_returns_1
```



```

    sharpe_1[x] = sharpe_ratio_1
    std_1[x] = std_returns_1
sharpe_array_1 = np.array(list(sharpe_1.values()))
sharpe_array_1

```

```
[49]: array([0.0178, 0.0137, 0.0149, ..., 0.0189, 0.0408, 0.0379])
```

```

[50]: returns_3 = pd.DataFrame({'sharpe_ratios': sharpe_array_1})
returns_3['Portfolio'] = pd.qcut(sharpe_array_1, q=5, labels=['Portfolio 1',
    ↪ 'Portfolio 2', 'Portfolio 3', 'Portfolio 4', 'Portfolio 5'])
returns_3

```

```

[50]:      sharpe_ratios  Portfolio
0          0.0178  Portfolio 2
1          0.0137  Portfolio 1
2          0.0149  Portfolio 1
3          0.0246  Portfolio 3
4          0.0323  Portfolio 5
...          ...          ...
1005         0.0122  Portfolio 1
1006         0.0206  Portfolio 2
1007         0.0189  Portfolio 2
1008         0.0408  Portfolio 5
1009         0.0379  Portfolio 5

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[1010 rows x 2 columns]

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[51]: pd.set_option('display.max_rows', None)
pd.set_option('display.max_columns', None)
print(returns_1['portfolio'])

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Date
1962-01-31    Portfolio 1
1962-02-28    Portfolio 1
1962-03-31    Portfolio 2
1962-04-30    Portfolio 1
1962-05-31    Portfolio 3
1962-06-30    Portfolio 5
1962-07-31    Portfolio 4
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2022-09-30	Portfolio 5
2022-10-31	Portfolio 5
2022-11-30	Portfolio 5
2022-12-31	Portfolio 5

Freq: M, Name: portfolio, dtype: category

Categories (5, object): ['Portfolio 1' < 'Portfolio 2' < 'Portfolio 3' < 'Portfolio 4' < 'Portfolio 5']


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[52]: print(returns_2['Portfolio'])
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1962-02-28	Portfolio 1
1962-03-31	Portfolio 2
1962-04-30	Portfolio 1
1962-05-31	Portfolio 3
1962-06-30	Portfolio 5
1962-07-31	Portfolio 4
1962-08-31	Portfolio 3
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1962-10-31	Portfolio 3
1962-11-30	Portfolio 4
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1963-05-31	Portfolio 1
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1963-08-31	Portfolio 2
1963-09-30	Portfolio 3
1963-10-31	Portfolio 1
1963-11-30	Portfolio 4
1963-12-31	Portfolio 2
1964-01-31	Portfolio 2
1964-02-29	Portfolio 1
1964-03-31	Portfolio 1
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1965-02-28	Portfolio 2
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1965-07-31	Portfolio 1
1965-08-31	Portfolio 1

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2022-09-30    Portfolio 5
2022-10-31    Portfolio 5
2022-11-30    Portfolio 5
2022-12-31    Portfolio 5
Freq: M, Name: Portfolio, dtype: category
Categories (5, object): ['Portfolio 1' < 'Portfolio 2' < 'Portfolio 3' <
'Portfolio 4' < 'Portfolio 5']

```

```
[53]: returns_3
```

```

[53]:      sharpe_ratios    Portfolio
0          0.0178    Portfolio 2
1          0.0137    Portfolio 1
2          0.0149    Portfolio 1
3          0.0246    Portfolio 3
4          0.0323    Portfolio 5
5          0.0436    Portfolio 5
6          0.0319    Portfolio 5
7         -0.0147    Portfolio 1
8          0.0336    Portfolio 5
9          0.0257    Portfolio 3
10         0.0235    Portfolio 3
11         0.0449    Portfolio 5
12         0.0197    Portfolio 2
13         0.0315    Portfolio 4
14         0.0362    Portfolio 5
15         0.0272    Portfolio 4
16         0.0227    Portfolio 3
17         0.0335    Portfolio 5
18         0.0307    Portfolio 4
19         0.0083    Portfolio 1
20         0.0168    Portfolio 2
21         0.0161    Portfolio 2
22         0.0204    Portfolio 2
23         0.0226    Portfolio 3

```


24	0.0326	Portfolio 5
25	-0.0313	Portfolio 1
26	0.0245	Portfolio 3
27	-0.0261	Portfolio 1
28	0.0220	Portfolio 3
29	0.0207	Portfolio 2
30	0.0126	Portfolio 1
31	0.0118	Portfolio 1
32	-0.0060	Portfolio 1
33	0.0220	Portfolio 3
34	0.0338	Portfolio 5
35	0.0135	Portfolio 1
36	0.0123	Portfolio 1
37	0.0272	Portfolio 4
38	0.0413	Portfolio 5
39	0.0265	Portfolio 4
40	0.0212	Portfolio 2
41	0.0211	Portfolio 2
42	0.0203	Portfolio 2
43	0.0065	Portfolio 1
44	0.0336	Portfolio 5
45	0.0151	Portfolio 1
46	0.0059	Portfolio 1
47	0.0315	Portfolio 4
48	-0.0610	Portfolio 1
49	0.0192	Portfolio 2
50	0.0159	Portfolio 1
51	0.0217	Portfolio 3
52	0.0280	Portfolio 4
53	0.0267	Portfolio 4
54	0.0201	Portfolio 2
55	0.0337	Portfolio 5
56	0.0177	Portfolio 2
57	0.0283	Portfolio 4
58	0.0236	Portfolio 3
59	0.0420	Portfolio 5
60	0.0240	Portfolio 3
61	0.0443	Portfolio 5
62	0.0317	Portfolio 5
63	0.0289	Portfolio 4
64	0.0257	Portfolio 3
65	0.0183	Portfolio 2
66	0.0267	Portfolio 4
67	0.0357	Portfolio 5
68	0.0356	Portfolio 5
69	-0.0630	Portfolio 1
70	0.0313	Portfolio 4

71	0.0092	Portfolio 1
72	0.0239	Portfolio 3
73	0.0389	Portfolio 5
74	0.0175	Portfolio 2
75	0.0178	Portfolio 2
76	0.0194	Portfolio 2
77	0.0263	Portfolio 4
78	0.0259	Portfolio 3
79	-0.0321	Portfolio 1
80	0.0298	Portfolio 4
81	0.0231	Portfolio 3
82	0.0547	Portfolio 5
83	0.0164	Portfolio 2
84	0.0226	Portfolio 3
85	0.0191	Portfolio 2
86	0.0168	Portfolio 2
87	0.0391	Portfolio 5
88	0.0427	Portfolio 5
89	0.0202	Portfolio 2
90	0.0134	Portfolio 1
91	0.0070	Portfolio 1
92	0.0277	Portfolio 4
93	0.0361	Portfolio 5
94	-0.0042	Portfolio 1
95	0.0387	Portfolio 5
96	0.0275	Portfolio 4
97	0.0220	Portfolio 3
98	0.0237	Portfolio 3
99	0.0148	Portfolio 1
100	0.0480	Portfolio 5
101	0.0256	Portfolio 3
102	0.0185	Portfolio 2
103	0.0230	Portfolio 3
104	0.0327	Portfolio 5
105	0.0225	Portfolio 3
106	0.0239	Portfolio 3
107	0.0289	Portfolio 4
108	0.0063	Portfolio 1
109	0.0290	Portfolio 4
110	0.0308	Portfolio 4
111	0.0313	Portfolio 4
112	0.0177	Portfolio 2
113	0.0222	Portfolio 3
114	0.0041	Portfolio 1
115	0.0290	Portfolio 4
116	0.0499	Portfolio 5
117	0.0248	Portfolio 3

118	0.0430	Portfolio 5
119	0.0191	Portfolio 2
120	0.0237	Portfolio 3
121	0.0216	Portfolio 3
122	0.0130	Portfolio 1
123	0.0446	Portfolio 5
124	0.0249	Portfolio 3
125	0.0372	Portfolio 5
126	0.0217	Portfolio 3
127	0.0235	Portfolio 3
128	0.0253	Portfolio 3
129	0.0220	Portfolio 3
130	0.0210	Portfolio 2
131	0.0313	Portfolio 4
132	0.0221	Portfolio 3
133	0.0187	Portfolio 2
134	0.0318	Portfolio 5
135	0.0137	Portfolio 1
136	0.0180	Portfolio 2
137	0.0152	Portfolio 1
138	0.0412	Portfolio 5
139	0.0211	Portfolio 2
140	0.0243	Portfolio 3
141	0.0228	Portfolio 3
142	0.0177	Portfolio 2
143	0.0157	Portfolio 1
144	0.0121	Portfolio 1
145	0.0183	Portfolio 2
146	0.0317	Portfolio 5
147	0.0292	Portfolio 4
148	0.0285	Portfolio 4
149	0.0259	Portfolio 3
150	0.0268	Portfolio 4
151	0.0736	Portfolio 5
152	0.0285	Portfolio 4
153	0.0218	Portfolio 3
154	0.0263	Portfolio 4
155	0.0267	Portfolio 4
156	0.0274	Portfolio 4
157	0.0291	Portfolio 4
158	0.0240	Portfolio 3
159	-0.0159	Portfolio 1
160	0.0237	Portfolio 3
161	0.0189	Portfolio 2
162	0.0133	Portfolio 1
163	0.0298	Portfolio 4
164	0.0259	Portfolio 3

165	0.0545	Portfolio 5
166	0.0244	Portfolio 3
167	0.1110	Portfolio 5
168	-0.0271	Portfolio 1
169	0.0369	Portfolio 5
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171	-0.0067	Portfolio 1
172	0.0223	Portfolio 3
173	0.0190	Portfolio 2
174	0.0297	Portfolio 4
175	0.0348	Portfolio 5
176	0.0234	Portfolio 3
177	0.0213	Portfolio 2
178	0.0264	Portfolio 4
179	0.0745	Portfolio 5
180	0.0183	Portfolio 2
181	0.0267	Portfolio 4
182	0.0380	Portfolio 5
183	0.0259	Portfolio 3
184	0.0142	Portfolio 1
185	0.0282	Portfolio 4
186	0.0228	Portfolio 3
187	0.0176	Portfolio 2
188	0.0247	Portfolio 3
189	0.0035	Portfolio 1
190	0.0188	Portfolio 2
191	0.0217	Portfolio 3
192	0.0293	Portfolio 4
193	0.0356	Portfolio 5
194	0.0381	Portfolio 5
195	0.0204	Portfolio 2
196	0.0077	Portfolio 1
197	0.0136	Portfolio 1
198	0.0359	Portfolio 5
199	0.0062	Portfolio 1
200	0.0156	Portfolio 1
201	0.0429	Portfolio 5
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203	0.0269	Portfolio 4
204	-0.0649	Portfolio 1
205	0.0258	Portfolio 3
206	0.0231	Portfolio 3
207	0.0190	Portfolio 2
208	0.0240	Portfolio 3
209	0.0237	Portfolio 3
210	0.0047	Portfolio 1
211	0.0285	Portfolio 4

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213	0.0190	Portfolio 2
214	0.0204	Portfolio 2
215	0.0353	Portfolio 5
216	0.0232	Portfolio 3
217	0.0215	Portfolio 3
218	0.0205	Portfolio 2
219	0.0217	Portfolio 3
220	0.0344	Portfolio 5
221	0.0233	Portfolio 3
222	0.0323	Portfolio 5
223	0.0382	Portfolio 5
224	0.0333	Portfolio 5
225	0.0276	Portfolio 4
226	0.0274	Portfolio 4
227	0.0349	Portfolio 5
228	0.0210	Portfolio 2
229	0.0211	Portfolio 2
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231	0.0399	Portfolio 5
232	0.0192	Portfolio 2
233	0.0195	Portfolio 2
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235	0.0211	Portfolio 2
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237	0.0268	Portfolio 4
238	0.0430	Portfolio 5
239	0.0280	Portfolio 4
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243	-0.0004	Portfolio 1
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245	0.0176	Portfolio 2
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248	0.0290	Portfolio 4
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252	0.0433	Portfolio 5
253	0.0331	Portfolio 5
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258	0.0253	Portfolio 3

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261	0.0353	Portfolio 5
262	0.0159	Portfolio 1
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266	-0.0490	Portfolio 1
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269	0.0268	Portfolio 4
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271	0.0189	Portfolio 2
272	0.0419	Portfolio 5
273	0.0272	Portfolio 4
274	0.0017	Portfolio 1
275	0.0285	Portfolio 4
276	0.0218	Portfolio 3
277	0.0494	Portfolio 5
278	0.0270	Portfolio 4
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280	0.0235	Portfolio 3
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282	0.0199	Portfolio 2
283	0.0358	Portfolio 5
284	0.0310	Portfolio 4
285	0.0306	Portfolio 4
286	0.0200	Portfolio 2
287	0.0233	Portfolio 3
288	0.0202	Portfolio 2
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292	0.0273	Portfolio 4
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294	0.0283	Portfolio 4
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296	0.0306	Portfolio 4
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298	0.0164	Portfolio 2
299	0.0205	Portfolio 2
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302	0.0215	Portfolio 3
303	0.0262	Portfolio 3
304	0.0498	Portfolio 5
305	0.0212	Portfolio 2

306	0.0211	Portfolio 2
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310	0.0267	Portfolio 4
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312	-0.0031	Portfolio 1
313	0.0144	Portfolio 1
314	0.0275	Portfolio 4
315	0.0069	Portfolio 1
316	0.0261	Portfolio 3
317	0.0197	Portfolio 2
318	0.0333	Portfolio 5
319	0.0383	Portfolio 5
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321	0.0150	Portfolio 1
322	0.0359	Portfolio 5
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324	0.0234	Portfolio 3
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326	0.0178	Portfolio 2
327	0.0262	Portfolio 3
328	0.0343	Portfolio 5
329	0.0165	Portfolio 2
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331	0.0168	Portfolio 2
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333	0.0377	Portfolio 5
334	0.0385	Portfolio 5
335	0.0325	Portfolio 5
336	0.0277	Portfolio 4
337	0.0201	Portfolio 2
338	0.0185	Portfolio 2
339	0.0354	Portfolio 5
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341	0.0137	Portfolio 1
342	0.0275	Portfolio 4
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345	0.0213	Portfolio 2
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357	0.0278	Portfolio 4
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359	0.0356	Portfolio 5
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364	0.0264	Portfolio 4
365	0.0229	Portfolio 3
366	0.0258	Portfolio 3
367	0.0458	Portfolio 5
368	0.0159	Portfolio 1
369	0.0212	Portfolio 2
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372	0.0170	Portfolio 2
373	0.0252	Portfolio 3
374	0.0328	Portfolio 5
375	0.0154	Portfolio 1
376	-0.1420	Portfolio 1
377	0.0269	Portfolio 4
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390	0.0355	Portfolio 5
391	0.0285	Portfolio 4
392	0.0074	Portfolio 1
393	0.0407	Portfolio 5
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395	0.0269	Portfolio 4
396	0.0194	Portfolio 2
397	0.0311	Portfolio 4
398	0.0289	Portfolio 4
399	0.0261	Portfolio 3

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403	0.0237	Portfolio 3
404	-0.0076	Portfolio 1
405	0.0195	Portfolio 2
406	0.0166	Portfolio 2
407	0.0327	Portfolio 5
408	-0.0300	Portfolio 1
409	0.0182	Portfolio 2
410	0.0116	Portfolio 1
411	0.0388	Portfolio 5
412	0.0447	Portfolio 5
413	0.0164	Portfolio 2
414	0.0319	Portfolio 5
415	0.0278	Portfolio 4
416	0.0184	Portfolio 2
417	0.0138	Portfolio 1
418	0.0180	Portfolio 2
419	0.0374	Portfolio 5
420	0.0153	Portfolio 1
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422	0.0283	Portfolio 4
423	0.0241	Portfolio 3
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425	-0.0430	Portfolio 1
426	0.0209	Portfolio 2
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430	0.0232	Portfolio 3
431	0.0311	Portfolio 4
432	0.0225	Portfolio 3
433	0.0216	Portfolio 3
434	0.0353	Portfolio 5
435	-0.0164	Portfolio 1
436	0.0124	Portfolio 1
437	0.0446	Portfolio 5
438	0.0274	Portfolio 4
439	0.0151	Portfolio 1
440	0.0257	Portfolio 3
441	0.0143	Portfolio 1
442	0.0376	Portfolio 5
443	0.0111	Portfolio 1
444	0.0322	Portfolio 5
445	0.0220	Portfolio 3
446	0.0157	Portfolio 1

447	0.0155	Portfolio 1
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452	0.0313	Portfolio 4
453	0.0178	Portfolio 2
454	0.0248	Portfolio 3
455	0.0287	Portfolio 4
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459	0.0319	Portfolio 5
460	0.0187	Portfolio 2
461	0.0203	Portfolio 2
462	0.0129	Portfolio 1
463	0.0217	Portfolio 3
464	0.0195	Portfolio 2
465	0.0361	Portfolio 5
466	0.0318	Portfolio 5
467	0.0283	Portfolio 4
468	0.0373	Portfolio 5
469	0.0309	Portfolio 4
470	0.0270	Portfolio 4
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472	0.0167	Portfolio 2
473	0.0256	Portfolio 3
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477	0.0264	Portfolio 4
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483	0.0323	Portfolio 5
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487	0.0233	Portfolio 3
488	0.0177	Portfolio 2
489	0.0211	Portfolio 2
490	0.0176	Portfolio 2
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493	0.0175	Portfolio 2

494	0.0161	Portfolio 2
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497	0.0215	Portfolio 3
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500	0.0287	Portfolio 4
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503	0.0186	Portfolio 2
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507	0.0139	Portfolio 1
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526	0.0261	Portfolio 3
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528	0.0296	Portfolio 4
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578	0.0292	Portfolio 4
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581	0.0221	Portfolio 3
582	0.0232	Portfolio 3
583	0.0183	Portfolio 2
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585	0.0362	Portfolio 5
586	0.0319	Portfolio 5
587	0.0298	Portfolio 4

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591	0.0172	Portfolio 2
592	0.0367	Portfolio 5
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594	0.0276	Portfolio 4
595	0.0653	Portfolio 5
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597	0.0348	Portfolio 5
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605	0.0211	Portfolio 2
606	0.0202	Portfolio 2
607	0.0325	Portfolio 5
608	0.0311	Portfolio 4
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610	0.0183	Portfolio 2
611	0.0214	Portfolio 2
612	0.0177	Portfolio 2
613	0.0244	Portfolio 3
614	0.0205	Portfolio 2
615	0.0245	Portfolio 3
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622	0.0132	Portfolio 1
623	0.0433	Portfolio 5
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625	0.0182	Portfolio 2
626	0.0457	Portfolio 5
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632	0.0216	Portfolio 3
633	0.0286	Portfolio 4
634	0.0188	Portfolio 2

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636	0.0170	Portfolio 2
637	0.0371	Portfolio 5
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639	0.0298	Portfolio 4
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641	0.0271	Portfolio 4
642	0.0271	Portfolio 4
643	0.0278	Portfolio 4
644	0.0226	Portfolio 3
645	0.0322	Portfolio 5
646	0.0404	Portfolio 5
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652	0.0058	Portfolio 1
653	0.0297	Portfolio 4
654	0.0248	Portfolio 3
655	0.0173	Portfolio 2
656	0.0296	Portfolio 4
657	0.0184	Portfolio 2
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660	-0.0093	Portfolio 1
661	0.0187	Portfolio 2
662	0.0235	Portfolio 3
663	0.0340	Portfolio 5
664	0.0273	Portfolio 4
665	0.0234	Portfolio 3
666	0.0197	Portfolio 2
667	-0.0623	Portfolio 1
668	0.0246	Portfolio 3
669	0.0251	Portfolio 3
670	0.0192	Portfolio 2
671	-0.0293	Portfolio 1
672	0.0358	Portfolio 5
673	0.0246	Portfolio 3
674	0.0394	Portfolio 5
675	-0.0044	Portfolio 1
676	0.0236	Portfolio 3
677	0.0446	Portfolio 5
678	0.0163	Portfolio 2
679	0.0145	Portfolio 1
680	0.0194	Portfolio 2
681	0.0317	Portfolio 4

682	0.0146	Portfolio 1
683	0.0206	Portfolio 2
684	0.0374	Portfolio 5
685	0.0073	Portfolio 1
686	-0.0109	Portfolio 1
687	-0.0669	Portfolio 1
688	0.0555	Portfolio 5
689	0.0357	Portfolio 5
690	0.0252	Portfolio 3
691	0.0272	Portfolio 4
692	0.0139	Portfolio 1
693	-0.0292	Portfolio 1
694	0.0413	Portfolio 5
695	0.0318	Portfolio 5
696	0.0234	Portfolio 3
697	0.0273	Portfolio 4
698	0.0227	Portfolio 3
699	0.0406	Portfolio 5
700	0.0327	Portfolio 5
701	0.0275	Portfolio 4
702	0.0245	Portfolio 3
703	0.0208	Portfolio 2
704	0.0298	Portfolio 4
705	0.0248	Portfolio 3
706	0.0427	Portfolio 5
707	0.0236	Portfolio 3
708	0.0271	Portfolio 4
709	0.0309	Portfolio 4
710	0.0029	Portfolio 1
711	0.0183	Portfolio 2
712	0.0004	Portfolio 1
713	0.0274	Portfolio 4
714	0.0236	Portfolio 3
715	0.0221	Portfolio 3
716	0.0406	Portfolio 5
717	-0.0633	Portfolio 1
718	0.0053	Portfolio 1
719	0.0185	Portfolio 2
720	0.0215	Portfolio 3
721	0.0241	Portfolio 3
722	0.0259	Portfolio 3
723	0.0192	Portfolio 2
724	0.0107	Portfolio 1
725	0.0337	Portfolio 5
726	0.0428	Portfolio 5
727	0.0323	Portfolio 5
728	0.0223	Portfolio 3

729	0.0275	Portfolio 4
730	0.0216	Portfolio 3
731	0.0118	Portfolio 1
732	0.0353	Portfolio 5
733	0.0199	Portfolio 2
734	0.0244	Portfolio 3
735	0.0182	Portfolio 2
736	0.0281	Portfolio 4
737	0.0269	Portfolio 4
738	-0.0021	Portfolio 1
739	0.0219	Portfolio 3
740	0.0266	Portfolio 4
741	0.0195	Portfolio 2
742	0.0071	Portfolio 1
743	0.0197	Portfolio 2
744	0.0333	Portfolio 5
745	0.0240	Portfolio 3
746	0.0254	Portfolio 3
747	0.0121	Portfolio 1
748	0.0221	Portfolio 3
749	0.0185	Portfolio 2
750	0.0154	Portfolio 1
751	-0.0090	Portfolio 1
752	0.0192	Portfolio 2
753	0.0254	Portfolio 3
754	0.0201	Portfolio 2
755	0.0269	Portfolio 4
756	0.0398	Portfolio 5
757	0.0092	Portfolio 1
758	0.0196	Portfolio 2
759	0.0200	Portfolio 2
760	0.0264	Portfolio 4
761	0.0275	Portfolio 4
762	0.0363	Portfolio 5
763	0.0313	Portfolio 4
764	0.0160	Portfolio 2
765	-0.0731	Portfolio 1
766	0.0287	Portfolio 4
767	-0.0163	Portfolio 1
768	0.0147	Portfolio 1
769	0.0391	Portfolio 5
770	0.0197	Portfolio 2
771	0.0302	Portfolio 4
772	0.0292	Portfolio 4
773	0.0296	Portfolio 4
774	0.0291	Portfolio 4
775	0.0358	Portfolio 5

776	0.0292	Portfolio 4
777	0.0274	Portfolio 4
778	-0.0049	Portfolio 1
779	0.0186	Portfolio 2
780	0.0240	Portfolio 3
781	0.0304	Portfolio 4
782	0.0216	Portfolio 3
783	0.0249	Portfolio 3
784	0.0281	Portfolio 4
785	-0.0926	Portfolio 1
786	0.0505	Portfolio 5
787	0.0209	Portfolio 2
788	-0.0336	Portfolio 1
789	0.0326	Portfolio 5
790	0.0200	Portfolio 2
791	0.0297	Portfolio 4
792	0.0211	Portfolio 2
793	0.0370	Portfolio 5
794	0.0312	Portfolio 4
795	0.0310	Portfolio 4
796	0.0270	Portfolio 4
797	0.0257	Portfolio 3
798	0.0276	Portfolio 4
799	0.0288	Portfolio 4
800	0.0196	Portfolio 2
801	0.0263	Portfolio 4
802	0.0107	Portfolio 1
803	-0.0444	Portfolio 1
804	0.0370	Portfolio 5
805	0.0215	Portfolio 3
806	0.0400	Portfolio 5
807	0.0304	Portfolio 4
808	0.0220	Portfolio 3
809	0.0198	Portfolio 2
810	0.0248	Portfolio 3
811	0.0138	Portfolio 1
812	0.0143	Portfolio 1
813	0.0253	Portfolio 3
814	0.0241	Portfolio 3
815	0.0304	Portfolio 4
816	0.0148	Portfolio 1
817	0.0182	Portfolio 2
818	0.0138	Portfolio 1
819	-0.0048	Portfolio 1
820	0.0248	Portfolio 3
821	0.0168	Portfolio 2
822	0.0281	Portfolio 4

823	0.0344	Portfolio 5
824	-0.0121	Portfolio 1
825	0.0241	Portfolio 3
826	0.0127	Portfolio 1
827	0.0232	Portfolio 3
828	0.0294	Portfolio 4
829	0.0204	Portfolio 2
830	-0.0061	Portfolio 1
831	0.0102	Portfolio 1
832	0.0377	Portfolio 5
833	0.0177	Portfolio 2
834	0.0241	Portfolio 3
835	0.0236	Portfolio 3
836	0.0267	Portfolio 4
837	0.0334	Portfolio 5
838	0.0209	Portfolio 2
839	0.0136	Portfolio 1
840	0.0307	Portfolio 4
841	0.0269	Portfolio 4
842	0.0310	Portfolio 4
843	0.0203	Portfolio 2
844	0.0338	Portfolio 5
845	0.0286	Portfolio 4
846	0.0186	Portfolio 2
847	0.0229	Portfolio 3
848	0.0162	Portfolio 2
849	0.0152	Portfolio 1
850	0.0379	Portfolio 5
851	0.0201	Portfolio 2
852	0.0292	Portfolio 4
853	0.0235	Portfolio 3
854	0.0100	Portfolio 1
855	0.0078	Portfolio 1
856	0.0482	Portfolio 5
857	0.0191	Portfolio 2
858	0.0320	Portfolio 5
859	0.0423	Portfolio 5
860	0.0372	Portfolio 5
861	0.0215	Portfolio 3
862	0.0215	Portfolio 2
863	0.0072	Portfolio 1
864	0.0283	Portfolio 4
865	0.0277	Portfolio 4
866	0.0129	Portfolio 1
867	0.0172	Portfolio 2
868	0.0262	Portfolio 3
869	0.0302	Portfolio 4

870	0.0146	Portfolio 1
871	0.0282	Portfolio 4
872	0.0180	Portfolio 2
873	0.0076	Portfolio 1
874	0.0200	Portfolio 2
875	0.0235	Portfolio 3
876	-0.0533	Portfolio 1
877	0.0296	Portfolio 4
878	0.0278	Portfolio 4
879	0.0264	Portfolio 4
880	0.0289	Portfolio 4
881	0.0289	Portfolio 4
882	0.0067	Portfolio 1
883	0.0235	Portfolio 3
884	0.0305	Portfolio 4
885	0.0232	Portfolio 3
886	0.0191	Portfolio 2
887	0.0321	Portfolio 5
888	0.0516	Portfolio 5
889	0.0204	Portfolio 2
890	0.0256	Portfolio 3
891	0.0284	Portfolio 4
892	0.0556	Portfolio 5
893	0.0291	Portfolio 4
894	0.0266	Portfolio 4
895	0.0335	Portfolio 5
896	-0.0737	Portfolio 1
897	0.0240	Portfolio 3
898	0.0079	Portfolio 1
899	0.0225	Portfolio 3
900	0.0170	Portfolio 2
901	0.0277	Portfolio 4
902	-0.0044	Portfolio 1
903	-0.0168	Portfolio 1
904	0.0193	Portfolio 2
905	0.0175	Portfolio 2
906	-0.0008	Portfolio 1
907	0.0248	Portfolio 3
908	0.0282	Portfolio 4
909	0.0267	Portfolio 4
910	0.0568	Portfolio 5
911	0.0242	Portfolio 3
912	0.0419	Portfolio 5
913	0.0336	Portfolio 5
914	0.0133	Portfolio 1
915	0.0405	Portfolio 5
916	0.0171	Portfolio 2

917	0.0267	Portfolio 4
918	0.0139	Portfolio 1
919	0.0135	Portfolio 1
920	0.0218	Portfolio 3
921	0.0267	Portfolio 4
922	0.0242	Portfolio 3
923	0.0146	Portfolio 1
924	0.0315	Portfolio 4
925	-0.0342	Portfolio 1
926	0.0400	Portfolio 5
927	0.0362	Portfolio 5
928	0.0308	Portfolio 4
929	0.0271	Portfolio 4
930	0.0303	Portfolio 4
931	0.0096	Portfolio 1
932	0.0226	Portfolio 3
933	0.0249	Portfolio 3
934	0.0274	Portfolio 4
935	0.0184	Portfolio 2
936	0.0243	Portfolio 3
937	-0.0409	Portfolio 1
938	0.0250	Portfolio 3
939	0.0353	Portfolio 5
940	0.0293	Portfolio 4
941	0.0197	Portfolio 2
942	0.0274	Portfolio 4
943	0.0207	Portfolio 2
944	0.0041	Portfolio 1
945	0.0229	Portfolio 3
946	0.0182	Portfolio 2
947	0.0167	Portfolio 2
948	NaN	NaN
949	0.0162	Portfolio 2
950	0.0193	Portfolio 2
951	0.0179	Portfolio 2
952	0.0209	Portfolio 2
953	0.0170	Portfolio 2
954	0.0326	Portfolio 5
955	0.0294	Portfolio 4
956	0.0071	Portfolio 1
957	0.0186	Portfolio 2
958	0.0198	Portfolio 2
959	0.0249	Portfolio 3
960	0.0228	Portfolio 3
961	-0.0915	Portfolio 1
962	0.0317	Portfolio 5
963	0.0258	Portfolio 3

964	0.0213	Portfolio 2
965	0.0258	Portfolio 3
966	0.0233	Portfolio 3
967	0.0137	Portfolio 1
968	0.0151	Portfolio 1
969	0.0318	Portfolio 5
970	0.0301	Portfolio 4
971	0.0244	Portfolio 3
972	0.0215	Portfolio 3
973	0.0377	Portfolio 5
974	0.0352	Portfolio 5
975	0.0297	Portfolio 4
976	-0.0592	Portfolio 1
977	0.0262	Portfolio 3
978	0.0266	Portfolio 4
979	-0.0006	Portfolio 1
980	0.0407	Portfolio 5
981	0.0267	Portfolio 4
982	0.0292	Portfolio 4
983	0.0321	Portfolio 5
984	0.0194	Portfolio 2
985	0.0246	Portfolio 3
986	0.0132	Portfolio 1
987	0.0222	Portfolio 3
988	0.0026	Portfolio 1
989	0.0265	Portfolio 4
990	0.0187	Portfolio 2
991	0.0139	Portfolio 1
992	0.0256	Portfolio 3
993	0.0135	Portfolio 1
994	0.0184	Portfolio 2
995	0.0270	Portfolio 4
996	0.0299	Portfolio 4
997	0.0239	Portfolio 3
998	0.0333	Portfolio 5
999	0.0365	Portfolio 5
1000	0.0298	Portfolio 4
1001	0.0150	Portfolio 1
1002	0.0158	Portfolio 1
1003	0.0266	Portfolio 4
1004	0.0228	Portfolio 3
1005	0.0122	Portfolio 1
1006	0.0206	Portfolio 2
1007	0.0189	Portfolio 2
1008	0.0408	Portfolio 5
1009	0.0379	Portfolio 5

A higher Sharpe ratio indicates a good risk-adjusted return.

If high volatility portfolios have high mean returns and high Sharpe ratios it means that investors are being rewarded for the additional risk they are taking over & above the market. This could be because the market is inefficient and/or investors are able to exploit this by picking riskier assets that are mispriced.

High volatility also implies higher risk, which may not be suitable for all investors, especially those with lower risk tolerance or shorter investment horizons. Therefore, the portfolio manager needs to carefully consider individual investment goals and risk preferences before allocating capital to high volatility portfolios.

Portfolios Mean Return, Volatility(STD), Sharpe Ratio Portfolio 1 -0.0042 0.0113 -0.0147 Portfolio 2 0.0026 0.0153 0.0178 Portfolio 3 -0.0047 0.0168 0.0260 Portfolio 5 -0.0020 0.0263 0.0323 respectively. High volatility portfolios do not necessarily have high mean returns & Sharpe ratio. A portfolio with high return & low volatility have higher sharpe ratio than a portfolio with same retrun but higher volatility. We can even infer the return in respect to volatility through Efficient frontier as welll.

We can see that Portfolio 5 has the highest volatility, but it does not have the highest mean return or Sharpe Ratio. Portfolio 2 has a higher Sharpe Ratio than Portfolio 5 despite having lower volatility.

So we can conclude that Higher volatility doesn't predict higher mean return & sharpe ratio.

2.6 Discussion

2.6.1 Task 10: Discuss and explain any limitations of your analysis above

1)The analysis that has been provided in this project for each & every task has some limitations for certain stocks provide in the dataset. Due to the mismatch of data time frame few stocks data weren't availble for the specified start & end date that were needed for the project , therefore, few stocks had to be dropped from our calculations & estimates to best fit the needs of the project. As per the instructions provided we weren't allowed to hamper the real time dataset because of which these limitations persist in our analysis.

2)The limitation of the data being limited and inconsistent is that the correlation between volatility and mean returns may heavily rely on the specific years being analyzed (year t and t+1), which may not provide a comprehensive understanding of the stock's performance in other time periods or market conditions. The dataset provided to us had in total 1010 stocks, due to the persisting limitations we could only use 925 stocks for our calculations & estimation.

3)An important limitation of analyzing a group of random stocks is that the portfolio may not be a representative sample of the overall market or a particular industry. Consequently, any analysis conducted may not provide a complete and accurate understanding of the factors that influence stock prices and returns. Moreover, the performance of individual stocks may be influenced by unique factors that do not apply to the broader market or industry, potentially distorting the analysis and any conclusions drawn from it.

4)For task 9 we have used 995 stocks out of 1010 stocks that were provided in the dataset for the completion of the task. As per the instructions we had to drop stocks with less than fifteen returns which leads for the limitation of the analysis.

3 Criteria

1. All tasks are worth ten points
2. Discuss and explain your findings for all ten tasks
3. Here are a few more tips
 1. ***Your goal is to convince me of your calculations and conclusions***
 2. I typically find figures most convincing
 3. If you use correlations, consider how a handful of outliers may affect your findings
 4. Remove unnecessary code, outputs, and print statements
 5. Write functions for calculations that you expect to use more than once
 6. ***I will not penalize code style, but I will penalize submissions that are difficult to follow or do not follow these instructions***
4. How to submit your project
 1. Restart your kernel, run all cells, and save your notebook
 2. Export your notebook to PDF (File > Save And Export Notebook As ... > PDF in JupyterLab)
 1. If this export does not work, you can either (1) Install MikTeX on your laptop with the default settings or (2) use DataCamp Workspace to export your notebook to PDF
 2. You do not need to re-run your notebook to export it because notebooks store output cells
 3. Upload your notebook and PDF to Canvas
 4. Upload your PDF only to Gradescope and tag your teammates
 5. Gradescope helps me give better feedback more quickly, but I do not consider it reliable for sharing and storing your submission files