File Edit View Run Kernel Tabs Settings Help

tmp.ipynb | DATA618_W5_VaR.ipynb | DATA698_ResearchPropos | DATA618_Portfolio_Allocati

Code | Python 3 (ipykernel)

[118]:
```
import warnings
warnings.filterwarnings('ignore')

import pandas as pd
from pandas_datareader import data as pdr
import numpy as np
from datetime import datetime, date, timedelta

import yfinance as yfin
from var import VaR
import scipy.stats

import matplotlib.pyplot as plt
import seaborn as sns
#from yahoofinancials import YahooFinancials

#pd.set_option('display.float_format', '{:.10f}'.format)

pd.set_option('display.float_format', lambda x: f'{x:,.4f}')
```

## Assignment

Create a Github account if you do not already have one and download a VAR library. Using the library that you have chosen and historical data (available from Yahoo Finance and other sources) calculate the VaR for your investment portfolio. Document your work in a presentation and post it to the Discussion Forum and comment on and discuss the document and posted work of others.

## Variables

[119]:
```
start_date = datetime(2022, 1, 1)
end_date = datetime.now()
alpha = 0.05

yfin.pdr_override()

#start_date = "2022-01-01"
#end_date = "2023-08-31"
#alpha = 0.01
```

## Functions

## Load Data

[120]:
```
folio_df = pd.read_csv('https://raw.githubusercontent.com/dsimband/DATA618/main/w5/data/DATA618_Portfolio.csv',
                       dtype={
                          'ID': 'int',
                          'Price': 'float',
                          'Shares': 'float',
                          'Value': 'float',
                       })


folio_df = folio_df[folio_df['Shares'] > 0]
folio_df = folio_df.groupby(['Ticker','BondName','Class'])[['Shares','Value']].sum()
folio_df.reset_index(inplace=True)
#folio_df['Morningstar_Category'].fillna('Other', inplace=True)
folio_df
```

[120]:

| | Ticker | BondName | Class | Shares | Value |
|---|---|---|---|---|---|
| 0 | ALTVX | AB Municipal Income National Advisor | Interest Rate Sensitive | 106,383.0000 | 1,000.0000 |
| 1 | BLUEX | AMG Veritas Global Real Return I | Economically Sensitive | 14,201.0000 | 500.0000 |
| 2 | BPLSX | Boston Partners Long/Short Equity Instl | Economically Sensitive | 49,967.0000 | 750.0000 |
| 3 | C_A_S_H | Cash | Cash | 4,469,000.0000 | 4,469.0000 |
| 4 | DFAR | Dimensional US Real Estate ETF | Economically Sensitive | 108,468.0000 | 2,250.0000 |
| ... | ... | ... | ... | ... | ... |
| 30 | VIGI | Vanguard Intl Div Apprec ETF | Economically Sensitive | 40,481.0000 | 3,000.0000 |
| 31 | VNQ | Vanguard Real Estate ETF | Economically Sensitive | 40,221.0000 | 3,250.0000 |
| 32 | VO | Vanguard Mid-Cap ETF | Economically Sensitive | 9,234.0000 | 2,000.0000 |
| 33 | VONG | Vanguard Russell 1000 Growth ETF | Economically Sensitive | 41,501.0000 | 3,000.0000 |
| 34 | VTEB | Vanguard Tax-Exempt Bond ETF | Interest Rate Sensitive | 20,333.0000 | 1,000.0000 |

35 rows × 5 columns

[121]:
```
folio_df.groupby(['Class'])[['Value']].sum()
```

[121]:

| | Value |
|---|---|
| Class | |
| Cash | 4,469.0000 |
| Economically Sensitive | 50,250.0000 |
| Interest Rate Sensitive | 29,000.0000 |

## Calculate Percentage

[122]:
```
portfolio_total = folio_df['Value'].sum()
folio_df['port_percent'] = folio_df['Value'] / portfolio_total
```

[123]:
```
ticker_lst = list(folio_df['Ticker'])
weights = (folio_df['port_percent'].values)
```

[124]:
```
price_df = pdr.get_data_yahoo(ticker_lst, start=start_date, end=end_date)
price_df = price_df[['Adj Close']]
price_df.columns = price_df.columns.get_level_values(1)
price_df['C_A_S_H'] = 1

price_df
```

```
[**********100%%**********]  35 of 35 completed

1 Failed download:
['C_A_S_H']: Exception('%ticker%: No timezone found, symbol may be delisted')
```

[C_A_S_H ]: Exception('%ticker%: No timezone found, symbol may be delisted')

[124]:

| Date | ALTVX | BLUEX | BPLSX | C_A_S_H | DFAR | FREL | FSMD | ... | VGCAX | VICSX | VIGI | VNQ | VO | VONG | VTEB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2022-01-03** | 10.4183 | 36.7510 | 13.1206 | 1 | NaN | 32.6081 | 35.1562 | ... | 20.7575 | 23.9542 | 82.4521 | 107.5871 | 246.6520 | 77.9475 | 52.7748 |
| **2022-01-04** | 10.4087 | 36.6256 | 13.3690 | 1 | NaN | 32.6081 | 35.4690 | ... | 20.7382 | 23.9542 | 82.2496 | 107.4563 | 246.4671 | 77.1101 | 52.7748 |
| **2022-01-05** | 10.3990 | 36.3122 | 13.4133 | 1 | NaN | 31.6710 | 34.6969 | ... | 20.6996 | 23.8771 | 81.1115 | 104.3810 | 240.2957 | 74.6471 | 52.7075 |
| **2022-01-06** | 10.3796 | 36.2943 | 13.4932 | 1 | NaN | 31.6900 | 34.9129 | ... | 20.6610 | 23.8097 | 80.5425 | 104.4745 | 240.9089 | 74.4895 | 52.6498 |
| **2022-01-07** | 10.3700 | 36.3480 | 13.5109 | 1 | NaN | 31.4912 | 34.6871 | ... | 20.6225 | 23.7519 | 80.6389 | 103.7828 | 239.4682 | 73.6718 | 52.5248 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **2023-09-25** | 9.2300 | 34.2600 | 15.0000 | 1 | 19.7800 | 23.0400 | 32.2600 | ... | 18.2200 | 20.6100 | 72.2400 | 76.6245 | 209.5800 | 68.9900 | 48.3700 |
| **2023-09-26** | 9.2200 | 33.8200 | 14.8800 | 1 | 19.4100 | 22.6100 | 31.8900 | ... | 18.2000 | 20.5800 | 71.4600 | 75.2281 | 206.6000 | 67.8600 | 48.3300 |
| **2023-09-27** | 9.2000 | 33.8100 | 14.8600 | 1 | 19.2600 | 22.4400 | 32.1000 | ... | 18.1400 | 20.4800 | 71.3000 | 74.7230 | 207.2900 | 67.9600 | 48.2400 |
| **2023-09-28** | 9.1500 | 34.1200 | 14.9300 | 1 | 19.4800 | 22.6900 | 32.4350 | ... | 18.1400 | 20.5100 | 71.6100 | 75.4400 | 208.8600 | 68.4800 | 48.0300 |
| **2023-09-29** | 9.1700 | 33.9900 | 14.8200 | 1 | 19.5200 | 22.7500 | 32.2700 | ... | 17.9500 | 20.4400 | 71.3300 | 75.6600 | 208.2400 | 68.4400 | 48.1000 |

438 rows × 35 columns

[125]:
```
percent_df = price_df.pct_change()
percent_df = percent_df[1:]
percent_df.fillna(0, inplace=True)
percent_df.index = pd.to_datetime(percent_df.index)

percent_df
```

[125]:

| Date | ALTVX | BLUEX | BPLSX | C_A_S_H | DFAR | FREL | FSMD | ... | VGCAX | VICSX | VIGI | VNQ | VO | VONG | VTEB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2022-01-04** | -0.0009 | -0.0034 | 0.0189 | 0.0000 | 0.0000 | 0.0000 | 0.0089 | ... | -0.0009 | 0.0000 | -0.0025 | -0.0012 | -0.0007 | -0.0107 | 0.0000 |
| **2022-01-05** | -0.0009 | -0.0086 | 0.0033 | 0.0000 | 0.0000 | -0.0287 | -0.0218 | ... | -0.0019 | -0.0032 | -0.0138 | -0.0286 | -0.0250 | -0.0319 | -0.0013 |
| **2022-01-06** | -0.0019 | -0.0005 | 0.0060 | 0.0000 | 0.0000 | 0.0006 | 0.0062 | ... | -0.0019 | -0.0028 | -0.0070 | 0.0009 | 0.0026 | -0.0021 | -0.0011 |
| **2022-01-07** | -0.0009 | 0.0015 | 0.0013 | 0.0000 | 0.0000 | -0.0063 | -0.0065 | ... | -0.0019 | -0.0024 | 0.0012 | -0.0066 | -0.0060 | -0.0110 | -0.0024 |
| **2022-01-10** | -0.0028 | 0.0047 | 0.0007 | 0.0000 | 0.0000 | -0.0066 | -0.0028 | ... | -0.0009 | -0.0016 | -0.0087 | -0.0058 | -0.0033 | -0.0008 | -0.0020 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **2023-09-25** | -0.0065 | -0.0003 | 0.0040 | 0.0000 | -0.0010 | -0.0009 | 0.0031 | ... | -0.0049 | -0.0053 | -0.0017 | -0.0009 | 0.0027 | 0.0052 | -0.0072 |
| **2023-09-26** | -0.0011 | -0.0128 | -0.0080 | 0.0000 | -0.0187 | -0.0187 | -0.0115 | ... | -0.0011 | -0.0015 | -0.0108 | -0.0182 | -0.0142 | -0.0164 | -0.0008 |
| **2023-09-27** | -0.0022 | -0.0003 | -0.0013 | 0.0000 | -0.0077 | -0.0075 | 0.0066 | ... | -0.0033 | -0.0049 | -0.0022 | -0.0067 | 0.0033 | 0.0015 | -0.0019 |
| **2023-09-28** | -0.0054 | 0.0092 | 0.0047 | 0.0000 | 0.0114 | 0.0111 | 0.0104 | ... | 0.0000 | 0.0015 | 0.0043 | 0.0096 | 0.0076 | 0.0077 | -0.0044 |
| **2023-09-29** | 0.0022 | -0.0038 | -0.0074 | 0.0000 | 0.0021 | 0.0026 | -0.0051 | ... | -0.0105 | -0.0034 | -0.0039 | 0.0029 | -0.0030 | -0.0006 | 0.0015 |

437 rows × 35 columns

[126]:
```
price_df.query("index == '2023-09-11 00:00:00'")
```

[126]:

| Date | ALTVX | BLUEX | BPLSX | C_A_S_H | DFAR | FREL | FSMD | ... | VGCAX | VICSX | VIGI | VNQ | VO | VONG | VTEB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2023-09-11 00:00:00** | 9.4000 | 35.2100 | 15.0100 | 1 | 20.7436 | 24.2468 | 33.1387 | ... | 18.3700 | 20.8500 | 74.1083 | 80.8038 | 216.5903 | 72.2877 | 49.1800 |

1 rows × 35 columns

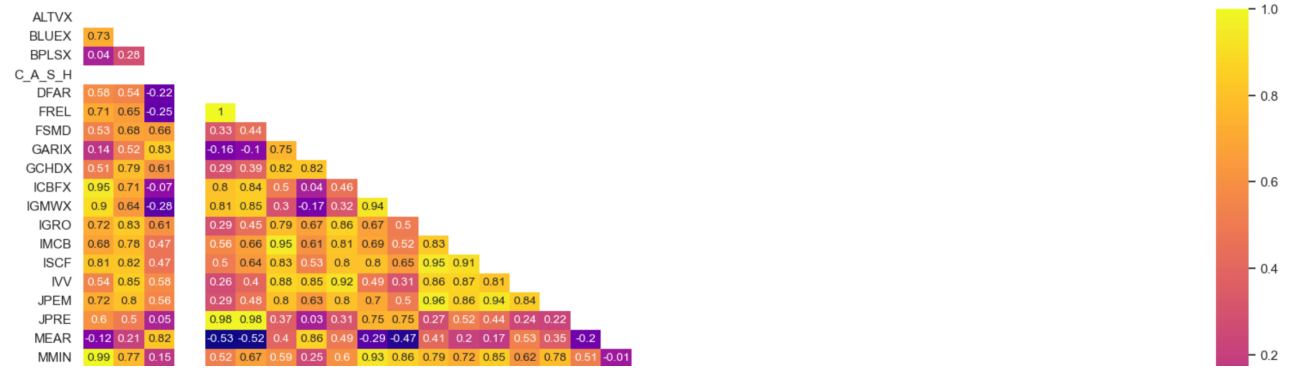
[127]:
```
price_df.corr()
```

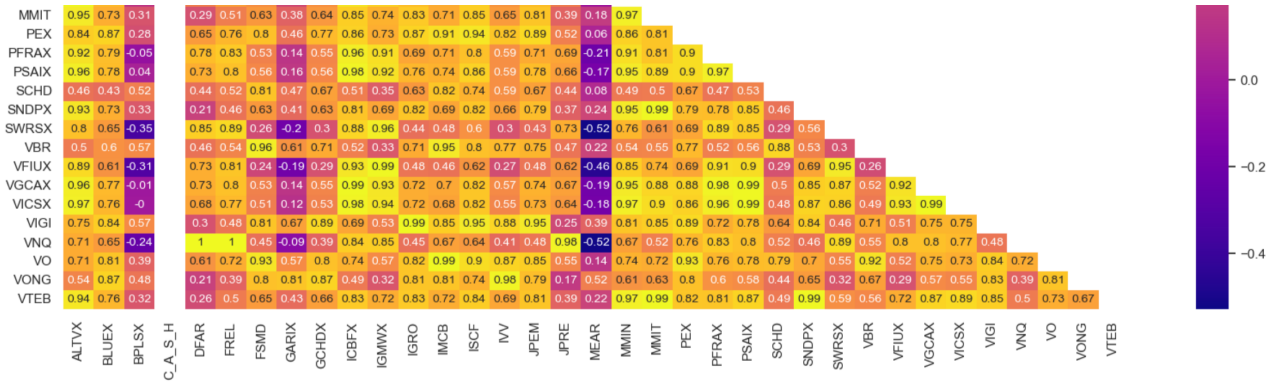
[127]:

| | ALTVX | BLUEX | BPLSX | C_A_S_H | DFAR | FREL | FSMD | ... | VGCAX | VICSX | VIGI | VNQ | VO | VONG | VTEB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALTVX** | 1.0000 | 0.7306 | 0.0422 | NaN | 0.5828 | 0.7124 | 0.5319 | ... | 0.9614 | 0.9737 | 0.7453 | 0.7125 | 0.7131 | 0.5385 | 0.9368 |
| **BLUEX** | 0.7306 | 1.0000 | 0.2824 | NaN | 0.5420 | 0.6478 | 0.6820 | ... | 0.7700 | 0.7579 | 0.8364 | 0.6497 | 0.8059 | 0.8658 | 0.7592 |
| **BPLSX** | 0.0422 | 0.2824 | 1.0000 | NaN | -0.2181 | -0.2469 | 0.6561 | ... | -0.0097 | -0.0049 | 0.5657 | -0.2412 | 0.3946 | 0.4758 | 0.3235 |
| **C_A_S_H** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | ... | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| **DFAR** | 0.5828 | 0.5420 | -0.2181 | NaN | 1.0000 | 0.9979 | 0.3313 | ... | 0.7299 | 0.6825 | 0.3014 | 0.9989 | 0.6128 | 0.2130 | 0.2650 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **VIGI** | 0.7453 | 0.8364 | 0.5657 | NaN | 0.3014 | 0.4769 | 0.8078 | ... | 0.7498 | 0.7487 | 1.0000 | 0.4783 | 0.8431 | 0.8276 | 0.8547 |
| **VNQ** | 0.7125 | 0.6497 | -0.2412 | NaN | 0.9989 | 0.9997 | 0.4497 | ... | 0.7972 | 0.7715 | 0.4783 | 1.0000 | 0.7198 | 0.3883 | 0.5031 |
| **VO** | 0.7131 | 0.8059 | 0.3946 | NaN | 0.6128 | 0.7154 | 0.9256 | ... | 0.7472 | 0.7257 | 0.8431 | 0.7198 | 1.0000 | 0.8135 | 0.7293 |
| **VONG** | 0.5385 | 0.8658 | 0.4758 | NaN | 0.2130 | 0.3851 | 0.8015 | ... | 0.5703 | 0.5454 | 0.8276 | 0.3883 | 0.8135 | 1.0000 | 0.6747 |
| **VTEB** | 0.9368 | 0.7592 | 0.3235 | NaN | 0.2650 | 0.5005 | 0.6474 | ... | 0.8698 | 0.8895 | 0.8547 | 0.5031 | 0.7293 | 0.6747 | 1.0000 |

35 rows × 35 columns

[128]:
```
#t_df = df

plt.figure(figsize=(20,10))
mask = np.zeros_like(price_df.corr())
mask[np.triu_indices_from(mask)] = True
sns.set_style("white")
_p = sns.heatmap(price_df.corr().round(2),
                 annot=True, mask=mask,
                 cmap="plasma", annot_kws={"size": 10})
```






## Calculate Portfolio Values

[129]:
```
## Number of Shares
```

[130]:
```
shares_df = folio_df[['Ticker','Shares']]
shares_df.set_index('Ticker', drop=True, inplace=True)
shares_df[['Shares']].round(0)
```

[130]:

| Ticker | Shares |
|---|---|
| ALTVX | 106,383.0000 |
| BLUEX | 14,201.0000 |
| BPLSX | 49,967.0000 |
| C_A_S_H | 4,469,000.0000 |
| DFAR | 108,468.0000 |
| ... | ... |
| VIGI | 40,481.0000 |
| VNQ | 40,221.0000 |
| VO | 9,234.0000 |
| VONG | 41,501.0000 |
| VTEB | 20,333.0000 |

35 rows × 1 columns

## Prices Timeseries

[131]:
```
price_df
```

[131]:

| Date | ALTVX | BLUEX | BPLSX | C_A_S_H | DFAR | FREL | FSMD | ... | VGCAX | VICSX | VIGI | VNQ | VO | VONG | VTEB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022-01-03 | 10.4183 | 36.7510 | 13.1206 | 1 | NaN | 32.6081 | 35.1562 | ... | 20.7575 | 23.9542 | 82.4521 | 107.5871 | 246.6520 | 77.9475 | 52.7748 |
| 2022-01-04 | 10.4087 | 36.6256 | 13.3690 | 1 | NaN | 32.6081 | 35.4690 | ... | 20.7382 | 23.9542 | 82.2496 | 107.4563 | 246.4671 | 77.1101 | 52.7748 |
| 2022-01-05 | 10.3990 | 36.3122 | 13.4133 | 1 | NaN | 31.6710 | 34.6969 | ... | 20.6996 | 23.8771 | 81.1115 | 104.3810 | 240.2957 | 74.6471 | 52.7075 |
| 2022-01-06 | 10.3796 | 36.2943 | 13.4932 | 1 | NaN | 31.6900 | 34.9129 | ... | 20.6610 | 23.8097 | 80.5425 | 104.4745 | 240.9089 | 74.4895 | 52.6498 |
| 2022-01-07 | 10.3700 | 36.3480 | 13.5109 | 1 | NaN | 31.4912 | 34.6871 | ... | 20.6225 | 23.7519 | 80.6389 | 103.7828 | 239.4682 | 73.6718 | 52.5248 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 2023-09-25 | 9.2300 | 34.2600 | 15.0000 | 1 | 19.7800 | 23.0400 | 32.2600 | ... | 18.2200 | 20.6100 | 72.2400 | 76.6245 | 209.5800 | 68.9900 | 48.3700 |
| 2023-09-26 | 9.2200 | 33.8200 | 14.8800 | 1 | 19.4100 | 22.6100 | 31.8900 | ... | 18.2000 | 20.5800 | 71.4600 | 75.2281 | 206.6000 | 67.8600 | 48.3300 |
| 2023-09-27 | 9.2000 | 33.8100 | 14.8600 | 1 | 19.2600 | 22.4400 | 32.1000 | ... | 18.1400 | 20.4800 | 71.3000 | 74.7230 | 207.2900 | 67.9600 | 48.2400 |
| 2023-09-28 | 9.1500 | 34.1200 | 14.9300 | 1 | 19.4800 | 22.6900 | 32.4350 | ... | 18.1400 | 20.5100 | 71.6100 | 75.4400 | 208.8600 | 68.4800 | 48.0300 |
| 2023-09-29 | 9.1700 | 33.9900 | 14.8200 | 1 | 19.5200 | 22.7500 | 32.2700 | ... | 17.9500 | 20.4400 | 71.3300 | 75.6600 | 208.2400 | 68.4400 | 48.1000 |

438 rows × 35 columns

[132]:
```
m_df = price_df.copy()
m_df.reset_index(inplace=True)
m_df = m_df.melt(id_vars=['Date'])
m_df.columns = ['Date','Ticker','Price']
m_df
```

[132]:

| | Date | Ticker | Price |
|---|---|---|---|
| 0 | 2022-01-03 | ALTVX | 10.4183 |
| 1 | 2022-01-04 | ALTVX | 10.4087 |
| 2 | 2022-01-05 | ALTVX | 10.3990 |
| 3 | 2022-01-06 | ALTVX | 10.3796 |
| 4 | 2022-01-07 | ALTVX | 10.3700 |
| ... | ... | ... | ... |
| 15325 | 2023-09-25 | VTEB | 48.3700 |
| 15326 | 2023-09-26 | VTEB | 48.3300 |
| 15327 | 2023-09-27 | VTEB | 48.2400 |
| 15328 | 2023-09-28 | VTEB | 48.0300 |
| 15329 | 2023-09-29 | VTEB | 48.1000 |

15330 rows × 3 columns

## Add Asset Classes

[133]:
```
l_df = folio_df[['Ticker','Class']] #.drop_duplicates()
l_df
```

[133]:

| Ticker | Class |
|---|---|

| | | |
|---|---|---|
| 0 | ALTVX | Interest Rate Sensitive |
| 1 | BLUEX | Economically Sensitive |
| 2 | BPLSX | Economically Sensitive |
| 3 | C_A_S_H | Cash |
| 4 | DFAR | Economically Sensitive |
| ... | ... | ... |
| 30 | VIGI | Economically Sensitive |
| 31 | VNQ | Economically Sensitive |
| 32 | VO | Economically Sensitive |
| 33 | VONG | Economically Sensitive |
| 34 | VTEB | Interest Rate Sensitive |

35 rows × 2 columns

## Calculate Asset Value Overtime

[134]:
```
merg_df = m_df.merge(l_df, how='left', left_on='Ticker', right_on='Ticker').merge(shares_df,how='left' ,left_on='Ticker', right_on='Ticker')
merg_df['share_value'] = merg_df['Price'] * merg_df['Shares']
merg_df
```

[134]:

| | Date | Ticker | Price | Class | Shares | share_value |
|---|---|---|---|---|---|---|
| 0 | 2022-01-03 | ALTVX | 10.4183 | Interest Rate Sensitive | 106,383.0000 | 1,108,334.3369 |
| 1 | 2022-01-04 | ALTVX | 10.4087 | Interest Rate Sensitive | 106,383.0000 | 1,107,305.0786 |
| 2 | 2022-01-05 | ALTVX | 10.3990 | Interest Rate Sensitive | 106,383.0000 | 1,106,276.0232 |
| 3 | 2022-01-06 | ALTVX | 10.3796 | Interest Rate Sensitive | 106,383.0000 | 1,104,217.9125 |
| 4 | 2022-01-07 | ALTVX | 10.3700 | Interest Rate Sensitive | 106,383.0000 | 1,103,188.7556 |
| ... | ... | ... | ... | ... | ... | ... |
| 15325 | 2023-09-25 | VTEB | 48.3700 | Interest Rate Sensitive | 20,333.0000 | 983,507.1883 |
| 15326 | 2023-09-26 | VTEB | 48.3300 | Interest Rate Sensitive | 20,333.0000 | 982,693.9272 |
| 15327 | 2023-09-27 | VTEB | 48.2400 | Interest Rate Sensitive | 20,333.0000 | 980,863.9541 |
| 15328 | 2023-09-28 | VTEB | 48.0300 | Interest Rate Sensitive | 20,333.0000 | 976,593.9652 |
| 15329 | 2023-09-29 | VTEB | 48.1000 | Interest Rate Sensitive | 20,333.0000 | 978,017.2690 |

15330 rows × 6 columns

[135]:
```
t_df = merg_df.groupby(['Date','Class'])[['share_value']].sum().reset_index()
t_df
```

[135]:

| | Date | Class | share_value |
|---|---|---|---|
| 0 | 2022-01-03 | Cash | 4,469,000.0000 |
| 1 | 2022-01-03 | Economically Sensitive | 50,862,544.7504 |
| 2 | 2022-01-03 | Interest Rate Sensitive | 32,415,221.6159 |
| 3 | 2022-01-04 | Cash | 4,469,000.0000 |
| 4 | 2022-01-04 | Economically Sensitive | 50,981,435.3014 |
| ... | ... | ... | ... |
| 1309 | 2023-09-28 | Economically Sensitive | 48,229,242.3354 |
| 1310 | 2023-09-28 | Interest Rate Sensitive | 28,546,307.5982 |
| 1311 | 2023-09-29 | Cash | 4,469,000.0000 |
| 1312 | 2023-09-29 | Economically Sensitive | 48,193,309.1122 |
| 1313 | 2023-09-29 | Interest Rate Sensitive | 28,468,744.5006 |

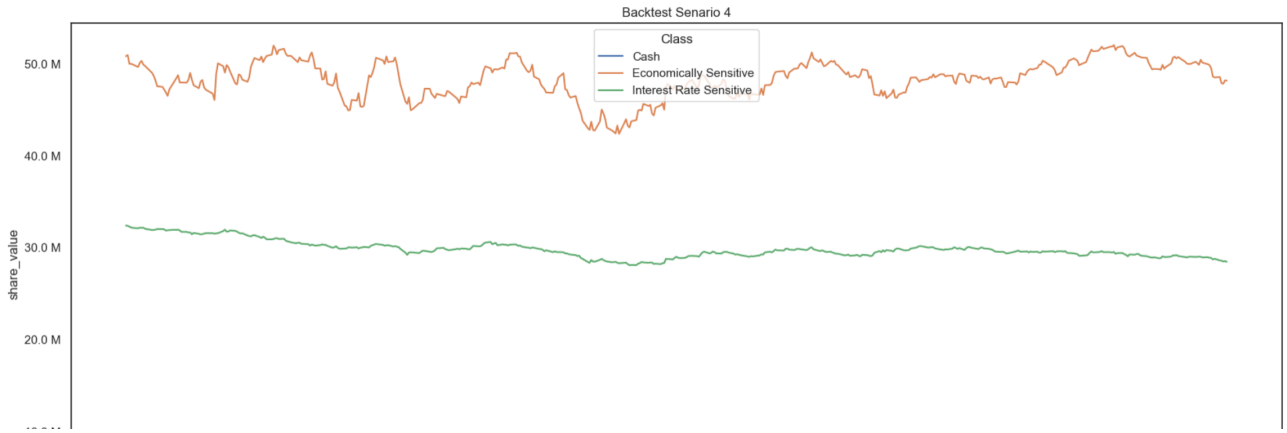
1314 rows × 3 columns

[136]:
```
t_df[t_df['Date'] == '2023-09-11']
```

[136]:

| | Date | Class | share_value |
|---|---|---|---|
| 1269 | 2023-09-11 | Cash | 4,469,000.0000 |
| 1270 | 2023-09-11 | Economically Sensitive | 50,250,088.6926 |
| 1271 | 2023-09-11 | Interest Rate Sensitive | 28,999,975.7671 |

[137]:
```
# Graph
fig, ax = plt.subplots(figsize=(20,8))
plt.ticklabel_format(style='plain', axis='y')

# Plot
sns.set_style("white")
g = sns.lineplot(data=t_df, x="Date", y="share_value", hue='Class')
g.set_yticklabels(['{:,.1f}'.format(x) + ' M' for x in g.get_yticks()/1000000])

ax.set(title='Backtest Senario 4');
```




## Asset Class Correlation

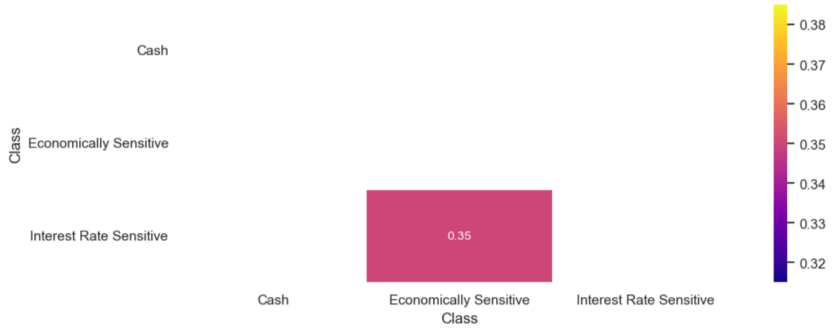
[138]:
```
s_df = t_df.copy()
s_df = s_df.pivot(index='Date', columns='Class', values='share_value')

s_df
```

[138]:

| Class | Cash | Economically Sensitive | Interest Rate Sensitive |
|---|---|---|---|
| Date | | | |
| **2022-01-03** | 4,469,000.0000 | 50,862,544.7504 | 32,415,221.6159 |
| **2022-01-04** | 4,469,000.0000 | 50,981,435.3014 | 32,381,811.5918 |
| **2022-01-05** | 4,469,000.0000 | 50,032,926.9210 | 32,289,563.2214 |
| **2022-01-06** | 4,469,000.0000 | 50,027,840.4456 | 32,208,385.4021 |
| **2022-01-07** | 4,469,000.0000 | 49,949,813.2751 | 32,157,512.2056 |
| ... | ... | ... | ... |
| **2023-09-25** | 4,469,000.0000 | 48,594,635.3662 | 28,619,242.2175 |
| **2023-09-26** | 4,469,000.0000 | 47,913,704.2044 | 28,593,708.2587 |
| **2023-09-27** | 4,469,000.0000 | 47,864,633.1783 | 28,502,372.2289 |
| **2023-09-28** | 4,469,000.0000 | 48,229,242.3354 | 28,546,307.5982 |
| **2023-09-29** | 4,469,000.0000 | 48,193,309.1122 | 28,468,744.5006 |

438 rows × 3 columns

[139]:
```
plt.figure(figsize=(10,4))
mask = np.zeros_like(s_df.corr())
mask[np.triu_indices_from(mask)] = True
sns.set_style("white")
_p = sns.heatmap(s_df.corr().round(2), annot=True, mask=mask, cmap="plasma", annot_kws={"size": 10})
```




## Calculate VaR

[140]:
```
l2 = list(folio_df['Ticker'])
l1 = percent_df.columns
list_dif = set(l2).symmetric_difference(set(l1))


print('l1: ', len(l1), 'l2: ', len(l2), 'dif: ', list_dif)
```

```
l1:  35 l2:  35 dif:  set()
```

[141]:
```
var = VaR(percent_df, weights, alpha=[0.05,0.025,0.01])
#var = VaR(percent_df, weights, alpha=0.05)
var
```

[141]:
```
<VaR – μ: -0.03%, σ: 0.7151%, Portfolio σ: 0.7159%>
```

[142]:
```
var.info
```

[142]:
```
{'Daily Mean PnL': -0.00025741804339413863,
 'Daily Volatility': 0.007150601883874462,
 'Portfolio Volatility': 0.007158797418809501 6}
```

[143]:
```
var.historic()
```

[143]:

| | VaR(95.0) | VaR(97.5) | VaR(99.0) | CVaR(95.0) | CVaR(97.5) | CVaR(99.0) | CDaR(95.0) | CDaR(97.5) | CDaR(99.0) |
|---|---|---|---|---|---|---|---|---|---|
| **2023-09-29** | -0.0123 | -0.0148 | -0.0180 | -0.0158 | -0.0184 | -0.0216 | -0.1772 | -0.1835 | -0.1862 |

[144]:
```
print('VaR(95.0):', var.historic()['VaR(95.0)'][0]*100)
print('Portfolio VaR(95.0)', var.historic()['VaR(95.0)'][0]*portfolio_total*1000)
```

```
VaR(95.0): -1.2315075343638227
Portfolio VaR(95.0) -1031005.7926940487
```

[145]:
```
var.parametric()
```

[145]:

| | VaR(95.0) | VaR(97.5) | VaR(99.0) | CVaR(95.0) | CVaR(97.5) | CVaR(99.0) | CDaR(95.0) | CDaR(97.5) | CDaR(99.0) |
|---|---|---|---|---|---|---|---|---|---|
| **2023-09-29** | -0.0238 | -0.0252 | -0.0269 | -0.0289 | -0.0289 | -0.0289 | -0.1772 | -0.1835 | -0.1862 |

[146]:
```
print('VaR(95.0):', var.parametric()['VaR(95.0)'][0]*100)
print('Portfolio VaR(95.0)', var.parametric()['VaR(95.0)'][0]*portfolio_total*1000)
```

```
VaR(95.0): -2.3813632315321978
Portfolio VaR(95.0) -1993653.4838064406
```

[147]:
```
var.monte_carlo()
```

[147]:

| | VaR(95.0) | VaR(97.5) | VaR(99.0) | CVaR(95.0) | CVaR(97.5) | CVaR(99.0) | CDaR(95.0) | CDaR(97.5) | CDaR(99.0) |
|---|---|---|---|---|---|---|---|---|---|
| **2023-09-29** | -0.0120 | -0.0143 | -0.0170 | -0.0151 | -0.0171 | -0.0195 | -0.1772 | -0.1835 | -0.1862 |

[148]:
```
print('VaR(95.0):', var.monte_carlo()['VaR(95.0)'][0]*100)
```

```
print('Portfolio VaR(95.0)', var.monte_carlo()['VaR(95.0)'][0]*portfolio_total*1000)
```

```
VaR(95.0): -1.1991295392246542
Portfolio VaR(95.0) -1008330.0855807732
```

[149]:
```
var.monte_carlo(stressed=True)
```

[149]:

| | VaR(95.0) | VaR(97.5) | VaR(99.0) | CVaR(95.0) | CVaR(97.5) | CVaR(99.0) | CDaR(95.0) | CDaR(97.5) | CDaR(99.0) |
|---|---|---|---|---|---|---|---|---|---|
| **2023-09-29** | -0.0181 | -0.0195 | -0.0210 | -0.0199 | -0.0210 | -0.0222 | -0.4974 | -0.5025 | -0.5057 |

## Backtest

[150]:
```
bth = var.backtest(method='h')
```

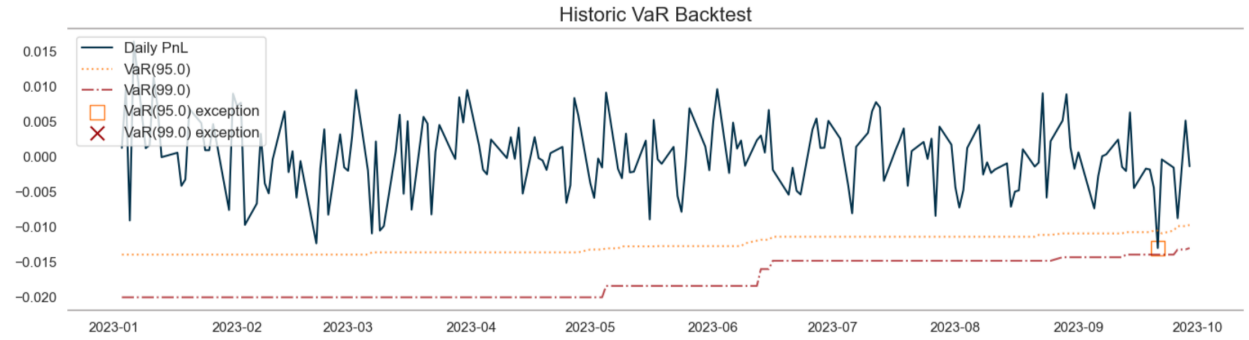
```
Backtest: Historic Method: 100%|██████████| 187/187 [00:00<00:00, 3105.94it/s]
```

[151]:
```
var.evaluate(bth)
```

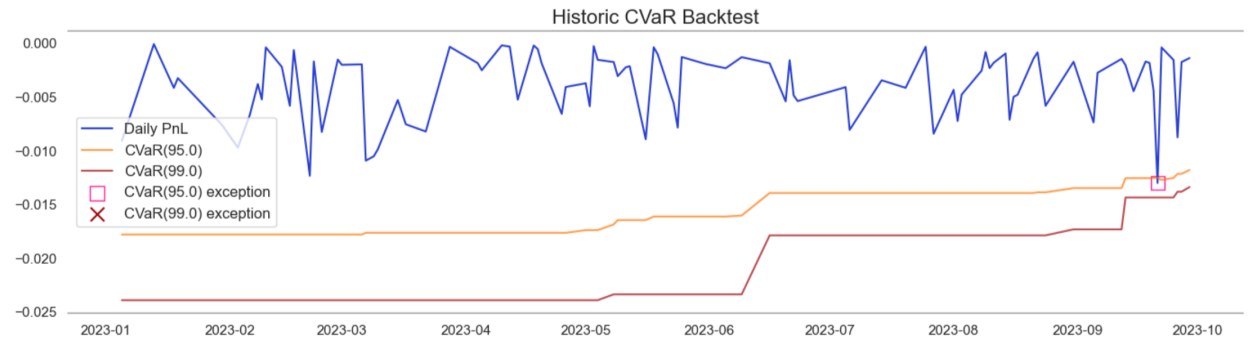
[151]:

| | Amount | Percent | Mean Deviation | STD Deviation | Min Deviation | Max Deviation |
|---|---|---|---|---|---|---|
| **Observations** | 187 | 1 | 0 | 0 | 0 | 0 |
| **VaR(95.0)** | 1 | 0.0053 | -0.0025 | 0.0000 | -0.0025 | -0.0025 |
| **VaR(99.0)** | 0 | 0.0000 | NaN | NaN | NaN | NaN |
| **CVaR(95.0)** | 1 | 0.0053 | -0.0005 | 0.0000 | -0.0005 | -0.0005 |
| **CVaR(99.0)** | 0 | 0.0000 | NaN | NaN | NaN | NaN |
| **CDaR(95.0)** | 0 | 0.0000 | 0 | 0 | 0 | 0 |
| **CDaR(99.0)** | 0 | 0.0000 | 0 | 0 | 0 | 0 |

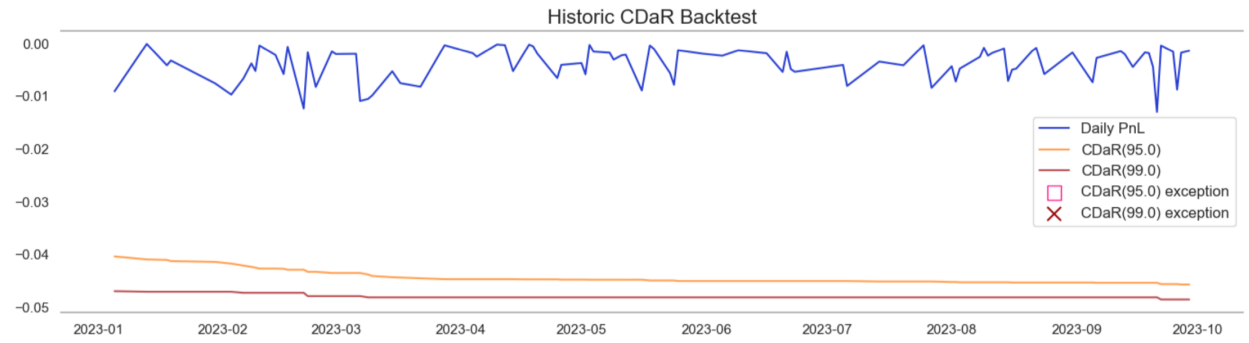
[152]:
```
var.var_plot(bth)
```

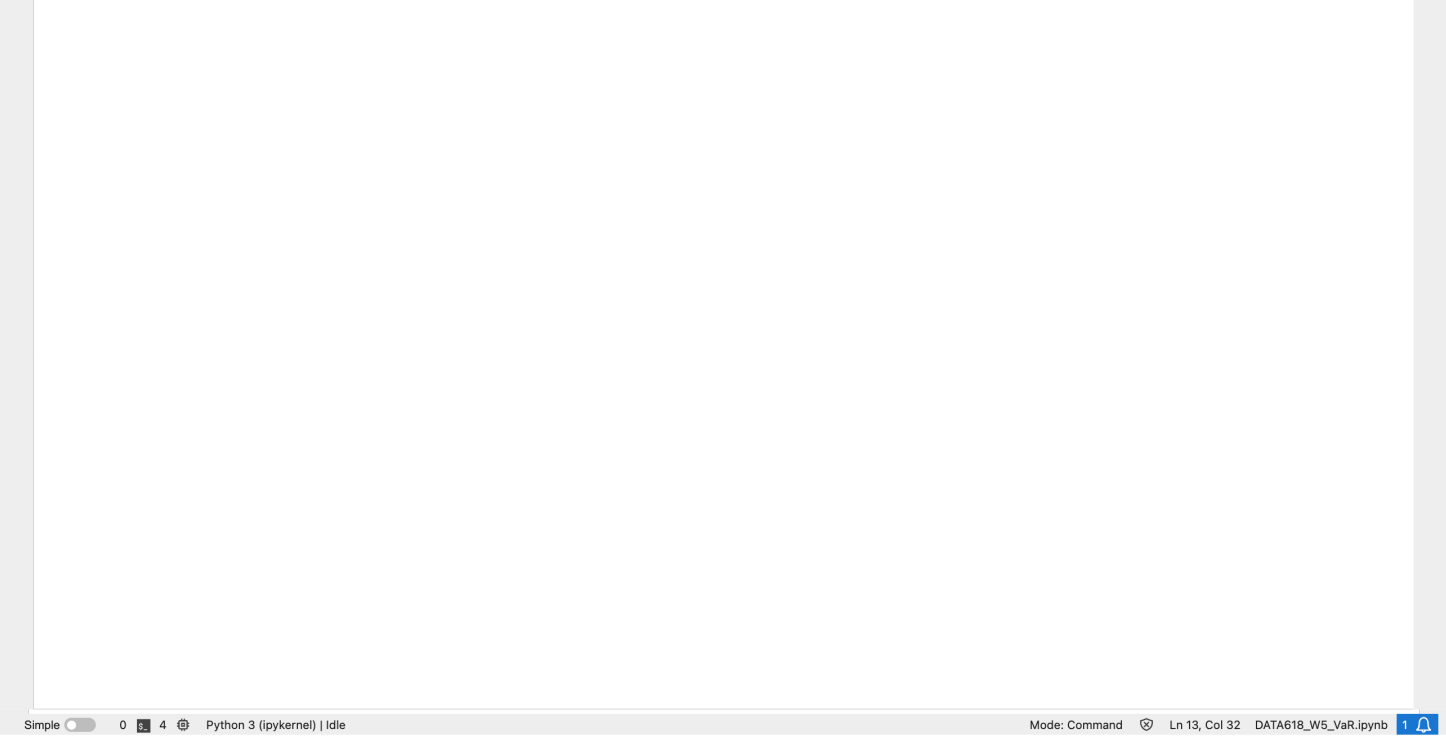



[153]:
```
var.cvar_plot(bth)
```




[154]:
```
var.cdar_plot(bth)
```




Simple
0
4
Python 3 (ipykernel) | Idle
Mode: Command
Ln 13, Col 32
DATA618_W5_VaR.ipynb
1