In [15]:

```python
import pandas as pd
import numpy as np
```

In [16]:

```python
stock_prices = pd.read_csv("sample_prices.csv")
```

In [17]:

```python
stock_prices.head()
```

Out[17]:

	BLUE	ORANGE
0	8.7000	10.6600
1	8.9055	11.0828
2	8.7113	10.7100
3	8.4346	11.5907
4	8.7254	12.1070

In [18]:

```python
returns = stock_prices.pct_change()
```

In [19]:

```python
returns
```

Out[19]:

	BLUE	ORANGE
0	NaN	NaN
1	0.023621	0.039662
2	-0.021807	-0.033638
3	-0.031763	0.082232
4	0.034477	0.044544
5	0.037786	-0.026381
6	-0.011452	-0.049187
7	0.032676	0.117008
8	-0.012581	0.067353
9	0.029581	0.078249
10	0.006151	-0.168261
11	0.012162	0.024041
12	0.021149	-0.055623

In [20]:

```
# drop first row
returns = returns.dropna()
returns
```

Out[20]:

	BLUE	ORANGE
1	0.023621	0.039662
2	-0.021807	-0.033638
3	-0.031763	0.082232
4	0.034477	0.044544
5	0.037786	-0.026381
6	-0.011452	-0.049187
7	0.032676	0.117008
8	-0.012581	0.067353
9	0.029581	0.078249
10	0.006151	-0.168261
11	0.012162	0.024041
12	0.021149	-0.055623

In [21]:

```
# standard deviation
returns.std()
```

Out[21]:

```
BLUE      0.023977
ORANGE    0.079601
dtype: float64
```

In [28]:

```
# How to calculate STD
deviations = returns - returns.mean()
sqr_deviations = deviations**2
variance = sqr_deviations.mean()
volatility = np.sqrt(variance)
volatility
```

Out[28]:

```
BLUE      0.022957
ORANGE    0.076212
dtype: float64
```

In [29]:

```
number_of_obs = returns.shape[0]
variance = sqr_deviations.sum()/(number_of_obs - 1)
volatility = variance**0.5
```

In [30]:

```
# this will give you the std
volatility
```

Out[30]:

```
BLUE      0.023977
ORANGE    0.079601
dtype: float64
```

In [31]:

```
# the return Annualized option 1
returns.std()*np.sqrt(12)
```

Out[31]:

```
BLUE      0.083060
ORANGE    0.275747
dtype: float64
```

In [32]:
```
#option 2
returns.std()*(12**0.5)
```

Out[32]:
```
BLUE       0.083060
ORANGE     0.275747
dtype: float64
```

In [36]:
```
returns_portfolio = pd.read_csv("Portfolios_Formed_on_ME_monthly_EW.csv", header=
0, index_col=0,
                               parse_dates=True, na_values=-99.99)
```

In [37]:
```
returns_portfolio.head()
```

Out[37]:

	<= 0	Lo 30	Med 40	Hi 30	Lo 20	Qnt 2	Qnt 3	Qnt 4	Hi 20	Lo 10	Dec 2	Dec 3	Dec 4	Dec 5	Dec 6	Dec 7
192607	NaN	-0.43	1.52	2.68	-0.57	0.59	1.60	1.47	3.33	-1.45	0.29	-0.15	1.33	1.24	1.98	1.55
192608	NaN	3.90	3.04	2.09	3.84	3.59	3.71	1.61	2.33	5.12	2.59	4.03	3.15	2.72	4.72	1.60
192609	NaN	-1.08	-0.54	0.16	-0.48	-1.40	0.00	-0.50	-0.09	0.93	-1.87	-2.27	-0.53	0.07	-0.07	-1.64
192610	NaN	-3.32	-3.52	-3.06	-3.29	-4.10	-2.89	-3.36	-2.95	-4.84	-1.77	-3.36	-4.83	-2.98	-2.80	-3.45
192611	NaN	-0.46	3.82	3.09	-0.55	2.18	3.41	3.39	3.16	-0.78	-0.32	-0.29	4.65	3.24	3.57	3.82

In [38]:
```
columns = ['Lo 10', 'Hi 10']
returns_portfolio_one = returns_portfolio[columns]
returns_portfolio_one.head()
```

Out[38]:

	Lo 10	Hi 10
192607	-1.45	3.29
192608	5.12	3.70
192609	0.93	0.67
192610	-4.84	-2.43
192611	-0.78	2.70

In [39]:
```
# to work with the raw data
returns_portfolio_one = returns_portfolio_one/100
returns_portfolio_one.head()
```

Out[39]:

	Lo 10	Hi 10
192607	-0.0145	0.0329
192608	0.0512	0.0370
192609	0.0093	0.0067
192610	-0.0484	-0.0243
192611	-0.0078	0.0270

In [41]:

```
#Change columns names
returns_portfolio_one.columns = ['SmallCap', 'LargeCap']
returns_portfolio_one.head()
```

Out[41]:

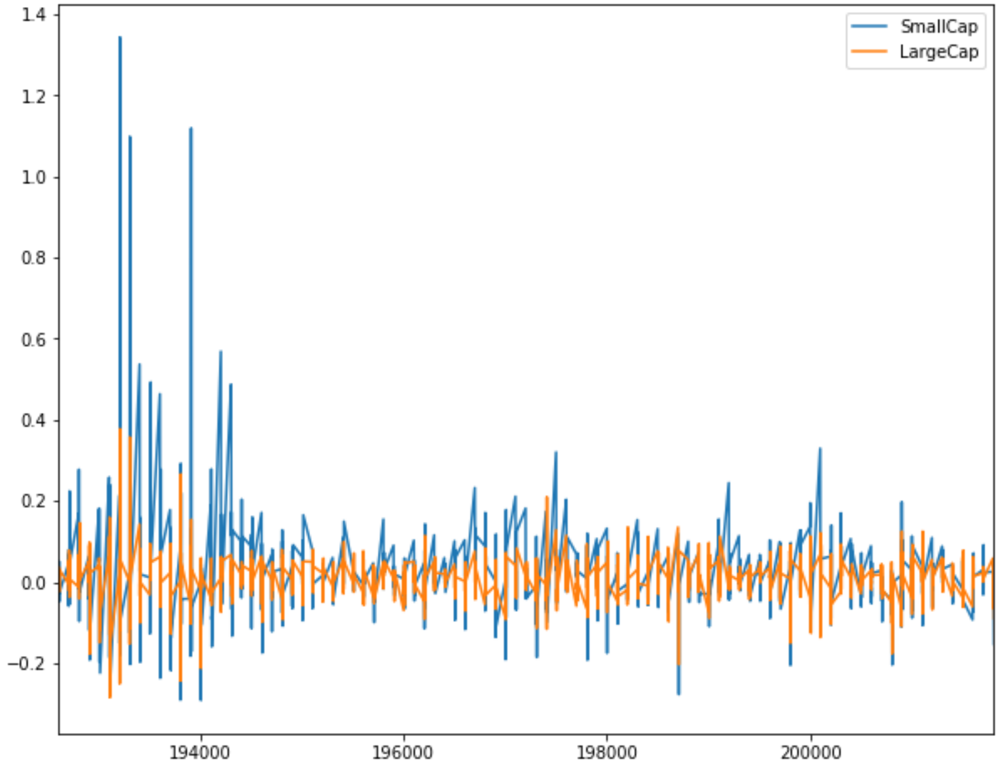
	SmallCap	LargeCap
192607	-0.0145	0.0329
192608	0.0512	0.0370
192609	0.0093	0.0067
192610	-0.0484	-0.0243
192611	-0.0078	0.0270

In [44]:

```
returns_portfolio_one.plot.line(figsize=(10,8))
```

Out[44]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x11f7f2940>
```



In [45]:

```
returns_portfolio_one.std()
```

Out[45]:

```
SmallCap    0.106288
LargeCap    0.053900
dtype: float64
```

In [46]:

```
annualized_vol = returns_portfolio_one.std()*np.sqrt(12)
annualized_vol
```

Out[46]:

```
SmallCap    0.368193
LargeCap    0.186716
dtype: float64
```

In [47]:

```
# Calculate monthly returns

# Find how many months in the data set
n_months = returns_portfolio_one.shape[0]

#Calculate the return per month
return_per_month = (returns_portfolio_one + 1).prod()**(1/n_months) - 1
return_per_month
```

Out[47]:

```
SmallCap    0.012986
LargeCap    0.007423
dtype: float64
```

In [48]:

```
annualized_vol
```

Out[48]:

```
SmallCap    0.368193
LargeCap    0.186716
dtype: float64
```

In [49]:

```
annualized_return = (return_per_month + 1)**12-1
annualized_return
```

Out[49]:

```
SmallCap    0.167463
LargeCap    0.092810
dtype: float64
```

In [50]:

```
# Another way to calculate annualized returns
annualized_return_simple_format = (returns_portfolio_one + 1).prod()**(12/n_month
s) - 1
annualized_return_simple_format
```

Out[50]:

```
SmallCap    0.167463
LargeCap    0.092810
dtype: float64
```

In [51]:

```
annualized_return / annualized_vol
```

Out[51]:

```
SmallCap    0.454825
LargeCap    0.497063
dtype: float64
```

In [52]:

```
risk_free_rate = 0.025
excess_return = annualized_return - risk_free_rate
sharpe_ratio = excess_return / annualized_vol
sharpe_ratio
```

Out[52]:

```
SmallCap    0.386926
LargeCap    0.363170
dtype: float64
```

In [ ]:

```
```