The City College of New York

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ECO 41552 – Quantitative Finance (Fall 2022)

PORTFOLIO ANALYSIS PROJECT

OBJECTIVE

Complete all the steps below and return the risk analysis for your seven (7) stock portfolio against the S&P500 (SPY), Russell 2000 (IWM), and the Dow Jones Industrial Average (DIA)

REQUIREMENTS

1. Create a table showing constituent (stocks) risk analysis in the equal-weight portfolio analysis as of the current date.

CODE

```
#################### Tickers ####################
"""""
These stocks were chosen by weight from S&P500
AAPL =  Apple Inc
MSFT =  Microsoft Corporation
AMAZN = Amazon.com Inc
TSLA =  Tesla Inc
GOOGL = Alphabet Inc. Class A
UNH =   UnitedHealth Group Incorporate
JNJ =   Johnson and Johnson
"""""
tickers = ['AAPL','MSFT','AMZN','TSLA','GOOGL','UNH','JNJ']
#################### Exchange Traded Fund ####################
"""
SPY =   SPDR S&P 500 ETF Trust
```

```
  IWM =   iShares Russell 2000 ETF
  DIA =   SPDR Dow Jones Industrial Average ETF Trust
  """
  etf = ['SPY','IWM','DIA']
  dataFinance = yf.download(tickers+etf, period= ' 10y')
  dataFinance = dataFinance['Adj Close']
  dataFinance.head()



  ##################### Portfolio Weight Calculator ####################
  dataFinance['Portfolio'] = dataFinance[tickers].mean(axis=1)
  returns = dataFinance.pct_change()
  table = pd.DataFrame(index=tickers)
  table['Portfolio Weight [%]'] = (format((1/len(tickers))*100,'.2f'))


  ########## Annualized Volatility ##########
  # Number 63 means 63-days ~ 3-month back until today
  volatilityTrailing3Month = returns[-63:].dropna()
  table['Annualized Volatility (Trailing 3-months)'] =
(((volatilityTrailing3Month.var()/volatilityTrailing3Month.std())**(1/np.sqrt
(4)))*100)


  ##################### Beta against ETF ####################
  # Number 252 means 252-days ~ 12-month back until today
  beta = returns[-252:].cov()/returns[-252:].var()
  for eachItem in etf:
      table['Beta Against '+eachItem]=beta[eachItem]


  ##################### Drawdown Calculation ####################
  drawdown = (returns[-252:].rolling(5).min() -
     returns[-252:].rolling(5).max())/returns[-252:].rolling(5).max()
```

```
   table['Average Weekly Drawdown'] = drawdown.mean()

   table['Maximum Weekly Drawdown'] = drawdown.max()


   ######## Total Return and Annualized Total Return (using trailing 10-years)
############


   table['TotalReturn']=dataFinance.pct_change(len(dataFinance)-1)[-1:].T

   table['Annualized Total Returns']=table.TotalReturn**(1/np.sqrt(252))


   table.T
```

TABLE

	AAPL	MSFT	AMZN	TSLA	GOOGL	UNH	JNJ
Portfolio Weight [%]	14.29	14.29	14.29	14.29	14.29	14.29	14.29
Annualized Volatility (Trailing 3-months)	13.975643	13.911727	16.694701	17.995934	15.092641	11.853217	10.188978
Beta Against SPY	1.230697	1.20544	1.612473	1.825513	1.307799	0.640931	0.287949
Beta Against IWM	0.881527	0.834712	1.199653	1.522624	0.917414	0.397517	0.121849
Beta Against DIA	1.366202	1.310316	1.731641	1.799429	1.417061	0.84698	0.436654
Average Weekly Drawdown	-2.094911	-2.695035	-1.328757	-3.505494	-3.227105	-3.863572	-2.099727
Maximum Weekly Drawdown	21.666143	39.152941	415.16831	6.799648	14.960796	3.289699	88.421339
TotalReturn	6.499015	9.204575	8.341079	121.189226	4.396266	9.641309	2.093024
Annualized Total Returns	1.125135	1.150076	1.142961	1.352838	1.097768	1.153439	1.047627

2. Create a table showing Portfolio Risk against the three ETFs

CODE

```
   ########## Correlation against ETF ##########

   tableETF = pd.DataFrame(index=etf)

   tableETF['Correlation']=returns[etf+['Portfolio']].corr().Portfolio


   ########## Covariance of Portfolio against ETF ##########

   tableETF['Covariance']=returns[etf+['Portfolio']].cov().Portfolio*10000


   ########## Tracking Errors (Using trailing 10-years) ##########

   for eachItem in etf:
```

```
      tableETF.loc[eachItem, 'TrackingError'] = (returns[eachItem]-
returns.Portfolio).std()*100



  ########## Sharpe Ratio (using current risk-free rate) ##########

  excessReturn = (returns.Portfolio[-252:]-(0.02/np.sqrt(252)))

  tableETF['Sharpe'] = 0

  for eachItem in etf:

      tableETF.loc[eachItem, 'Sharpe'] = (excessReturn/(returns[-
252:].Portfolio - returns[-252:][eachItem]).std())[-1]



  ### Annualized Volatility (252 days) Spread (Portfolio Volatility - ETF
Volatility) ###

  tableETF['VolatilitySpread'] = returns[etf+['Portfolio']][-252:].std() **
(1/252)

  tableETF.T
```

TABLE

	SPY	IWM	DIA
Correlation	0.886033	0.726437	0.832937
Covariance	1.201432	1.232689	1.134738
TrackingError	0.584817	0.967679	0.697368
Sharpe	-0.643256	-0.429430	-0.484675
VolatilitySpread	0.983196	0.983937	0.982471

3. Create a correlation matrix showing the correlations between the equal-weighted portfolio, 3 ETFs, and your 7 stocks.

CODE

```
  # A correlation matrix is a heatmap



  fig, ax = plt.subplots(figsize=(10,10))

  sns.heatmap(returns[etf+['Portfolio']+tickers].corr())

  plt.show
```

CORRELATION MATRIX