Newmont Corporation

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```
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import statsmodels.formula.api as smf
import yfinance as yf
import seaborn as sns
```

Question 1

```
# Organization and Preparation of Data
mydata   = yf.download("SPY, NEM", start="2018-02-17", end="2023-02-17")
```

```
## [                       0%                       ][**********************100%**********************]
```

```
returns_m = mydata['Adj Close'].resample('M').ffill().pct_change()
price_m = mydata['Adj Close'].resample('M').ffill()
log_price = np.log(mydata['Adj Close']/mydata['Adj Close'].shift(1))
returns_m.dropna(inplace=True)

mydata.head()
```

```
##             Adj Close                  Close  ...        Open   Volume
##                   NEM         SPY        NEM  ...         SPY      NEM        SPY
## Date                                          ...
## 2018-02-20  33.026012  249.181290  38.389999  ...  272.029999  5718400   86369700
## 2018-02-21  32.828167  247.941849  38.160000  ...  271.899994  5736600   98883700
## 2018-02-22  32.372208  248.263245  37.630001  ...  271.100006  4903500  110511300
## 2018-02-23  33.284100  252.220322  38.689999  ...  271.790009  4812800   92766400
## 2018-02-26  33.826077  255.149216  39.320000  ...  275.929993  4770400   86491400
##
## [5 rows x 12 columns]
```

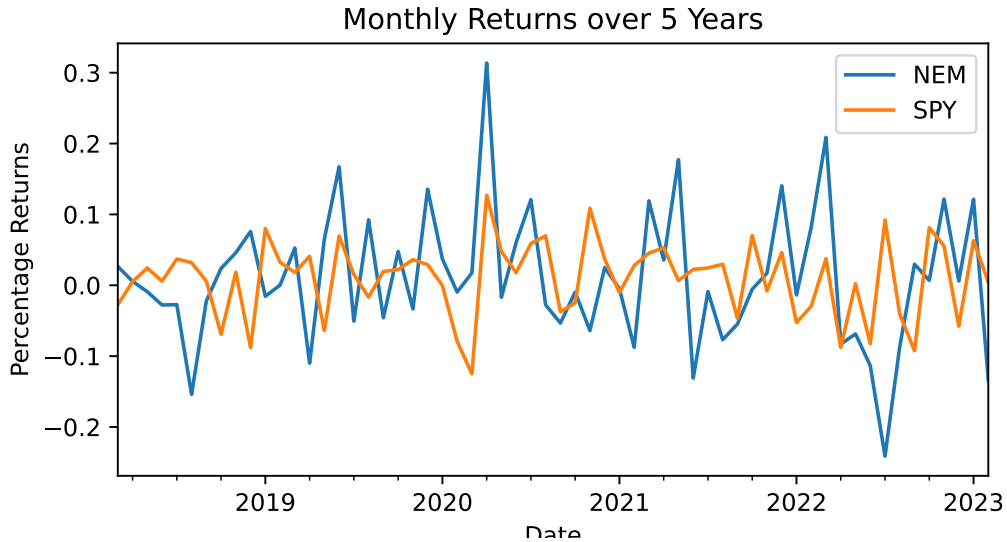
```
mydata.tail()
```

```
##             Adj Close                  Close  ...        Open   Volume
##                   NEM         SPY        NEM  ...         SPY      NEM       SPY
## Date                                          ...
## 2023-02-10  47.980000  408.040009  47.980000  ...  405.859985  4671700  70738000
## 2023-02-13  48.299999  412.829987  48.299999  ...  408.720001  5201900  64913500
## 2023-02-14  47.009998  412.640015  47.009998  ...  411.239990  8593200  88389300
## 2023-02-15  46.299999  413.980011  46.299999  ...  410.350006  8632100  61685300
## 2023-02-16  45.849998  408.279999  45.849998  ...  408.790009  7494700  76431500
```

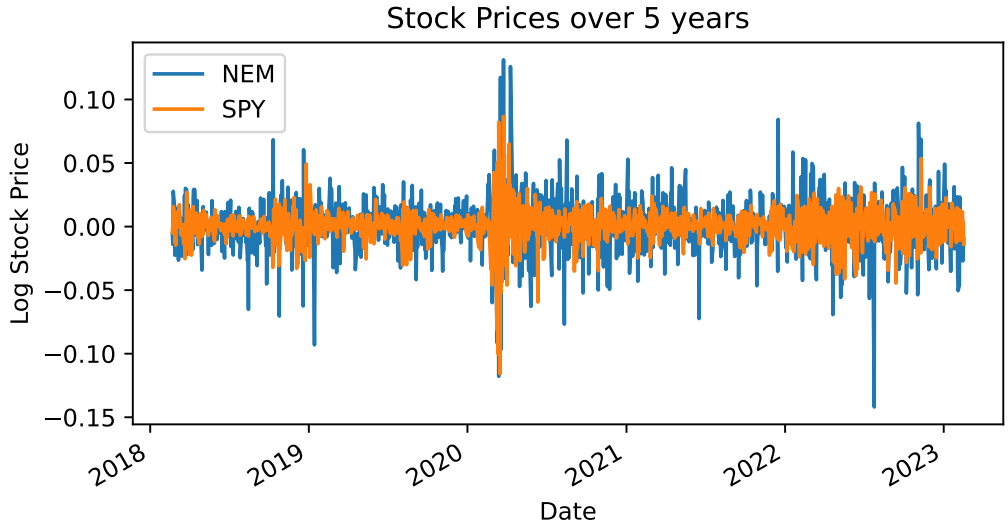
```
##
## [5 rows x 12 columns]
```

Graphing returns and Log price

```
returns_m.plot()
plt.xlabel("Date")
plt.ylabel("Percentage Returns")
plt.title("Monthly Returns over 5 Years")
plt.show()
```




```
log_price.plot()
plt.ylabel("Log Stock Price")
plt.title("Stock Prices over 5 years")
plt.show()
```



From the monthly return chart we can see that Newmont(NEM) produces the highest returns compare to the ETF at the cost of high volality, correlation is quite clear, it does seem to be a slight positive correlation. Moving over to the stock price graph we can confirm the volatility statement as well as that correlation in early 2020 that could have been costed by the Covid-19 pandemic.

Question 2 Calculation of Mean, Standard Deviation, Skewness and Kurtosis

```
print(returns_m.describe())
```

```
##              NEM        SPY
## count  60.000000  60.000000
## mean    0.009877   0.009671
## std     0.094636   0.053591
## min    -0.241160  -0.124871
## 25%    -0.047086  -0.025553
## 50%    -0.002274   0.019004
## 75%     0.054588   0.041989
## max     0.313604   0.126984
```

mean = expected returns

```
print(returns_m.kurt())
```

Kurtosis

```
## NEM    1.316857
## SPY   -0.117125
## dtype: float64
```

```
print(returns_m.skew())
```

Skewness

```
## NEM    0.432150
## SPY   -0.408804
## dtype: float64
```

Above is the data if you were to buy theses investment 5 years ago. NEM produced slighly higher monthly returns at 0.9877% compare to the ETF at 0.9671%, an 0.0206% difference which is a 0.24% yearly difference over the 5 years.‘

Both the observation from the graphs were confirmed, the volatility(standard deviation) of the stock investment was 77% higher than the ETF making NEM the worst investment for a risk averse portfolio

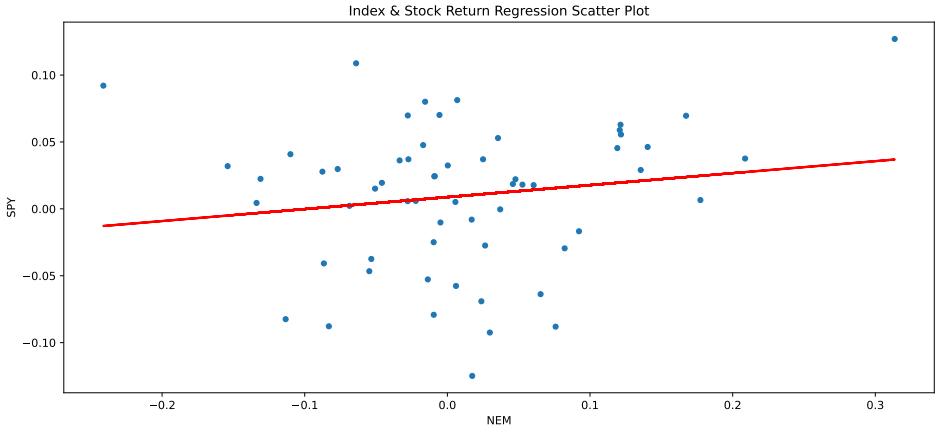
Taking a look to the Kurtosis of both investments, NEM produces a Leptokurtic curve which can be assumed from the graph as there is a large separation in the min and max returns. The ETF produces a Platykurtic curve. the Kurtosis on the NEM stock states that this investment has high risk. The Kurtosis of the ETF is slighly negative and is a more desireable investment as this means returns are much more consistent.

When looking at the skewness NEM is a much more attractive offer as it we can expected investors to have some large gains with small frequent losses

Question 3 Scatter Plot

```
regression = np.polyfit(returns_m['NEM'], returns_m['SPY'], deg =1)

returns_m.plot(kind='scatter', x= 'NEM', y='SPY', figsize=(14,6))
plt.plot(returns_m['NEM'], np.polyval(regression, returns_m['NEM']), 'r', lw=2)
plt.title("Index & Stock Return Regression Scatter Plot")
plt.show()
```



The scatter plot above suggest that these two investment have a positive correlation, the regression line on a slight angle suggesting that this correlation is not quite large, this was also the conclusion when we graphed the monthly returns over the last 5 years.

Question 4 Correlation Between Newmont and SPY ETF

```
print(returns_m.corr())
```

```
##            NEM       SPY
## NEM  1.000000  0.158145
## SPY  0.158145  1.000000
```

Using the .corr() on the monthly returns we are given the correlation between NEM and SPY which is 0.158145 which shown by the graph is the slighly positive relationship we been seeing. What correlation means is how the performance of one stock or investment is linked by to another investment. In other words if one investment goes up the other will also go up. In this case since the correlation are is so close to zero we can say that NEM is rarely affected by the performance of the market. I believe the major reason to which this correlation is more positive than it should be is due to the events of March 2020 where the United States decided to implement restrictions which lead to a market crash.

Question 5 OLS Regression Table Correlation between NEM with SPY

```
model = smf.ols('NEM ~ SPY', data=returns_m).fit()
model.summary()
```

```
## <class 'statsmodels.iolib.summary.Summary'>
## """
##                             OLS Regression Results
## ==============================================================================
## Dep. Variable:                    NEM   R-squared:                       0.025
## Model:                            OLS   Adj. R-squared:                  0.008
## Method:                 Least Squares   F-statistic:                     1.488
## Date:                Tue, 21 Feb 2023   Prob (F-statistic):              0.227
## Time:                        21:06:09   Log-Likelihood:                 57.591
## No. Observations:                  60   AIC:                            -111.2
## Df Residuals:                      58   BIC:                            -107.0
## Df Model:                           1
## Covariance Type:            nonrobust
## ==============================================================================
##                  coef    std err          t      P>|t|      [0.025      0.975]
## ------------------------------------------------------------------------------
## Intercept      0.0072      0.012      0.580      0.564      -0.018       0.032
## SPY            0.2793      0.229      1.220      0.227      -0.179       0.738
## ==============================================================================
## Omnibus:                        2.567   Durbin-Watson:                   1.897
## Prob(Omnibus):                  0.277   Jarque-Bera (JB):                1.970
## Skew:                           0.100   Prob(JB):                        0.373
## Kurtosis:                       3.865   Cond. No.                         18.8
## ==============================================================================
##
## Notes:
## [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
## """
```

Taking a look at the coef intercept this gives us our constant term(Beta0) 0.0072 Quite low. below this, we get the coef of SPY(Beta1) which means for every unit change in SPY theres a 0.2793 change in NEM. the most significant information we can get from this regression table is R^2 which is at a very low 0.008 which means that only 0.8% of the variation in NEM can be explained by SPY. Merely anything, which is not a surprised as we established that the correlation between these two investments are very low.

Looking at the prob(F-stat) which lays at 0.227 this is the overall significance of the regression. the smaller the prob(F-stat) the more significant the parameter in this case SPY is not as significant to the changes in NEM.

Question 6 Estimating Quadratic Model

```
model = np.poly1d(np.polyfit(returns_m['NEM'], returns_m['SPY'], 2))
print(model)
```

```
##        2
## 1.313 x + 0.01169 x - 0.002139
```

I dont believe a non linear form can help explain the relation of the ETF and NEM. usually relationship are measured through linearity, but the non linear relationship can be more beneficial when explaining the pontential growth. in this case the non linear model can be helpful to predict some future returns based on market growth.