In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
from scipy import stats


# Load the Excel file
excel_file = pd.ExcelFile('D:\Derivatives Trading\TAIEX derivatives trading record.

# Get the sheet you want to read
sheet_name = 'ForPython' # Replace with the name of the sheet you want to read
df = excel_file.parse(sheet_name)
```

In [2]:
```
# Output data information
print(df.head())

#******Plotting setup*****#
# Generate some data
Date = df["Date"]
Date
y1 =df["PnL Index"]
y1
y2 = df["TAIEX"]
y2
```

Out[2]:
```
        Date   PnL Index     TAIEX    VIX   Returns  Unnamed: 5  Unnamed: 6  \
0 2022-07-01  100.000000  14343.08  27.01  0.000000         NaN         NaN
1 2022-07-04   95.577858  14217.06  27.56 -0.044221         NaN         NaN
2 2022-07-05   93.953178  14349.20  27.18 -0.016998         NaN         NaN
3 2022-07-06   92.057052  13985.51  29.40 -0.020182         NaN         NaN
4 2022-07-07   92.698962  14335.27  28.26  0.006973         NaN         NaN

    Base
0  100.0
1    NaN
2    NaN
3    NaN
4    NaN
0      14343.08
1      14217.06
2      14349.20
3      13985.51
4      14335.27
         ...
355    17653.11
356    17673.87
357    17652.03
358    17576.55
359    17635.20
Name: TAIEX, Length: 360, dtype: float64
```

In [3]:
```
# Get the maximum PnL value
max_pnl = df['PnL Index'].max()
max_pnl_date = df.loc[df['PnL Index']==max_pnl, 'Date'].values[0]
```

In [4]:
```
# Create the plot and set the first y-axis (left)
fig, ax1 = plt.subplots()
plt.xticks(rotation=90)
ax1.plot(Date, y1, 'b-')
ax1.scatter(max_pnl_date, max_pnl, color='red', marker='*')
ax1.set_xlabel('Date')
ax1.set_ylabel('PnL Index (Base = 100)', color='b')
```

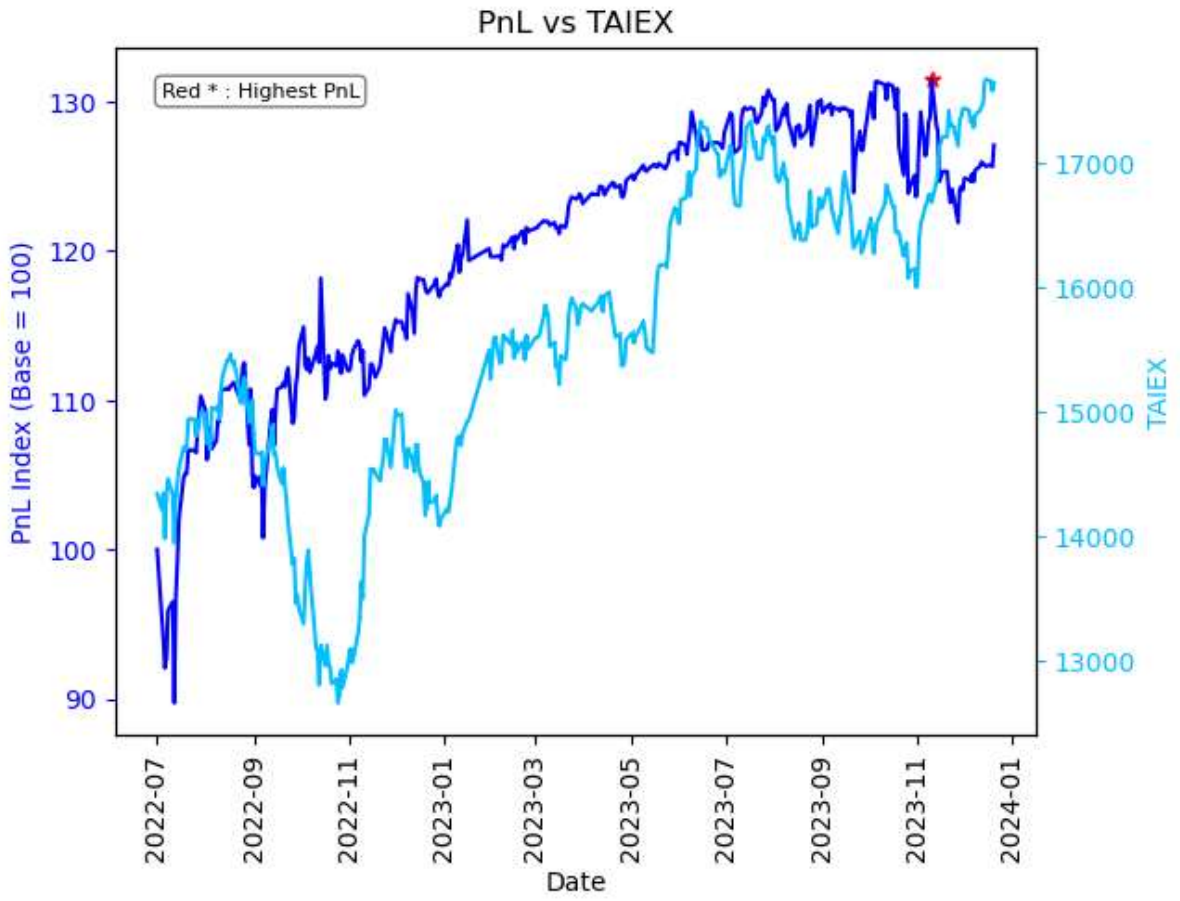
```
ax1.tick_params('y', colors='b')

# Set the second y-axis (right)
ax2 = ax1.twinx()
ax2.plot(Date, y2, color='deepskyblue', marker=',')
ax2.set_ylabel('TAIEX', color='deepskyblue')
ax2.tick_params('y', colors='deepskyblue')

# Add message box
msg = "Red * : Highest PnL"
props = dict(boxstyle='round', facecolor='white', alpha=0.5)
ax1.text(0.05, 0.95, msg, transform=ax1.transAxes, fontsize=8,
        verticalalignment='top', bbox=props)

# Show the plot
plt.title('PnL vs TAIEX')
plt.show()

#Pnl vs VIX
y3 = df["VIX"]
y3
```

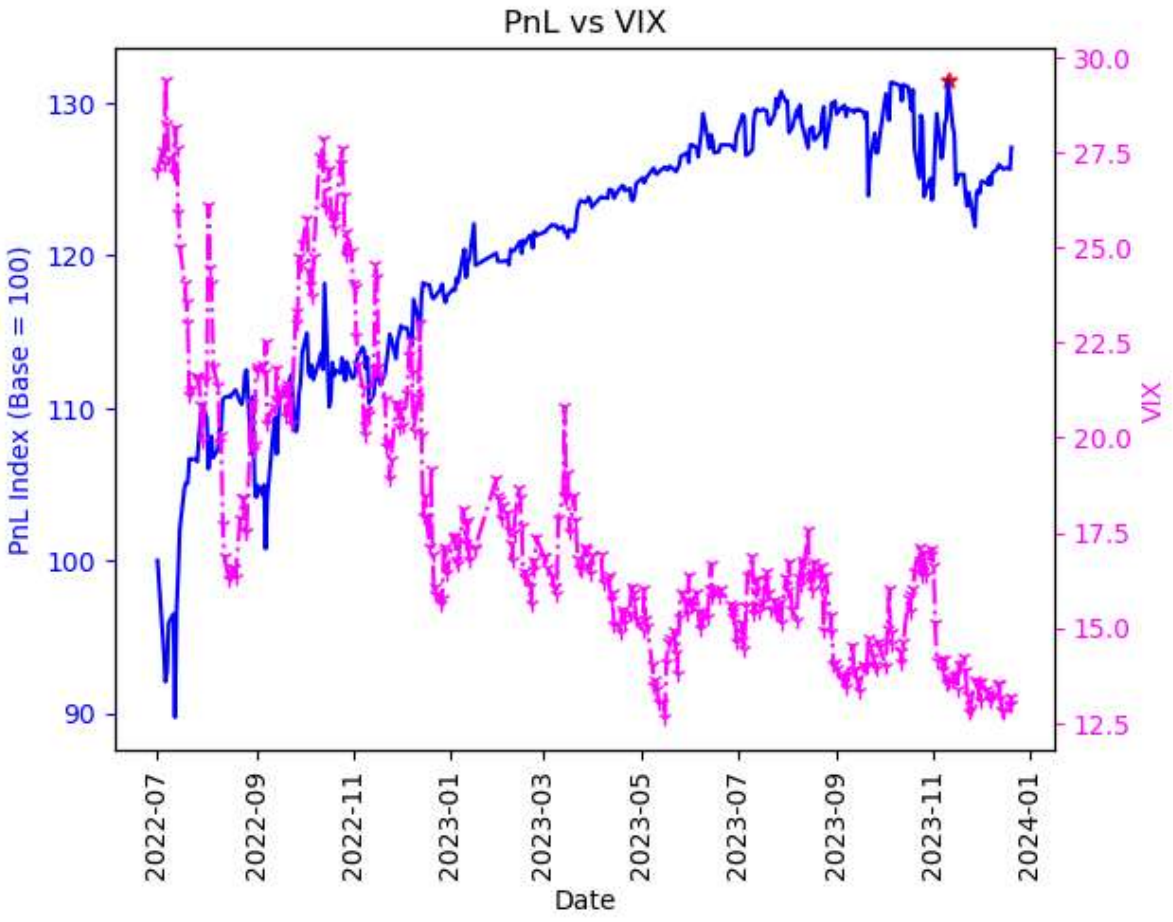


Out[4]:
```
0      27.01
1      27.56
2      27.18
3      29.40
4      28.26
       ...
355    12.86
356    12.77
357    12.97
358    13.20
359    12.97
Name: VIX, Length: 360, dtype: float64
```

In [5]:
```
# Create the plot and set the first y-axis (left)
fig, ax1 = plt.subplots()
plt.xticks(rotation=90)
ax1.plot(Date, y1, 'b-')
ax1.scatter(max_pnl_date, max_pnl, color='red', marker='*')
ax1.set_xlabel('Date')
ax1.set_ylabel('PnL Index (Base = 100)', color='b')
ax1.tick_params('y', colors='b')

# Set the second y-axis (right)
ax3 = ax1.twinx()
ax3.plot(Date, y3, 'fuchsia', marker='1', linestyle='-.')
ax3.set_ylabel('VIX', color='fuchsia')
ax3.tick_params('y', colors='fuchsia')


# Show the plot
plt.title('PnL vs VIX')
plt.show()
```

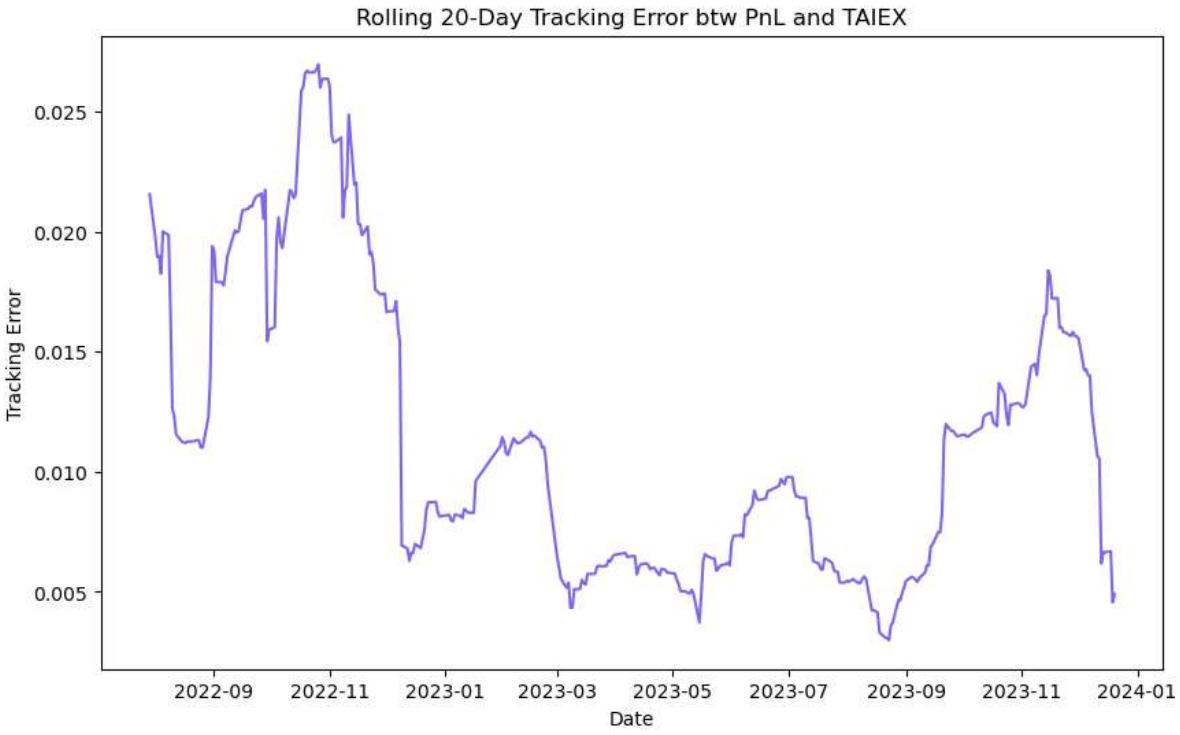


In [6]:
```
#Tracking error between PnL and TAIEX
PNL_returns = df['PnL Index'].pct_change()
TAIEX_returns = df['TAIEX'].pct_change()
diff_returns = PNL_returns  - TAIEX_returns
tracking_error = diff_returns.std()
```

In [7]:
```
roll_te = diff_returns.rolling(20).std()

plt.figure(figsize=(10, 6))
plt.title('Rolling 20-Day Tracking Error btw PnL and TAIEX')
plt.plot(df['Date'], roll_te, color='mediumslateblue')
plt.xlabel('Date')
```

```
plt.ylabel('Tracking Error')
plt.show()
```



In [8]:
```
#Historical volatility
#GARCH model volatility

from arch import arch_model
from scipy.stats import mstats

# Calculate log returns
log_returns = np.log(y2/y2.shift(1))

# Remove NaN values
log_returns = log_returns.dropna()
log_returns = mstats.winsorize(log_returns, limits=0.1)

# Fit GARCH model
garch = arch_model(log_returns, p=1, q=1, dist='StudentsT')
garch_fit = garch.fit(update_freq=10)

# Extract volatility
sigma = garch_fit.conditional_volatility
annual_vol = sigma.mean()*np.sqrt(250)*100

print(annual_vol)
```

```
Iteration:     10,   Func. Count:     91,   Neg. LLF: 7087.385759740146
Iteration:     20,   Func. Count:    151,   Neg. LLF: 7063.013173139667
Iteration:     30,   Func. Count:    228,   Neg. LLF: 343.2298775747909
Iteration:     40,   Func. Count:    346,   Neg. LLF: 1120.8884857883943
Optimization terminated successfully    (Exit mode 0)
            Current function value: 1113.5072971912282
            Iterations: 45
            Function evaluations: 352
            Gradient evaluations: 41
5777.098751897284
```

```
C:\Users\user\anaconda3\lib\site-packages\arch\univariate\base.py:310: DataScaleWa
rning: y is poorly scaled, which may affect convergence of the optimizer when
estimating the model parameters. The scale of y is 5.568e-05. Parameter
estimation work better when this value is between 1 and 1000. The recommended
rescaling is 100 * y.

This warning can be disabled by either rescaling y before initializing the
model or by setting rescale=False.

  warnings.warn(
```

In [9]:
```
##########################################Performance##############################
#Sharpe ratio
# Read in the portfolio returns data from a CSV file
R_first=df["PnL Index"].iloc[0,]
R_first
R_last = df["PnL Index"].iloc[-1]   #Always excel's actual row-2
R_last


portfolio_returns=(R_last-R_first)/R_first
portfolio_returns


daily_returns=df["Returns"]
daily_returns
```

Out[9]:
```
0      0.000000
1     -0.044221
2     -0.016998
3     -0.020182
4      0.006973
         ...
355   -0.001056
356   -0.000469
357    0.000812
358   -0.001057
359    0.011579
Name: Returns, Length: 360, dtype: float64
```

In [10]:
```
# Max Drawdown Calculation for PnL Index
cumulative_returns = (1 + df["Returns"]).cumprod()
cumulative_max = cumulative_returns.cummax()
drawdown = (cumulative_returns / cumulative_max) - 1
max_drawdown = drawdown.min()

print("Max Drawdown:", max_drawdown)
```

```
Max Drawdown: -0.10420949154156467
```

In [11]:
```
# Calculate the excess returns and standard deviation
risk_free_rate = 0.0159  # Taiwan savings rate
excess_returns = portfolio_returns - risk_free_rate
std_dev = np.std(daily_returns)
print("Standard Deviation of Daily Return:", std_dev)



# Calculate the Sharpe ratio
Sharpe_Ratio = excess_returns / std_dev
print("Sharpe Ratio:", Sharpe_Ratio)
```

```
Standard Deviation of Daily Return: 0.01334577033992153
Sharpe Ratio: 19.110815409743974
```

In [12]:
```
#Annualized Sharpe ratio
risk_free_rate_daily = (1 + risk_free_rate) ** (1/250) - 1
risk_free_rate_daily
average_daily_returns = daily_returns.sum()/250
average_daily_returns
excess_daily_return=average_daily_returns-risk_free_rate_daily
excess_daily_return
Annualized_Sharpe_Ratio=excess_daily_return/std_dev*np.sqrt(250)
print("Annualized Sharpe Ratio:", Annualized_Sharpe_Ratio)
```

```
Annualized Sharpe Ratio: 1.214584686926328
```

In [13]:
```
# Calculate the Profit Factor
positive_returns = daily_returns[daily_returns > 0].sum()
negative_returns = daily_returns[daily_returns < 0].sum()

# Avoid division by zero
if negative_returns != 0:
    profit_factor = abs(positive_returns / negative_returns)
else:
    profit_factor = float('inf')

print("Profit Factor:", profit_factor)
```

```
Profit Factor: 1.213513021060508
```

In [14]:
```
#Portfolio Alpha
# Compute the mean returns
mean_PNL = PNL_returns.mean()
mean_TAIEX = TAIEX_returns.mean()

# Compute beta
covariance = PNL_returns.cov(TAIEX_returns)
variance = TAIEX_returns.var()
beta = covariance / variance
beta

# Compute alpha (assuming risk-free rate is 0)
alpha = (mean_PNL - (risk_free_rate_daily  +beta * mean_TAIEX))*np.sqrt(250)

# Print alpha
print("Alpha: ", alpha)
```

```
Alpha:  0.005952308762887567
```

In [ ]: