1.**Collecting Nigerian Government Securities Data:**

We will use data from the Debt Management Office Nigeria for FGN Bonds, Treasury Bills, and Open Market Operations (OMO) securities. The maturities range from short-term (6 months) to long-term (20–30 years).

```
Example Data (from sources➡️www.dmo.gov.ng)
Security Type         | Maturity (Years)    | Yield (%)
Treasury Bill              0.5                      5.2
Treasury Bill               1                       5.5
OMO Bill                    2                       6.0
FGN Bond                    5                       7.2
FGN Bond                   10                       8.0
FGN Bond                   20                       9.5
FGN Bond                   30                       10.0
```

2. Yield Curve Modeling

Fitting the Nelson-Siegel Model The Nelson-Siegel model is defined as:

```
import numpy as np
import pandas as pd
from scipy.optimize import curve_fit

# Real Nigerian data (from sources: ➡️www.dmo.gov.ng)
maturities = np.array([0.5, 1, 2, 5, 10, 20, 30])
yields = np.array([5.2, 5.5, 6.0, 7.2, 8.0, 9.5, 10.0])  # Example rates

# Nelson-Siegel function
def nelson_siegel(t, beta0, beta1, beta2, tau):
    return beta0 + beta1 * ((1 - np.exp(-t/tau)) / (t/tau)) + beta2 * (((1 - np.exp(-t/tau)) / (t/tau)) - np.exp(-t/tau))

# Fit the model
params, _ = curve_fit(nelson_siegel, maturities, yields, p0=[5, -1, 1, 2])
beta0, beta1, beta2, tau = params

print(f"Estimated Parameters: Beta0={beta0}, Beta1={beta1}, Beta2={beta2}, Tau={tau}")
```

```
Estimated Parameters: Beta0=11.222265532076278, Beta1=-6.203636667585154, Beta2=2.983015149936622e-05, Tau=5.967641975767709
```

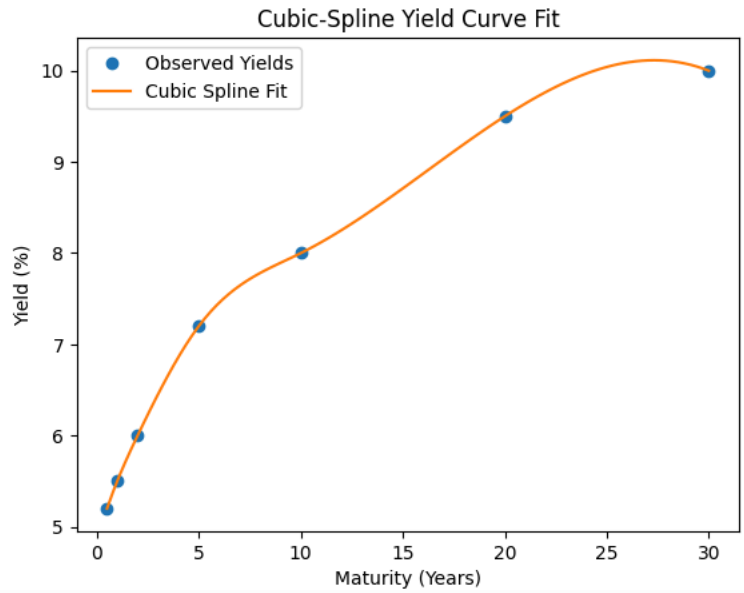
3. Fitting a Cubic-Spline Model

A Cubic-Spline model provides a more flexible fit:

```
from scipy.interpolate import CubicSpline
import matplotlib.pyplot as plt

# Fit cubic spline
spline = CubicSpline(maturities, yields)

# Plot results
x_vals = np.linspace(0.5, 30, 100)
plt.plot(maturities, yields, 'o', label="Observed Yields")
plt.plot(x_vals, spline(x_vals), label="Cubic Spline Fit")
plt.legend()
plt.xlabel("Maturity (Years)")
plt.ylabel("Yield (%)")
plt.title("Cubic-Spline Yield Curve Fit")
plt.show()
```



Start coding or generate with AI.