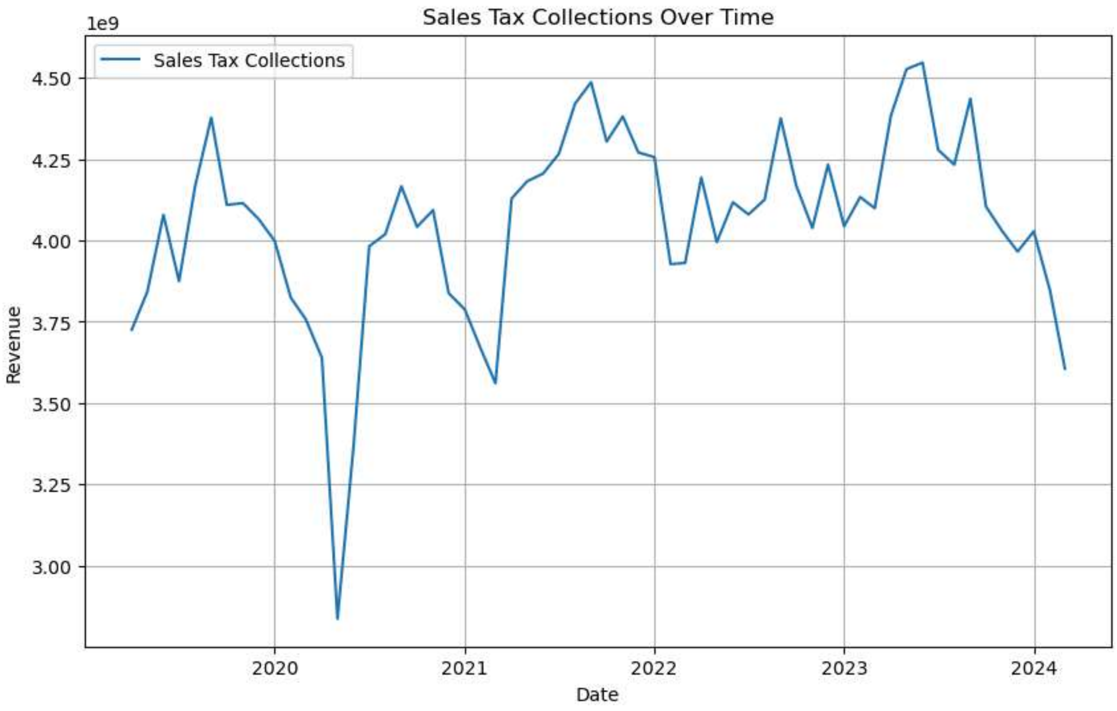
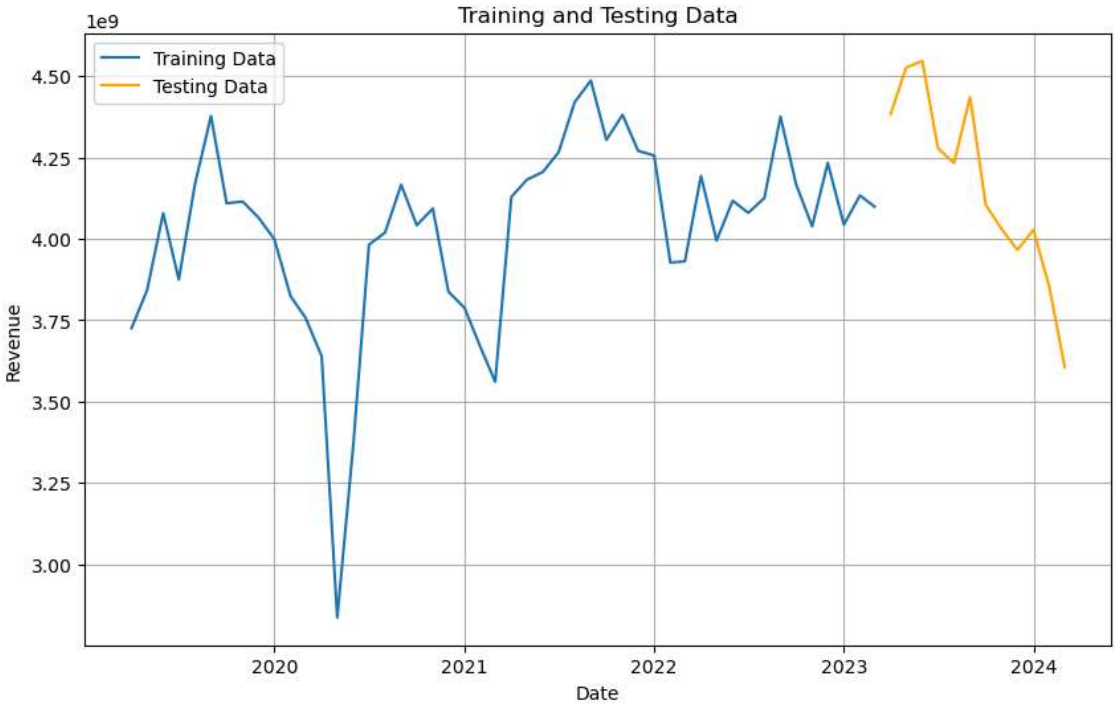
Entrée [1]:

```
import pandas as pd
import matplotlib.pyplot as plt

# Load the dataset
file_path = r'C:\Users\meman\Downloads\Sales_Tax_Collections_by_State.csv'
df = pd.read_csv(file_path)

# Create a Date column by combining month and year
df['Date'] = pd.to_datetime(df['year'].astype(str) + '-' + df['numeric mon

# Aggregate data by Date
df_aggregated = df.groupby('Date').agg({'value': 'sum'}).reset_index()

# Set the Date as the index
df_aggregated.set_index('Date', inplace=True)

# Plot the data
plt.figure(figsize=(10, 6))
plt.plot(df_aggregated.index, df_aggregated['value'], label='Sales Tax Col
plt.title('Sales Tax Collections Over Time')
plt.ylabel('Revenue')
plt.xlabel('Date')
plt.legend()
plt.grid(True)
plt.show()
```



Entrée [2]:

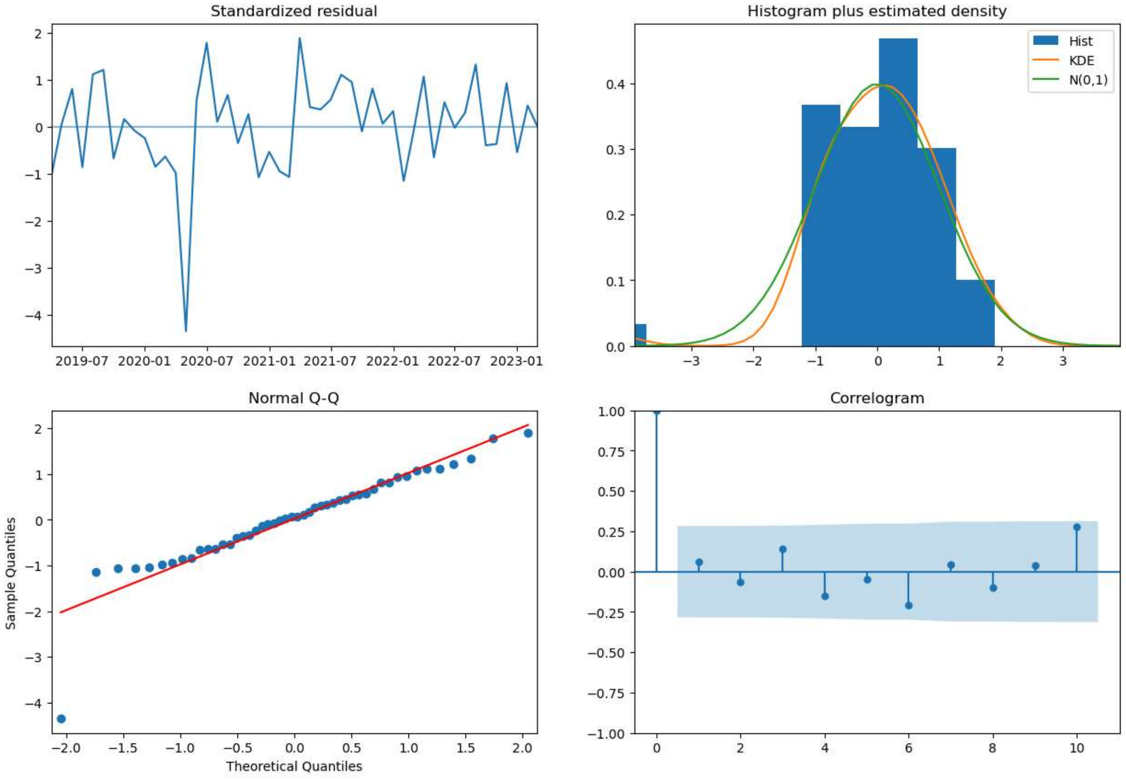
```
# Split the data into training and testing sets
train = df_aggregated.iloc[:-12]  # Use all data except the last 12 months
test = df_aggregated.iloc[-12:]  # Use the last 12 months for testing

# Plot training and testing data
plt.figure(figsize=(10, 6))
plt.plot(train.index, train['value'], label='Training Data')
plt.plot(test.index, test['value'], label='Testing Data', color='orange')
plt.title('Training and Testing Data')
plt.ylabel('Revenue')
plt.xlabel('Date')
plt.legend()
plt.grid(True)
plt.show()
```



Entrée [3]:

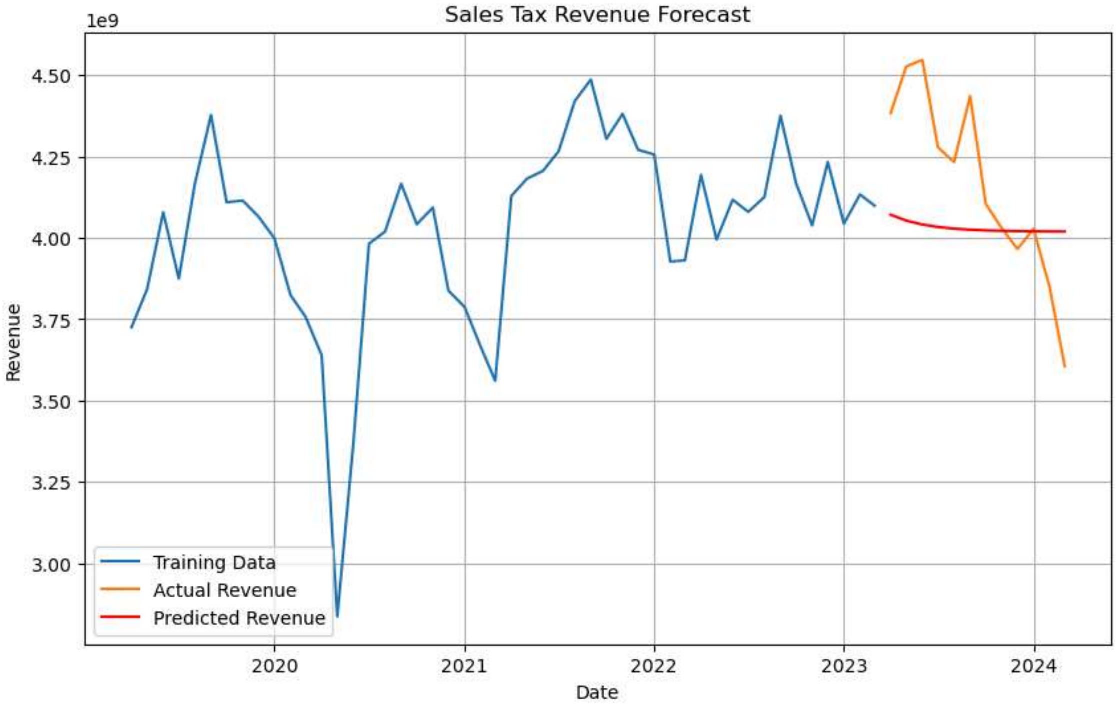
```
from pmdarima import auto_arima

# Fit the auto ARIMA model
model = auto_arima(train['value'], seasonal=True, m=12, trace=True, error_

# Plot model diagnostics
model.plot_diagnostics(figsize=(15, 10))
plt.show()
```

```
Performing stepwise search to minimize aic
 ARIMA(2,0,2)(1,0,1)[12] intercept   : AIC=1988.368, Time=0.93 sec
 ARIMA(0,0,0)(0,0,0)[12] intercept   : AIC=2009.995, Time=0.03 sec
 ARIMA(1,0,0)(1,0,0)[12] intercept   : AIC=1986.577, Time=0.11 sec
 ARIMA(0,0,1)(0,0,1)[12] intercept   : AIC=1990.877, Time=0.08 sec
 ARIMA(0,0,0)(0,0,0)[12]             : AIC=2261.631, Time=0.02 sec
 ARIMA(1,0,0)(0,0,0)[12] intercept   : AIC=1985.017, Time=0.03 sec
 ARIMA(1,0,0)(0,0,1)[12] intercept   : AIC=1986.557, Time=0.07 sec
 ARIMA(1,0,0)(1,0,1)[12] intercept   : AIC=1988.538, Time=0.53 sec
 ARIMA(2,0,0)(0,0,0)[12] intercept   : AIC=1986.629, Time=0.06 sec
 ARIMA(1,0,1)(0,0,0)[12] intercept   : AIC=1986.720, Time=0.05 sec
 ARIMA(0,0,1)(0,0,0)[12] intercept   : AIC=1989.694, Time=0.03 sec
 ARIMA(2,0,1)(0,0,0)[12] intercept   : AIC=1988.650, Time=0.16 sec
 ARIMA(1,0,0)(0,0,0)[12]             : AIC=inf, Time=0.06 sec

Best model:  ARIMA(1,0,0)(0,0,0)[12] intercept
Total fit time: 2.212 seconds
```



Entrée [4]:

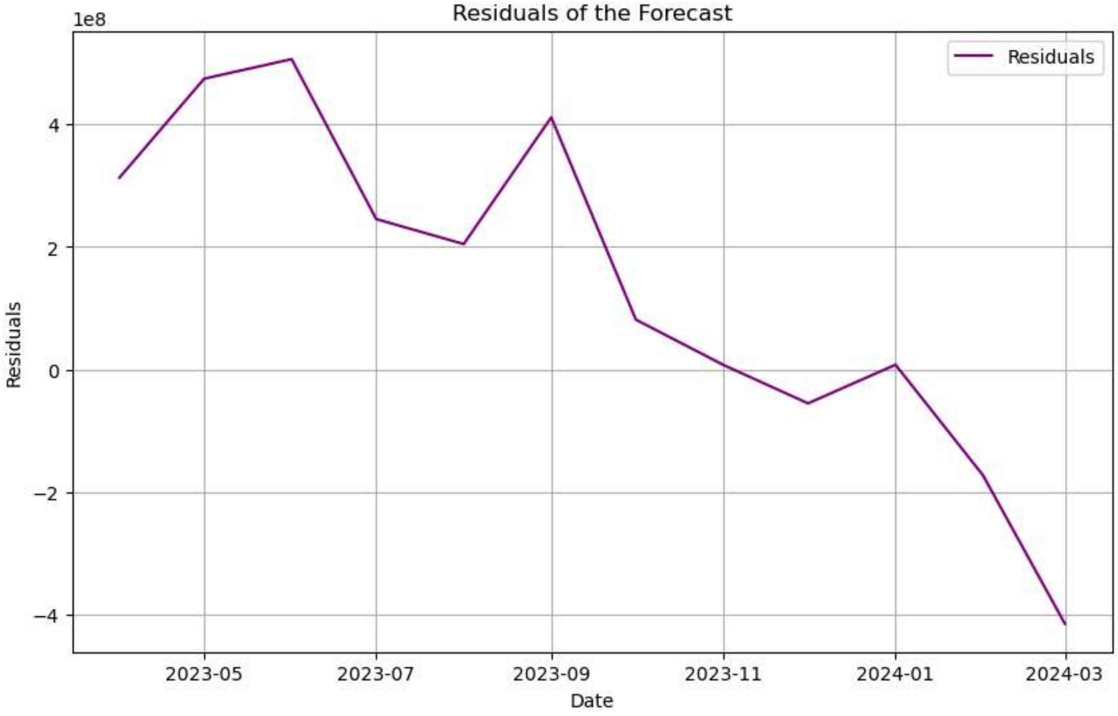
```
from sklearn.metrics import mean_squared_error

# Make predictions
predictions = model.predict(n_periods=12)
predicted_mean = pd.Series(predictions, index=test.index)

# Plot the predictions
plt.figure(figsize=(10, 6))
plt.plot(train.index, train['value'], label='Training Data')
plt.plot(test.index, test['value'], label='Actual Revenue')
plt.plot(predicted_mean.index, predicted_mean, label='Predicted Revenue', 
plt.title('Sales Tax Revenue Forecast')
plt.ylabel('Revenue')
plt.xlabel('Date')
plt.legend()
plt.grid(True)
plt.show()

# Calculate the mean squared error
mse = mean_squared_error(test['value'], predicted_mean)
print(f'Mean Squared Error: {mse}')
```



```
Mean Squared Error: 8.838306816258245e+16
```

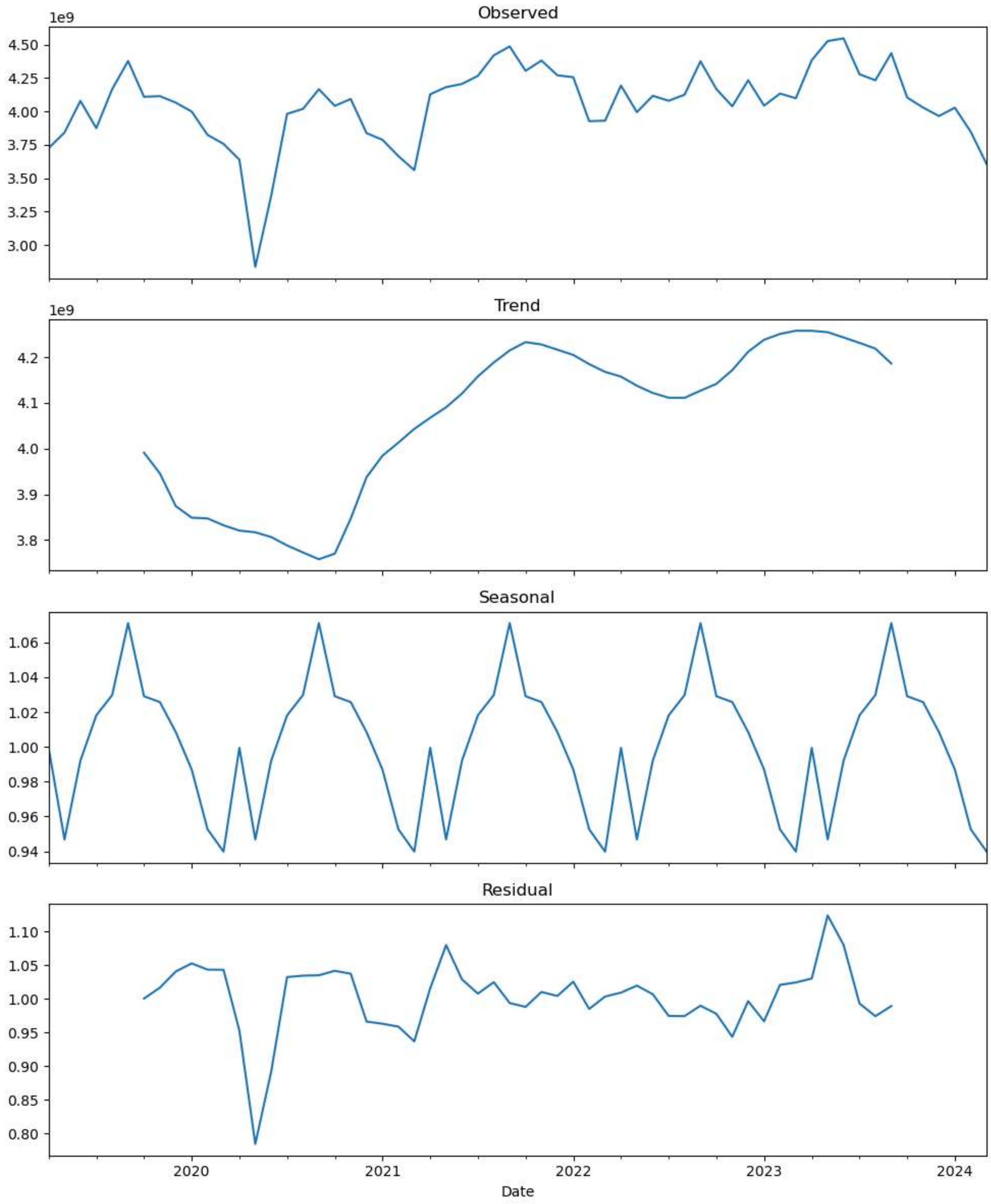
Entrée [5]:

```
# Get residuals
residuals = test['value'] - predicted_mean

# Plot residuals
plt.figure(figsize=(10, 6))
plt.plot(residuals.index, residuals, label='Residuals', color='purple')
plt.title('Residuals of the Forecast')
plt.ylabel('Residuals')
plt.xlabel('Date')
plt.legend()
plt.grid(True)
plt.show()
```



Entrée [6]:

```
from statsmodels.tsa.seasonal import seasonal_decompose

# Decompose the time series
decomposition = seasonal_decompose(df_aggregated['value'], model='multipli

# Plot the decomposition
fig, (ax1, ax2, ax3, ax4) = plt.subplots(4, 1, figsize=(10, 12), sharex=Tr
decomposition.observed.plot(ax=ax1, title='Observed')
decomposition.trend.plot(ax=ax2, title='Trend')
decomposition.seasonal.plot(ax=ax3, title='Seasonal')
decomposition.resid.plot(ax=ax4, title='Residual')
plt.xlabel('Date')
plt.tight_layout()
plt.show()
```


Observed
1e9
4.50
4.25
4.00
3.75
3.50
3.25
3.00
Trend
1e9
4.2
4.1
4.0
3.9
3.8
Seasonal
1.06
1.04
1.02
1.00
0.98
0.96
0.94
Residual
1.10
1.05
1.00
0.95
0.90
0.85
0.80
2020
2021
2022
2023
2024
Date

Entrée [ ]: