Unemployment ARIMA Model - Training (1997-2020), Training (2021-2023)

In [ ]:

```
# 1. Import Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.arima.model import ARIMA
from sklearn.metrics import mean_squared_error
from sklearn.model_selection import TimeSeriesSplit
import gdown
```

In [ ]:

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# 2. Load the dataset
url = 'https://drive.google.com/uc?id=1iJ-fXzt1maahR-_YH36yFBrHQ7lYQWf9'

# Download the file
output = 'data_unemployment.csv'
gdown.download(url, output, quiet=False)

# Check the content of the downloaded file
with open(output, 'r') as file:
    content = file.read()
    print("File content preview:")
    print(content[:500])

# Load the CSV file into a pandas DataFrame
try:
    data_unemployment = pd.read_csv(output, delimiter=',')
    print(data_unemployment.head())
except pd.errors.ParserError as e:
    print("Error parsing CSV file:", e)
```

```
Downloading...
From: https://drive.google.com/uc?id=1iJ-fXzt1maahR-_YH36yFBrHQ7lYQWf9
To: d:\OneDrive (Personal)\OneDrive\~ TMU 2023\CIND 820 - Big Data Analytics Project
\06 - Initial Results & Code (10%)\data_unemployment.csv
100%|██████████| 799k/799k [00:00<00:00, 4.82MB/s]
```

```
File content preview:
ref_date,geo,labour_force,sex,age_group,uom,value,industry_classification,naics,sex_
binary,age_group_numeric,geo_code,date_ordinal
1997,newfoundland and labrador,unemployment rate,males,25 to 54 years,Percentage,12.
1,"fishing, hunting and trapping",114,1,1,210,729025
1998,newfoundland and labrador,unemployment rate,males,25 to 54 years,Percentage,9.
0,"fishing, hunting and trapping",114,1,1,210,729390
1999,newfoundland and labrador,unemployment rate,males,25 to 54 years,Percentage,9.
4,"fishing, h
   ref_date                        geo       labour_force    sex  \
0      1997  newfoundland and labrador  unemployment rate  males   
1      1998  newfoundland and labrador  unemployment rate  males   
2      1999  newfoundland and labrador  unemployment rate  males   
3      2000  newfoundland and labrador  unemployment rate  males   
4      2001  newfoundland and labrador  unemployment rate  males   

         age_group         uom  value        industry_classification naics  \
0  25 to 54 years  Percentage   12.1  fishing, hunting and trapping   114   
1  25 to 54 years  Percentage    9.0  fishing, hunting and trapping   114   
2  25 to 54 years  Percentage    9.4  fishing, hunting and trapping   114   
3  25 to 54 years  Percentage   11.4  fishing, hunting and trapping   114   
4  25 to 54 years  Percentage   20.7  fishing, hunting and trapping   114   

   sex_binary  age_group_numeric  geo_code  date_ordinal  
0           1                  1       210        729025  
1           1                  1       210        729390  
2           1                  1       210        729755  
3           1                  1       210        730120  
4           1                  1       210        730486  
```

In [ ]:

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# 3. Preprocess Data
# Convert 'ref_date' to datetime with year format
data_unemployment['ref_date'] = pd.to_datetime(data_unemployment['ref_date'], forma

# Set 'ref_date' as index
data_unemployment.set_index('ref_date', inplace=True)

# Ensure only numeric columns are included
numeric_cols = data_unemployment.select_dtypes(include=[np.number]).columns
data_unemployment = data_unemployment[numeric_cols]

# Aggregate data by year to reduce noise
data_annual = data_unemployment.resample('Y').mean()

# Select the 'value' column for ARIMA modeling
unemployment_rate = data_annual['value']

# Split the data into training and testing sets based on the date
train_data = unemployment_rate[unemployment_rate.index < '2021']
test_data = unemployment_rate[unemployment_rate.index >= '2021']
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In [ ]:

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# 4. Define Cross-Validation Procedure
tscv = TimeSeriesSplit(n_splits=5)
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In [ ]:

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# 5. Perform Cross-Validation
cv_mse_scores = []
for train_index, val_index in tscv.split(train_data):
    train_cv, val_cv = train_data.iloc[train_index], train_data.iloc[val_index]

    # Fit the ARIMA model
    model = ARIMA(train_cv, order=(1, 1, 1))
    model_fit = model.fit()

    # Forecast
    forecast = model_fit.forecast(steps=len(val_cv))

    # Calculate Mean Squared Error
    mse = mean_squared_error(val_cv, forecast)
    cv_mse_scores.append(mse)

print('Cross-Validation Mean Squared Error:', np.mean(cv_mse_scores))
```

```
c:\Users\nesha\AppData\Local\Programs\Python\Python311\Lib\site-packages\statsmodels
\tsa\statespace\sarimax.py:866: UserWarning: Too few observations to estimate starti
ng parameters for ARMA and trend. All parameters except for variances will be set to
zeros.
  warn('Too few observations to estimate starting parameters%s.'
c:\Users\nesha\AppData\Local\Programs\Python\Python311\Lib\site-packages\statsmodels
\tsa\statespace\sarimax.py:966: UserWarning: Non-stationary starting autoregressive
parameters found. Using zeros as starting parameters.
  warn('Non-stationary starting autoregressive parameters'
c:\Users\nesha\AppData\Local\Programs\Python\Python311\Lib\site-packages\statsmodels
\tsa\statespace\sarimax.py:978: UserWarning: Non-invertible starting MA parameters f
ound. Using zeros as starting parameters.
  warn('Non-invertible starting MA parameters found.'
Cross-Validation Mean Squared Error: 0.7502746838927979
```

In [ ]:

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# 6. Train Final Model on Entire Training Set and Forecast on Test Set
final_model = ARIMA(train_data, order=(1, 1, 1))
final_model_fit = final_model.fit()

# Forecast
final_forecast = final_model_fit.forecast(steps=len(test_data))
forecast_index = test_data.index
```

In [ ]:

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# 7. Visualize the Data
# Visualize the Forecasted Data
plt.figure(figsize=(10, 6))
plt.plot(train_data, label='Training Data (1997-2020)')
plt.plot(test_data, label='Testing Data (2021-2023)')
plt.plot(forecast_index, final_forecast, label='Forecasted Data (2021-2023)', color
plt.title('Unemployment Rate Forecast')
plt.xlabel('Year')
plt.ylabel('Unemployment Rate (%)')
plt.legend()
plt.show()

# Calculate Mean Squared Error for the final model
```
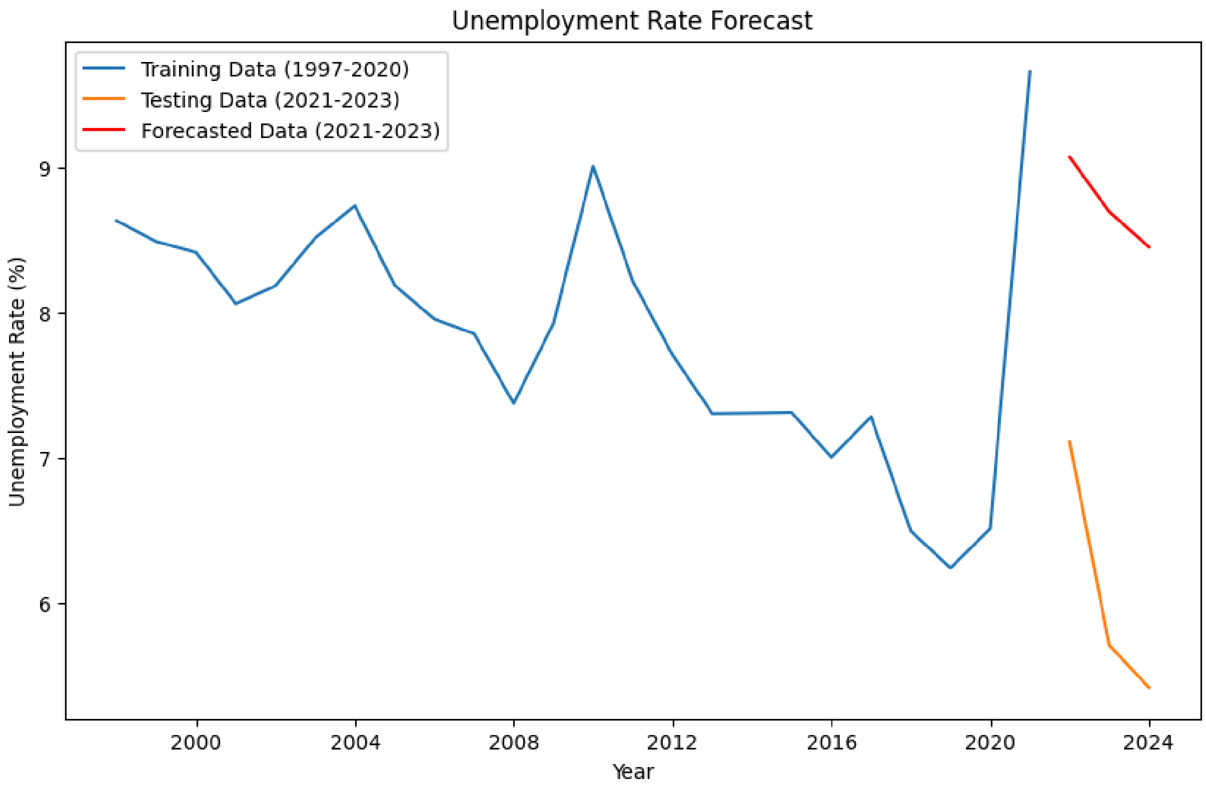

```
final_mse = mean_squared_error(test_data, final_forecast)
print('Final Model Mean Squared Error:', final_mse)
```



```
Final Model Mean Squared Error: 7.2992481838765855
```