MACROECONOMIC FORECASTING OF U.S. UNEMPLOYMENT USING ARIMA-X MODEL IN EVIEWS

1. Overview

Client:

An independent economic advisory group serving U.S. public policy institutions and Fortune 500 workforce strategy teams

Objective:

To develop a short- to medium-term forecasting model for the U.S. unemployment rate using macroeconomic indicators. EViews was used to implement an ARIMA model with exogenous variables (ARIMA-X), enabling robust projections to support decision-making.

2. Background

Clients expressed a need for timely and defensible unemployment forecasts that incorporate real economic signals rather than relying on basic trend extrapolation. Previous models lacked responsiveness to external shocks such as inflation surges or demand-side sentiment changes. EViews' ARIMA-X functionality offered a methodologically rigorous yet transparent forecasting solution.

3. Data Summary

Timeframe:

Q1 1990 – Q4 2022 (132 quarterly observations)

Variables Used:

Variable	Type	Source
Unemployment_Rate	Time series	U.S. Bureau of Labor Statistics
CPI_Inflation	Time series	U.S. Bureau of Economic Analysis
Consumer_Confidence	Time series	University of Michigan Survey

All series were seasonally adjusted. Log differences were applied where necessary to achieve stationarity.

4. Methodology

Software Used:

EViews 13

Model Type:

ARIMA-X (AutoRegressive Integrated Moving Average with Exogenous Variables)

Steps in EViews:

1. **Stationarity Testing:**

   o ADF test showed that Unemployment_Rate was I(1)

   o CPI_Inflation and Consumer_Confidence also differenced to achieve I(0)

2. **ARIMA Identification:**

   o Used EViews' *View > Correlogram* and *Automatic ARIMA selection*

   o Optimal specification: ARIMA(1,1,1)

3. **Model Estimation (ARIMA-X):**

   o *Quick > Estimate Equation > ARIMA*

   o Exogenous regressors: CPI_Inflation, Consumer_Confidence

   o Forecast horizon: 8 quarters (2 years)

4. **Model Diagnostics:**

   o Ljung-Box Q-test for residual autocorrelation

   o Residual plots and histogram

   o Root analysis for stability (all roots < 1)

5. Key Results

Output	Result/Interpretation
AR(1) coefficient	0.65 ($p < 0.01$), indicating strong autoregressive behavior
MA(1) coefficient	–0.49 ($p < 0.05$), suggesting short-run shock adjustment
CPI_Inflation (exogenous)	–0.37 ($p = 0.021$), higher inflation slightly reduces unemployment

Consumer_Confidence (exogenous)	–0.51 (p = 0.007), improved sentiment lowers unemployment
Model Fit (Adjusted R²)	0.72
Forecast RMSE (out-of-sample test)	0.34 (acceptable for macro-level quarterly forecasts)

6. Visual Outputs (EViews)

- Actual vs. Forecasted unemployment graph (in-sample and forecast horizon)
- Residual histogram with normal fit overlay
- Correlogram of residuals (showing no autocorrelation)
- Dynamic forecast bands (95% confidence interval)

7. Deliverables

- EViews .wf1 project file with fully labeled variables and model output
- Forecast Excel file with raw and graphical output
- Written report (18 pages) including:
  - Model structure and rationale
  - Forecast performance and interpretation
  - Strategic implications for policy and business
  - Appendix with diagnostics and EViews commands
- Executive briefing note (2 pages) with forecast summary and policy recommendations

8. Application & Impact

- Used by a U.S. labor department to project hiring demand across sectors
- Referenced in HR planning frameworks for large enterprises (budgeting, hiring cycles)
- Integrated into a monthly labor dashboard distributed to business clients and policy stakeholders

9. Strategic Value Delivered

- Demonstrated how EViews' ARIMA-X capability can be **used to blend macro structure with real indicators**

- Provided **dynamic, interpretable unemployment forecasts** with economic rationale

- Enabled both public and private clients to **anticipate labor trends under various inflation and confidence scenarios**