Modeling Pakistan's Macroeconomic Dynamics

A Time Series Approach Using VAR, SVAR, and VECM

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1 🎯 Project Aim

To explore and model key macroeconomic relationships in Pakistan using modern time series econometric techniques. This project simulates a real-world macroeconomic research workflow.

2 📈 Variables to be Used (Quarterly Data)

Variable	Source	Notes
Real GDP	PBS / SBP	Convert to log, adjust for inflation
Govt Spending	SBP / IMF IFS	Central Govt Expenditure (Real)
Tax Revenue	MoF / SBP	Use Net Revenue or Tax-to-GDP
Inflation (CPI)	PBS	Quarterly average of CPI
Interest Rate	SBP (Policy Rate)	Use as-is

3 Data Sources

- State Bank of Pakistan
- Pakistan Bureau of Statistics
- [IMF IFS Data API]
- World Bank WDI
- Ministry of Finance

4 🧭 Project Tasks & Workflow

4.1 1. Data Collection & Cleaning

- Collect at least 10 years (40 quarters) of data
- Convert to `ts` or `zoo` objects
- Log-transform and seasonally adjust if necessary
- Plot and visually inspect time series

4.2 2. Univariate Time Series Analysis

- Plot and describe patterns for each variable
- Run ADF and KPSS tests for stationarity
- Log and/or difference the data
- Fit ARIMA models where relevant

4.3 3. Vector Autoregression (VAR)

- Ensure all series are stationary
- Use `VARselect()` for lag length selection
- Estimate VAR model
- Perform:
  - Granger causality tests
  - Impulse Response Functions (IRFs)
  - Forecast Error Variance Decomposition (FEVD)

4.4 4. Structural VAR (SVAR)

- Impose short-run (AB-model) identification
- Use institutional knowledge (e.g., BP method)
- Estimate SVAR using `svars` or `vars` package
- Plot IRFs for:
  - Govt spending ⟶ GDP, inflation
  - Tax ⟶ GDP
  - Interest rate ⟶ Inflation

4.5 5. Cointegration and VECM

- Johansen cointegration test

- Estimate VECM using `tsDyn` or `urca`
- Interpret long-run cointegrating vectors
- Explain short-run adjustments via error correction terms

5 Deliverables

- **Report (6–10 pages)** with:
  - Introduction
  - Methodology
  - Results and interpretation
  - Policy implications for Pakistan
- **RMarkdown or Quarto Notebook** with full code and graphs

6 Tools Recommended

Task	R Package
Data Wrangling	`readxl`, `imfr`, `WDI`
VAR/SVAR	`vars`, `svars`, `urca`
VECM	`tsDyn`
Plotting	`ggplot2`, `plotly`

7 Evaluation Criteria

Component	Weight
Data Collection & Preprocessing	15%
Model Estimation & Interpretation	35%
Diagnostic Tests & Justifications	20%
Report Writing & Policy Insight	30%

8 Suggested Report Structure

1. Introduction
2. Data and Methodology
3. Univariate Analysis
4. VAR Analysis
5. SVAR Identification & IRFs
6. Cointegration and VECM
7. Conclusion & Policy Recommendations