



Tecnológico de Monterrey

Examen final

Federico Alberto Vinatier Villarreal A00838009

Series de tiempo.

Grupo #102

Prof. Raymundo Diaz

14/03/2025

EJERCICIO 1

Link colab: <https://colab.research.google.com/drive/11xrhWh-FyNmI8dnBMBGks1kv33XIpASt?usp=sharing>

Github: <https://github.com/Federicoavv03/Series-de-tiempo.git>

Prompt de Grok: https://grok.com/share/bGVnYWN5_0349c802-4440-4197-91c4-787471a975b2

Interpretations:

- **Stationarity:** The log PDI series is non-stationary but becomes stationary after first differencing ($d=1$), as confirmed by the ADF test.
- **Model Choice:** The ARIMA(0,1,1) model is a parsimonious choice based on the ACF/PACF, but it fails the Ljung-Box test, suggesting it doesn't fully capture the series' dynamics.
- **Diagnostics:**
 - The residuals show some autocorrelation (Ljung-Box p-value = 0.03), indicating the model is too simple.
 - Non-normality (Jarque-Bera) and heteroskedasticity (H) persist, likely due to the initial spike and economic shocks.
- **Forecasting:** The forecast should trend upward.

After creating the first ARIMA model the results showed no stationarity, however after adjusting the model we finally got stationarity but we still had a flat forecast. Finally after further adjustments the ARIMA(1,1,1) model is the best choice for modeling the log PDI data based on the provided criteria. The forecast values (8.180231 to 8.223832 over 1992–1993) reflect a reasonable continuation of the historical trend, and the diagnostics support its adequacy despite minor issues with normality and heteroskedasticity.

EJERCICIO 2

Link de colab: https://colab.research.google.com/drive/16db2olh_3ve74FHFzNQDc1B5-56GiiOS?usp=sharing

Prompt de Grok: https://grok.com/share/bGVnYWN5_0a93b4d2-fe1f-42a6-aa3d-963935bbf466

Interpretations and answers:

1. Graph of 3- and 6-Month Treasury Bill Rates (TB3M and TB6M)

The graph shows the interest rates on 3- and 6-month Treasury bills from January 1982 to March 2008.

It is observed that both rates follow similar patterns, with significant fluctuations at first and then relative stability.

This suggests that short-term interest rates are closely related.

2. Stationarity Tests (ADF Test)

Initial ADF tests (TB3M and TB6M):

The results show that both TB3M and TB6M are stationary in their original form.

The p-values are extremely low (close to zero), indicating a strong rejection of the null hypothesis of non-stationarity.

The ADF statistic is much more negative than the critical values, which also confirms stationarity.

ADF Tests after the First Difference (TB3M_diff and TB6M_diff):

After applying the first difference (i.e., calculating the difference between consecutive values), both series remain stationary.

The p-values are even lower, and the ADF statistics are even more negative, reinforcing stationarity.

The first difference is a common way to treat non-stationary time series; however, in this case, it was not necessary because the series were already stationary.

3. Cointegration Test

Result: Cointegrated

The cointegration test indicates a long-term relationship between TB3M and TB6M.

Despite short-term fluctuations, the two series tend to move together over the long term.

The p-value is very low, indicating strong evidence of cointegration.

4. VAR (Vector Autoregression) Model

Model Summary:

A VAR model was fitted to analyze the relationship between the first differences of TB3M and TB6M (TB3M_diff and TB6M_diff).

The model includes four lags (L1, L2, L3, L4) of both series.

The information criteria (BIC, HQIC, AIC) and the FPE (Final Prediction Error) provide measures of the model's fit.

Equation Results:

For both equations (TB3M_diff and TB6M_diff), the lag coefficients are highly significant (p-values = 0.000).

This indicates that the past values of both series have a significant impact on their future values.

The coefficient values indicate the magnitude and direction of these impacts.

Residual Correlation Matrix:

The correlation between the residuals of the two equations is low (0.021763).

This suggests that the model has captured most of the linear relationship between the series.