Tecnológico de Monterrey

Pregunta Examen (19):

Maria Sofia Villarreal A01722872

June 13th, 2025

Series de Tiempo

Raymundo Diaz

19) Link google collab:

https://colab.research.google.com/drive/16trbaMb2RpJgQ_PJhI1R-FV2gs4p2h1h?usp=sharing

Link Grok:

https://grok.com/share/c2hhcmQtMg%3D%3D_4fea6b17-ff2e-4ccf-a18b-b520c5397233

Link Github:

https://github.com/A01722872/Examen_Pregunta-19.git

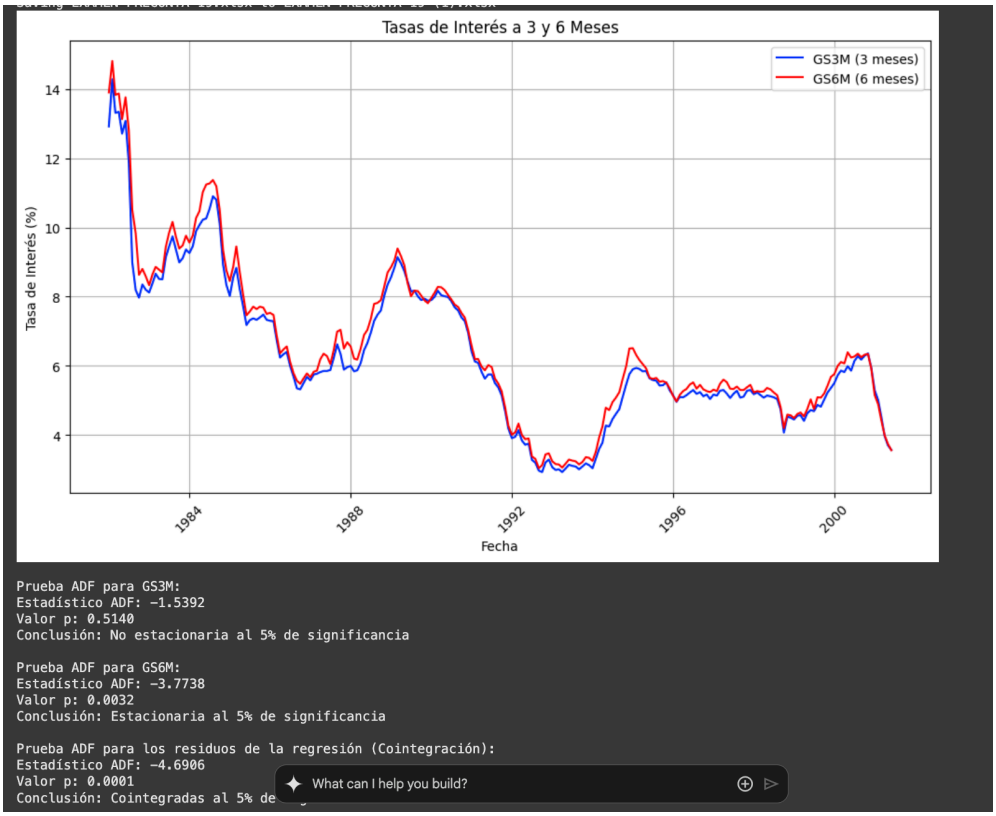
HTML: (Está dentro del github, aquí muestro la prueba)

```
In [3]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from statsmodels.tsa.stattools import adfuller
from statsmodels.regression.linear_model import OLS
from statsmodels.tools.tools import add_constant
from google.colab import files
import io

# Cargar el archivo Excel desde Colab
uploaded = files.upload()
file_name = next(iter(uploaded))  # Obtener el nombre del archivo cargado
df = pd.read_excel(io.BytesIO(uploaded[file_name]), sheet_name='Sheet1')

# Convertir la columna 'Date' al formato datetime con formato 'YYYY:MM'
df['Date'] = pd.to_datetime(df['Date'], format='%Y:%m')

# Graficar las series GS3M y GS6M
plt.figure(figsize=(10, 6))
plt.plot(df['Date'], df['GS3M'], label='GS3M (3 meses)', color='blue')
plt.plot(df['Date'], df['GS6M'], label='GS6M (6 meses)', color='red')
plt.title('Tasas de Interés a 3 y 6 Meses')
plt.xlabel('Fecha')
plt.ylabel('Tasa de Interés (%)')
plt.legend()
plt.grid(True)
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()

# Función para realizar la prueba ADF e imprimir resultados
def adf_test(series, title):
    result = adfuller(series, autolag='AIC')
    print(f'\nPrueba ADF para {title}:')
    print(f'Estadístico ADF: {result[0]:.4f}')
```

Link excels:

https://tecmx-my.sharepoint.com/:x:/g/personal/a01722872_tec_mx/EZzx5vE8W9dFiMOI737X5zEBe5cpXa1napFYIfs7Pq5l_Q?e=a8lVoD

Interpretaciones:



Durante el periodo observado, ambas tasas se comportan de manera muy similar, siguiendo patrones casi paralelos, lo cual indica una fuerte relación entre ambas. Ambas tasas muestran picos altos a principios de los años 80 (más del 14%) y una tendencia general a la baja con varios repuntes en momentos clave, como entre 1988-1989 y finales de los 90. Esta similitud visual sugiere que ambas series pueden estar relacionadas a largo plazo.

Resultados de la prueba ADF (estacionariedad):

- **GS3M (3 meses):**

  Estadístico ADF: -1.5392

  Valor p: 0.5140

  Conclusión: No es estacionaria al 5% de significancia. Es decir, tiene una tendencia o

estructura que cambia a lo largo del tiempo y no tiene una media constante.

- **GS6M (6 meses):**
  Estadístico ADF: -3.7738
  Valor p: 0.0032
  Conclusión: Sí es estacionaria al 5%. Esto significa que su comportamiento fluctúa alrededor de una media constante en el tiempo.

Prueba ADF para los residuos (cointegración):

Estadístico ADF: -4.6906
Valor p: 0.0001
Conclusión: Los residuos son estacionarios, lo que indica que sí existe una relación de cointegración entre las tasas a 3 y 6 meses.
Esto significa que, aunque una de las tasas no sea estacionaria individualmente, ambas series están ligadas a largo plazo y significa que se mueven juntas.

Resumen de interpretación:

a. Plot the two time series in the same diagram. What do you see?
When plotting the 3-month and 6-month interest rates on the same graph, we see that both follow very similar paths over time. Although there are some small differences, their movements are almost parallel, which suggests they are closely related and tend to move together.

b. Do a formal unit root analysis to find out if these time series are stationary.
An Augmented Dickey-Fuller (ADF) test was used to check for stationarity.

- The 3-month rate (GS3M) is **not stationary** (p-value = 0.5140).
- The 6-month rate (GS6M) **is stationary** at the 5% significance level (p-value = 0.0032).

c. Are the two time series cointegrated? How do you know? Show the necessary calculations.

Yes, the two series are cointegrated. A regression was run between the two, and then an ADF test was applied to the residuals. Since the residuals were found to be **stationary** (p-value = 0.0001), this confirms that the 3-month and 6-month rates are cointegrated.

d. What is the economic meaning of cointegration in the present context? If the two series are not cointegrated, what are the economic implications?

Cointegration means that, even though the two interest rates may move apart in the short run, they have a stable long-term relationship. If one changes, the other tends to adjust to maintain the balance. This behavior is expected in efficient financial markets, where different term rates are linked through investor expectations and arbitrage.

If the series were not cointegrated, they could drift apart permanently, which would suggest inefficiencies in the market or that different external factors affect each rate separately.

e. If you want to estimate a VAR model, say, with four lags of each variable, do you have to use the first differences of the two series or can you do the analysis in levels of the two series?

Since the series are not both stationary but are cointegrated, the best option is to use a VECM (Vector Error Correction Model) instead of a standard VAR. A VECM includes the long-term relationship and models short-term deviations. If you still want to use a VAR, you should apply it to the first differences to ensure stationarity—but doing that would ignore the long-run connection between the series.