Pregunta 19 Examen

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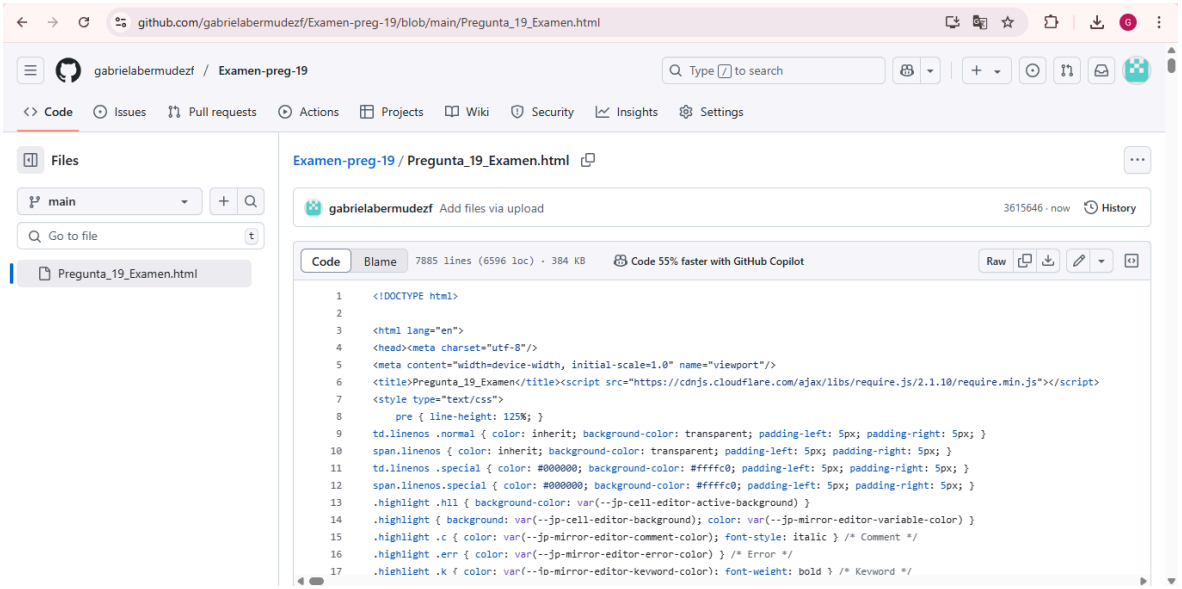
Enlaces

Enlace Grok
https://grok.com/share/c2hhcmQtMg%3D%3D_d301412b-56ec-4887-a0df-b9ae4fe64e74

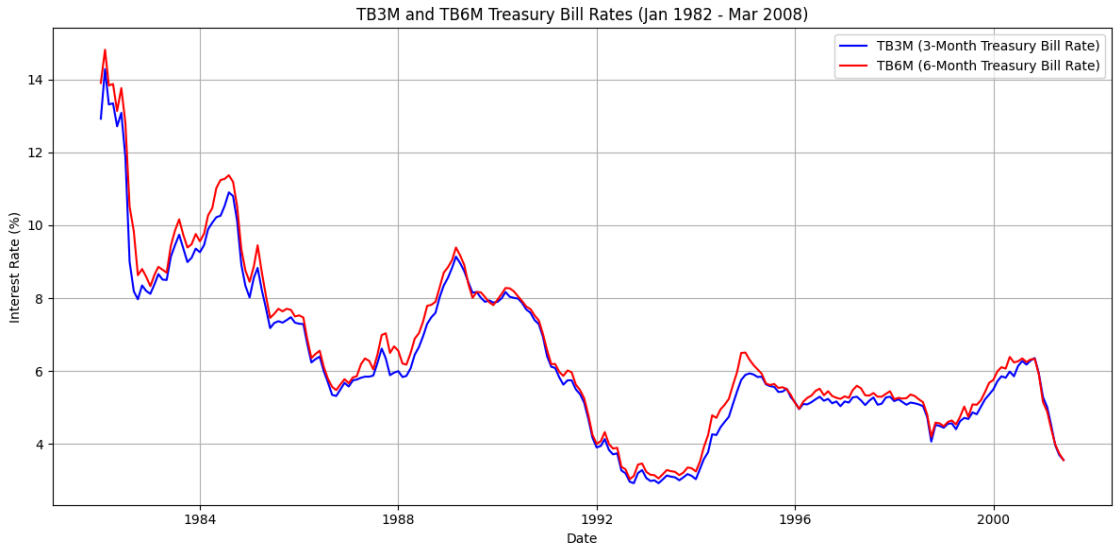
Enlace Github
https://github.com/gabrielabermudezf/Examen-preg-19

Enlace Colab
https://colab.research.google.com/drive/14PSXaZSOy_7oKI3QeW0A-fVy4I9sQSpx?usp=sharing

HTML (está dentro de github, aquí está la prueba):



Interpretaciones



When looking at the graph, we can clearly see that both the 3-month and 6-month Treasury bill rates follow almost the same pattern over time. Even though the 6-month rate (red line) is usually a little higher than the 3-month one (blue line), they tend to rise and fall together. This suggests that both rates are being influenced by similar economic factors and move closely in sync. We can also notice that there are several ups and downs, which reflect the different economic cycles from 1982 to the early 2000s. Overall, the fact that these two rates move almost identically over such a long period tells us that there's probably a long-term relationship between them.

```
ADF Test for TB3M:
Test Statistic: -1.5392
P-value: 0.5140
Critical Values:
   1%: -3.4600
   5%: -2.8746
   10%: -2.5737
Conclusion: TB3M is non-stationary at 5% significance level (p-value >= 0.05).

ADF Test for TB6M:
Test Statistic: -3.7738
P-value: 0.0032
Critical Values:
   1%: -3.4589
   5%: -2.8741
   10%: -2.5735
Conclusion: TB6M is stationary at 5% significance level (p-value < 0.05).
```

According to the ADF test results, the 3-month Treasury bill rate (TB3M) is not stationary because its p-value is way above 0.05, which means we can't reject the null hypothesis of a unit root. This time series has a trend and its values depend on time, so it doesn't stay stable around a fixed average. On the other hand, the 6-month Treasury bill rate (TB6M) is stationary since its p-value is below 0.05. That means its values fluctuate around a constant mean and are more stable over time. The fact that only one of them is stationary tells us that we can’t treat them the same in a time series model and we’ll need to be careful when analyzing their relationship.

```
OLS Regression Results (GS6M on GS3M):
                            OLS Regression Results
==============================================================================
Dep. Variable:                   GS6M   R-squared:                       0.992
Model:                            OLS   Adj. R-squared:                  0.992
Method:                 Least Squares   F-statistic:                 2.945e+04
Date:                Fri, 13 Jun 2025   Prob (F-statistic):          1.99e-246
Time:                        18:31:20   Log-Likelihood:                 40.346
No. Observations:                 234   AIC:                            -76.69
Df Residuals:                     232   BIC:                            -69.78
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -0.0457      0.041     -1.121      0.264      -0.126       0.035
GS3M           1.0466      0.006    171.624      0.000       1.035       1.059
==============================================================================
Omnibus:                      136.833   Durbin-Watson:                   0.406
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1196.555
Skew:                           2.156   Prob(JB):                    1.48e-260
Kurtosis:                      13.204   Cond. No.                         20.8
==============================================================================
```

The regression between the 6-month and 3-month Treasury bill rates shows a super strong relationship. The R-squared is 0.992, meaning that about 99% of the variation in the 6-month rate can be explained by the 3-month rate that's a very tight fit. The coefficient for GS3M is 1.0466 and it's highly significant, which tells us that changes in the 3-month rate are closely followed by changes in the 6-month one.

After that, the ADF test on the residuals gives a p-value below 0.05, which means we can reject the null hypothesis of a unit root. In other words, the residuals are stationary. That confirms that the two series even though one of them was non-stationary are cointegrated. So, they move together in the long run, and any short-term gap between them tends to disappear over time.

This supports the idea that these interest rates are linked by some long-term economic relationship, and they don't just randomly drift apart.

Questions:

a) Plot the two time series in the same diagram. What do you see?

When we graph the TB3M and TB6M rates together, we can clearly see that they move almost the same throughout the entire period. Although the 6-month rate is usually slightly higher, both series follow very similar trends. This shows that they're probably influenced by the same economic conditions and have a strong relationship over time.

b) Do a formal unit root analysis to find out if these time series are stationary.

According to the ADF test, TB3M is *not* stationary because its p-value is higher than 0.05. That means it has a trend and doesn't stay around a constant mean. TB6M, on the other hand, is stationary, since its p-value is below 0.05, so it's more stable over time. This difference is important when deciding which model to use.

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

Yes, they are cointegrated. We proved this by regressing TB6M on TB3M and then applying the ADF test to the residuals of that regression. The residuals were stationary (p-value < 0.05), which confirms cointegration. That means that even if TB3M isn't stationary by itself, the two series still move together in the long run.

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 here means that TB3M and TB6M are linked in the long term they don't just randomly drift apart. So if one of them changes, the other tends to follow in a way that keeps them close. This makes sense in financial markets, where different maturity rates are related. If they weren't cointegrated, it would suggest a lack of connection or inefficiency in the market.

e) If you want to estimate a VAR model 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? Justify your answer.

Since the series are not both stationary but are cointegrated, it's better to use a VECM model instead of a VAR. The VECM allows you to keep the long-run relationship (cointegration) while modeling the short-term changes. If you really want to use a VAR, you'd need to take first differences to make both series stationary but doing that would ignore the long-term link between them.