SOK 3021 Time series Econometric

2025-02-06

In this assignment, you will have the opportunity to analyze different commodity price or stock index data (e.g., Gold Futures, US Dollar Index) from the US market using various time series techniques. Specifically, you will perfom stationarity tests, forecasting with ARIMA modeling, performing cointegration analysis, estimating VAR/VEC models, and modeling volatility using ARCH/GARCH.

Specifically, you will analyze the monthly prices of one of the following seven commodities: Crude Oil WTI, Brent Oil, Natural Gas, Gold, Silver, Copper, or US Soybeans, all of which are available on the investing.com website.

Each group will be assigned a specific commodity to analyze. Here is the list of groups and their corresponding commodities:

Group 1: Crude Oil WTI

Group 2: Brent Oil

Group 3: Natural Gas

Group 4: Silver

Group 5: Copper

Group 6: US Soybeans

Group 7: Gold

In addition to the commodity price assigned to your group, you must also incorporate the US Dollar Index into your analysis. The US Dollar Index can be accessed separately on the same website in a different section. This will serve as a second variable for your analysis, which is important for cointegration analysis and modeling the relationship between commodity prices and the US Dollar.

1 Tasks

Each group is expected to perform the following tasks using their chosen commodity and the US Dollar Index:

1) Unit Root Test – Check for stationarity in the time series data. Clearly outline the steps taken, specify the tests applied, define the criteria for decision-making, and present and discuss the results obtained.

2) ARIMA Model – Fit an ARIMA model to the commodity price data and generate forecasts. Plot historical and forecasted values for visualization. Discuss the results and their implications.

3) Incorporate the US Dollar Index as an explanatory variable in the ARIMA model and forecast future prices. Assess whether its inclusion improves predictive accuracy and explain why. Plot historical and forecasted values for visualization. Discuss the results and their implications.

4) Cointegration Analysis – Test for cointegration between commodity prices and the US Dollar Index. Outline the steps, specify the tests applied, define the decision criteria, and present and interpret the results.

5) VAR/VEC Model – Estimate the relationship between commodity prices and the US Dollar Index. Outline the steps, justify the choice of VAR or VECM, and present and interpret the results.

6) ARCH/GARCH Model – Model the volatility of commodity prices using an ARCH/GARCH approach. Outline the steps, visualize the results with plots, and discuss the findings.

Important Notes:

- Please only use the commodity assigned to your group along with the US Dollar Index for your analysis.

- Use the **monthly** historical data from January 2010 to December 31, 2024.

- Ensure to follow all the necessary steps in your analysis (e.g., visulaization, stationarity tests, etc.).

- Discuss the results.

- You must submit your final analysis as a PDF report or R Quarto file on Canvas and also present your findings in class (10-minutes presentation).

- **Deadline:** The deadline for submitting your PDF through Canvas is Monday, February 24, **before 16:00**.

- **Presentation:**: Tuesday , February 25.

- **Collaboration:**

    - Work in pairs (maximum of 2 students per group).
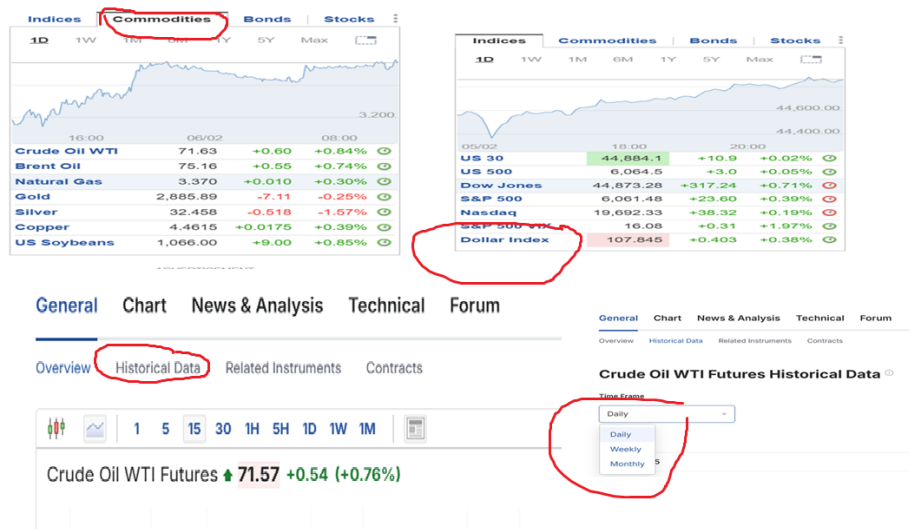   - Ensure all members contribute to analysis and report

Figure 1: How to download the data