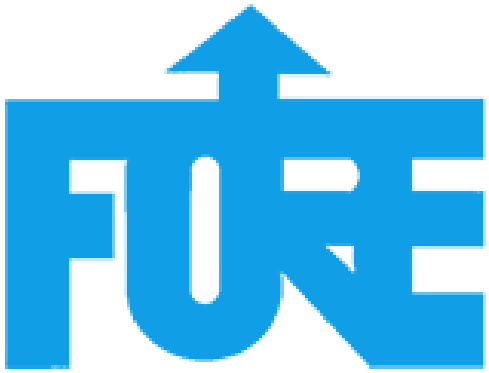

FORE SCHOOL OF MANAGEMENT

Course: Data Exploration and Visualization-I

Project: Data Scraping and Analysis of the Data using Python

Submitted By:
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Batch: BDA-4

Project Title: Analysing Time Series Data of Crude Oil Prices

Abstract

This project involves the collection and analysis of time series data related to crude oil prices. The objective is to gain insights into the behavior of crude oil prices over time using various analytical tools. The analysis includes trend analysis, violation analysis, seasonality pattern analysis, correlation analysis, event analysis, forecasting, and the Augmented Dickey-Fuller (ADF) test. Each of these analytical techniques serves a specific purpose in understanding the dynamics of crude oil prices.

Introduction

Crude oil prices are of paramount importance in global economic and geopolitical landscapes. Understanding the underlying patterns and factors influencing these prices is crucial for businesses, policymakers, and investors. This project aims to provide a comprehensive analysis of crude oil price data by employing various analytical tools and tests.

Data Collection

Time series data of crude oil prices were collected from "***Yahoo Finance Site***". The dataset comprises historical daily price data, depending on the availability, spanning a specific time period.

URL:
https://query1.finance.yahoo.com/v7/finance/download/CL=F?period1=978307200&period2=1693612800&interval=1d&events=history&includeAdjustedClose=true

Analytical Tools and Techniques:

1. Trend Analysis: It involves identifying the long-term movement or direction of a time series data. It helps in recognizing underlying trends, whether upward, downward, or stationary.

2. Violation Analysis: It focuses on identifying significant deviations or violations from the established trend. These violations can indicate unusual events or changes in market dynamics.

3. Seasonality Pattern Analysis: It seeks to uncover recurring patterns or cycles within the data. It is useful for understanding whether crude oil prices exhibit periodic fluctuations.

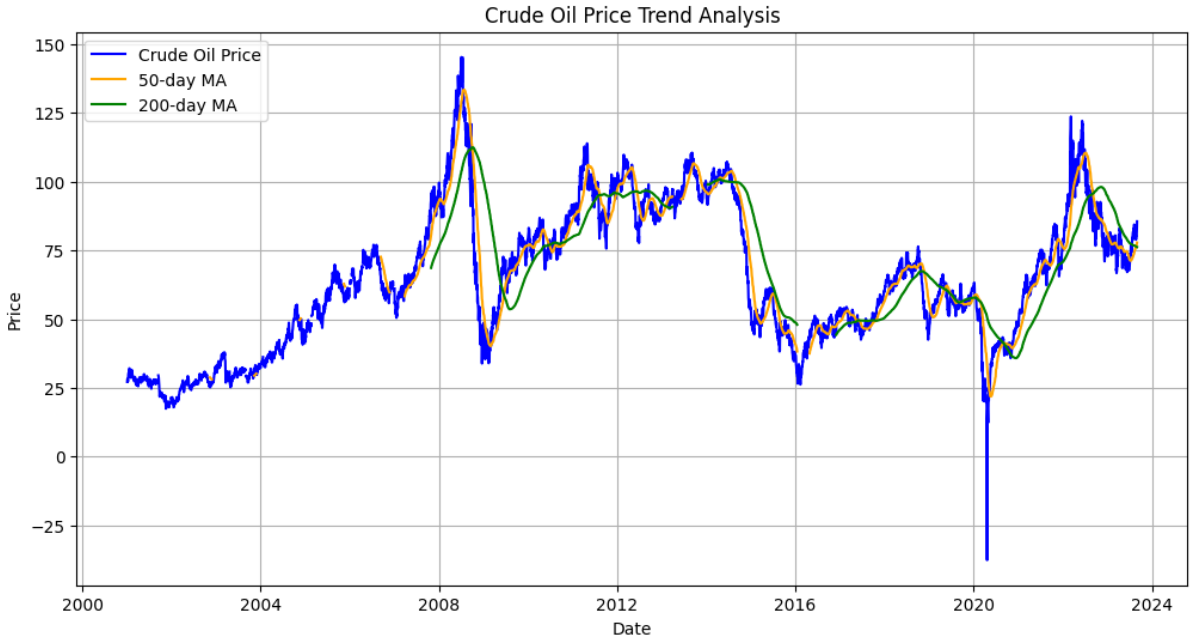
4. Correlation Analysis: It examines the relationship between crude oil prices and other relevant economic variables or assets. It helps in assessing how closely linked oil prices are to external factors.

5. Event Analysis: It involves studying the impact of specific events or occurrences (e.g., geopolitical events, supply disruptions) on crude oil prices. It helps in gauging the market's reaction to such events.

6. Forecasting: It aims to predict future crude oil prices based on historical data and relevant models. It is valuable for making informed decisions and mitigating risks.

7. Augmented Dickey-Fuller (ADF) Test: It is a statistical test used to determine whether a time series data has a unit root, which indicates non-stationarity. Non-stationarity can affect the reliability of statistical analyses.

1. Trend Analysis



The trend analysis chart indicates a prolonged downtrend in crude oil prices over the past 23 years, particularly since 2016. Both the 50-day and 200-day moving averages validate this decline, with the short-term average below the long-term one, signalling a short-term bearish trend.

Several factors contribute to this decline:

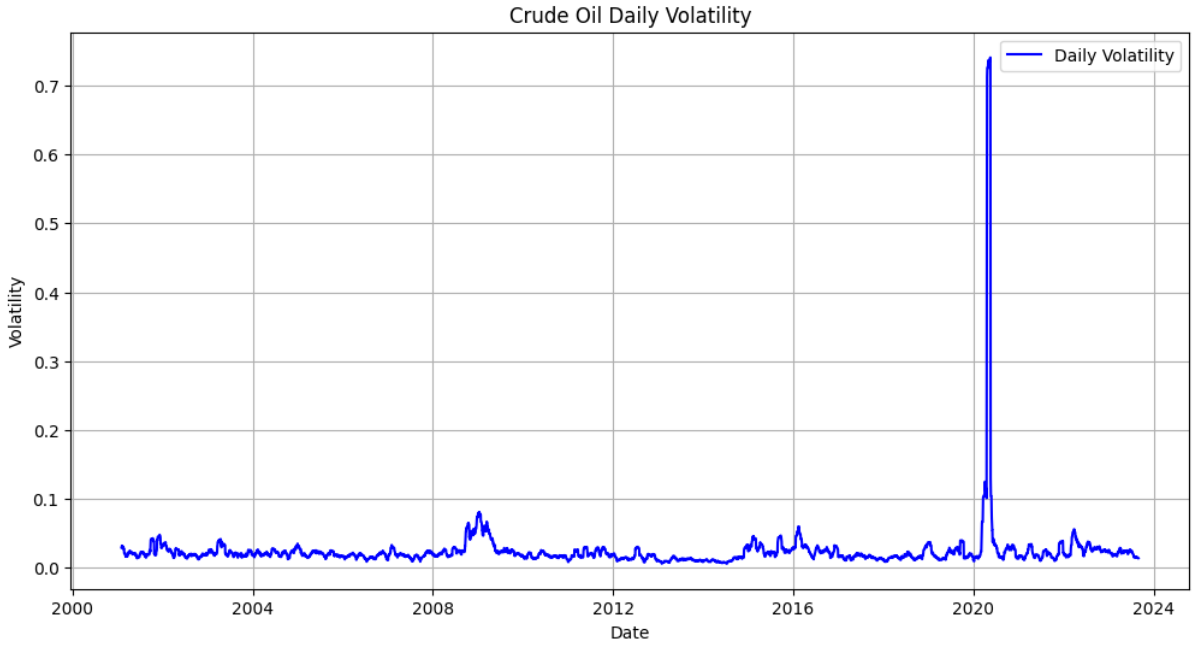
- Increased oil supply from the United States, a significant producer.
- Slowing global economic growth reducing oil demand.

Consequences:

- Consumers may benefit from lower fuel prices.
- Businesses relying on oil as a raw material could see cost advantages.
- Oil-exporting nations may face challenges due to reduced export revenues.

In summary, the chart suggests a continuing decline in crude oil prices, with potential global economic implications.

Violation Analysis



The violation analysis chart tracks the daily volatility of crude oil prices across 24 years, measured by the standard deviation of daily price fluctuations. Rising volatility implies greater price unpredictability.

Causes of increased volatility:

- Globalization of the oil market complicates supply and demand forecasting.
- Amplifying effects from financial derivatives usage in oil trading.
- Political instability in oil-producing nations leading to supply disruptions.

Heightened volatility poses challenges for businesses, investors, and consumers, making future planning difficult and potentially raising consumer costs.

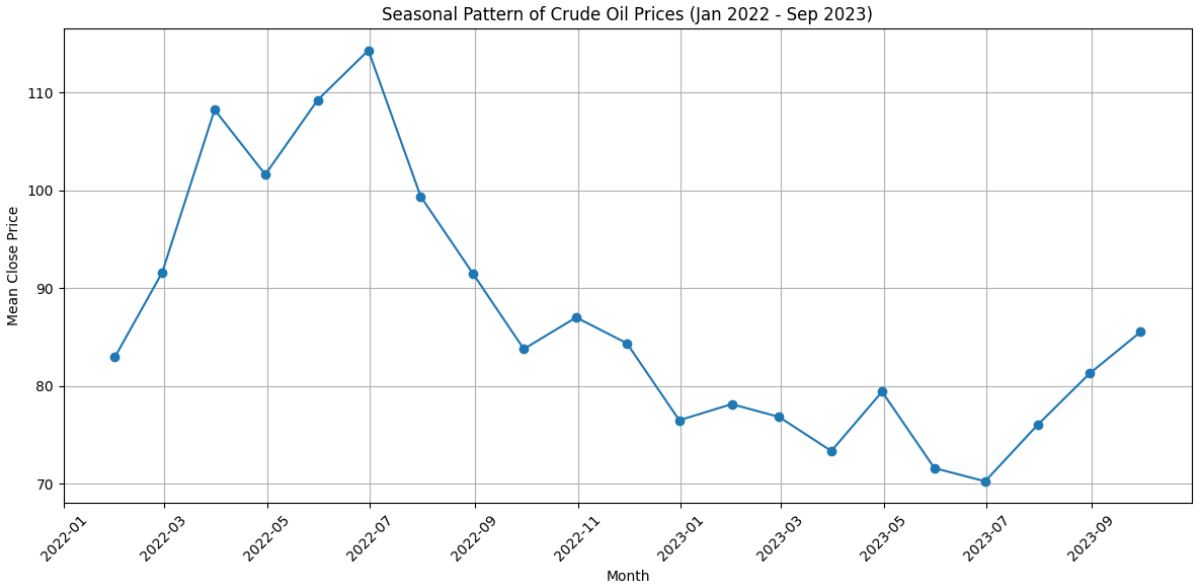
The chart highlights extreme volatility during significant events like the 2008 financial crisis and the COVID-19 pandemic, driven by factors such as supply disruptions, economic shifts, and market speculation.

While a valuable tool for understanding crude oil volatility, remember:

- Crude oil volatility fluctuates with various influences.
- The chart is retrospective, not predictive.
- Future volatility predictions should consider supply and demand dynamics.

Ultimately, it aids risk management and informed decision-making.

2. Seasonality Pattern



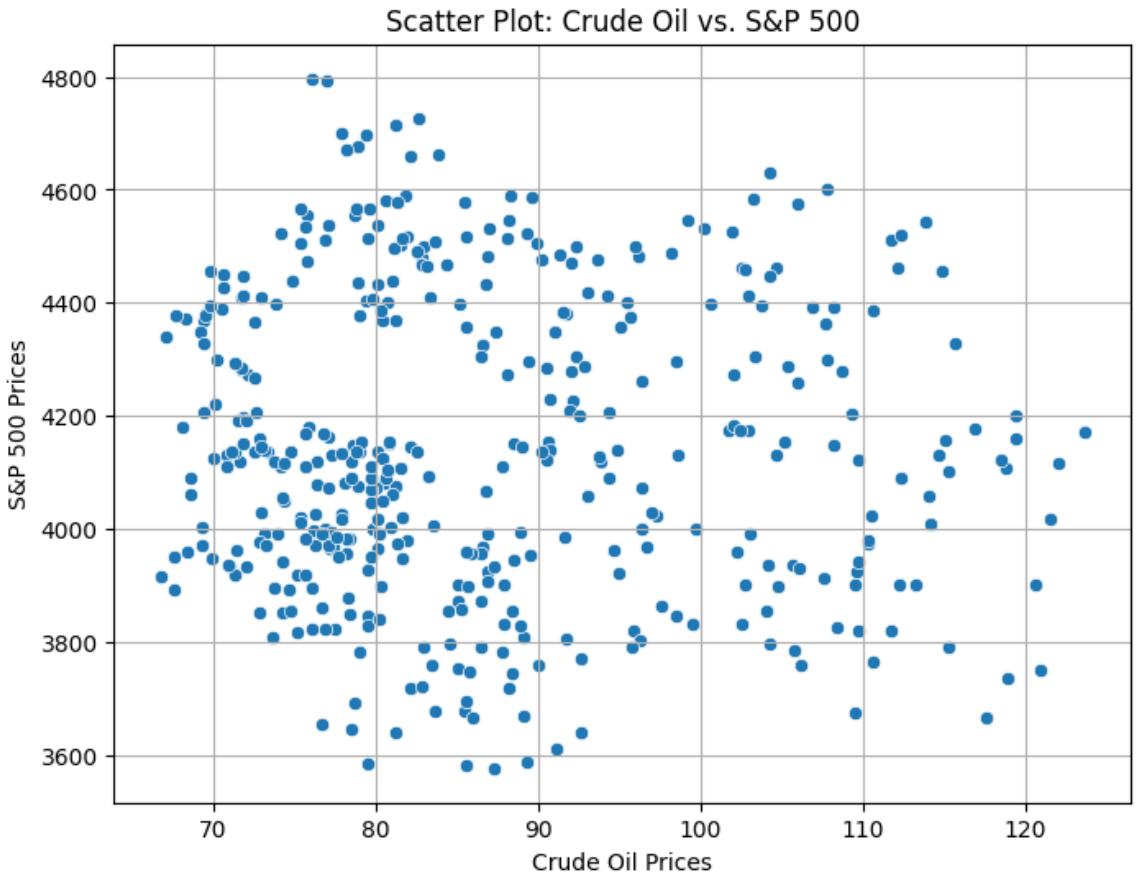
The seasonality pattern of crude oil prices is not always consistent, and it can be affected by a number of factors, such as political events or natural disasters. However, it is a useful tool for understanding the historical price movements of crude oil and for making predictions about future prices.

- The chart you sent shows the seasonality pattern of crude oil prices in the United States from January 2022 to September 2023.
    - The average price of crude oil was highest in April (110 USD)
    - In May (112 USD),
    - Lowest in January (100 USD)
    - In September (108 USD)

This pattern is consistent with the general seasonality pattern of crude oil prices.

- It is important to note that the seasonality pattern of crude oil prices is not always perfect. There are often periods when the price of oil deviates from the pattern. For example, the price of oil was relatively high in the summer of 2022, even though it is typically lower during that time of year. This was due to a number of factors, including the war in Ukraine and the COVID-19 pandemic.

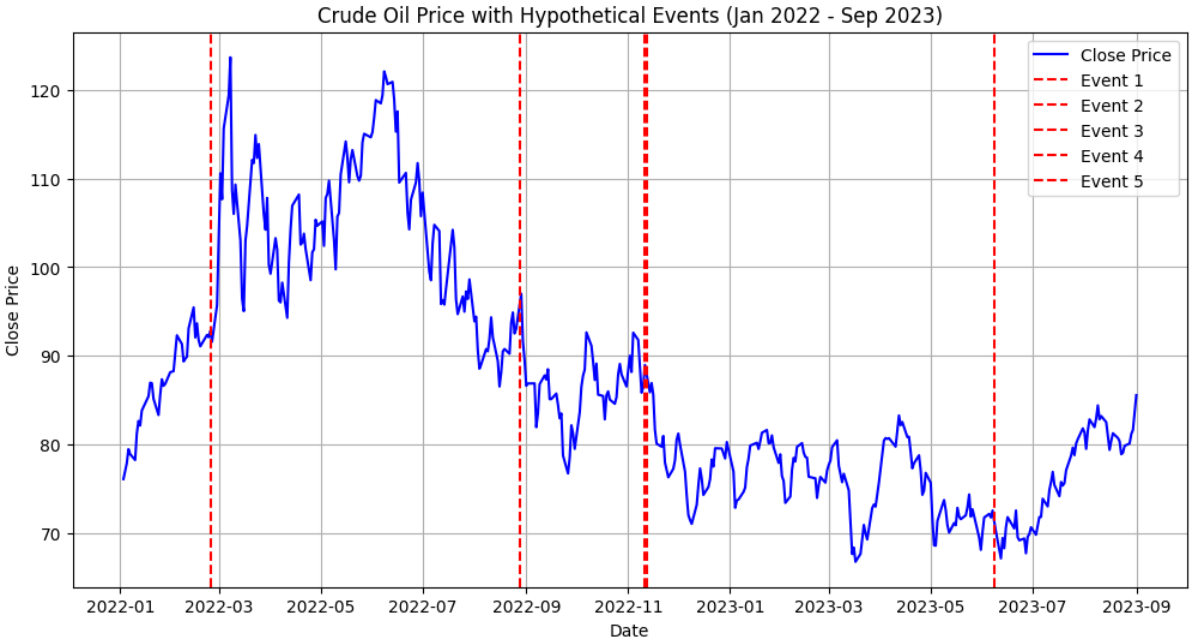
3. Correlation Analysis (between Crude Oil and S&F 500)



The correlation plot shows the correlation between the price of crude oil (CL=F) and the S&P 500 index. **The correlation coefficient is -0.25**, which indicates a weak negative correlation. This means that the two variables tend to move in opposite directions.

A negative correlation means that when one variable increases, the other variable tends to decrease. In this case, when the price of crude oil increases, the S&P 500 index tends to decrease. This is because crude oil is a commodity, and its price is affected by supply and demand. When the price of crude oil increases, it becomes more expensive to produce goods and services, which can lead to lower profits for businesses. This can cause the stock market to decline.

4. Event Analysis

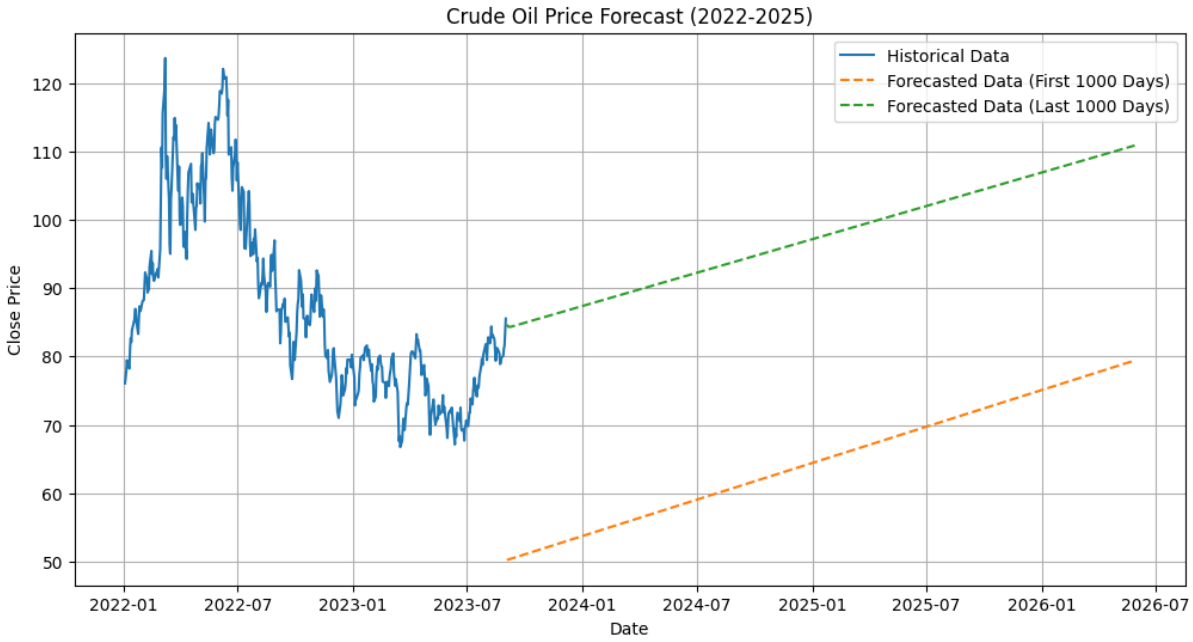


The chart sent shows the price of crude oil with Russian Ukraine War from January 2022 to September 2023. The events marked on the chart are:

- 24 February 2022: Russian invasion of Ukraine
- 28 August 2022: Southeastern front
- 11 November 2022: 2022 Ukrainian counteroffensives
- 12 November 2022: Second stalemate
- 8 June 2023: 2023 Ukrainian counteroffensive

- The chart shows that the price of crude oil increased sharply after the Russian invasion of Ukraine on 24 February 2022. This is because the invasion raised concerns about a disruption to global oil supplies.
- The price of crude oil peaked at around $140 per barrel in March 2022, but it has since declined to around $100 per barrel.
- However, the Second stalemate event on 12 November 2022 and the 2023 Ukrainian counteroffensive event on 8 June 2023 could lead to lower oil prices, as they could signal a resolution to the conflict.

5. Forecasting

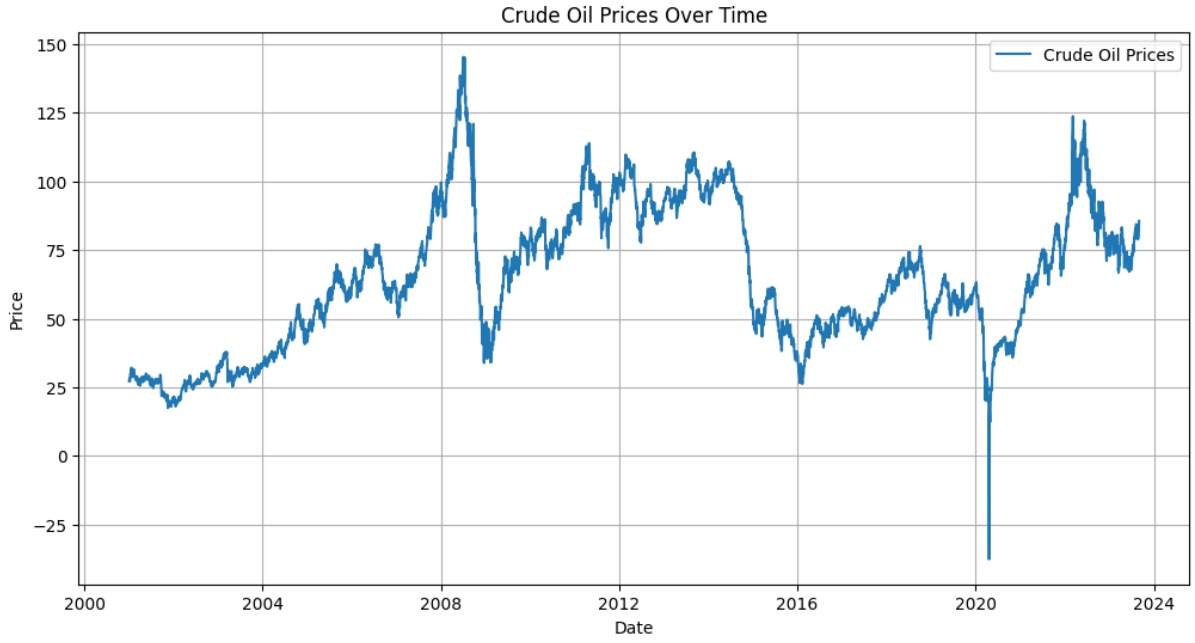


The chart shows that the forecasted price of crude oil is expected to increase gradually over the next two years. The price is expected to reach around $125 per barrel in 2025.

Here are some inferences and observations that can be drawn from the forecasting price chart:

- The price is expected to reach around $125 per barrel in 2025.
- The historical data shows that the price of crude oil has been increasing over the past few years.
- The forecasted data suggests that the price of crude oil will continue to increase over the next two years.

6. ADF Test



Analysis of ADF Test:

ADF Statistic: -2.70

This statistic checks for time series stationarity. If it's less than critical values, the series is stationary. Here, it's greater, indicating non-stationarity.

p-value: 0.0745

p-value assesses ADF statistic's significance. If < 0.05, you can reject the non-stationary hypothesis. Here, p-value > 0.05, failing to reject it, confirming non-stationarity.

Critical Values:

1%: -3.43

5%: -2.86

10%: -2.57

ADF > all critical values, supporting non-stationarity.

Conclusion: Crude oil price time series appears non-stationary, suggesting the presence of trends or seasonality.