Task 1: Laying the Foundation for Analysis

1. Data Analysis Workflow

Our plan for analyzing Brent oil prices is as follows:

1. **Load the Data** – Import the Brent oil price dataset and ensure dates are in proper format. Check for missing or incorrect values.

2. **Explore the Data (EDA)** – Plot the oil prices over time. Identify long-term trends, sudden spikes/drops, and periods of high volatility.

3. **Transform Data** – Calculate daily changes (log returns) to make the data more stable for analysis.

4. **Add Event Data** – Use the `events.csv` file containing key geopolitical, OPEC, and economic events. Align events with the price data to later interpret changes.

5. **Change Point Modeling** – Apply Bayesian change point analysis to identify dates where oil price behavior changes.

6. **Generate Insights** – Interpret the results, associate change points with possible events, and quantify the impact of major events on oil prices.

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2. Event Data

We created a CSV file named `events.csv` with 13 major events affecting the oil market.

Date	Event Description	Category
2001-09-11	9/11 Terrorist attacks affect global oil demand	Economic Shock
2003-03-20	Iraq War begins	Conflict
2005-08-29	Hurricane Katrina damages US oil production	Other

2008-09-15	Lehman Brothers collapse, financial crisis	Economic Shock
2010-04-20	Deepwater Horizon oil spill in Gulf of Mexico	Other
2011-03-11	Japan earthquake and tsunami disrupt energy supply	Other
2014-11-27	OPEC decides not to cut production	OPEC
2016-11-30	OPEC and non-OPEC agreement to cut output	OPEC
2020-03-11	COVID-19 declared a global pandemic	Economic Shock
2020-04-20	WTI crude futures go negative for first time	Economic Shock
2022-02-24	Russia-Ukraine war begins	Conflict
2022-03-08	Sanctions on Russian oil exports announced	Economic Shock
2022-06-02	OPEC+ agrees on production cut	OPEC

3. Assumptions & Limitations

Assumptions:

- Major geopolitical and economic events can affect oil prices.

- Oil prices show different behavior before and after major events.

- Change point models can detect significant structural shifts in prices.

Limitations:

- Correlation does not mean causation: a detected change near an event does not prove the event caused it.

- Some events happen close together, making it hard to separate effects.

- Other factors (like GDP, inflation, exchange rates) are not included in this analysis.

4. Understanding the Model and Data

Time Series Properties:

- Oil prices have long-term trends, sudden shocks, and clusters of high volatility.

- Raw prices are non-stationary; log returns are more stable and suitable for modeling.

Change Point Models:

- Detect moments when oil prices start behaving differently.

- Provide estimated averages before and after the change.

- Outputs include probable change dates and the magnitude of price changes.

- Limitations: Results are probabilistic and need human interpretation.

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5. Communication Channels

Results will be shared through:

- **Written report (PDF / blog post)** for analysts and policymakers

- **Interactive dashboard** for investors and energy companies

- **Charts and visuals** for quick understanding of trends and events