Analysis Steps:

1. **Data Acquisition & Cleaning**
   - Load historical Brent oil prices (1987-2022)
   - Handle missing values and outliers
   - Convert date formats and ensure chronological order
2. **Exploratory Data Analysis (EDA)**
   - Visualize price trends over time
   - Calculate log returns for stationarity
   - Analyze statistical properties (mean, variance, distribution)
3. **Event Research & Compilation**
   - Identify major geopolitical and economic events
   - Create structured event dataset with dates and descriptions
4. **Change Point Detection**
   - Implement Bayesian change point model using PyMC
   - Run MCMC sampling for parameter estimation
   - Identify significant structural breaks
5. **Event Correlation Analysis**
   - Match detected change points with historical events
   - Quantify price impacts around event dates
6. **Advanced Modeling (Optional)**
   - Explore additional factors (GDP, inflation, exchange rates)
   - Consider alternative models (VAR, Markov-Switching)
7. **Insight Generation & Communication**
   - Develop actionable insights for stakeholders
   - Create interactive dashboard for exploration
   - Prepare comprehensive report

1.2 Event Dataset

File: `data/processed/events_dataset.csv`

Date	Event Name	Category	Description	Expected Impact
1990-08-02	Gulf War	Conflict	Iraq invades Kuwait	Severe negative
2008-09-15	Lehman Brothers Collapse	Economic	Global financial crisis begins	Severe negative
2014-11-27	OPEC Maintains Production	Policy	OPEC decides not to cut production	Negative
2016-11-30	OPEC Production Cut	Policy	OPEC agrees to cut production by 1.2M bpd	Positive
2020-03-06	OPEC+ Price War	Policy	Russia-Saudi Arabia price war begins	Severe negative
2020-04-20	COVID-19 Demand Collapse	Pandemic	Oil demand drops 30%	Extreme negative
2022-02-24	Russia-Ukraine War	Conflict	Russia invades Ukraine	Severe positive
2011-02-15	Arab Spring	Political	Middle East political instability	Positive
2015-07-14	Iran Nuclear Deal	Sanctions	Sanctions lifted on Iran	Negative
2018-05-08	US Iran Sanctions	Sanctions	US reinstates sanctions on Iran	Positive

2019-09-14	Saudi Oil Attacks	Conflict	Drone attacks on Saudi facilities	Positive
2021-01-20	Biden Inauguration	Policy	US energy policy shift	Mixed
2020-11-03	US Elections	Political	Election uncertainty	Volatile
2005-08-29	Hurricane Katrina	Natural Disaster	US Gulf Coast disruption	Positive
2017-09-20	Hurricane Harvey	Natural Disaster	Texas refinery shutdowns	Positive

1.3 Assumptions and Limitations

Assumptions:

1. Price data is accurate and representative of global Brent crude market
2. Daily closing prices capture relevant market information
3. Events have immediate or near-immediate impact on prices
4. Market reactions are efficient (prices adjust quickly to new information)

Limitations:

1. **Correlation ≠ Causation**: Detected change points coinciding with events suggest association but not definitive causation
2. **Multiple Concurrent Events**: Isolating individual event impacts is challenging during periods of multiple shocks
3. **Lag Effects**: Some events may have delayed impacts not captured by immediate change points
4. **External Factors**: Unobserved variables (speculative trading, inventory levels) may influence prices
5. **Model Simplicity**: Basic change point models may miss complex, gradual transitions

Causal Inference Caution:

- Temporal correlation between events and price changes does not prove causation
- Confounding variables may drive both events and price changes
- Counterfactual scenarios cannot be observed
- Recommended approach: Use change points as hypothesis generators for further investigation

1.4 Communication Channels

Primary Channels:

1. **Interactive Dashboard**: Real-time exploration for technical stakeholders
2. **Executive Summary Report**: PDF (5-10 pages) for decision-makers
3. **Presentation Slides**: Key findings for board meetings
4. **API Endpoints**: For integration with internal systems
5. **Email Alerts**: For significant new change point detections

Target Audiences:

- **Investors**: Focus on risk management and opportunity identification
- **Policymakers**: Emphasis on market stability and energy security
- **Energy Companies**: Operational planning and cost management insights