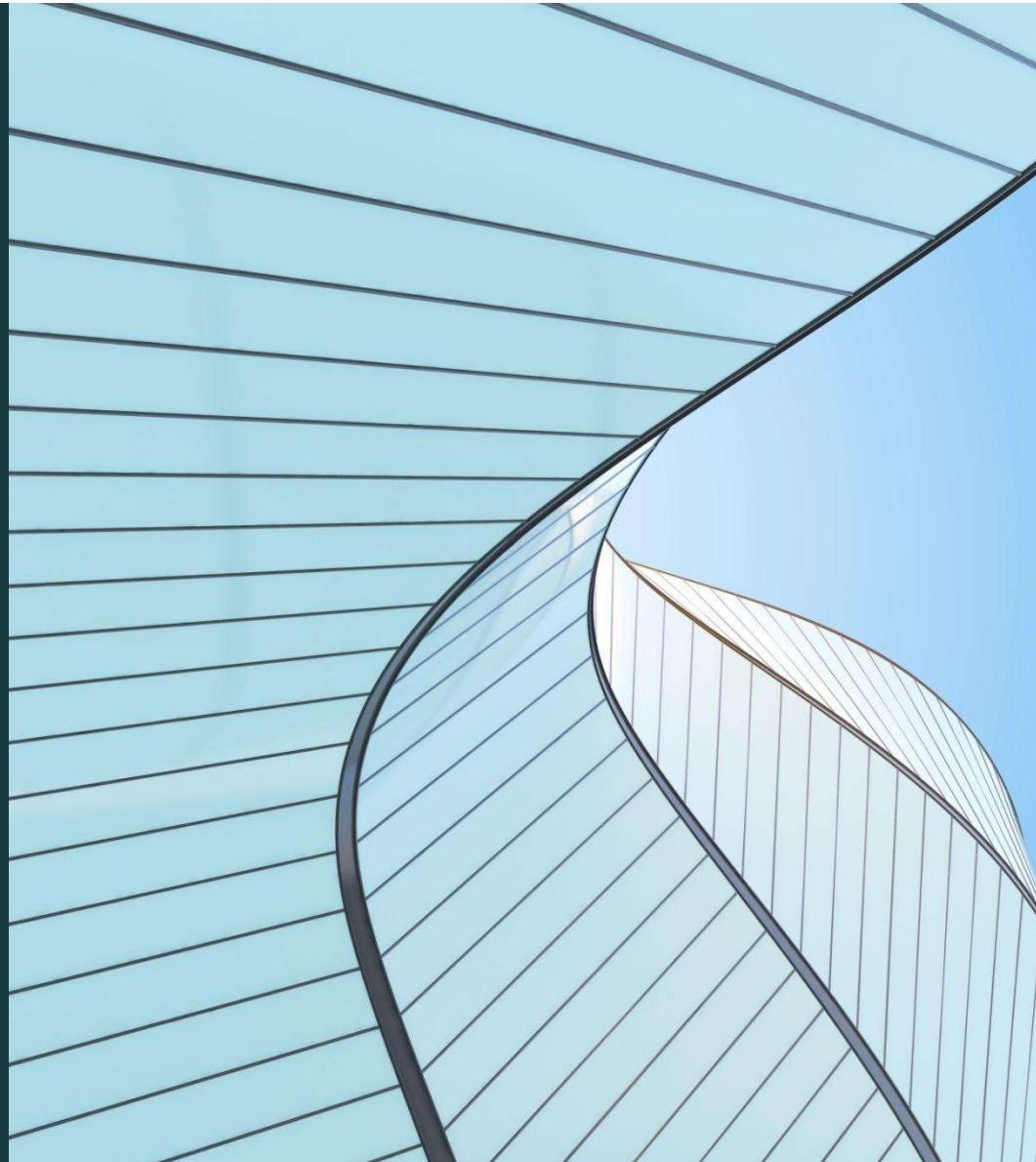


# CPI Japan Data Analysis Project

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Key Takeaways

Research Question

*Which categories show the highest volatility in Japan's CPI over the past 50 years?*



# Background Information

- The Consumer Price Index (**CPI**) is one of the most widely used measures of inflation.
- Understanding which categories are stable vs. volatile helps identify risks in the economy.
- Japan has faced several major economic disruptions over the past 50 years:
  - **1970s oil shocks** that drove energy prices up
  - **The 1990s “Lost Decade”** of stagnation and deflation
  - **Global recessions** (2008 financial crisis, COVID-19 pandemic)

# Dataset Overview

- **Source:** Statistics Bureau of Japan, published on Kaggle.
  - URL: [kaggle.com/datasets/yutodennou/consumer-price-index-of-japan-by-2022/](https://kaggle.com/datasets/yutodennou/consumer-price-index-of-japan-by-2022/)
- **Files included (4 Datasets):**
  - *Goods & Services Classification Index* – category-level breakdown (e.g., energy, food, transport).
  - *Composite Index* – headline inflation measure (excluding imputed rent).
  - *Price Index by Item* – long historical series of individual items.
  - *Middle-Level Index* – sector-level groupings of CPI.
- **Time Coverage:** 1946–2022
- **Data Acquisition:** Downloaded using the Kaggle API directly into the project environment.
- **Organization:** Stored in a structured project folder (/data/raw/ and /data/processed/) for reproducibility.

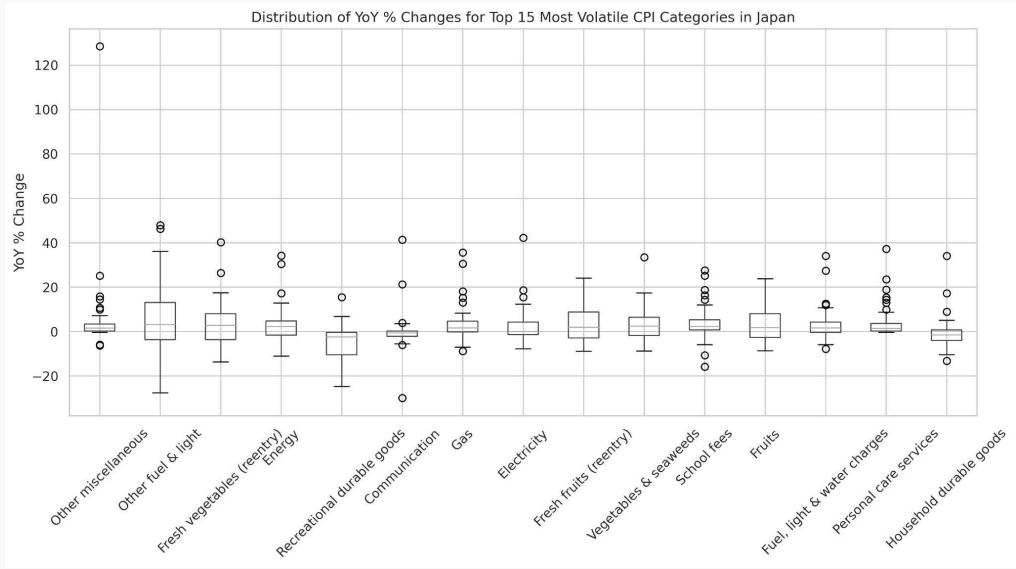
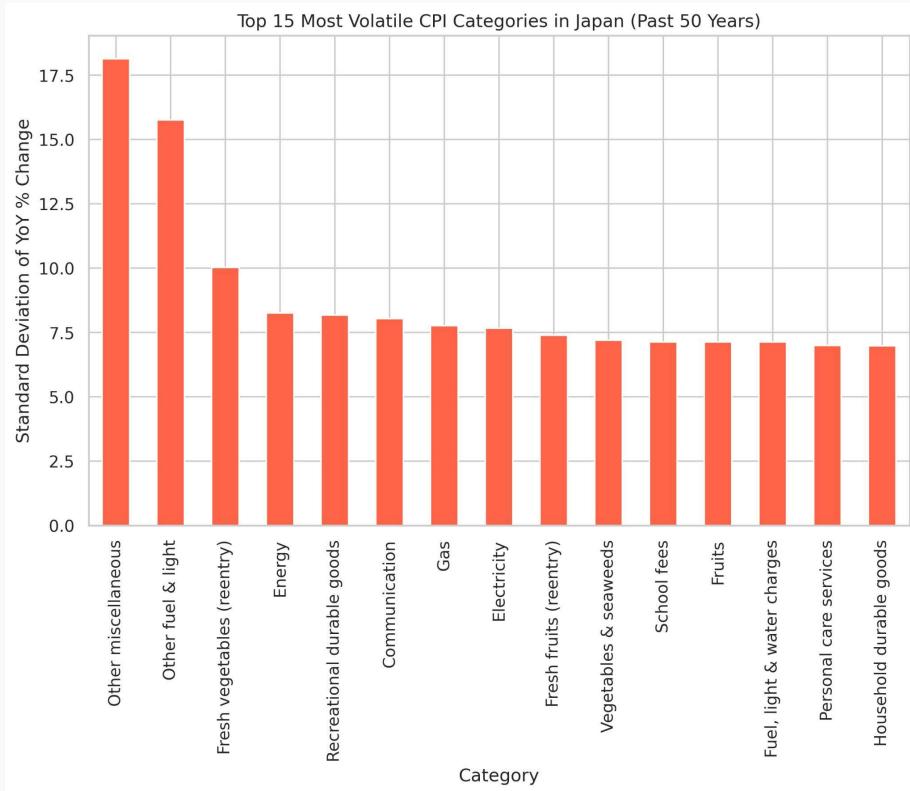
# Methodology

- **Data Cleaning & Preparation**
  - Removed columns with insufficient entries (fewer than 53 values).
  - Addressed missing values (dropped sparse columns, preserved long-term series).
- **Exploratory Data Analysis**
  - Generated descriptive statistics and visualized key CPI categories.
  - Focused on long-term trends (50+ years of data).
- **Volatility Analysis**
  - Measured standard deviation across categories to compare stability.
  - Used line plots & box plots to visualize fluctuations.
  - Highlighted major economic events with markers (1970s oil shocks, 1990s slowdown, 2008 crisis, COVID-19).

# Findings

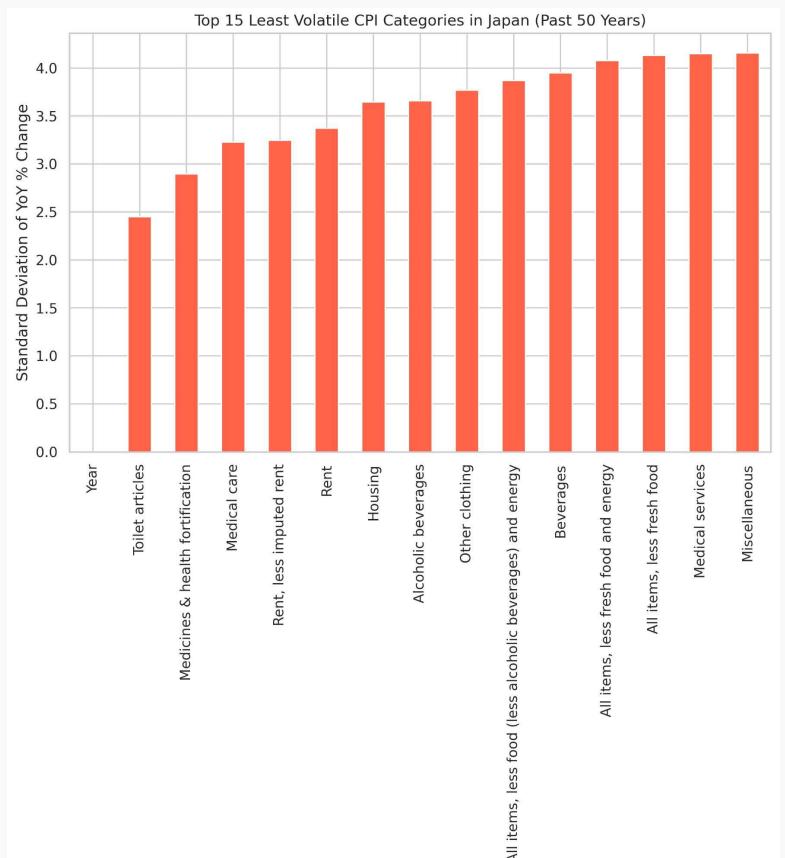
- Significant differences in **volatility** exist across CPI categories.
- **Gas, Fuel, and Energy-related sectors** showed the highest swings, strongly influenced by external shocks such as the 1970s oil crisis, the 2008 financial crash, and the COVID-19 pandemic.
- **Food categories** (like fresh fish, vegetables, and fruits) also displayed notable short-term fluctuations, often tied to seasonality and supply shocks.
- In contrast, **Housing and Education** remained relatively stable, reflecting long-term pricing structures and government regulation.
- The analysis confirms that Japan's CPI volatility is event-driven in some sectors, but structurally stable in others.

# Results (Most Volatile)

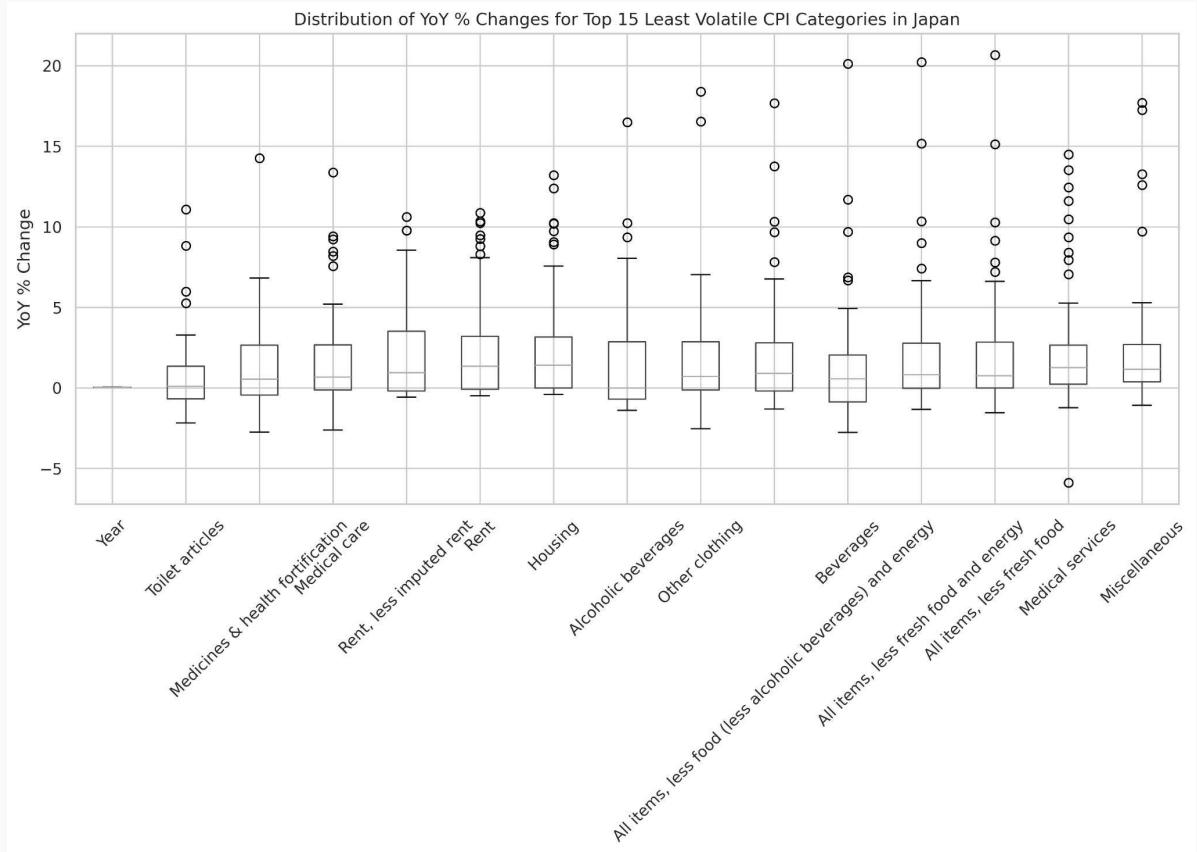


Boxplot Distribution of Most Volatile Categories

# Results (Least Volatile)

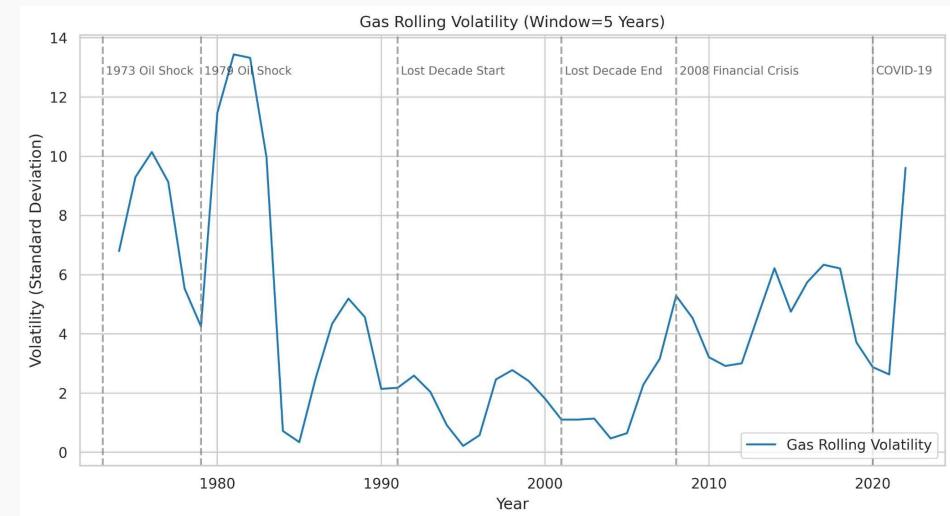
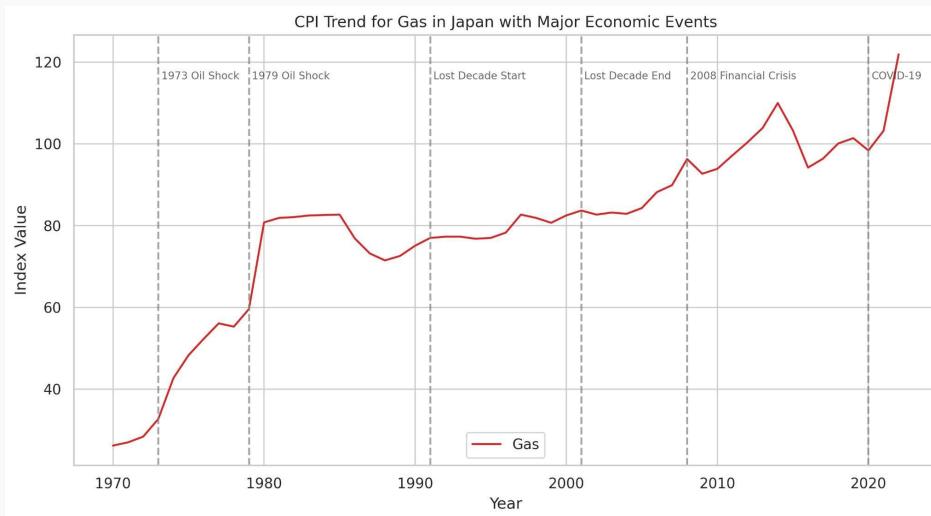


Bar Chart of Least Volatile Categories



Boxplot Distribution of Least Volatile Categories

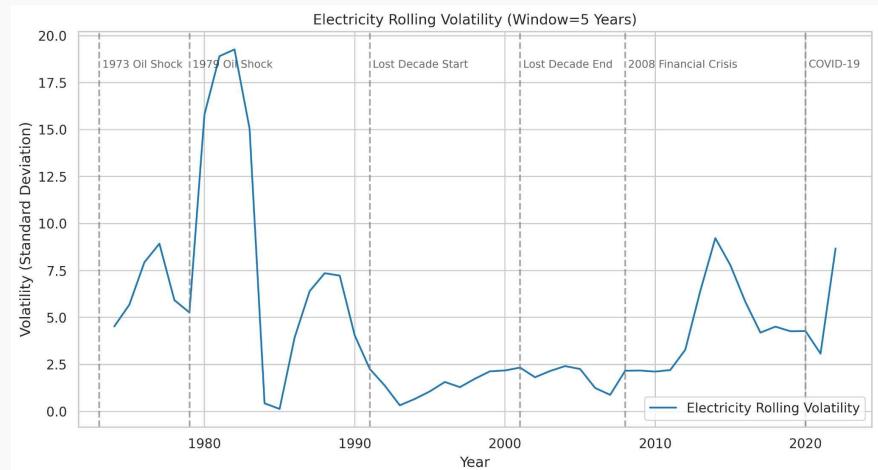
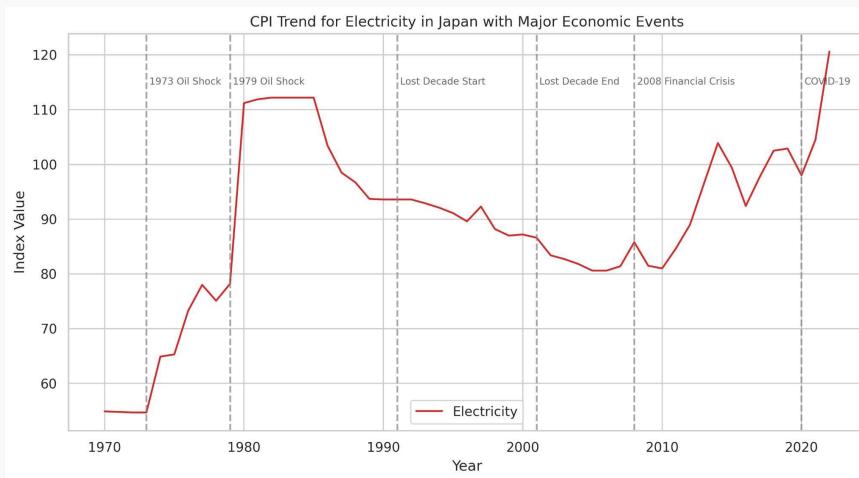
# Results (Gas)



Gas prices show clear spikes during major economic events:

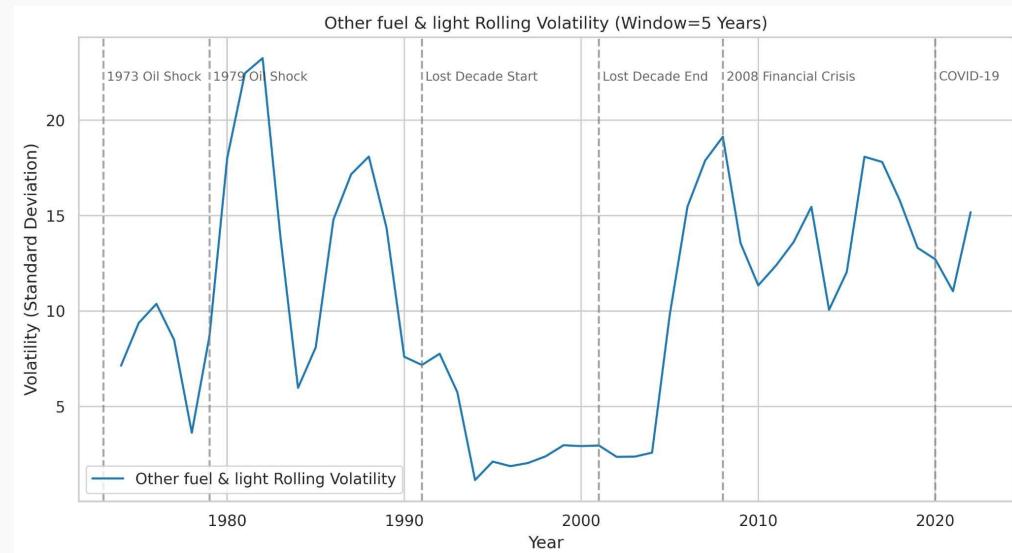
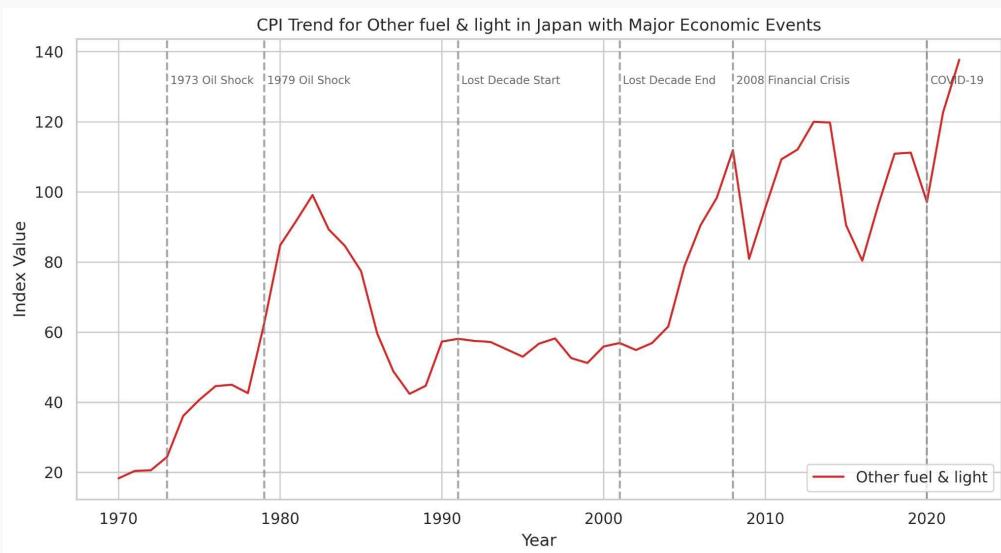
- 1973 & 1979 Oil Shocks resulted in steep increases
- 2008 Financial Crisis had sharp but brief drop
- 2020 COVID-19 resulted in increases
- During Japan's Lost Decade (1991–2001), Gas CPI remained relatively stable, reflecting domestic economic stagnation.

# Results (Electricity)



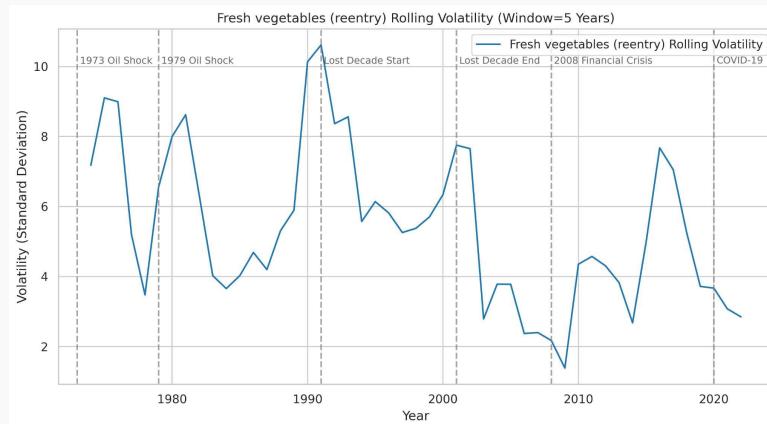
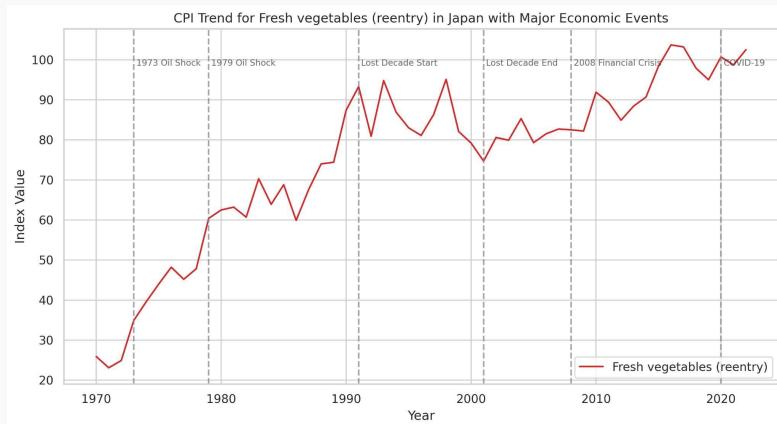
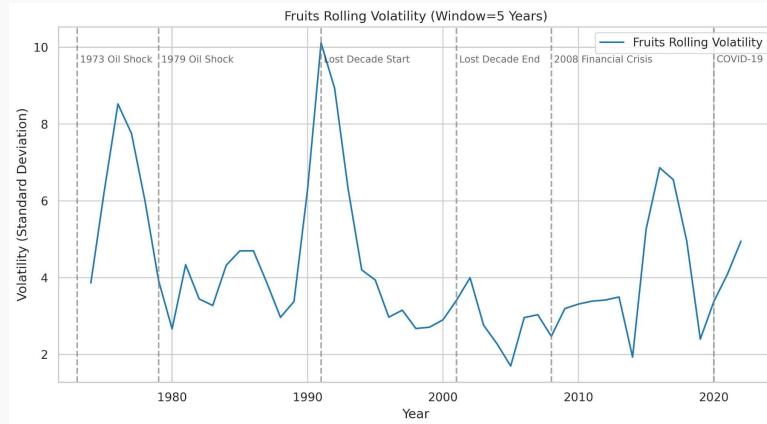
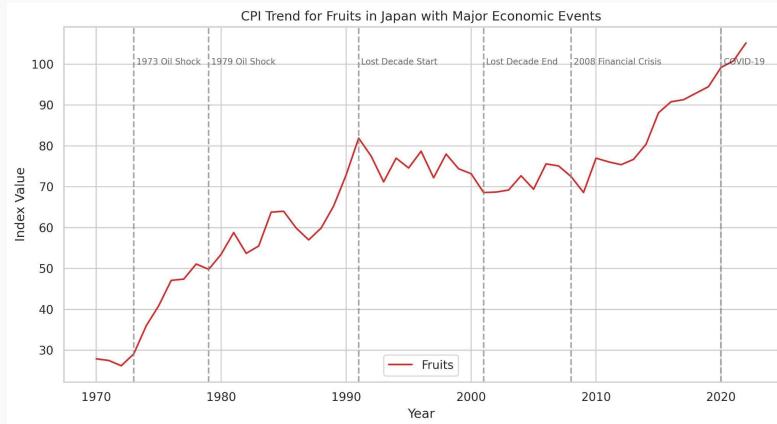
- Both Gas and Electricity show sharp increases during global energy crises (1973, 1979 Oil Shocks, 2008 Financial Crisis, Covid 19)
- During Japan's Lost Decade (1991–2001), gas CPI rose but electricity dropped
- Rolling volatility graphs reveals lots of instability, with peaks during major global events.
- Energy categories (Gas + Electricity) are consistently the most shock-sensitive components of Japan's CPI.

# Results (Other Fuel & Light)

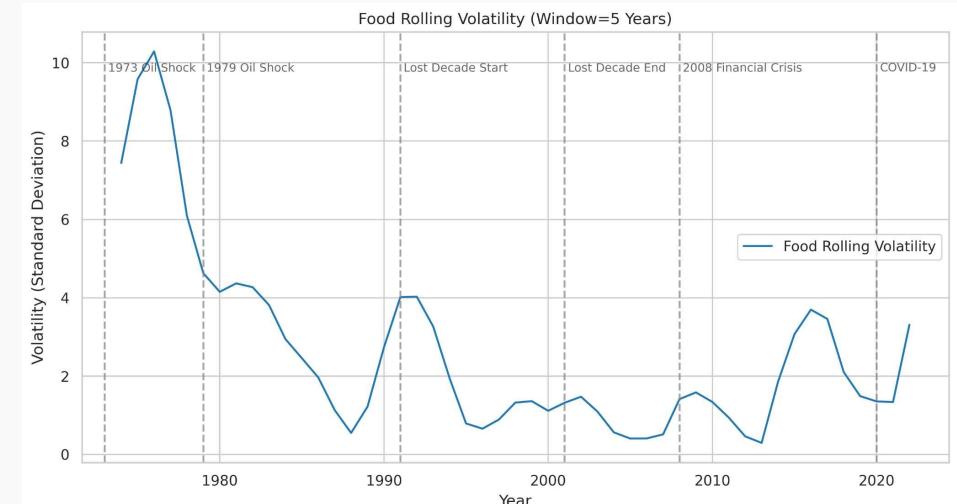
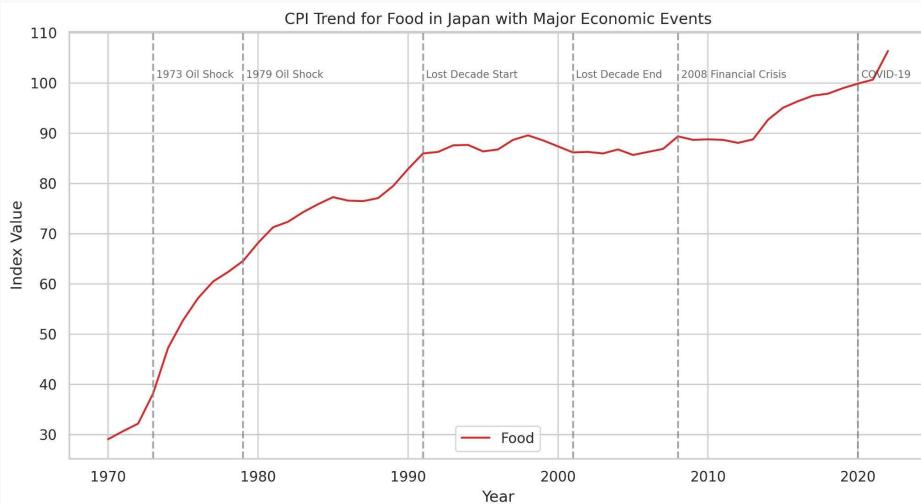


- Energy categories (Gas, Electricity, and Other Fuel & Light – e.g., kerosene, coal, household fuel) all show sharp spikes during global crises.

# Results (Fruits and Vegetables)



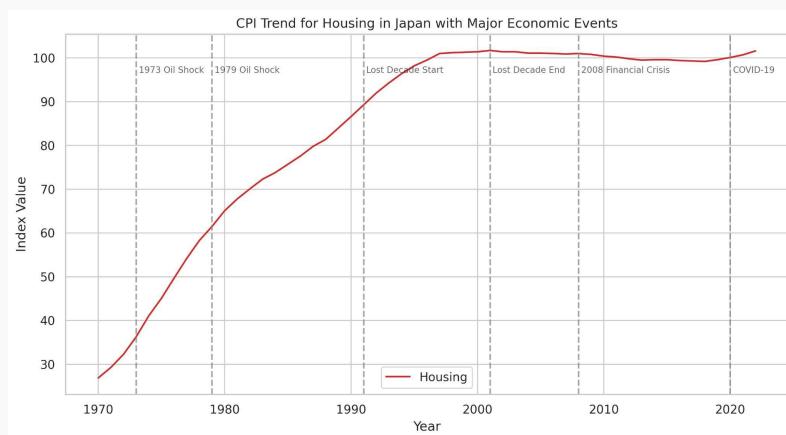
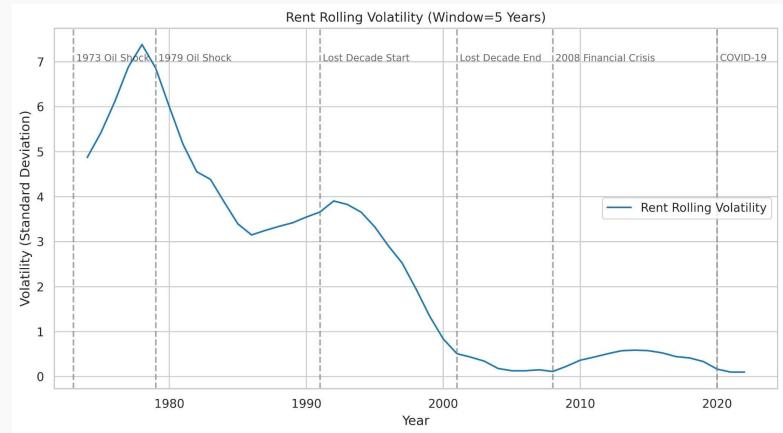
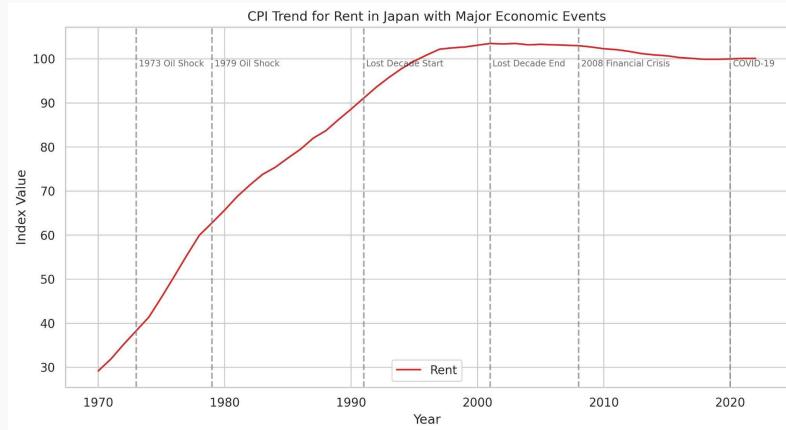
# Results (Food)



# Results (Food, Fruit, and Vegetables)

- Overall Food CPI shows a steady upward trend, reflecting gradual increases in basic living costs.
- Fruits and Vegetables display much higher volatility, with frequent sharp rises and drops.
- Spikes in Fruits/Vegetables often reflect domestic supply shocks (e.g., poor harvests, natural disasters) rather than global crises.
- During Japan's Lost Decade (1991–2001), Food remained relatively stable, but fresh items still fluctuated.
- Compared to Energy, Food categories are less tied to international markets, which shows local drivers of price instability.

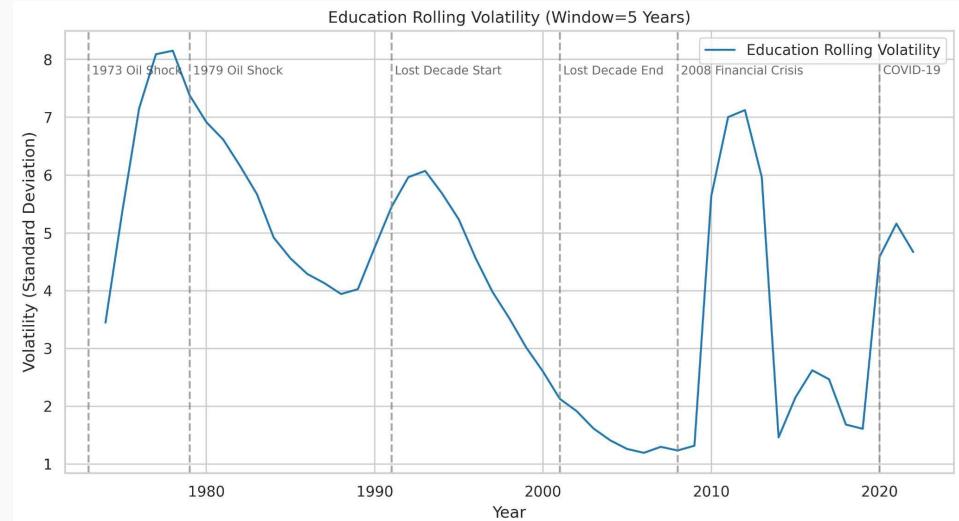
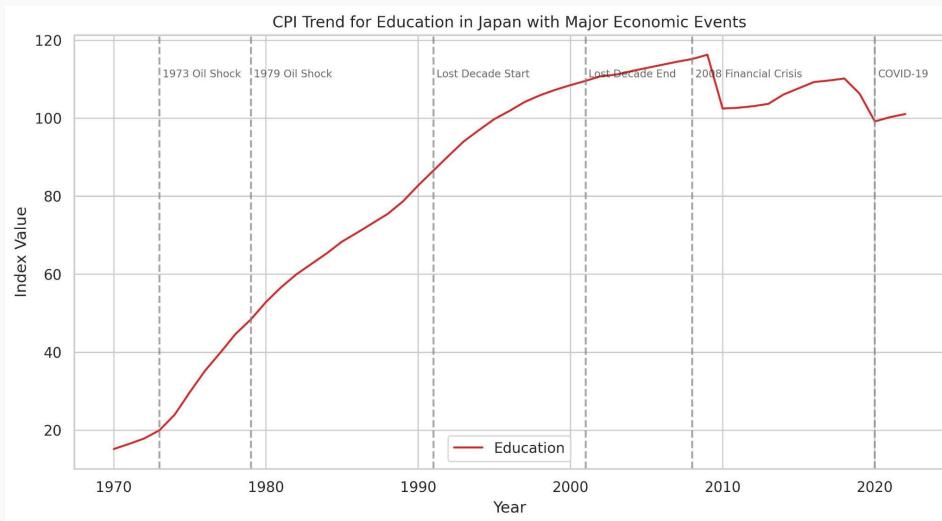
# Results (Rent and Housing)



# Results (Rent and Housing)

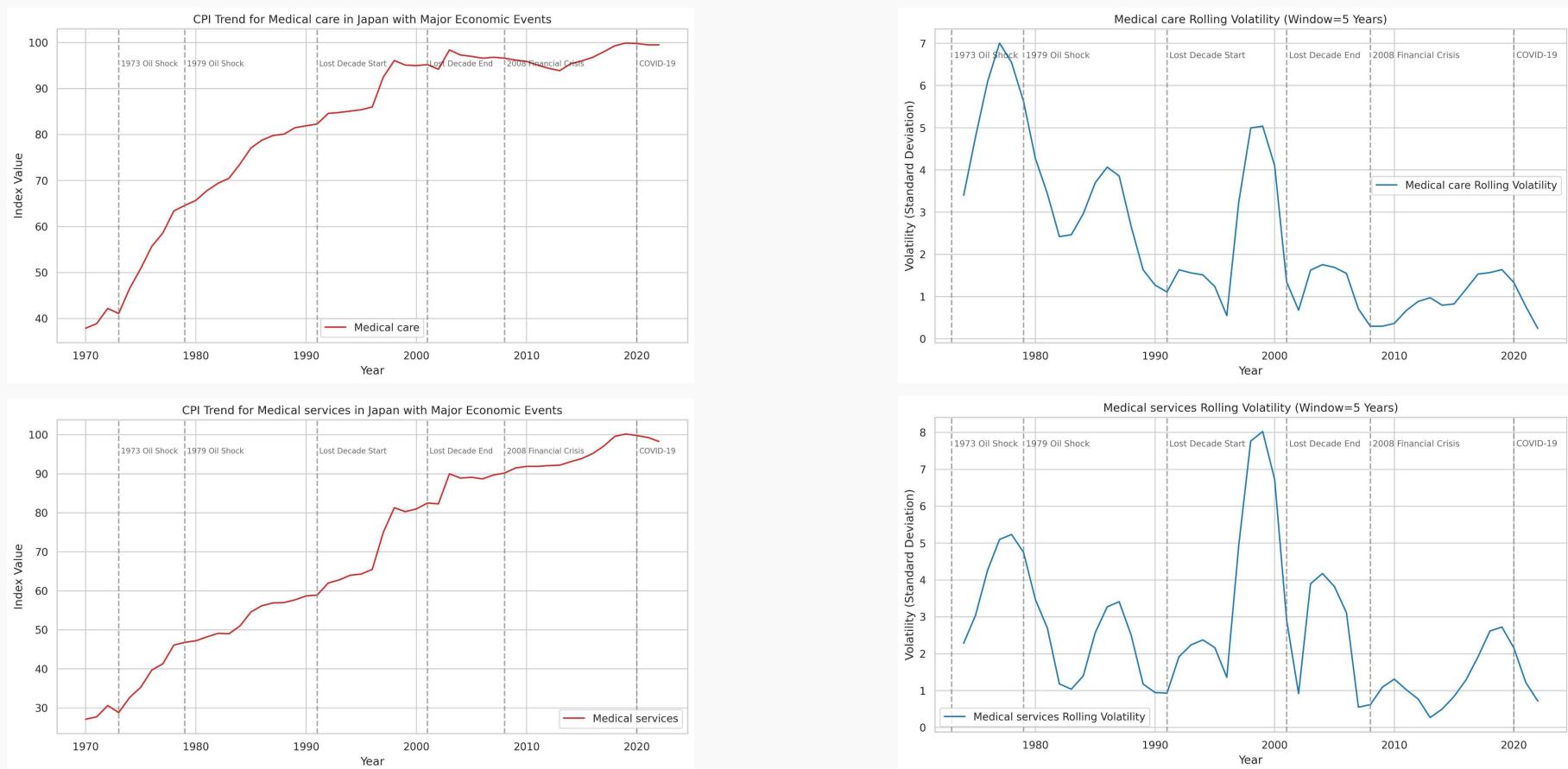
- Rent CPI shows a steady, near-linear increase, with low volatility compared to food and energy.
- Housing CPI (broader category) moves almost in parallel with Rent, reinforcing long-run stability.
- Unlike volatile necessities (e.g., fuel, fruits), housing prices reflect structural, slow-moving trends tied to demographics and policy
- During the Lost Decade, rent and housing costs continued to rise gradually, highlighting stickiness even amid deflationary pressures.
- These patterns suggest housing is a stable, long-term cost burden, not subject to short-term shocks.

# Results (Education)

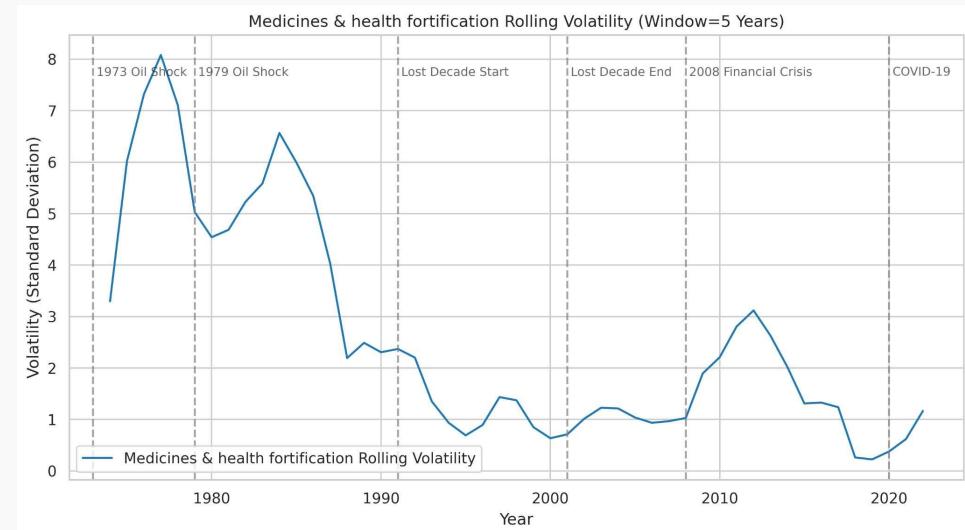
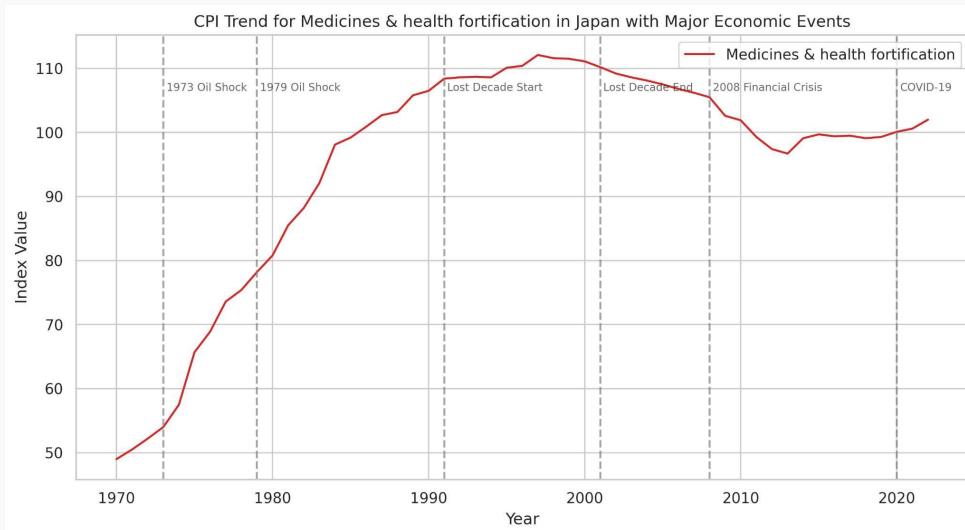


- Education costs rose steadily and consistently, showing little short-term volatility.
- This reflects a structural upward trend, driven more by policy and demographics than market shocks and volatility.

# Results (Medical Care and Medical Services)



# Results (Medicines)



# Results (Medical Care At Large)

- Medical Care CPI overall trends upward, showing healthcare costs steadily rising over time.
- Volatility is relatively low, unlike energy or food, reflecting persistent demand.
- Medical Services (doctor visits, hospital care) climb at a consistent pace, with minimal shocks.
- Medicines & Health Fortification also show sustained increases, linked to prescription and wellness markets.
- Growth in services is slightly faster than goods, highlighting labor and facility cost pressures.
- Healthcare inflation appears structural and ongoing, rather than cyclical or event driven.

# Key Takeaways & Future Work

## Conclusion

- Japan's CPI trends reveal clear differences in volatility: energy prices are highly reactive to global shocks, while housing and education remain more stable.
- Major economic events, from the 1970s oil crises to COVID-19, show direct, visible impacts on consumer prices.
- This analysis highlights the importance of separating stable vs. volatile CPI components for understanding inflation dynamics

## Future Work

- Compare CPI volatility across other countries, such as the United States
- Use time-series models (ARIMA, LSTM) to forecast CPI movements in volatile categories.
- Incorporate additional macroeconomic indicators (wages, unemployment, exchange rates) for richer analysis.