EDA of Milling Copra and Coconut Oil Prices

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Overview

This dataset contains monthly average price records (in Rs/Ql) of Milling Copra and Coconut Oil Prices from Kangayam market between January 2012 and March 2025.

Dataset has three columns:

- Product (‘Coconut Oil’, ’Milling Copra’)
- Month
- Monthly Average Price

Let's perform a comprehensive EDA to understand the price trends and patterns.

Key observations:

- The dataset contains 310 monthly average price records
- Date range: 1st January 2012 to 1st March 2025
- Product: Coconut Oil and Milling Copra
- Single market: "Kangayam"
- Price column: "Kangayam-Price(Rs/Ql)"

Findings:

- No missing values found
- No duplicate records found
- Date format standardized

Dataset Description:

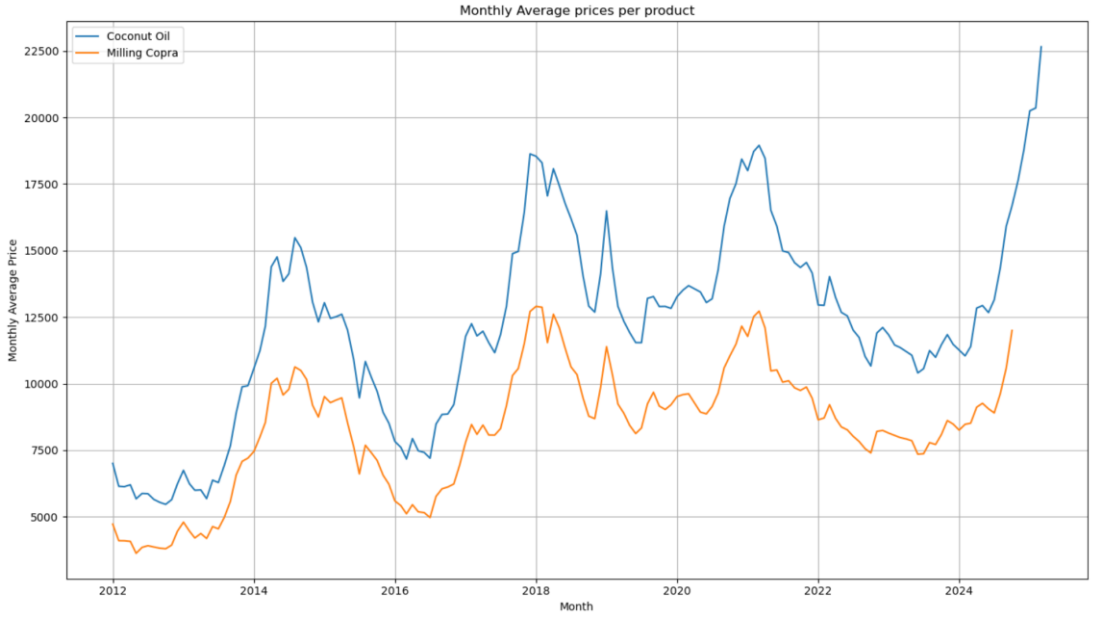
	Monthly Average Price
Count	311.000000
Mean	10282.399254
Std	3655.568401
Min	3624.193548
25%	7827.822581
50%	9848.387097
75%	12639.950000
Max	22658.096774

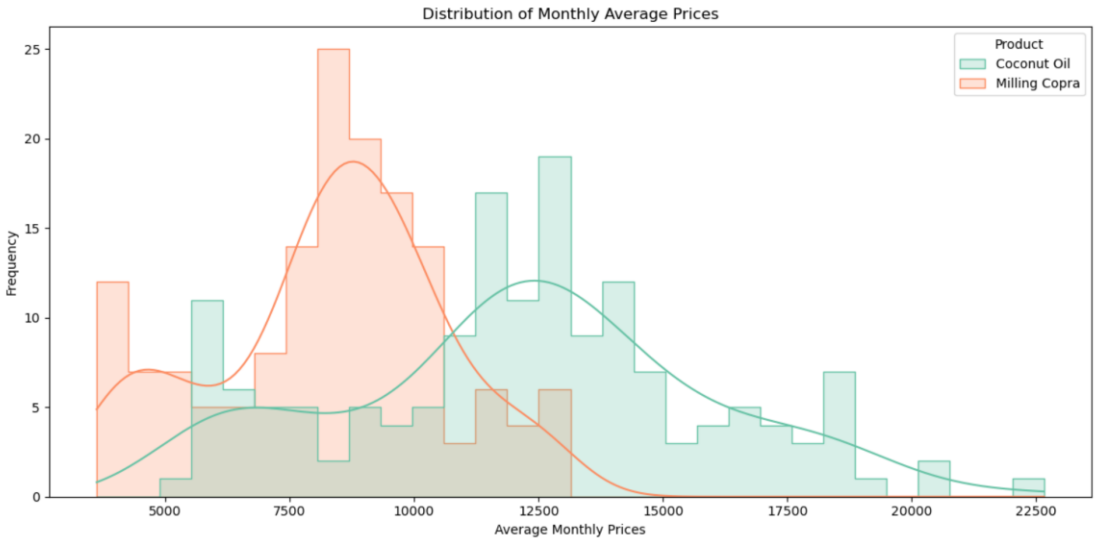
Time Series Analysis

Distribution:

1) Monthly Average Price Per Product

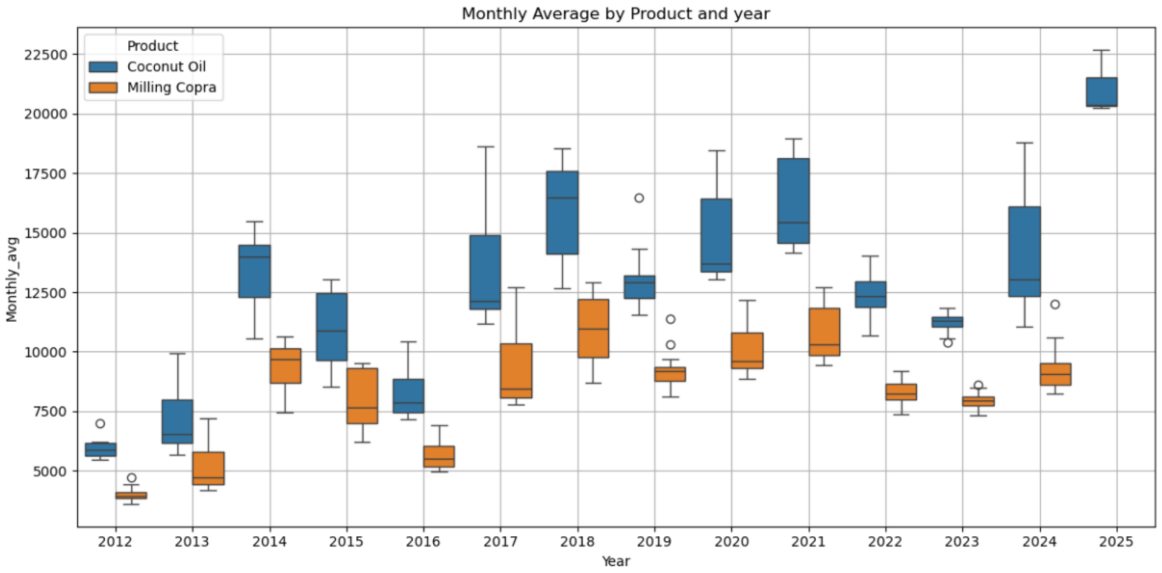
- In the below graph, we can consistently see that the prices of coconut oil are higher than milling copra throughout the time period.
- There are sudden spikes in prices in both the product in 2014, 2018 and time period between 2020 to 2022.
- There is also sudden drop in both products in time period between 2022 to 2024.
- Coconut oil prices show much more volatility than compared to milling copra.
- Coconut Oil distribution is wider and rightly skewed.
- Coconut Oil shows more variation in prices ranging from 6000 to 22000.
- Milling Copra distribution is more symmetric and much narrower concentrated between 6000 to 12000.
- Coconut Oil prices are more volatile and susceptible to variation, giving more profit to traders.





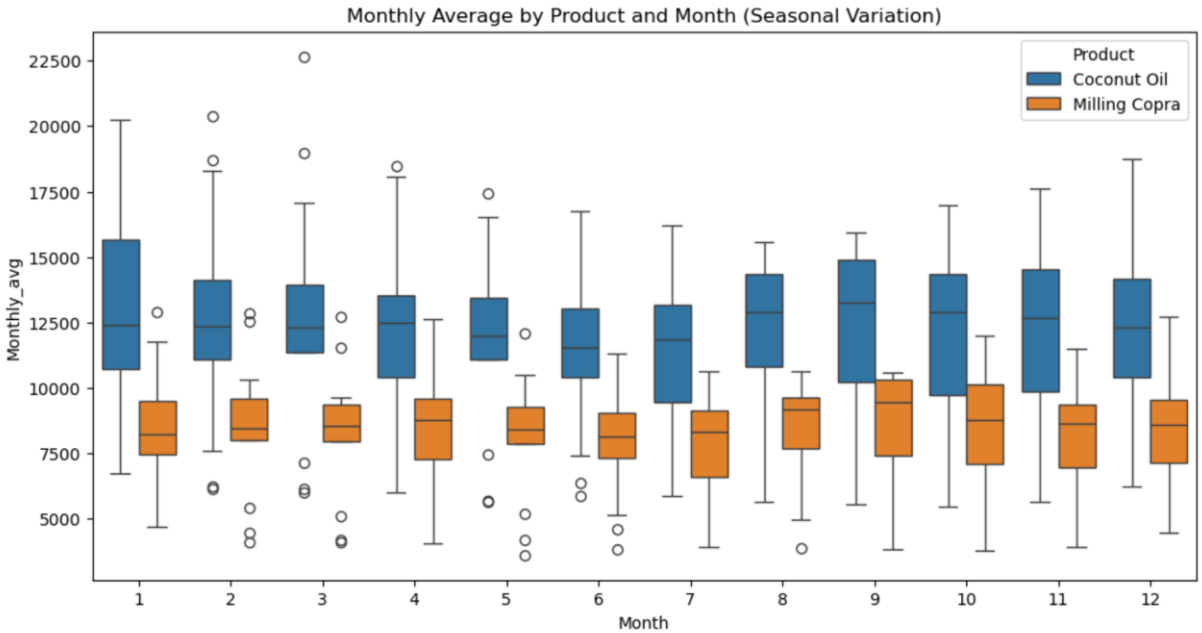
2) Monthly Average Price By Product and Year

- In the below box plot, Coconut Oil has higher prices and volatility each year.
- Milling Copra is more stable has more consistent price.
- Major peaks in prices of Coconut Oil occurred in 2014, 2018, 2020 - 2021



3) Monthly Average Price By Product and Month (Seasonal Variation)

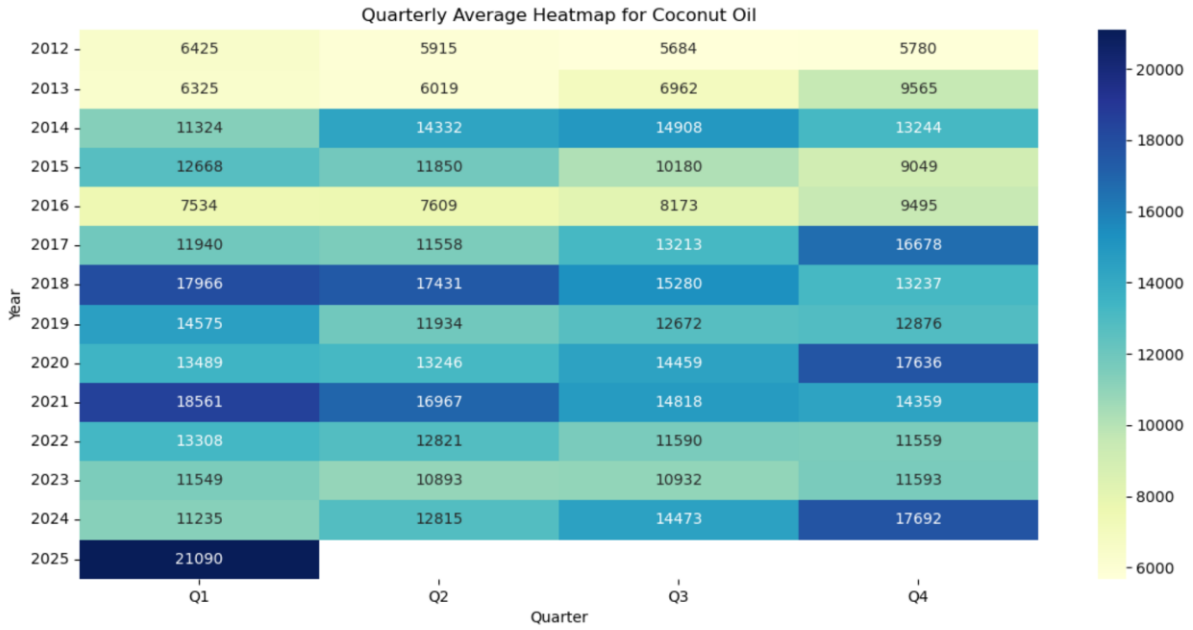
- In the below box plot, Coconut Oil has higher peaks in start and end of the year, and stabilizes in mid-year, which shows seasonality.
- End of the year in India coincides with various festivals and religious events increasing the demand for coconut oil. ex : **Sabarimala pilgrimage**
- Milling Copra shows more stable and consistent prices throughout the year possibly due to
    a. Year round harvesting
    b. MSPs
    c. Consistent Demand
- Milling Copra has slight rise from July to October indicating seasonal price lift possibly due to
    a. Farmers gets high prices from fresh Coconut than Copra
    b. July to October is rainy season in India which impacts factors like harvesting, supply, transportation.

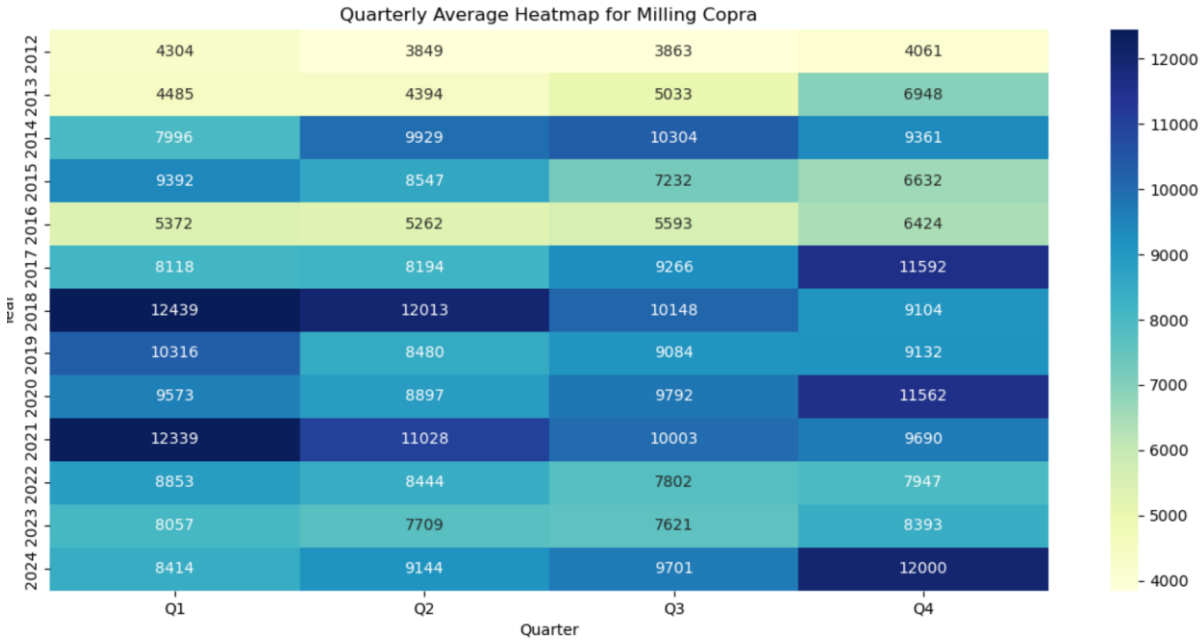


Heatmap:

Quarterly Average Heatmap

- In Coconut Oil we can see the highest price in Q1 and Q4 (recurring seasonal spikes), with highest been in March 2025.
- There are several high prices values between 2018 and 2021.
- Milling Copra we see significant price rise in 2018 and 2021 in Q1 and Q2,
- whereas in 2017,2020,2024 Q4 observes relevant spike in prices of copra.





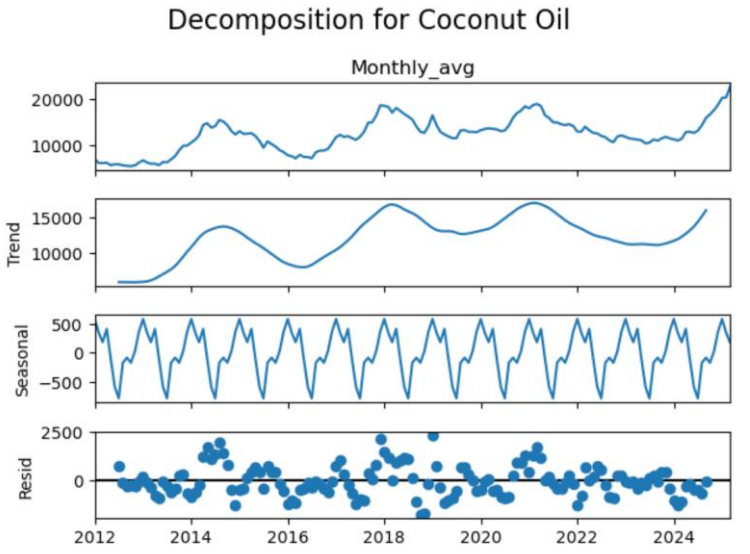
Decomposition:

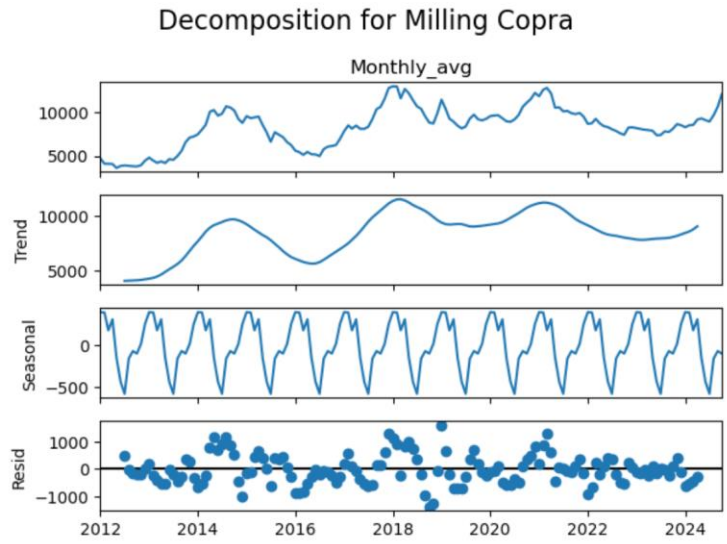
Coconut Oil Decomposition

- In raw time series we see major peaks around 2018 to 2022, trough during 2022 to 2024, then again rise from 2024.
- In overall time period it shows upward long term trend.
- There is a strong presence of seasonality, indicating annual cycle.
- Residuals mostly hover around zero, suggesting the decomposition has effectively separated the predictable parts from the noise.

Milling Copra Decomposition

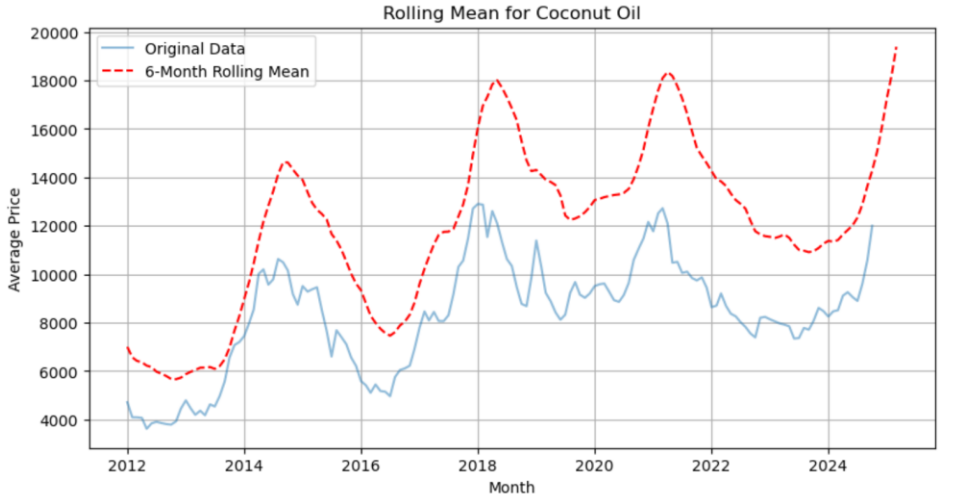
- In raw time series we see major peaks around 2014 to 2015 and 2018 and between 2020 to 2022, dips during 2016 and 2022 to 2024, then again rise from 2024.
- In overall time period it shows upward short term trend.
- There is a strong presence of seasonality, indicating annual cycle with few months having lower prices and some months observing price hikes.
- Residuals mostly hover around zero, suggesting the decomposition has effectively separated the predictable parts from the noise.
- Prices are consistent within year pattern.

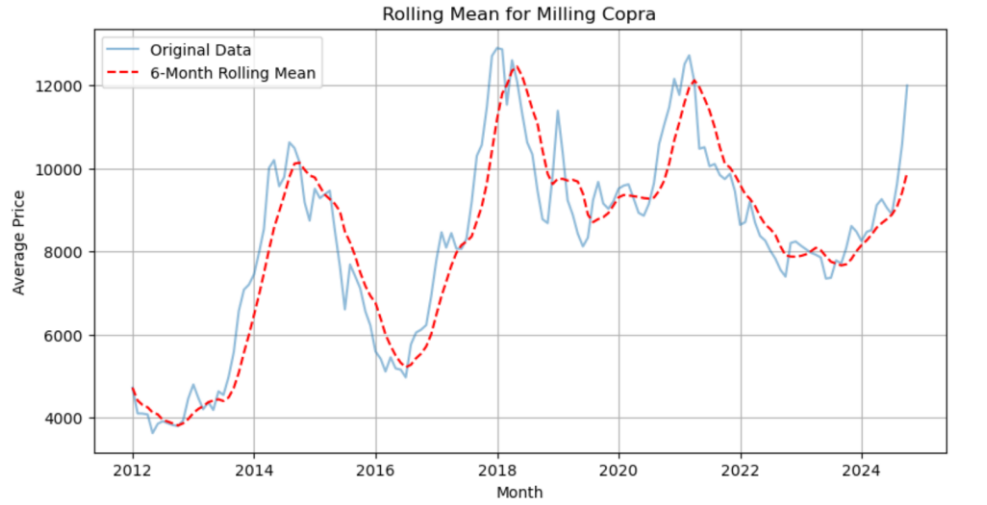




Rolling Mean:

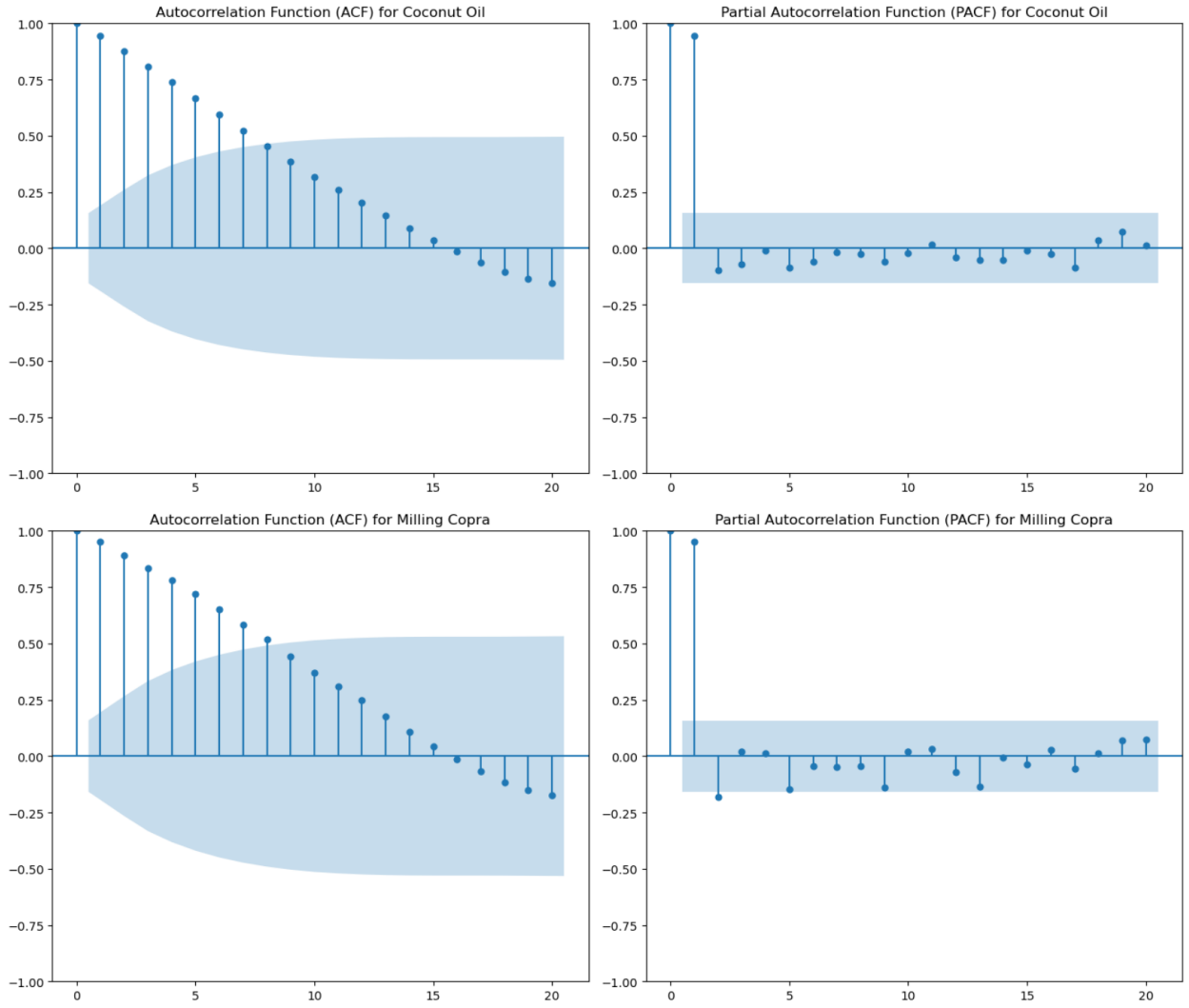
- After smoothing out random noises we can see clear upward trend in both Coconut Oil and Milling Copra.
- Coconut Oil shows sudden market surge in 2014,2018, 2021 whereas in Copra surge around 2015,2018.
- Both the product shows major dip around 2022 to 2024.
- Again market spikes from 2024.





Autocorrelation:

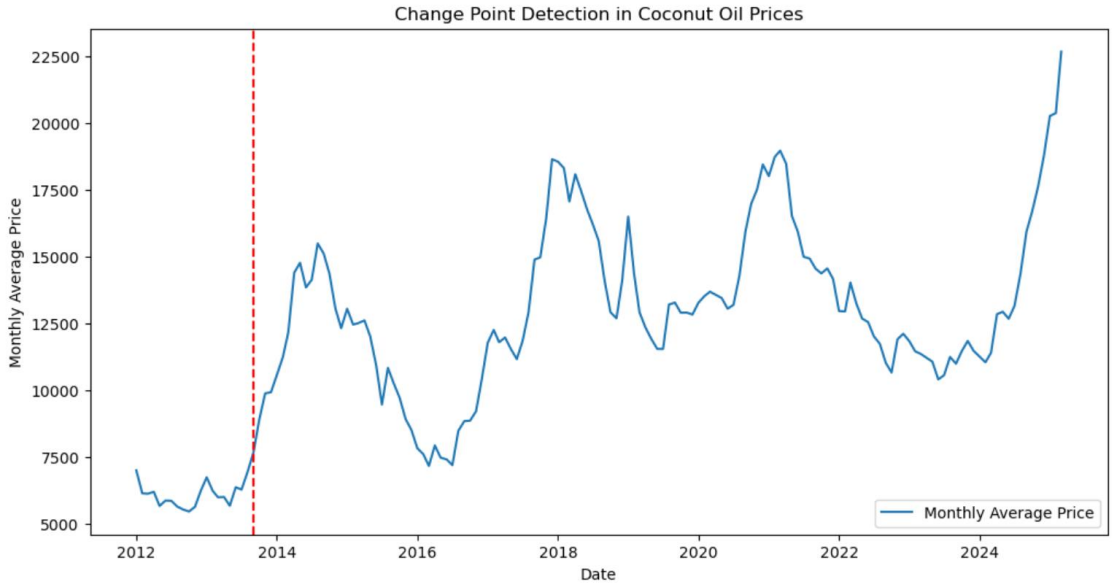
- Gradual exponential decay in lags in ACF plot of both Coconut Oil and Copra shows strong autocorrelation.
- This shows current prices are affected by previous month.
- PACF plot for both Coconut oil and copra shows sharp drop after lag 1.
- This PACF plot shows that previous month price has direct impact on current month price.

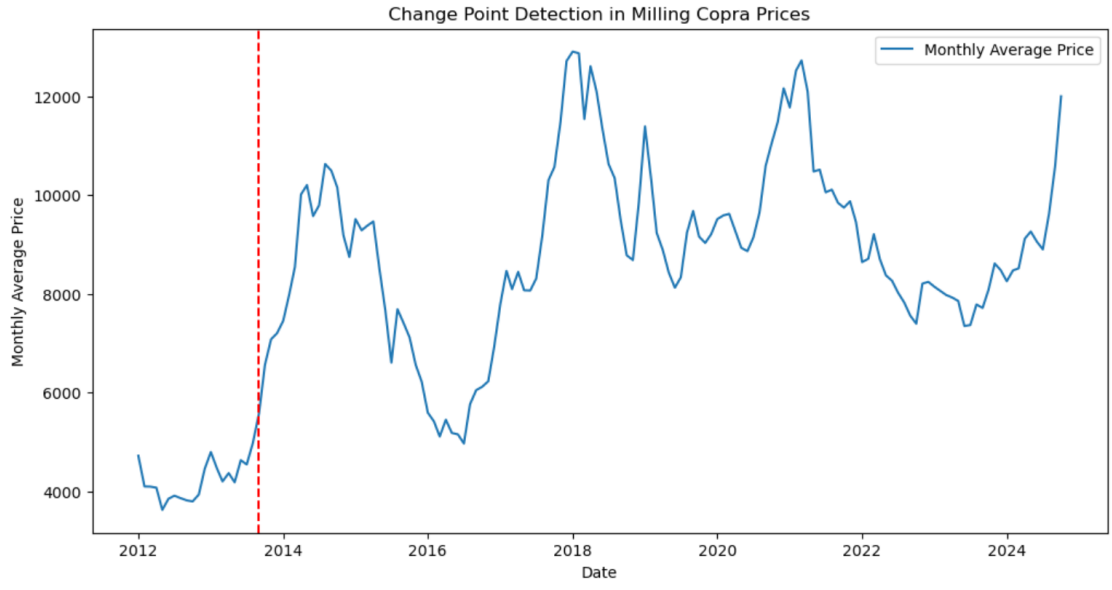


Change Point Detection:

Radial Basis Function (RBF)

- RBF model is used to detect non-linear changes in trend.
- Change point around late 2013 to early 2014.
- Before the change point: prices were relatively stable and low.
- After the change point: prices show higher fluctuations and multiple peaks, indicating increased market dynamics or policy/economic changes.





Volatility:

Annual

- For both products, you can clearly see three major volatility phases:
  - 2014
  - 2017–2018
  - 2024–2025
- In 2014 we see first major spike where price regime change (confirmed by change point detection)
- In 2017–2018 again we saw peak volatility which is caused by market disruption (possibly policy, weather, or demand shock)
- In 2024–2025 it rising again possibly due to renewed uncertainty, large price surges.

Product	Coconut Oil	Milling Copra
Year		
2012	426.996686	303.815586
2013	1525.602206	1119.256717
2014	1572.365725	1020.611705
2015	1574.107263	1234.938737
2016	982.901321	578.255085
2017	2353.525715	1602.859660
2018	2086.821533	1531.726501
2019	1347.750753	898.496373
2020	1987.476941	1100.951612
2021	1873.445530	1175.106270
2022	944.231213	516.797965
2023	440.404674	379.353895
2024	2607.654401	1136.937975
2025	1359.310571	NaN