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Correlation Analysis of Global Commodities and US Stock Indices (2010–2024)

A Time Series Exploration of Correlations Between Key Global Commodities and US Stock Indices

This presentation explores the correlation between key global commodities, such as crude oil, industrial metals, and the US dollar strength, alongside major stock indices like the NASDAQ 100, over the 2010-2024 period. We will explore why these correlations might exist and their potential implications.

by Mohammed Bookwala

Introduction

1 Objective

To explore and analyze the correlations between global commodities, such as crude oil, platinum, industrial metals, and the US dollar strength, alongside major US stock indices.

2 Importance

Understanding these correlations can provide valuable insights into market dynamics and reveal how different assets are interconnected, helping to explain broader economic trends.

Data Overview

Dataset

The data consists of multiple datasets sourced primarily from Kaggle, covering global commodities like crude oil, palladium, platinum, and industrial metals, as well as key US stock indices such as the Nasdaq 100 and the US dollar strength. The data spans from 2010 to 2024. These datasets were merged, cleaned, and any missing or null values were removed to ensure accuracy. The key columns in the dataset include the time period, commodity prices, stock indices, and the US dollar index.

Preprocessing

The data was scaled using the Min-Max normalization method to ensure comparability and for easier plotting of the correlations.
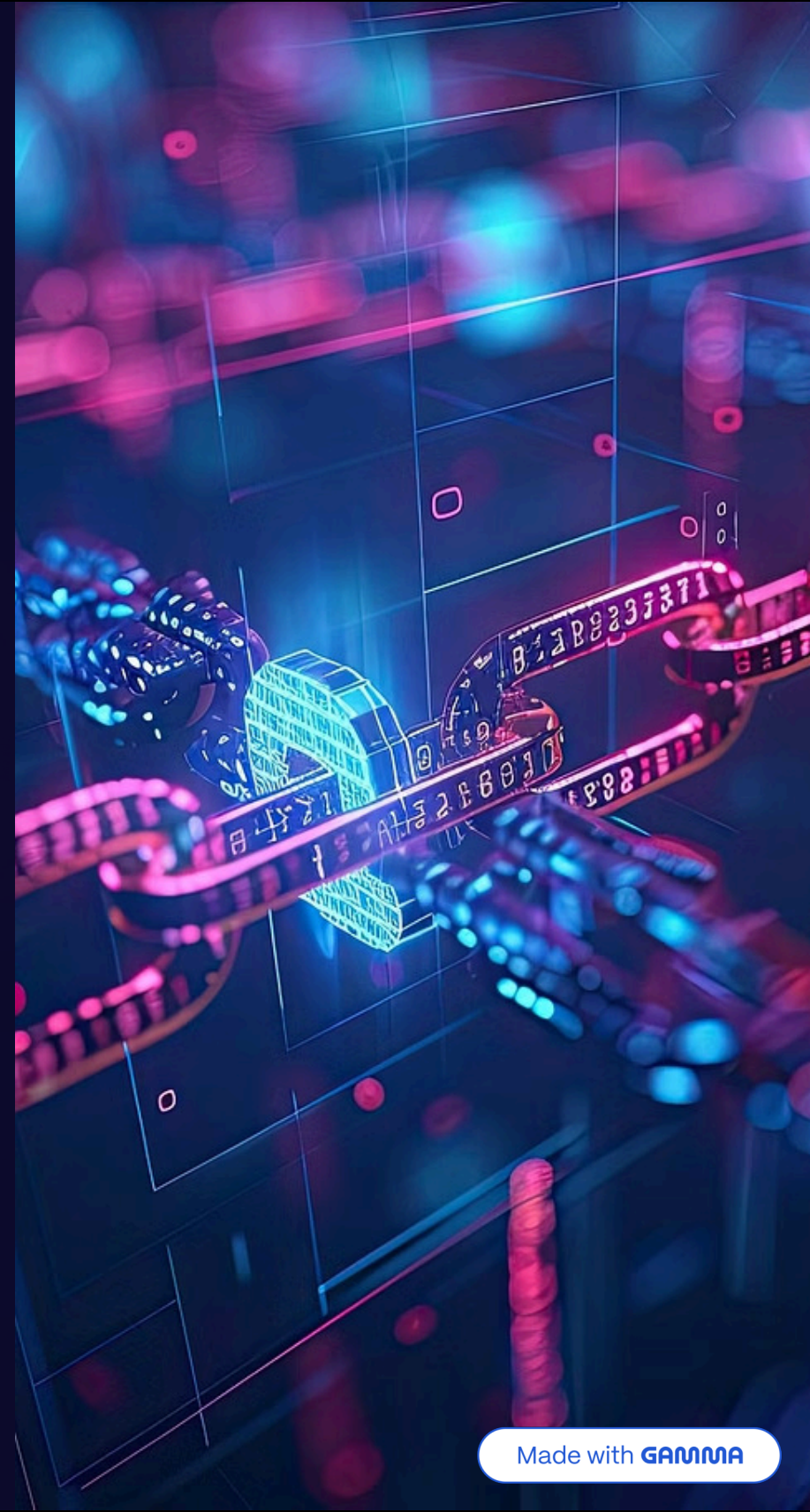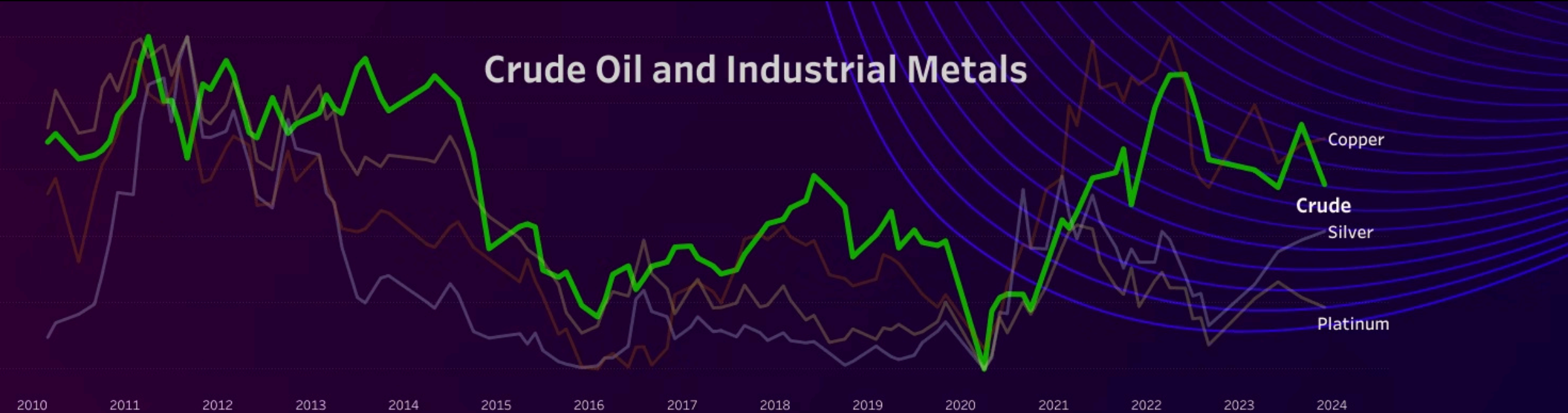
Methodology

Correlation Analysis

Pearson correlation coefficient was used to measure the strength and direction of relationships between variables.

Rolling correlation analysis was applied to explore time-based changes in the relationships.
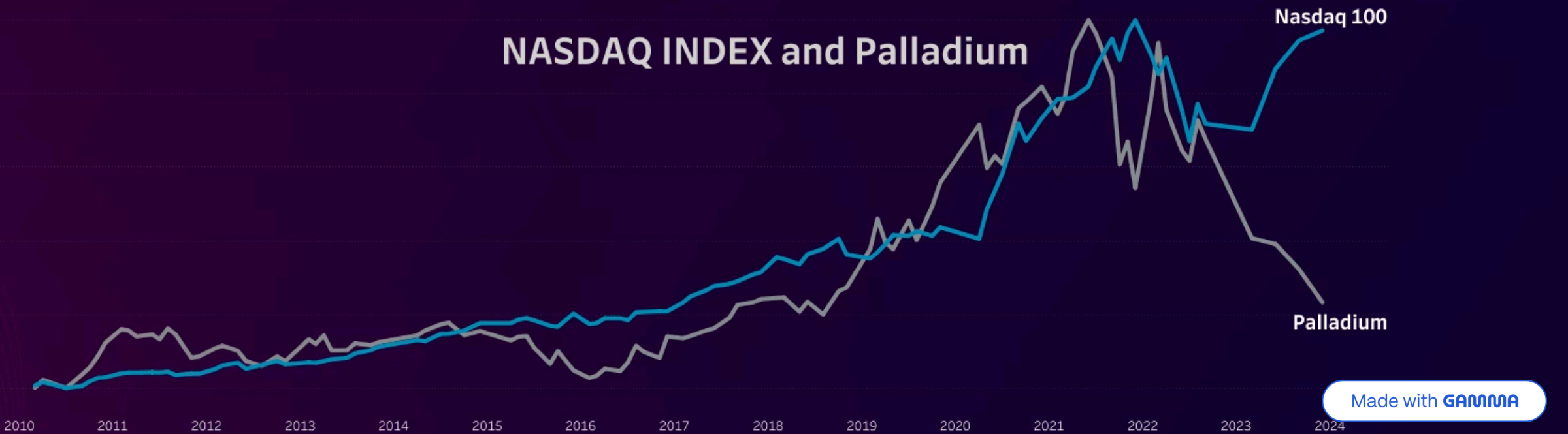
Tools Used

Jupyter Notebook was used for data processing, cleaning, normalization, and visualization. Key libraries such as pandas and Matplotlib were employed for these tasks. For advanced data visualization, **Tableau** was utilized.

Crude Oil and Industrial Metals

Copper
Crude
Silver
Platinum

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

NASDAQ INDEX and Palladium

Nasdaq 100
Palladium

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

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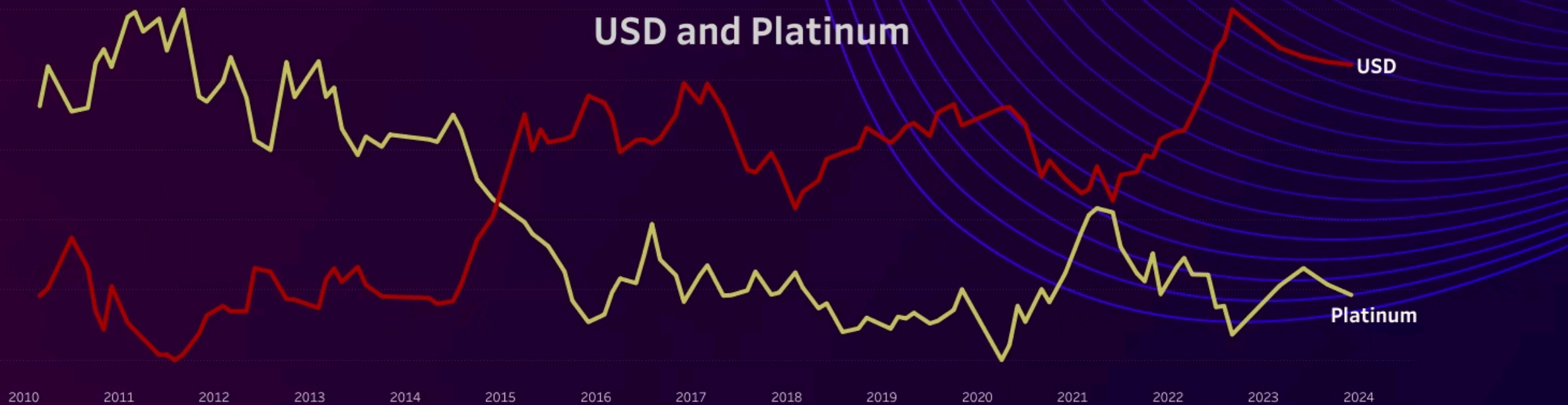
Key Positive Correlations

Crude Oil & Industrial Metals (**0.67** correlation)

These commodities show a strong positive correlation as both are driven by global economic activity. Industrial expansion increases the demand for energy (oil) and raw materials (metals).
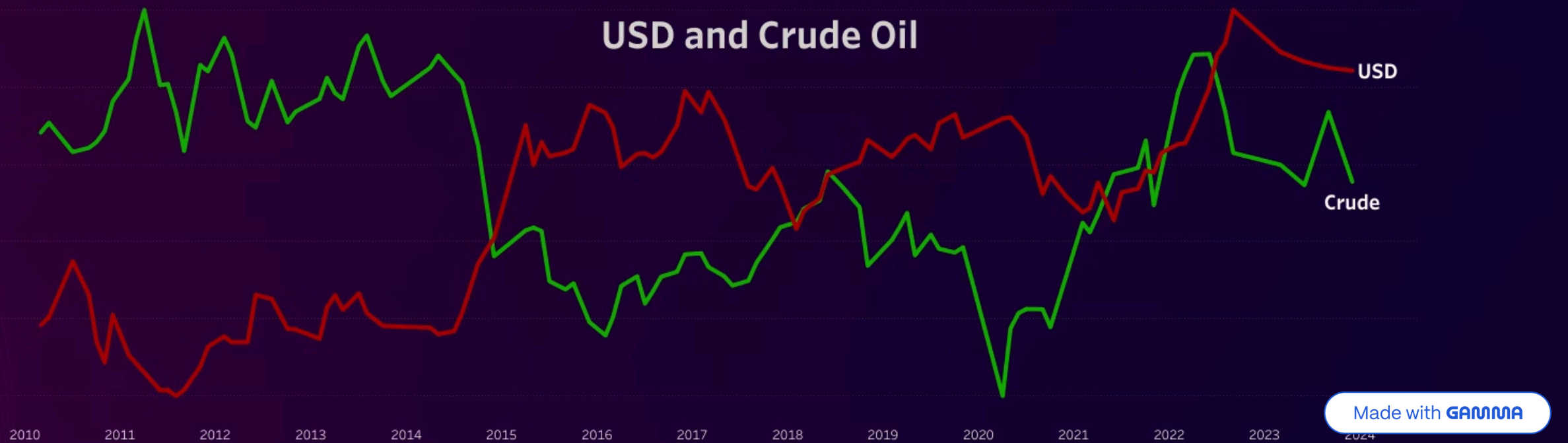
NASDAQ-100 & Palladium (**0.86** correlation)

The high correlation highlights the tech sector's reliance on palladium, which is essential for electronics. As tech demand grows, so does the need for palladium.

USD and Platinum

USD

Platinum

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

USD and Crude Oil

USD

Crude

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
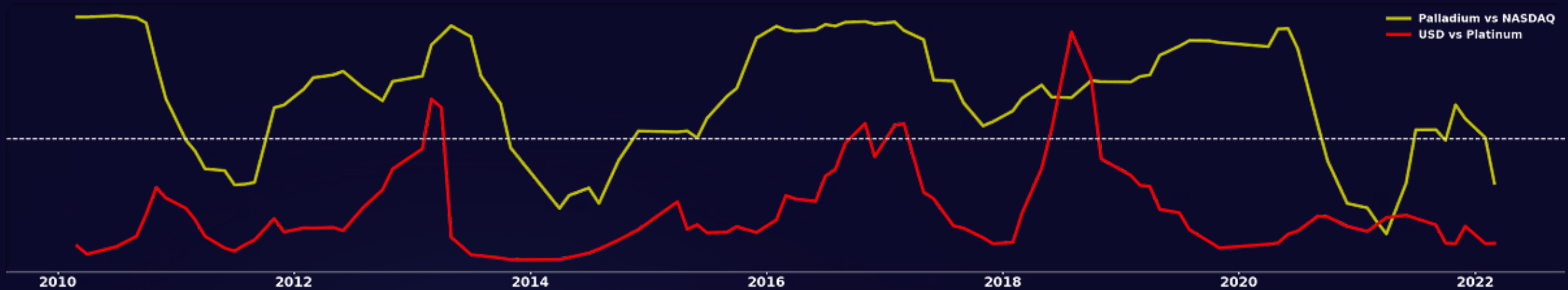
Key Negative Correlations

US Dollar & Platinum (**-0.91** correlation)

A strong negative correlation indicates that when the US dollar strengthens, platinum prices typically fall. This is common with precious metals, as they are often seen as a hedge against currency strength.

US Dollar & Crude Oil (**-0.60** correlation)

The moderate negative correlation shows that crude oil prices tend to decrease as the US dollar strengthens, likely due to oil being priced in dollars on global markets.

Rolling Correlations of US Dollar/Platinum and NASDAQ/Palladium

This plot displays the rolling correlation between two pairs of variables: the US Dollar and Platinum (negative correlation) and Palladium and NASDAQ (positive correlation). The rolling correlation helps visualize how the strength and direction of these relationships change over time, highlighting periods where the correlation was stronger or weaker.

Conclusion

Summary of Results

The analysis uncovers significant positive and negative correlations between global commodities (such as crude oil, platinum, and palladium) and major US stock indices, highlighting their dynamic relationships and the economic factors driving these correlations.

Future Directions

Future research could explore the use of machine learning and deep learning algorithms for forecasting trends and detecting anomalies in the dataset. These methods could uncover hidden patterns that may be linked to geopolitical or economic events, adding depth to the analysis. Additionally, expanding the dataset or incorporating more variables could enhance the predictive power and provide more accurate insights into market dynamics.