What Really Drives Inflation in Nigeria? A 21-Year Economic Analysis

This dataset provides a comprehensive overview of monthly inflation rates in Nigeria from March 2003 to June 2024, alongside key economic indicators such as crude oil prices, production levels, and various Consumer Price Index (CPI) components. The data captures important economic trends and is suitable for time series analysis, forecasting, and economic modeling.

The dataset includes the following features:

- **Inflation Rate**: The monthly inflation rate in Nigeria, reflecting the change in consumer prices.
- **Crude Oil Price**: The monthly average price of crude oil, which plays a significant role in Nigeria's economy.
- **Production and Export**: Monthly crude oil production and export figures, representing key components of Nigeria's GDP.
- **CPI Components**: Detailed breakdown of the Consumer Price Index, including food, energy, health, transport, communication, and education.

Data Source: This dataset was downloaded from Kaggle: Nigeria Inflation Rates - Kaggle

I plot a line chart showing monthly inflation rates in Nigeria from 2003 to 2024.

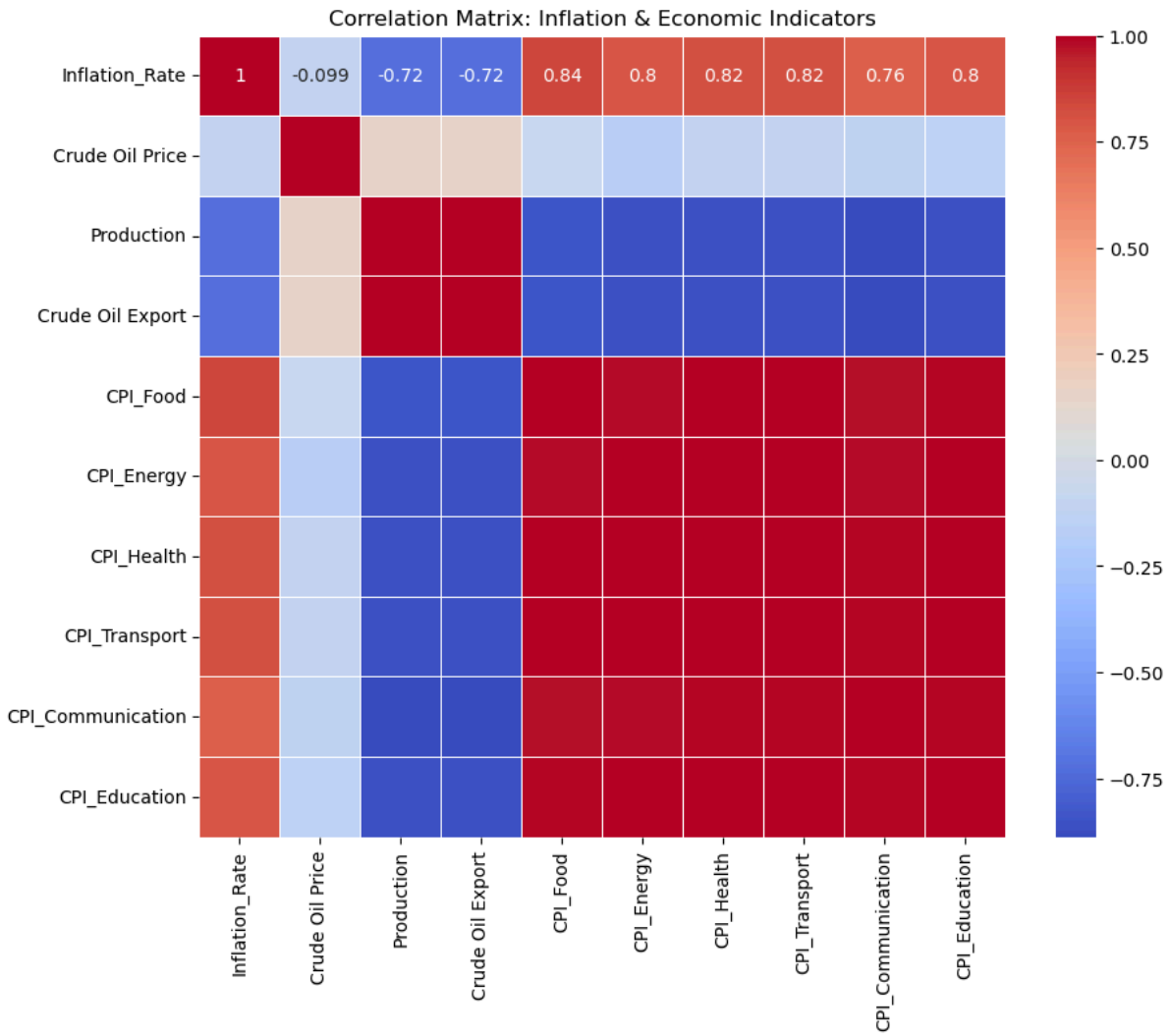
What is Inflation?

Inflation is the rate at which the prices of goods and services increase over time. If inflation is high, your money buys less than before.

Key Takeaways from the Graph

1. **2008–2015: Mostly Stable Inflation**
    - Inflation stayed between 8% and 15%
    - This means prices were rising, but not too fast — manageable for many people
2. **2016 Spike**
    - In 2016–2017, inflation rose sharply to nearly 19%
    - Likely caused by Nigeria's economic recession, falling oil prices, and a devaluation of the naira
3. **2018–2019: A Brief Calm**
    - Inflation dropped again, hovering around 11–12%
4. **2020 Onward: Rising Again**
    - Around COVID-19 and its aftermath (2020–2021), inflation began climbing again
    - By 2023–2024, it shot up to over 34%, which is very high
    - This means prices more than tripled over the years in some cases
    - Likely driven by economic instability, exchange rate issues, and rising cost of food and fuel

I also plotted a correlation heatmap that reveals several key insights into what drives inflation in Nigeria based on the dataset.



Key Findings from the Correlation Matrix

Strong Positive Correlations with Inflation:

Variable	Correlation with Inflation_Rate
CPI_Food	+0.84
CPI_Energy	+0.80
CPI_Health	+0.82
CPI_Transport	+0.76
CPI_Communication	+0.82
CPI_Education	+0.80

Interpretation: CPI components have the strongest influence on inflation. Particularly:

- Rising food and energy costs appear to drive up inflation
- Education, health, and communication costs also have high influence

Negative Correlations:

Variable	Correlation
Production	-0.72
Crude Oil Export	-0.84
Crude Oil Price	-0.099 (weak)

Interpretation:

- Higher oil exports & production correlate with lower inflation
- Surprisingly, oil price itself has a weak correlation (possibly due to subsidy, exchange rate controls, or delayed pass-through effects)

Insights Summary

What causes inflation in Nigeria (from this dataset)?

- Domestic price pressures in food, energy, transport, and basic services
- Structural weaknesses from low production and poor oil export performance
- Global oil prices are not the major driver of inflation alone — local inefficiencies may play a stronger role

Then I proceed with Granger Causality Testing to determine which variables "cause" changes in inflation, statistically speaking.
Granger causality doesn't prove true causation, but it tests whether past values of one variable help predict another.
E.g., does past CPI_Food help predict Inflation_Rate?

Granger Causality Results: Insights

From the results:

- **Crude Oil Export Granger-causes Inflation Rate**
    - Lag 1 ($p = 0.0134$) and Lag 6 ($p = 0.0090$) show statistical significance ($p < 0.05$)

    - This means changes in Crude Oil Export can help predict inflation one month ahead and also six months ahead

- **Other Variables**
    - No mention of significant causality for:
        - CPI_Food
        - CPI_Energy
        - CPI_Health
        - CPI_Transport
        - CPI_Education
        - Production

These may be correlated with inflation (as your heatmap showed), but their past values don't predict future inflation with statistical certainty at least in this test window.

Interpretation & Implications

Insight:
Despite strong correlations with CPI components, Crude Oil Export is the only variable that significantly Granger-causes inflation. This suggests:

- Export performance has predictive power over inflation trends.
- Inflation in Nigeria might be sensitive to foreign exchange earnings or government revenue from exports.

Why is it that the CPI components are strongly correlated to the inflation rate which means it's CPI components that cause inflation, but Granger causality predicted that crude oil export is the cause of inflation rate?

First: What is CPI and Inflation?
CPI (Consumer Price Index) is like a price basket of things people buy: food, energy, transport, health, etc.
Inflation means how fast the total cost of that basket goes up over time.
So if CPI goes up, it usually means inflation is going up too.

Then Why Are They So Strongly Correlated?
Because CPI is used to calculate inflation.
That's why the graph shows a strong link between CPI (especially food, energy) and inflation.

It's like saying: "When the thermometer goes up, it's hot."
Yes — but the thermometer doesn't cause the heat. It just measures it.

Then What's Granger Causality Saying?
Granger causality looks for what happens before what — like asking:
"What changes today can help us predict inflation tomorrow?"
And it found:

- Crude Oil Export helps predict future inflation
- But CPI components don't — even though they rise with inflation, they don't trigger it first

Imagine inflation is like a fever:

- The CPI is the thermometer — it shows how hot things are getting
- The cause of the fever (like an infection) is crude oil export — when the country earns less from exports, things start going wrong, and prices rise

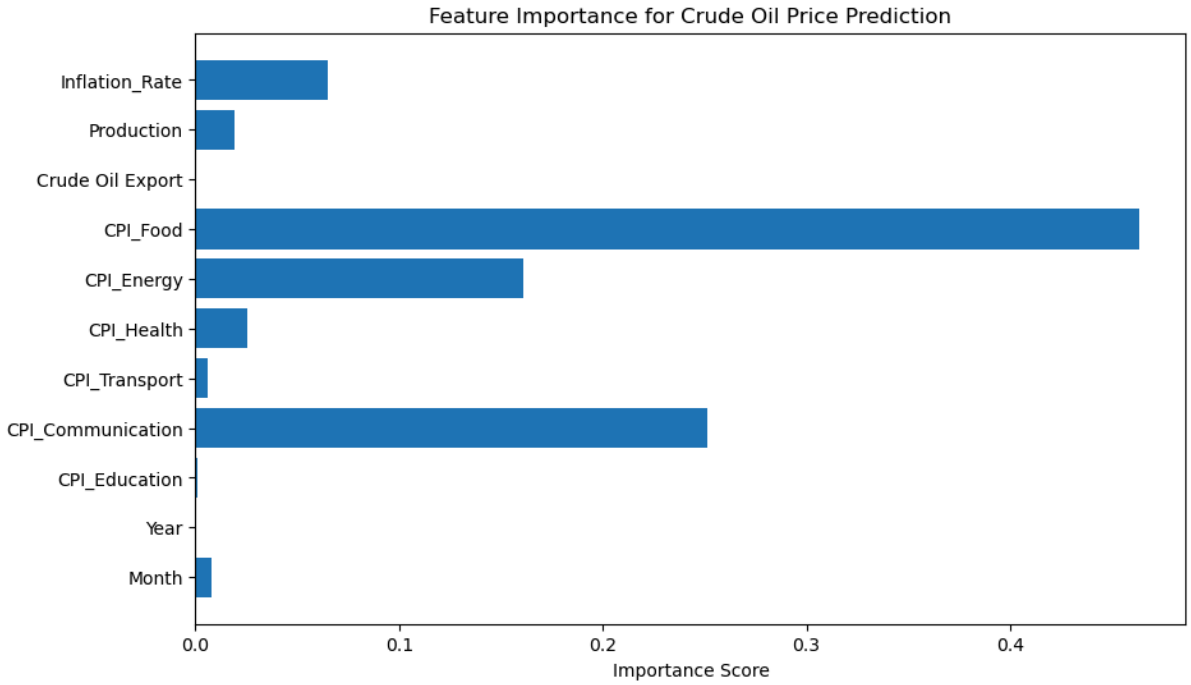
In Summary (Layman's Words):

- CPI is not the cause — it's more like a reflection of rising prices
- Crude oil export is more like the trigger: when Nigeria exports less oil or earns less money, it affects the economy badly and causes inflation later
- So: CPI shows the inflation; crude oil export starts the inflation

I then Proceed to Building a machine learning model to predict Crude Oil Price using other economic and temporal features.

- **RMSE (Root Mean Square Error)**: 6.47 — This indicates the average difference between the actual and predicted oil prices is around 6.47 units.
- **R^2 Score (Coefficient of Determination)**: 0.94 — This means your model explains 94% of the variance in the crude oil price, which indicates very high accuracy.

What the First Chart Shows (Feature Importance for Crude Oil Price Prediction)

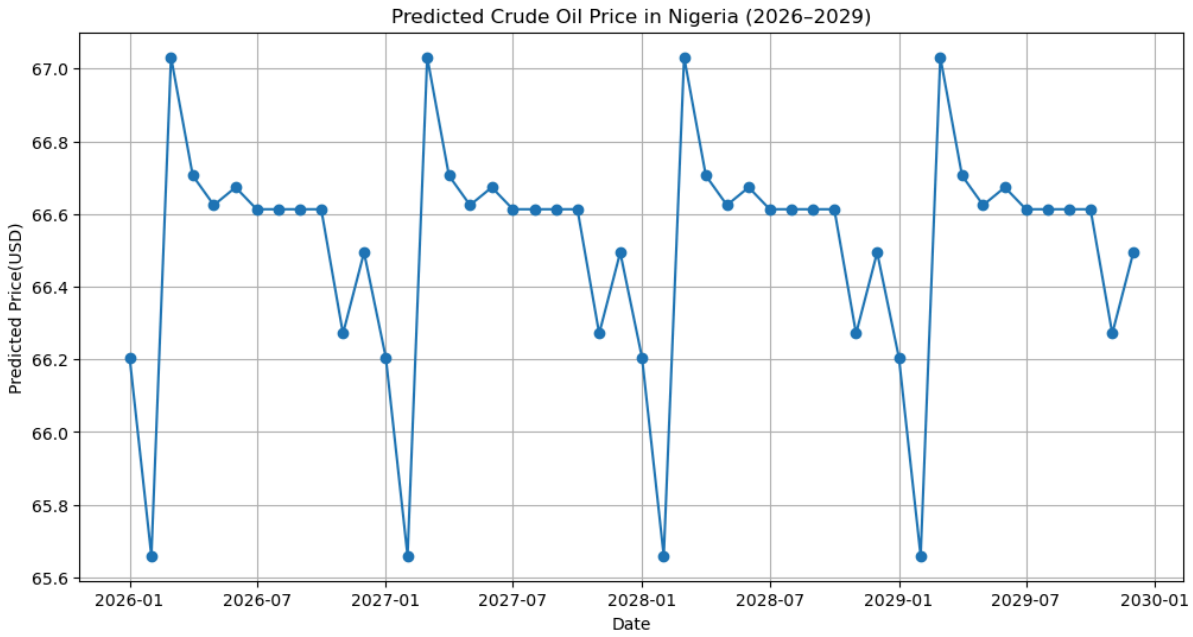


This chart tells us which factors have the biggest impact on oil prices:

- The cost of food affects oil prices the most.
- The cost of communication (like phone and internet) is also very important.
- Energy prices matter too.
- Surprisingly, things like how much oil Nigeria produces or exports don't affect the price as much as you'd expect.

Why this matters: It means oil prices are influenced more by what's happening in the daily economy (especially consumer prices) than just how much oil is being produced.

What the Second Chart Shows (Price Forecast)



This one shows your model's predictions for oil prices from 2026 to 2029:

- Prices stay mostly stable, moving between about ₦65.6 and ₦67.1.
- Each year, there's a little dip around January – kind of like a pattern that repeats every year.

Why this matters: You can expect oil prices to stay fairly steady, but they might drop slightly at the start of each year, possibly due to low demand or market adjustments.

Step-by-Step Estimation: What Will Petrol Cost in Nigeria?

If crude oil is priced at $65.6 per barrel:

1. **Barrel to Liters**:
    - 1 barrel of crude oil = 159 liters
    - So, $65.6 per 159 liters = $0.412 per liter of crude oil
2. **Refining Yield**:
    - A barrel of crude does not convert 100% into petrol.
    - On average, you get about 72 liters of petrol per barrel

- So, crude cost per liter of petrol = $65.6 / 72 ≈ $0.91

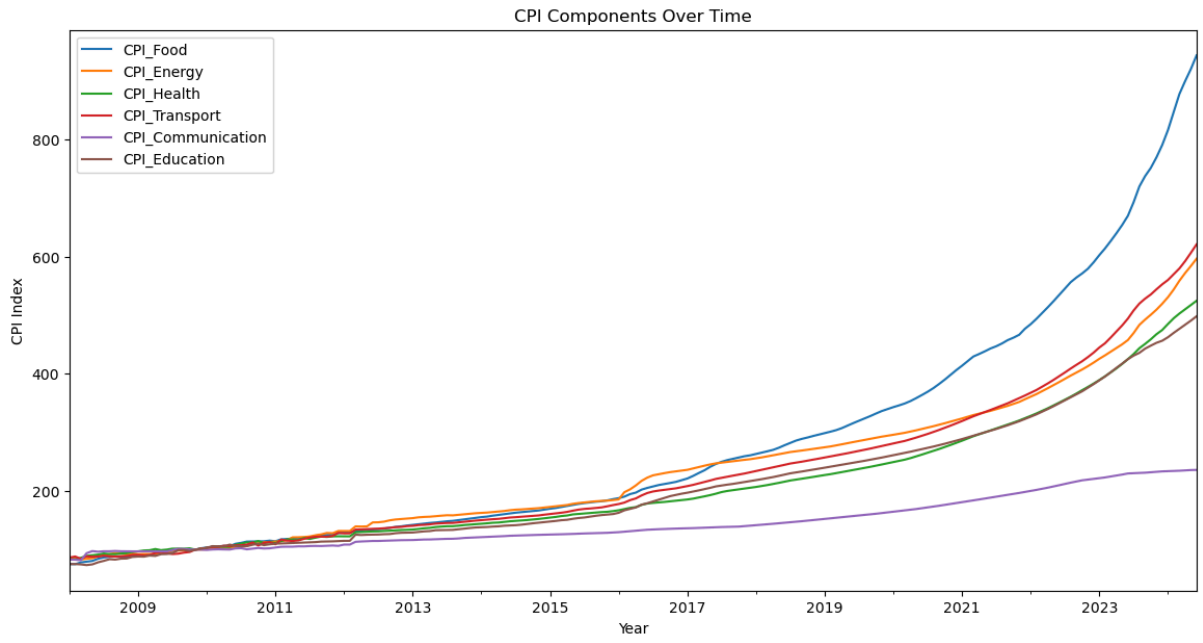
3. **Add Costs**:
    - Refining: ~$0.20
    - Transport/Distribution: ~$0.10
    - Retail Margin: ~$0.10
    - Total Base Cost: ≈ $1.31 per liter
4. **Convert to Naira** (at ₦1,500/USD):
    - $1.31 × 1,500 = ₦1,965 per liter

Summary:

If crude oil = $65.6/barrel, estimated **retail petrol price in Nigeria (no subsidy)** could be:
₦1,900 – ₦2,100 per liter, depending on local costs and policy.

I Also Plotted a Graph Showing How Cost of Living Has Changed Over Time

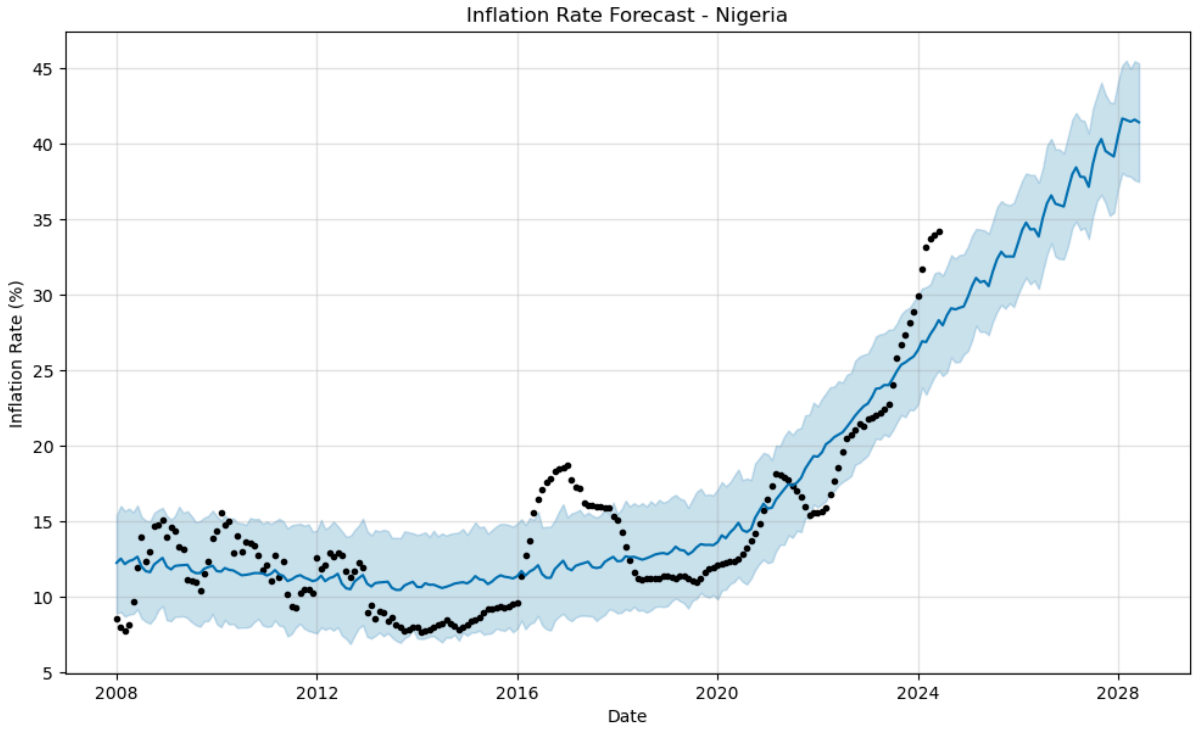
This chart shows how prices of food, energy, transport, education, and other essentials have increased between 2008 and 2024.



Key Takeaways:

- Everything is getting more expensive over time — all the lines are going up.
- **Food prices** have increased the most.
- **Transport and energy** also rose significantly.
- **Communication prices** increased the least.

Inflation Rate Forecast – Nigeria Graph



From the forecast graph:

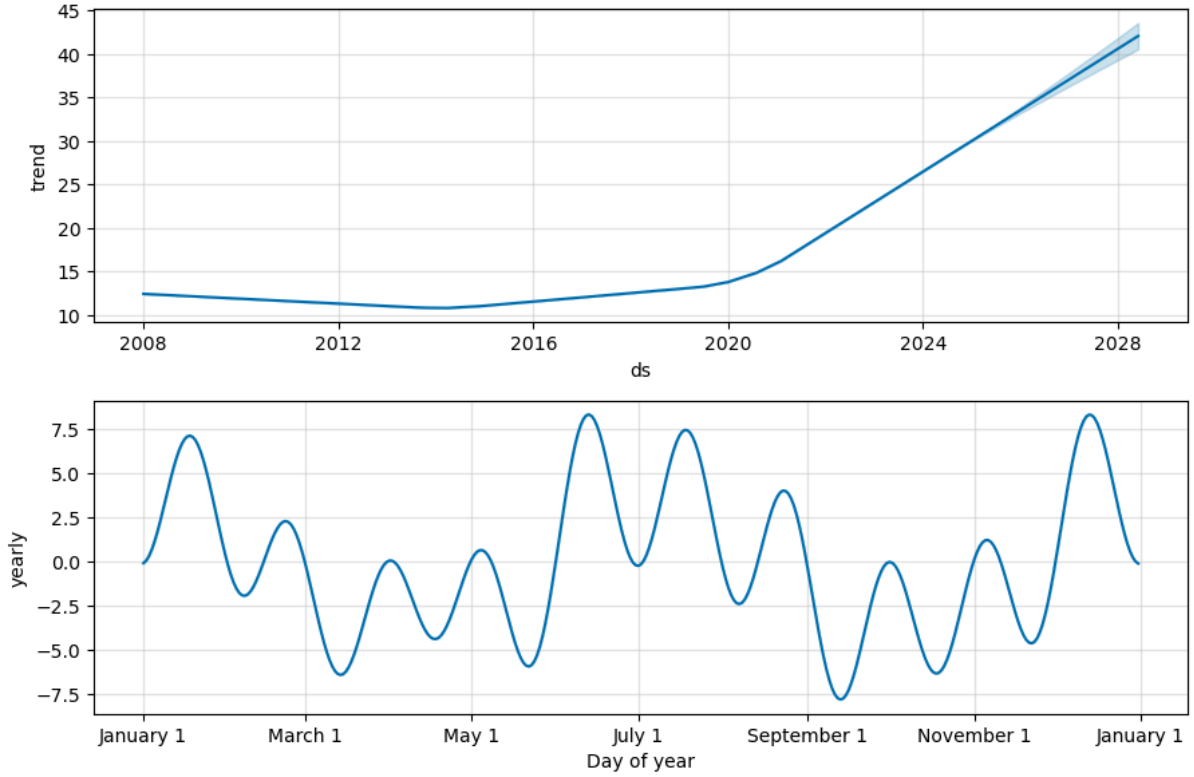
- **Black dots**: Actual historical inflation rates
- **Blue line**: Forecasted future rates
- **Shaded area**: Uncertainty in prediction

Key Insights:

- Stable inflation (below 15%) until 2016

- Steady rise post-2016
- Sharp increase post-2021, with forecasts suggesting it could hit **40–45% by 2028** if trends continue

Trend and Seasonality:



Top Part: Long-term trend — inflation going up significantly since 2020
Bottom Part: Seasonal patterns — prices often rise or fall during certain months

What Might Be the Solution?

Policy Recommendations:

- **Food Security Programs**: Invest in local farming to reduce food price shocks
- **Energy Reform**: Expand domestic power/fuel supply to cut dependency
- **Infrastructure Investment**: Improve health, transport to reduce basic cost-of-living pressure
- **Crude Oil Export Boost**: Earn more FX to stabilize economy

- **Education Funding**: Rising school costs need targeted support

Author Bio

Ayuba Agiri is a data scientist and educator with a good background in Python programming, machine learning, and data analysis. He has conducted impactful research and learnt data science in various bootcamps and academic settings. Passionate about turning complex data into actionable insights, he focuses on making data accessible to everyone.

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