



Forecasting Gas Prices in California

Matheus Grover

Table of Contents

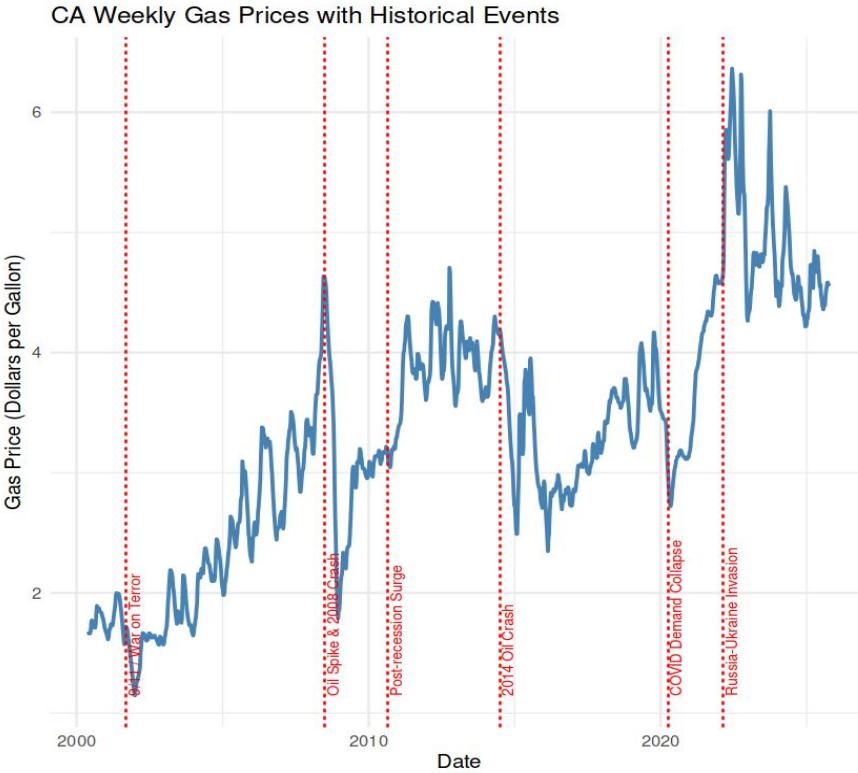
- 1) Motivation
- 2) Gas Price Trends Over Time
- 3) Inflation
- 4) Key Events Driving Gas Price Fluctuations
- 5) Forecast Based on Statistics
- 6) Forecast Based on Expert Judgement
- 7) Conclusion



Motivation

- Gas prices affect everyone: commuters, businesses, and global markets
- Influence inflation, consumer spending, and political decisions
- California gas prices are consistently higher than the U.S. average
- Highly volatile: driven by supply and demand, geopolitics, policies, and global shocks
- Our goal: analyze historical trends and apply forecasting techniques to predict future trends in gas prices

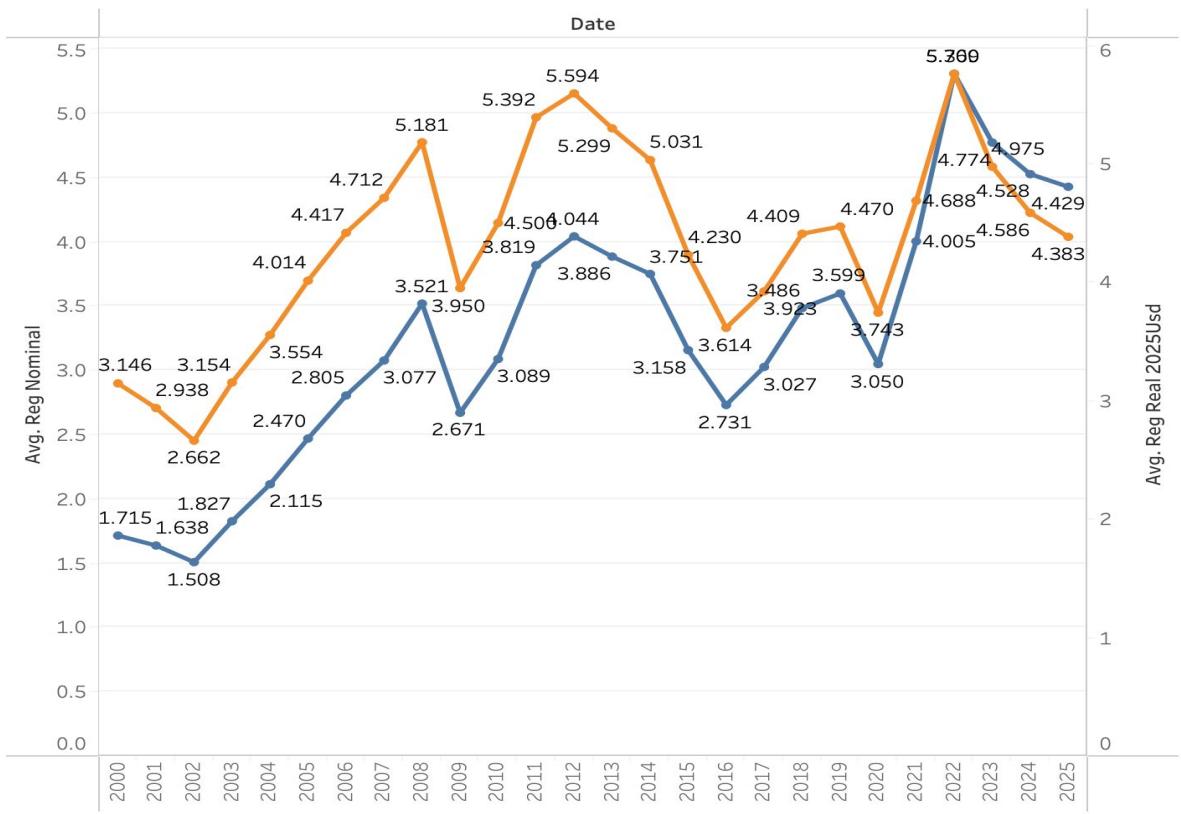
Gas Price Trends Over Time (2000 - Present)



- Long-term upward trend with sharp volatility
- **2001 War on Terror:** early spike
- **2008 Oil Spike & Crash:** sharp rise then collapse
- **2010 Post-Recession Surge:** prices rebounded
- **2014 Oil Crash:** significant drop
- **2020 COVID Demand Collapse:** record lows
- **2022 Russia-Ukraine Invasion:** record highs above \$6

Average Regular CA Gas Prices vs Adjusted for Inflation

- Inflation-adjusted prices allow fair comparisons over time
- Used CPI data from Bureau of Labor Statistics
- January 2025 set as the base month
- **Example:** gas costing \$3.50 per gallon in 2008 is equivalent to \$5.20 per gallon in 2025



9/11 & War on Terror

- The Middle East is home to some of the world's largest oil reserves
- After September 11 attacks, travel and economy slowed down, leading to a drop in gas prices
- Because of the uncertainty, companies started paying more for oil, which made gas more expensive
- As businesses went back to normal over the next year, the demand for gas increased and prices rose steadily



2008 Recession

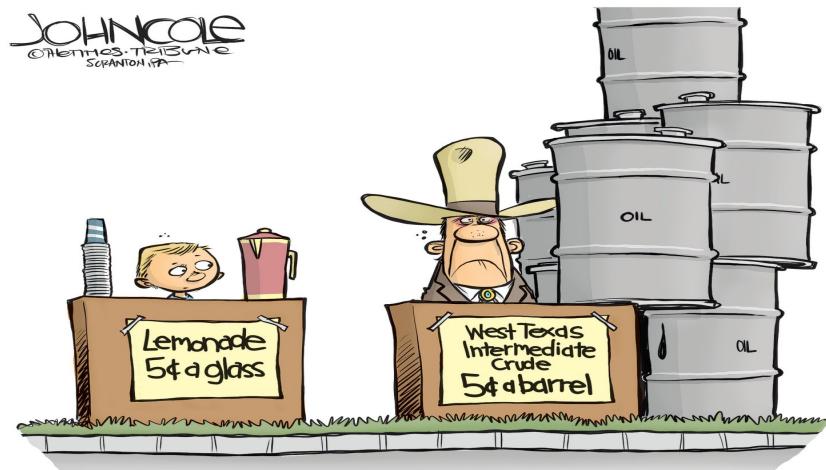
- Gas prices spiked in mid 2008 as global demand and tight supply drove oil to record highs before the recession
- The financial crisis and economic slowdown caused a steep drop in gas demand and prices
- As the economy stabilized post-2009, prices then rebounded and gradually increased once again



2014 Oil Crash

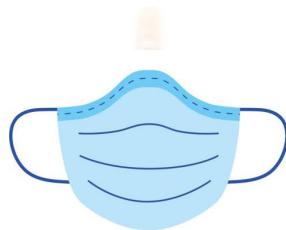
- Post Recession Surge
- 2014-2016
- U.S. oil production increased from 5 million barrels per day in 2008 to 9 million barrels per day in 2015
- Receding geopolitical concerns
- Shifting OPEC policies
- One of the three biggest declines since WW2

JOHN COLE
©HARRIS TRIBUNE
SCRANTON PA



2020 COVID Pandemic

- Global lockdowns caused demand for oil to collapse, pushing prices to record lows
- As economies reopened, demand rebounded faster than supply
- Oil producers and refineries were slow to ramp up production
- Supply chain disruptions created a shortage effect, driving prices higher
- COVID-19 caused a demand-driven increase in gas prices during recovery



2022 Russian-Ukrainian War

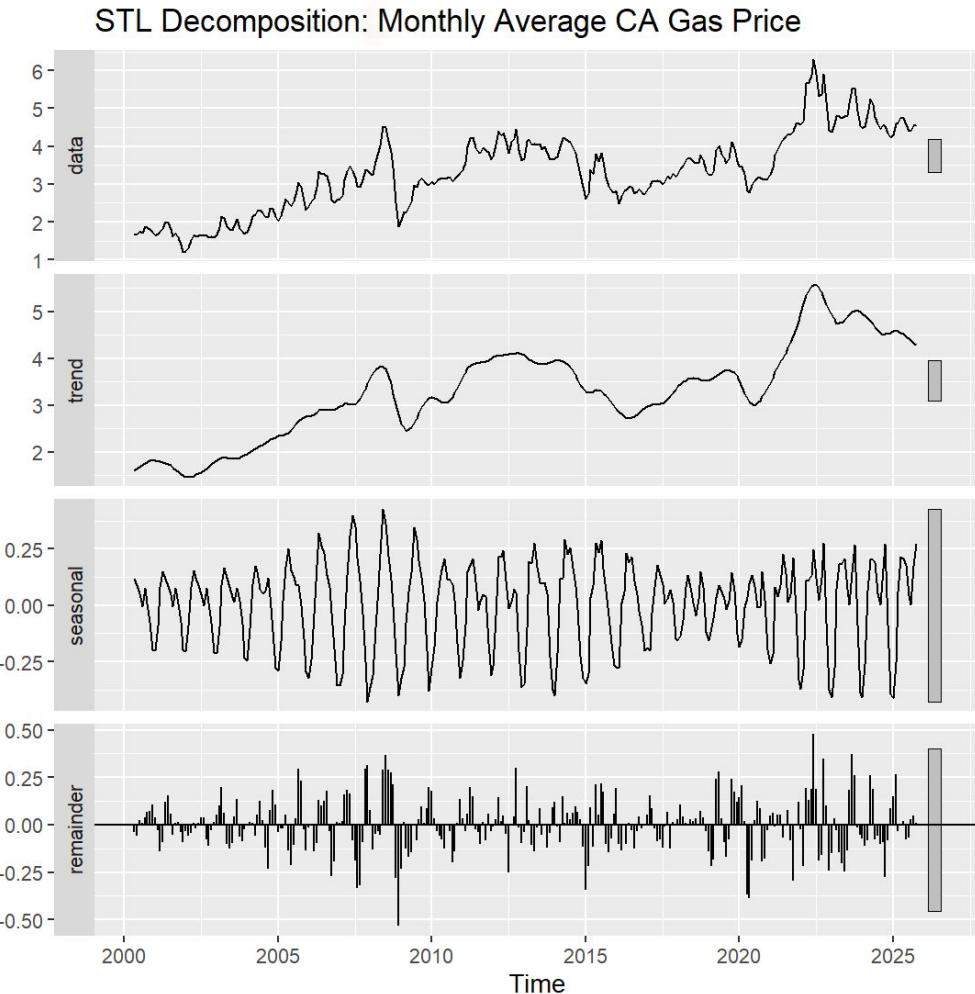
- Russia invaded Ukraine in February 2022
- Russia is one of the world's largest exporters of oil and natural gas
- After the sanctions, the US had to release oil from strategic reserves which only provided short term relief
- The war caused supply-driven increase in gas prices since major global supply was cut off



Seasonal Decomposition

Decomposed data into 3 components:

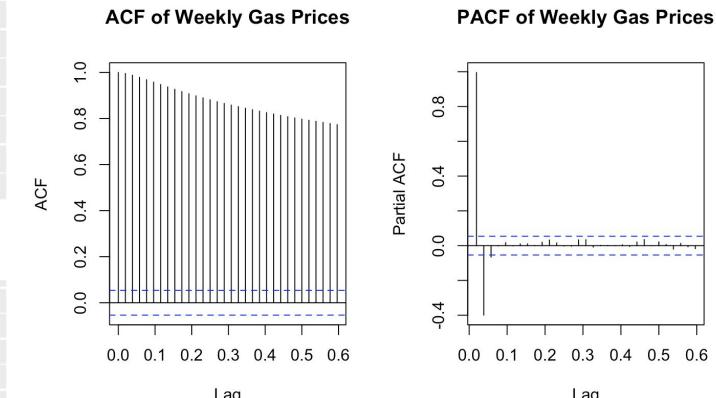
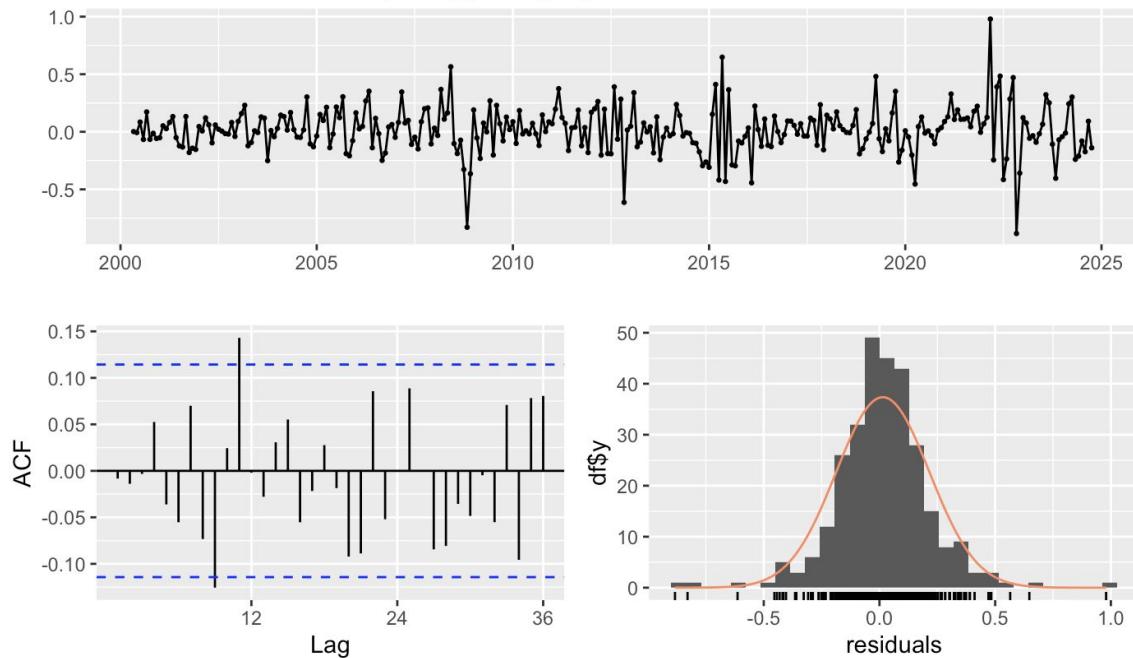
- Trend
- Seasonal
- Residuals



Seasonal ARIMA

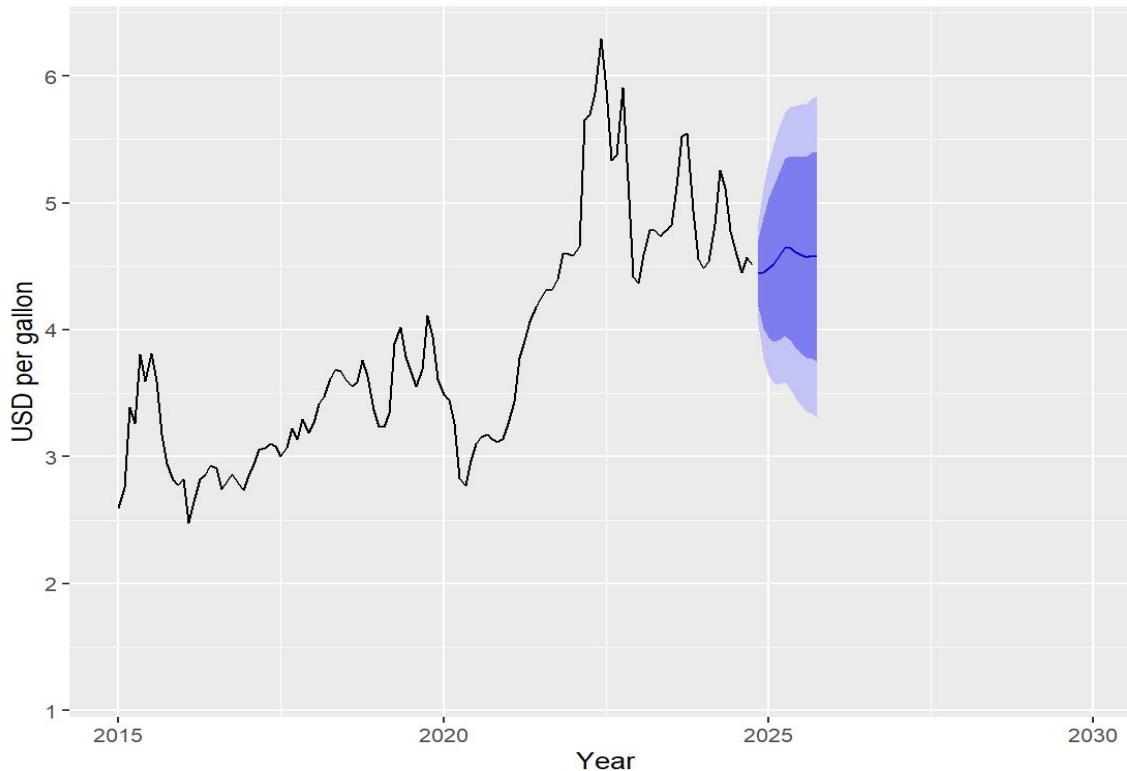
- SARIMA(p,d,q)(P, D, Q)s model selected using auto.arima(): **ARIMA(1,1,3)(0,0,1)[12]**

Residuals from ARIMA(1,1,3)(0,0,1)[12]



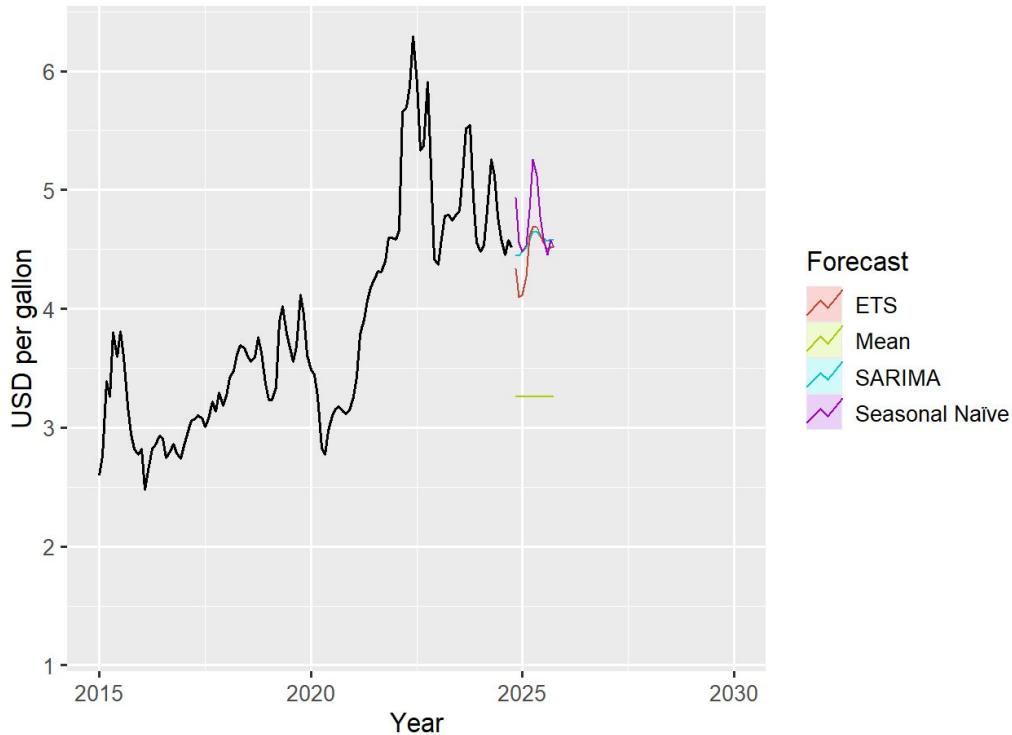
Seasonal ARIMA Forecast

SARIMA Forecast: Monthly CA Gas Price



Forecast Comparison

Forecasts for Monthly CA Gasoline Price



	RMSE	MAE	MAPE
S-ARIMA	0.12	0.101	2.265
Exponential Smoothing (ETS)	0.133	0.101	2.257
Seasonal Naïve	0.287	0.227	5.04

Forecast Based on Expert Judgement

- **EIA** forecasts a further decrease of about 18¢ /gal ($\approx 6\%$) in 2026 for U.S. average retail gasoline prices.
- **Nationwide gas consumption** is expected to decline as vehicle fleet efficiency continues to improve.
- **Exception:** West Coast region is projected to see higher gas prices.
 - Closure of Phillips 66 refinery will lead to reduced regional production



Conclusion

- **Key Findings:**
 - Our models were fitted to capture potential seasonal patterns in gas prices
 - The models produced different predictions, ranging from around \$4.10 to \$4.60 (Seasonal Naive) in comparison to the mean of \$3.25, indicating forecast uncertainty
- **Challenges in Forecasting Gas Prices:**
 - Volatility within historical data dominates underlying seasonal patterns and makes it difficult to distinguish visually
 - Major price spikes correspond to external shocks such as the COVID-19 pandemic
 - Limitations to time series forecasting as it cannot predict geopolitical events, economic shocks, or policy changes that drive price movements
- **Potential next steps: increase model complexity**
 - Perhaps consider probabilities of certain world events occurring