Project 3 Milestone 1

Forecasting Natural Gas Prices

Project Proposal and Data Selection

Michelle Helfman

Bellevue University

DSC680 -T302 Applied Data Science (2247-1)

Professor Amirfarrokh Iranitalab

July 26, 2024

Forecasting Natural Gas Prices

Project Proposal and Data Selection

Topic:

Forecasting natural gas prices primarily for the high-usage winter months can advise commodity traders to purchase future gas during the traditional cheaper summer months or wait until closer to winter in anticipation of lower prices.

Business Problem:

Natural gas is a vital part of our daily lives. It is primarily used to generate electricity and provide heat. Natural gas fuels cooking appliances, clothes dryers, and water heaters in residential settings. This connection to our everyday routines makes it a commodity of interest, traded through the New York Mercantile Exchange (NYMEX) for near-term consumption or stored for future use when demand increases.

Natural gas for future use is purchased for speculation and hedging. Speculative commodity purchasing is for making a profit; hedging mitigates risk. Prices are affected by the amount of available natural gas, economic growth, seasonality, and the availability and price of other fuels. No matter why it is necessary to forecast future prices, the information generated by the forecasting models is the same.

Using prior natural gas trading to forecast future prices for mitigating risk is a starting point. End-of-day closing prices by month, season, and extended periods can be used to analyze various historical trends and create statistical models to predict future trends.

Project Data:

The dataset is ten years of traded natural gas prices from the New York Mercantile Exchange (NYMEX). It includes the trade date, opening and closing prices, and the volume traded for each date.

Natural Gas Pricing Data (2529 rows, 6 columns)

- Date – Trading Date (Monday through Friday)
- Close/Last – Price at the end of the trading day
- Volume – Number of MMBTU (1 Million British Thermal Units) units traded per day
- Open – Price at the start of the trading day
- High – Highest traded price during the day
- Low – Lowest traded price during the day

Methodology:

I will perform Exploratory Data Analysis (EDA) to visualize the different pricing and volume trends: monthly, seasonal, and over an extended period. I will then compare the seasonal and annual results between the first five years and the second five years, looking for how things have changed.

After the initial evaluation, I found no NULLs or zeros; all columns contained meaningful information. I will examine the correlation between the daily closing prices and the volume traded that day. Finally, I will plot the results by forecasting the natural gas prices using Autoregressive Integrated Moving Average (Arima) and Prophet.

Ethical Considerations:

Climate change, with warmer summers and colder winters, contributes to an ever-growing demand for energy; the United States' economic growth and industry knowledge should

be included along with the forecasted information when considering whether to hedge on future natural gas prices. A hedging misstep will have consequences for both the company and the customer. The company loses money when the future natural gas price is below the hedged price because the company overpaid for the product and cannot pass on the difference to fixed-rate customers. Consumers, whose costs are based on market rates, will bear the brunt of hedging miscues.

The forecasted prices should be just one piece of the hedging decision. All pieces should be evaluated separately, and how they interact with each other when deciding whether to purchase future natural gas or wait to purchase closer to the time of use.

Challenges/Issues:

The natural gas pricing information from the National Association of Securities Dealers (NASDAQ/NASD) represents only Monday through Friday, suitable for training but not for corporate decision-making. After successfully training the initial time series models, index data that reflects all 365 days per year can retrain the model, providing a more complete picture.

While the ARIMA model is good for short-term forecasting, anything over six months is unreliable. Prophet works well for long-term predictions but is complex to tune because of all the options. Forecasting models do not consider outside forces, such as a freak snowstorm in Texas or geopolitical unrest disrupting the supply chain.

References

Nasdaq, Inc. (n.d.). (Retrieved, July 24, 2024)

https://www.nasdaq.com/market-activity/commodities/ng-nmx/historical?page=1&rows_per_page=10&timeline=y10

Michael Kuchar (n.d.), The Basics of Natural Gas Hedging That You Need to Know

https://tradingbeasts.com/the-basics-of-natural-gas-hedging/

EnergyInfrastructure.org (n.d.), Underground Natural Gas Storage Know

https://www.energyinfrastructure.org/energy-101/natural-gas-storage

U.S. Energy Information Administration (Updated October 25, 2023.),

Natural gas explained, Factors affecting natural gas prices

https://www.eia.gov/energyexplained/natural-gas/factors-affecting-natural-gas-prices.php