Minimizing Oil Revenue Volatility For Saudi Arabia: Statistical Analysis And Impact Overview

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Overview

The study discusses the challenges and opportunities within the energy sector, with all the transitions it is having nowadays. One of the main challenges facing the energy sector is the volatility of oil prices. This presents severe pressure on oil-dependent economies from both supply and demand points of view. From the perspective of oil exporting countries like Saudi Arabia, this challenge can be mitigated by finding the optimal hedging strategy using downstream, especially refineries. This was analysed using a stochastic simulation modelling approach to find the optimum refining capacity in Saudi Arabia in terms of maximum average revenue and minimum revenue volatility.

Methods

The optimization engine process:

1. Extract historical monthly oil prices from 1990-2022 June, opening, closing, and average.

2. Develop two data sets, one with the prices as is, and the other with the prices inflated (trended) to 2022 levels using consumer price index (CPI).

3. Fit both data sets to mixture of continuous distributions (Weibull and Lognormal) to generate additional data points from (interpolation and simulating data points).

4. Generate 100M simulated data points of oil prices.

5. Perform stochastic simulation by randomly choosing a price for 100k points (as a yearly average).

6. Once simulations were generated, construct a trade-off balance formula between the total revenue and revenue variance for each simulated price. This allows us to choose the best allocation between downstream and upstream to maximize the revenues while maintaining optimal minimum revenue volatility across scenarios.

Results

The analysis result suggests to increase Saudi Arabia's refining capacity by 20-40% of its current capacity. This will allow Saudi Arabia to have high sustainable level of oil revenue while maintaining minimal level of variation across the years.

Conclusions

This study has shed the light on the issues related with the overreliance on oil as the main revenue source for Saudi Arabia. The stochastic simulation analysis conducted aimed to address oil price volatility issue and suggested to increase Saudi Arabia's refining capacity by 20-40% of its current capacity to achieve optimal situation. Moreover, that would also have other positive impacts on the Saudi economy via increasing diversification, ensuring sustainable oil demand, and attaining more local content development while leveraging Saudi comparative advantages.