Scientific Research Publishing

American Journal of Industrial and Business Management, 2025, 15(4), 661-680
https://www.scirp.org/journal/ajibm
ISSN Online: 2164-5175
ISSN Print: 2164-5167

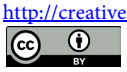
The Effects of Monthly Price Adjustments of Fuel by Energy Regulations Board (ERB) on Petroleum Companies in Zambia

Azele Banda[1], Terence Malama[2]

[1]Graduate School of Business, The University of Zambia, Lusaka, Zambia
[2]Technonlogy Advisory and Development Unit (TDAU), The University of Zambia, Lusaka, Zambia
Email: bandaazele@yahoo.com, terencemalama@gmail.com

How to cite this paper: Banda, A., & Malama, T. (2025). The Effects of Monthly Price Adjustments of Fuel by Energy Regulations Board (ERB) on Petroleum Companies in Zambia. *American Journal of Industrial and Business Management, 15,* 661-680.
https://doi.org/10.4236/ajibm.2025.154032

Received: March 18, 2025
Accepted: April 27, 2025
Published: April 30, 2025



Abstract

This study investigates the effect of fuel price adjustments by Zambia's Energy Regulation Board (ERB) on petroleum companies, particularly following the removal of fuel subsidies in December 2021. The research examines the impact of the ERB's pricing mechanisms, including the perceived volatility of the monthly review cycle, on operational costs, profit margins, and financial forecasting. Using a mixed-methods approach, combining quantitative analysis of financial reports and ERB data with qualitative insights from interviews and focus groups, the study reveals a significant negative relationship between fuel price increases and company revenues. Key factors influencing price adjustments include global oil prices, exchange rates, and transportation costs. Respondents criticized the ERB's pricing framework for its lack of transparency and predictability and highlighted the need for a transition to a quarterly review model to provide greater stability. The study recommends implementing a quarterly fuel price review, alongside predictive pricing models, a price stabilization fund, and enhanced transparency, to mitigate price volatility, balance stakeholder interests, and support industry stability. These findings contribute to understanding fuel pricing dynamics and their implications for Zambia's petroleum sector.

Keywords

Fuel Price Adjustments, Petroleum Companies, Energy Regulation Board, Zambia, Regulatory Framework

1. Introduction and Background of the Study

International fuel prices have exhibited significant volatility in recent years, driven by disruptions like COVID-19 and the Russia-Ukraine war. Between 2019 and

mid-2023, global oil prices surged more than fourfold (Smith & Joe, 2023). For net importers like Zambia, which relies entirely on fuel imports, such fluctuations present policy challenges for petroleum companies. According to Boyes and Melvin (2012), the dynamics of demand and supply shape the relationship between oil prices and energy consumption, influencing production costs and consumer prices. Rising oil prices often compel companies to explore alternative energy sources to sustain operations and profitability, highlighting oil's critical role in shaping the cost of goods and services.

Energy underpins sustainable development's economic, social, and environmental pillars (Smith & Johnson, 2023). Yet, access to modern fuels remains uneven, with around two billion people globally lacking access. Transitioning to modern fuels is critical for sustainability, especially as energy demand rises. Petroleum is a strategic sector in many economies, influencing GDP, government revenues, and foreign exchange expenditures. Additionally, taxes on petroleum products contribute significantly to fiscal revenues, often necessitating strong state involvement to regulate the sector.

In Zambia, fuel is essential for production, transport, and energy generation, with retail customers and the mining sector being the largest consumers (ERB, 2020). The country's reliance on imports makes fuel prices highly sensitive to international oil prices and exchange rate fluctuations. The Energy Regulation Board (ERB) shortened the fuel pricing review cycle from 60 to 30 days in December 2021 to align domestic prices more closely with global oil prices and the Kwacha/US Dollar exchange rate. Previously, Zambia's 60-day price-locking mechanism shielded consumers from market fluctuations but limited responsiveness to favourable trends.

The removal of fuel subsidies in 2021 further tied domestic prices to market forces. The monthly pricing cycle, as noted by *Petroleum Insight* (2022), ensures cost-reflective pricing and secures supply by aligning with global oil prices and exchange rate trends. However, these adjustments significantly impact consumers and businesses, underscoring the importance of a transparent and responsive pricing framework.

The escalating effects of the monthly fuel price adjustments by the ERB on petroleum companies in Zambia constitute a critical economic issue. The substantial percentage increases in petrol and diesel prices in December 2021 (20.1% and 29.2%, respectively) following the removal of fuel subsidies have created an environment of uncertainty (ERB, 2021). The subsequent adoption of a 30-day pricing cycle, tethering domestic fuel prices to the volatile international oil market and the fluctuating kwacha-dollar exchange rate, presents significant challenges for manufacturers (World Bank, 2022). This unpredictability, coupled with ongoing supply chain disruptions and unannounced electricity outages, places an undue burden on the manufacturing sector (ZAM, 2022).

With geopolitical events like the invasion of Ukraine by Russia, the spectre of heightened volatility in international oil prices looms large (International Energy

Agency, 2022). This uncertainty severely hampers manufacturers' ability to plan for the future, as the rise in domestic fuel prices amplifies production costs and logistical expenses. Despite efforts to maintain competitive pricing, manufacturers are reaching a tipping point where passing on increased fuel costs to consumers becomes unsustainable (EPRI, 2022).

The consequences of elevated production costs due to rising fuel prices are potentially dire, including the risk of higher inflation, increased poverty levels, and potential job losses within the manufacturing sector. Drawing lessons from other nations, such as Sri Lanka, which grappled with challenges from high oil prices and resorted to massive subsidies, underscores the need for a strategic and sustainable approach (ADB, 2022).

1.1. Purpose

The purpose of the study was to assess the effects of monthly price adjustments of fuel by Energy Regulations Board (ERB) on Petroleum Companies in Zambia.

Theoretical Framework

This study on the effects of monthly fuel price adjustments by ERB on petroleum companies in Zambia was guided by a robust theoretical framework that integrates principles from price adjustment theory, market structure theory, and game theory.

Price adjustment theory examines how market prices are determined and adapted over time. According to this theory, price changes, such as those enforced by regulatory authorities like the ERB, significantly influence market equilibrium, supply, and demand dynamics. In the context of Zambia's petroleum industry, the ERB's monthly pricing cycle impacts the operational strategies of companies, compelling them to continuously reassess pricing models, manage costs, and maintain profitability amidst fluctuating external factors.

Market structure theory analyses the organization and competitive dynamics of industries, particularly those operating under regulatory constraints. The petroleum industry in Zambia, largely oligopolistic, reflects these dynamics. Frequent interventions by the ERB, including monthly price adjustments, alter the competitive landscape by introducing uncertainties that shape pricing behaviours, market power, and strategic decision-making among petroleum companies.

Game theory offers a valuable framework for analysing the strategic interactions among stakeholders in the petroleum industry, particularly within the regulated pricing environment established by the Energy Regulation Board (ERB). Central to this framework is the concept of Nash equilibrium, which describes a state where no player can benefit by changing their strategy while the other players keep theirs unchanged. In this context, petroleum companies engage in strategic decision-making to optimize their outcomes, anticipating the actions of competitors and potential regulatory changes. By employing game theory, regulators can better understand these strategic interactions, allowing them to craft fuel price adjustments that consider the behaviours of both

oil producers and consumers.

Nash equilibrium concepts can predict how price changes influence production decisions and overall market behaviour, ensuring that price adjustments reflect the dynamics of supply and demand. Moreover, the potential implementation of automatic pricing mechanisms could stabilize markets by aligning domestic prices with international trends, thereby minimizing volatility. This strategic approach not only aims to achieve regulatory objectives but also acknowledges the realities of market behaviour, fostering a more balanced environment. Respondents in the study expressed strong agreement with this principle, indicating that the data gathered supports the effectiveness of using game theory in guiding regulatory practices (Smith & Johnson, 2023).

Price adjustment theory examines how market prices are determined and adapted over time. According to this theory, price changes, such as those enforced by regulatory authorities like the ERB, significantly influence market equilibrium, supply, and demand dynamics. In the context of Zambia's petroleum industry, the ERB's monthly pricing cycle impacts the operational strategies of companies, compelling them to continuously reassess pricing models, manage costs, and maintain profitability amidst fluctuating external factors.

Market structure theory analyses the organization and competitive dynamics of industries, particularly those operating under regulatory constraints. The petroleum industry in Zambia, largely oligopolistic, reflects these dynamics. Frequent interventions by the ERB, including monthly price adjustments, alter the competitive landscape by introducing uncertainties that shape pricing behaviours, market power, and strategic decision-making among petroleum companies.

Game theory offers a valuable framework for analysing the strategic interactions among stakeholders in the petroleum industry, particularly within the regulated pricing environment established by the Energy Regulation Board (ERB). Central to this framework is the concept of Nash equilibrium, which describes a state where no player can benefit by changing their strategy while the other players keep theirs unchanged. In this context, petroleum companies engage in strategic decision-making to optimize their outcomes, anticipating the actions of competitors and potential regulatory changes. By employing game theory, regulators can better understand these strategic interactions, allowing them to craft fuel price adjustments that consider the behaviours of both oil producers and consumers.

The integration of these theoretical perspectives provides a comprehensive understanding of the dynamics between fuel price adjustments and the performance of petroleum companies in Zambia. The findings presented in the document above reflect the practical application of these theories, highlighting the significant impact of monthly price adjustments on revenue, profit margins, and operational stability within the petroleum sector. The analysis of key factors influencing ERB's pricing decisions, such as global oil prices, exchange rates, and transportation costs, further illustrates the relevance of market structure theory and game

theory in this context. Additionally, the evaluation of the current regulatory framework's effectiveness in balancing stakeholder interests aligns with the strategic considerations emphasized in game theory, underscoring the need for adaptive and transparent pricing mechanisms that address the diverse needs of consumers, the government, and petroleum companies.

1.2. Empirical Review

Literature on the effects of fuel price adjustments on petroleum companies highlights various impacts, particularly on operational costs and profitability. Price fluctuations typically shift income between oil-importing and oil-producing nations, reducing disposable income and economic activity in oil-importing countries. Central banks often respond with higher interest rates, increasing capital costs and leading to changes in corporate financial structures. This cascade of effects causes liquidity constraints and reduced profitability.

Studies from diverse contexts reveal common challenges. Omagwa, Kihooto and Reardon (2017) found that crude oil prices and exchange rates significantly influence petroleum retail prices. Globally, Smith and Johnson (2019) and Johnson et al. (2018) identified that frequent price adjustments increase costs and reduce profitability, suggesting the need for long-term stability in regulatory policies. Similarly, Osei et al. (2018) in Ghana and Ndlovu and Moyo (2017) in Zimbabwe observed increased operational costs and reduced profitability due to frequent adjustments, recommending reviews of pricing mechanisms for sustainability and competitiveness.

In Zambia, several studies confirm similar trends. Chanda and Mulenga (2016), Kasonde and Banda (2015), and Sichone and Phiri (2014) highlighted the adverse effects of frequent price adjustments on costs and profit margins. They recommended stability, transparency, and accountability in pricing policies. Tembo and Mwamba (2013) emphasized exploring alternative regulatory mechanisms, while Mulenga and Chisanga (2012) advocated for policies promoting efficiency and competitiveness in the sector.

Overall, while studies consistently demonstrate the operational challenges caused by price adjustments, research gaps remain in areas such as long-term policy impacts, transparency, and alternative regulatory strategies.

1.3. Conceptual Framework

A conceptual framework integrates related concepts to provide a broader understanding of a research phenomenon (Imenda, 2014). For this study, the framework aims to examine the multifaceted effects of the ERB's monthly fuel price adjustments on the financial performance of petroleum companies in Zambia.

This framework focuses on three primary objectives, each linked to specific research questions that explore the relationship between regulatory fuel pricing and the petroleum industry. It highlights how ERB's pricing interventions influence

key financial metrics such as revenue, profitability, and market share. By mapping these relationships, the framework offers insights into the dynamic interaction between regulatory price adjustments and the operational outcomes of petroleum companies (Figure 1).

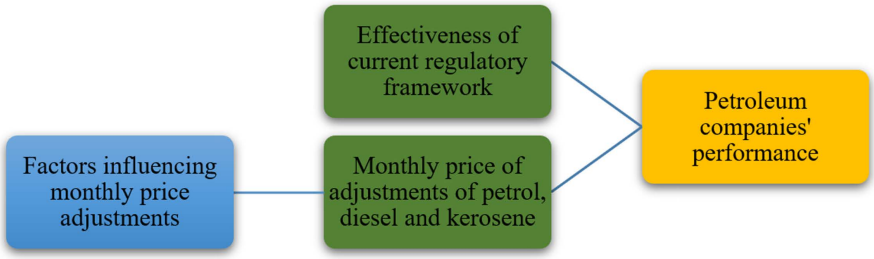


Figure 1. Conceptual framework illustrating the impact of ERB's monthly fuel price adjustments on the financial performance of petroleum companies in Zambia, highlighting the relationship between price changes, financial indicators, company strategies, and regulatory effectiveness in balancing stakeholder interests.

2. Research Methodology

2.1. Research Design and Methodology

This study employed a cross-section that used mixed-methods, combining both quantitative and qualitative approaches to leverage the strengths of each method. The quantitative aspect involved the use of secondary data collected data from petroleum companies' reports and ERB enabling the use of descriptive and inferential statistics to draw meaningful conclusions (Creswell, 2014). Qualitative aspect included in-depth interviews and focus group discussions with key informants to gather nuanced insights into policy impacts and recommendations (Tashakkori & Teddlie, 2010).

2.2. Study Setting

The research was conducted in Lusaka, Zambia, a hub for petroleum companies and ERB activities. Lusaka's dynamic petroleum sector made it an ideal site for assessing the impact of ERB policies on Oil Marketing Companies (OMCs). ERB (2023) states that there are about 18 OMCs registered with ERD in Zambia. Therefore, the target population consisted of 18 OMCs registered under ERB. For qualitative analysis, purposive sampling (also called, the partial Delphi Approach) identified industry experts, policymakers, and executives to provide in-depth insights. For quantitative analysis, secondary data from ERB and company reports were used.

2.3. Data Collection and Sampling

Collection and sampling was conducted as follows:

1. Quantitative data, sourced from ERB and OMC reports, covered financial performance metrics and pricing trends, ensuring consistency and reliability (Fowler, 2014). The study used the probability sampling from the target population, Using Cochran's formula; the adjusted sample size was 18, repre-

senting all OMCs. To enhance representativeness, the sample size was tripled to 54 respondents. The sample size was tripled because a larger sample size improves the likelihood that the sample will accurately reflect the diversity of the target population. By tripling the sample size, the researcher could a more rigorous and comprehensive study, ultimately leading to more valid insights regarding the financial performance metrics and pricing trends from the ERB and OMC reports.

2. Qualitative data were collected through in-depth interviews and focus groups using semi-structured guides, enabling detailed exploration of pricing policies and impacts (Kvale & Brinkmann, 2009). The respondents under qualitative were select purposively. Qualitative data for the study were gathered through 15 in-depth interviews and 3 focus groups (with 6 - 8 participants each), focusing on pricing policies and impacts in OMCs. Participants were selected purposively, emphasizing those with at least 3 years of experience and including a diverse range of roles, such as pricing managers and financial analysts.
3. Data Analysis**:** Quantitative analysis was conducted using Statistical Package for Social Sciences (SPSS), with descriptive statistics summarizing data and regression analysis examining variable relationships (Pallant, 2020). Descriptive thematic analysis was used to analyse data, it involved familiarizing with data, coding it using qualitative software, developing and refining themes, and ensuring findings were supported by direct participant quotes, ultimately providing a rich understanding of the subject matter. Content validity was ensured through literature review and expert feedback. Reliability was verified using Cronbach's alpha for quantitative data and inter-rater reliability for qualitative coding (Tavakol & Dennick, 2011).
4. Ethical Considerations: The study followed ethical guidelines, securing informed consent and ensuring data confidentiality. Ethical approval was obtained from relevant authorities, and participation was voluntary (Israel & Hay, 2006).

This integrated methodology provided a comprehensive analysis of the financial and operational impacts of ERB's price adjustments on Zambia's petroleum industry.

3. Research Findings

3.1. Background Information of Study Participants

Figure 2 shows the demographic profile of the respondents, it reveals a nearly balanced gender distribution, with 52.1% male and 47.9% female participants.

The majority of respondents (55.3%) are in the 26 - 35 age category, followed by 34.0% in the 36 - 45 age group, with only 2.1% aged 56 years or above as shown in Figure 3.

Figure 4**.** shows that the educational attainment among respondents is relatively high; over half (52.1%) hold a Bachelor's degree, and 43.8% have a Master's

degree, with only a small fraction holding a secondary education level (2.1%).

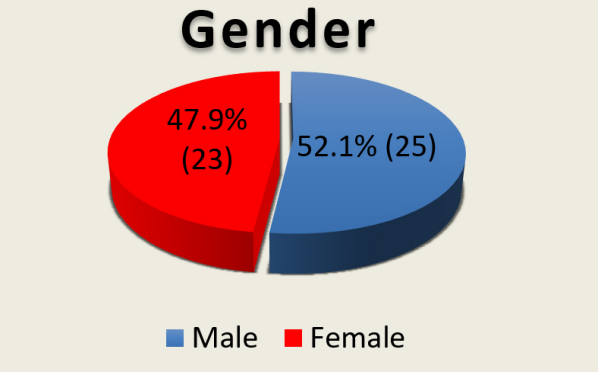


Figure 2. Gender of respondents.

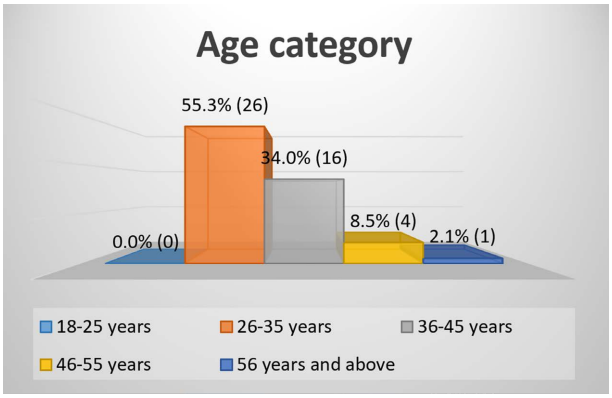


Figure 3. Age category of the respondents.

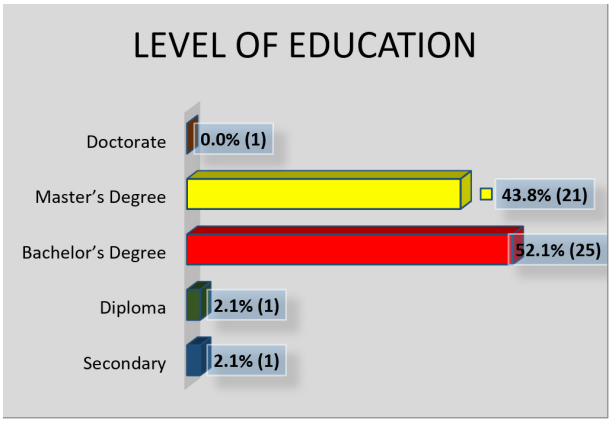


Figure 4. Highest level of education obtained by the respondents.

In terms of job roles Figure 5 reveals that more than half of the respondents (56.3%) occupy managerial positions, while 16.7% each are in executive roles or other positions, and 10.4% are supervisors.

Industry experience varies as shown in Figure 6, with the largest segment (37.5%) having more than 10 years in the petroleum sector, 29.2% having 6 - 10 years, and only 12.5% with less than one year. This diverse sample offers a com-

prehensive view of the respondents' backgrounds in terms of both professional and educational demographics.

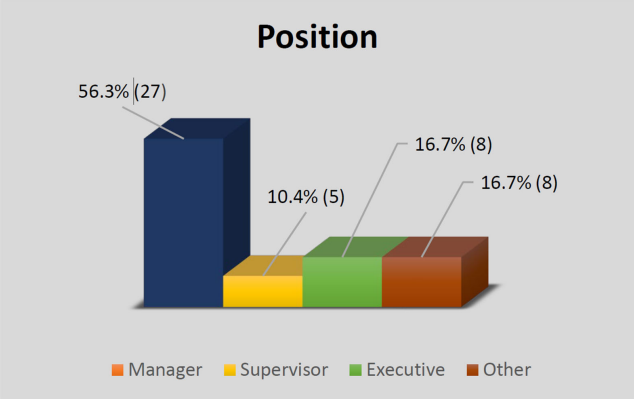


Figure 5. Position held by the respondents.

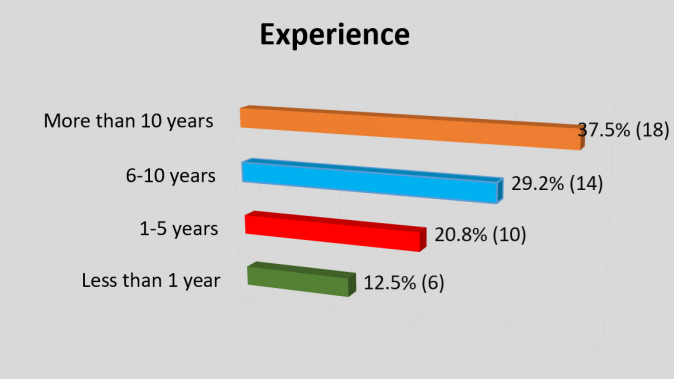


Figure 6. How long the respondent has been working in the industry.

3.2. The Effect of Monthly Fuel Price Adjustments by the ERB

The findings in Table 1 highlight a strong consensus on the significant effect of the Energy Regulation Board's (ERB) monthly fuel price adjustments on the financial performance of petroleum companies in Zambia. Most respondents (60.4%) strongly agreed that these adjustments affect revenue, with a mean score of 4.48 and a standard deviation of 0.875. Similarly, 52.1% strongly agreed that profit margins are influenced, with a mean of 4.35 and a standard deviation of 0.911. Overall financial performance also showed notable effects, with 47.9% agreeing and 41.7% strongly agreeing (mean = 4.25, SD = 0.838).

While respondents acknowledged the direct impact of price adjustments on key performance indicators like revenue and profit margins, strategic and operational responses were less uniform. Only 37.5% agreed that companies implemented strategic changes, with a mean of 3.40 and a higher variability (SD = 1.144). Operational adjustments saw slightly stronger agreement at 54.2% (mean = 3.63, SD = 0.937).

These findings underscore the financial significance of fuel price adjustments and the varied adaptive strategies among petroleum companies.

Table 1. The effect of monthly fuel adjustment by ERB.

Statement		Frequency	Percent	Mean	Std. dev
How do monthly price adjustments of petrol, diesel, and kerosene by the ERB affect your company's revenue?	Strongly Disagree	2	4.2%	4.48	0.875
	Disagree	0	0.0%		
	Neutral	0	0.0%		
	Agree	17	35.4%		
	Strongly Agree	29	60.4%		
The monthly price adjustments by the ERB have significantly impacted our profit margins.	Strongly Disagree	2	4.2%	4.35	0.911
	Disagree	0	0.0%		
	Neutral	2	4.2%		
	Agree	19	39.6%		
	Strongly Agree	25	52.1%		
Overall, the financial performance of our company is influenced by the monthly fuel price adjustments	Strongly Disagree	1	2.1%	4.25	0.838
	Disagree	1	2.1%		
	Neutral	3	6.3%		
	Agree	23	47.9%		
	Strongly Agree	20	41.7%		
The magnitude and direction of fuel price changes have a direct relationship with changes in our performance indicators (e.g., revenue, profit margins).	Strongly Disagree	2	4.2%	4.25	0.863
	Disagree	0	0.0%		
	Neutral	1	2.1%		
	Agree	26	54.2%		
	Strongly Agree	19	39.6%		
Our company has adapted its business strategies in response to the monthly fuel price adjustments by the ERB	Strongly Disagree	2	4.2%	3.40	1.144
	Disagree	11	22.9%		
	Neutral	9	18.8%		
	Agree	18	37.5%		
	Strongly Agree	8	16.7%		
Our company has adapted its operations in response to the monthly fuel price adjustments by the ERB.	Strongly Disagree	1	2.1%	3.63	0.937
	Disagree	6	12.5%		
	Neutral	9	18.8%		
	Agree	26	54.2%		
	Strongly Agree	6	12.5%		

3.3. Factors Affecting the Monthly Fuel Price Adjustments by the ERB

Table 2 reveals that respondents widely acknowledge global oil prices and exchange rates as key drivers of the Energy Regulation Board's (ERB) monthly fuel

price adjustments. A combined 77.1% either agree or strongly agree on the influence of global oil prices, with a mean of 4.00 (SD = 1.111). Exchange rates were similarly highlighted, with 85.4% agreeing or strongly agreeing, resulting in a mean of 4.27 (SD = 0.984). Transportation costs also emerged as a notable factor, with 72.9% in agreement (mean = 3.75, SD = 0.863).

In contrast, respondents expressed significant dissatisfaction with the alignment of ERB's pricing strategies to the financial needs and operational challenges of petroleum companies. A majority (68.8%) disagreed or strongly disagreed that price adjustments reflect companies' financial realities, with a mean of 2.25 (SD = 1.082). Similarly, 75% believed operational challenges were not adequately considered, yielding a mean of 1.98 (SD = 1.101).

Concerns also emerged regarding transparency and predictability in ERB's pricing mechanisms. Transparency received a mean score of 2.35 (SD = 1.101), while predictability was rated even lower, with a mean of 1.98 (SD = 0.887). These findings suggest that while external factors like global oil prices and exchange rates are acknowledged, there is widespread skepticism about the ERB's responsiveness to industry-specific financial and operational realities.

Table 2. Factors affecting the monthly fuel price adjustments by the ERB.

Statement		Frequency	Percent	Mean	Std. dev
Global oil prices are a key factor considered by the ERB in determining monthly fuel price adjustments.	Strongly Disagree	2	4.2%	4.00	1.111
	Disagree	4	8.3%		
	Neutral	5	10.4%		
	Agree	18	37.5%		
	Strongly Agree	19	39.6%		
Exchange rates are a significant factor in the ERB's fuel price adjustment decisions.	Strongly Disagree	1	2.1%	4.27	0.984
	Disagree	3	6.3%		
	Neutral	3	6.3%		
	Agree	16	33.3%		
	Strongly Agree	25	52.1%		
Transportation costs play a major role in the ERB's monthly fuel price adjustments.	Strongly Disagree	0	0.0%	3.75	0.863
	Disagree	6	12.5%		
	Neutral	7	14.6%		
	Agree	28	58.3%		
	Strongly Agree	7	14.6%		
The ERB's fuel price adjustment decisions reflect the financial needs of our company.	Strongly Disagree	12	25.0%	2.25	1.082
	Disagree	21	43.8%		
	Neutral	8	16.7%		
	Agree	5	10.4%		
	Strongly Agree	2	4.2%		

Continued

The ERB considers the operational challenges faced by petroleum companies when making price adjustments.	Strongly Disagree	**20**	**41.7%**	**1.98**	**1.101**
	Disagree	16	33.3%		
	Neutral	7	14.6%		
	Agree	3	6.3%		
	Strongly Agree	2	4.2%		
The ERB's fuel pricing mechanisms are transparent.	Strongly Disagree	14	29.2%	2.35	1.101
	Disagree	11	22.9%		
	Neutral	16	33.3%		
	Agree	6	12.5%		
	Strongly Agree	1	2.1%		
The ERB's fuel pricing mechanisms are predictable.	Strongly Disagree	18	37.5%	1.98	0.887
	Disagree	14	29.2%		
	Neutral	15	31.3%		
	Agree	1	2.1%		
	Strongly Agree	0	0.0%		

3.4. The Effectiveness of the Current Fuel Pricing Regulatory

Table 3 highlights mixed perceptions regarding the effectiveness of Zambia's current fuel pricing regulatory framework. Most respondents (75.0%) agree or strongly agree that monthly price adjustments by the Energy Regulation Board (ERB) impact fuel affordability, with a mean of 3.71 (SD = 1.271). Additionally, 81.2% acknowledge the broader economic effects of fuel pricing, such as influencing inflation, reflected in a mean of 4.04 (SD = 1.010).

Respondents strongly agreed on the role of fuel pricing in transportation costs, with 80.9% in agreement and a mean of 4.28 (SD = 0.949). The impact on the cost of living was even more pronounced, with 89.6% agreeing and a high mean of 4.48 (SD = 0.825), underscoring fuel pricing as a critical driver of living expenses.

However, dissatisfaction emerged regarding the framework's ability to balance stakeholder interests. A significant 77.1% disagreed that the current system effectively aligns the interests of consumers, the government, and petroleum companies, with a low mean of 1.85 (SD = 0.825). Conversely, 72.9% expressed support for exploring alternative pricing models, reflected in a mean of 3.96 (SD = 1.010), indicating a preference for reforms to better serve all stakeholders.

Table 3. The effectiveness of the current fuel pricing regulatory.

Statement		Frequency	Percent	Mean	Std. dev
The monthly fuel price adjustments by the ERB impact the affordability of fuel for consumers in Zambia.	Strongly Disagree	5	10.4%	3.71	1.271
	Disagree	5	10.4%		
	Neutral	2	4.2%		
	Agree	23	47.9%		
	Strongly Agree	13	27.1%		

Continued

The fuel pricing policies implemented by the ERB have broader economic implications, such as influencing inflation.	Strongly Disagree	**2**	**4.2%**	**4.04**	**1.010**
	Disagree	2	4.2%		
	Neutral	5	10.4%		
	Agree	22	45.8%		
	Strongly Agree	17	35.4%		
The ERB's fuel pricing policies affect transportation costs in Zambia.	Strongly Disagree	1	2.1%	4.28	0.949
	Disagree	1	2.1%		
	Neutral	7	14.9%		
	Agree	13	27.7%		
	Strongly Agree	25	53.2%		
The ERB's fuel pricing policies impact the overall cost of living in Zambia.	Strongly Disagree	1	2.1%	4.48	0.825
	Disagree	0	0.0%		
	Neutral	4	8.3%		
	Agree	13	27.1%		
	Strongly Agree	30	62.5%		
There are alternative fuel pricing models that could better align the interests of consumers, the government, and petroleum companies.	Strongly Disagree	2	4.2%	3.96	1.010
	Disagree	1	2.1%		
	Neutral	10	20.8%		
	Agree	19	39.6%		
	Strongly Agree	16	33.3%		
The current fuel pricing regulatory framework balances the interests of consumers, the government, and petroleum companies effectively.	Strongly Disagree	19	39.6%	1.85	0.825
	Disagree	18	37.5%		
	Neutral	10	20.8%		
	Agree	1	2.1%		
	Strongly Agree	0	0.0%		

Source: Field data.

Financial Performance of Petroleum Companies

The findings from the Table 4 below indicate a significant concern among respondents regarding the impact of fuel price adjustments on the financial performance of petroleum companies. A majority (over 62%) agree that fuel price fluctuations have influenced their ability to invest in new projects, highlighting a direct correlation between pricing volatility and strategic financial planning. Moreover, approximately 52% acknowledge that profit margins have been negatively affected by these fluctuations, suggesting that operational costs are increasingly challenging to manage in the face of unpredictable fuel prices. The mean scores, ranging from 3.54 to 3.85, reflect a general consensus that fuel price adjustments pose considerable challenges to revenue stability and financial

planning, underscoring the need for more predictable pricing mechanisms to support sustainable growth in the sector. These insights point to a critical need for petroleum companies to adapt their strategies in response to the dynamic nature of fuel pricing.

Table 4. Financial performance.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std…dev
Over the past year, our company's revenue has been significantly impacted by fuel price adjustments.	5 (10.4%)	7 (14.6%)	8 (16.7%)	20 (41.7%)	10 (20.8%)	3.55	1.20
Our company's profit margins have been affected by the fluctuations in fuel prices.	3 (6.3%)	5 (10.4%)	10 (20.8%)	25 (52.1%)	7 (14.6%)	3.75	1.05
The cost of operations in our company has increased due to frequent fuel price changes.	4 (8.3%)	6 (12.5%)	9 (18.8%)	22 (45.8%)	8 (16.7%)	3.63	1.15
Fuel price adjustments have influenced our company's ability to invest in new projects.	2 (4.2%)	4 (8.3%)	11 (22.9%)	30 (62.5%)	2 (4.2%)	3.85	0.95
Our company's financial planning has been challenged by the unpredictability of fuel price adjustments.	6 (12.5%)	8 (16.7%)	7 (14.6%)	18 (37.5%)	10 (20.8%)	3.54	1.30

Source: Field data.

(1) Financial performance due to MPA of Fuel by (ERB) on Petroleum Companies: example of OMC X

Table 5. Profit and loss statement.

Year	Profit Before Tax (K'000)	Net Profit After Tax (K'000)	Revenue (K'000)	Key Observations on Price Adjustments Impact
2018	176,051	115,133	4,158,737	Significant profit increases due to better margins from adjusted pricing. OMCs benefitted from a stable price environment.
2019	161,352	105,548	3,437,058	Slight decrease in profit attributed to operational challenges and reduced retail volumes. Price adjustments were less favorable. Prices were adjusted upwards in 2019 to reflect the challenges OMCs faced.
2020	243,722	160,181	3,836,519	Recovery in profits due to increased sales despite COVID-19 disruptions. Monthly adjustments helped stabilize revenue.
2021	128,232	76,878	5,841,402	Profits dropped significantly; volatility in global oil prices impacted financial performance. Monthly adjustments were reactive rather than proactive.
2022	325,900	231,510	8,718,527	Major recovery in profits driven by increased sales, mainly by capturing new businesses and opening new filling stations.
2023	393,000	255,000	10,532,000	Continued growth in revenue and profit, reflecting successful adaptation to monthly price adjustments and market conditions. Growth mainly by increasing sales in retail and B2B sectors.

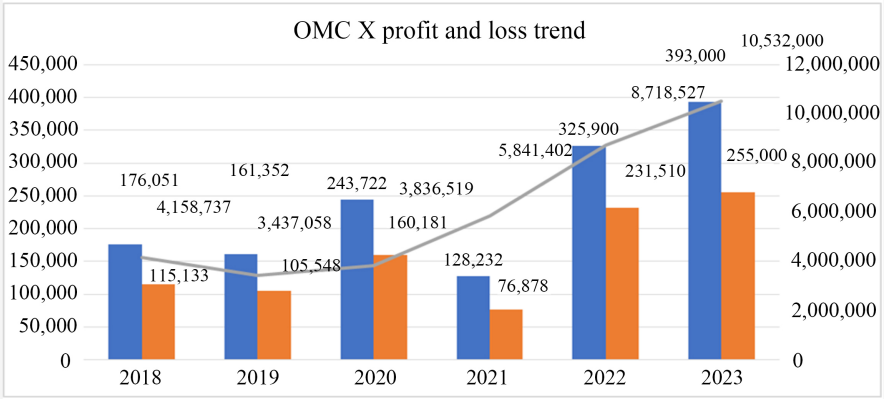


Figure 7. OMC X profit trend.

From Table 5 and Figure 7 we can deduce that:

i. Profit Trends: The profit before tax generally showed fluctuations influenced by both external market conditions (global oil prices, exchange rates) and internal operational efficiency.

ii. Impact of Price Adjustments: Monthly price adjustments by the ERB have had a mixed impact. While they have been beneficial in stabilizing revenue during certain periods, they have also exposed companies to volatility, particularly in 2021.

iii. Revenue Fluctuations: The significant increase in revenue in 2023 reflects a successful strategy in adapting to market changes and consumer demands, aided by effective pricing strategies.

iv. Operational Challenges: Factors such as COVID-19 and geopolitical tensions have affected operational capacity and financial performance, demonstrating the interconnectedness of global events and local market dynamics.

From the above, it can be noted that the financial performance of OMC X illustrates the critical role that fuel price adjustments play in influencing profitability and operational stability. The data supports the premise that while regulatory frameworks are essential for market stability, they must also be adaptable to changing economic conditions to ensure the long-term viability of petroleum companies in Zambia.

3.5. Regression Analysis

The regression analysis results (Table 6) indicate moderate explanatory power in predicting the performance of petroleum companies (OMCs) based on monthly fuel price adjustments and the effectiveness of the fuel price regulatory framework. With an R value of 0.534, the model shows a moderate positive correlation between the independent variables and OMC performance. The R-squared value of 0.285 reveals that 28.5% of the variation in OMC performance is explained by the model, while the adjusted R-squared value of 0.253 accounts for the number of predictors. A standard error of 0.50155 indicates the average deviation of observed values from the regression line.

The ANOVA results (Table 7) confirm the model's statistical significance in explaining OMC performance, with an F-value of 8.959 (p = 0.001). This highlights the meaningful impact of the independent variables on the dependent variable. The regression sum of squares (4.507) indicates the explained variation, while the residual sum of squares (11.320) represents unexplained variation. A higher mean square for regression (2.254) compared to residual (0.252) further supports the model's reliability.

Table 6. Results for the model summary.

Model Summary[b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
	0.534[a]	0.285	0.253	0.50155

a. Predictors: (Constant), Effectiveness current fuel price regulatory, Monthly fuel price adjustment; b. Dependent Variable: Performance of OMC.

Table 7. Results for the ANOVA table.

ANOVA[a]					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.507	2	2.254	8.959	0.001[b]
Residual	11.320	45	0.252		
Total	15.827	47			

a. Dependent Variable: Performance of OMC; b. Predictors: (Constant), Effectiveness current fuel price regulatory, Monthly fuel price adjustment.

The coefficients (Table 8) reveal distinct effects of the predictors on OMC performance. Monthly fuel price adjustments have a significant negative impact (β = −0.349, t = −2.449, p = 0.018), suggesting that increased price adjustments reduce OMC performance. In contrast, the effectiveness of the regulatory framework positively influences performance (β = 0.355, t = 2.688, p = 0.010), indicating that improved regulation enhances OMC outcomes. Standardized beta coefficients (−0.320 and 0.351) confirm the relative strength and direction of these relationships.

Table 8. Results for the coefficient estimates.

Coefficients[a]					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.822	0.729		5.246	0.000
Monthly fuel price adjustment	−0.349	0.143	−0.320	−2.449	0.018
Effectiveness current fuel price regulatory	0.355	0.132	0.351	2.688	0.010

a. Dependent Variable: Performance of OMC.

4. Discussion

The study's findings on the impact of monthly fuel price adjustments by the Energy Regulation Board (ERB) on the financial performance of petroleum companies in Zambia reveal the complex and multifaceted dynamics at play within the country's fuel pricing landscape. The significant negative correlation between these adjustments and key financial metrics, such as revenue and profit margins, underscores the inherent vulnerability of Zambia's price-sensitive petroleum sector, which is heavily reliant on imported fuel.

The study's integration of price adjustment theory, market structure theory, and game theory provides a robust analytical framework for understanding these dynamics. Price adjustment theory highlights how the ERB's monthly pricing decisions directly influence market equilibrium, supply, and demand, compelling petroleum companies to continuously adapt their operational strategies and pricing models to maintain profitability. The market structure theory further elucidates the competitive dynamics within Zambia's largely oligopolistic petroleum industry, where regulatory interventions like the ERB's price adjustments introduce uncertainties that shape the strategic decision-making of industry players.

Applying game theory, particularly the concept of Nash equilibrium, offers valuable insights into the strategic interactions among stakeholders, including petroleum companies, consumers, and the government. This framework reveals how factors such as global oil prices, exchange rates, and transportation costs identified as key determinants of the ERB's pricing decisions influence the pricing behaviours and market responses of both producers and consumers. By anticipating these strategic interactions, regulators can craft fuel price adjustments that better account for the diverse needs and reactions of all parties involved.

The study's findings also highlight the significant role that Zambia's currency depreciation plays in exacerbating the financial challenges faced by petroleum companies. As the Kwacha weakens against the US dollar, the import costs for these firms escalate, further squeezing profit margins and undermining operational stability.

Notably, the respondents' dissatisfaction with the ERB's pricing mechanisms, particularly the perceived lack of transparency and consideration for industry financial realities, reflects a critical disconnect between regulatory practices and the operational challenges faced by petroleum companies.

In addressing this disconnect, the study suggests that alternative pricing models, such as indexed pricing tied to macroeconomic indicators or automatic pricing mechanisms, could enhance stability and better align the interests of consumers, the government, and petroleum companies.

Ultimately, the complexities of Zambia's fuel pricing dynamics, as revealed by this study, highlight the need for a comprehensive and balanced regulatory approach that considers the strategic interactions among all stakeholders, the unique economic and geographic challenges faced by the petroleum sector, and the imperative for financial stability and operational resilience within this critical indus-

try. By integrating the theoretical insights from price adjustment theory, market structure theory, and game theory, policymakers and industry leaders can navigate these complexities and develop fuel pricing mechanisms that foster a sustainable and equitable energy landscape in Zambia.

5. Conclusion

This study revealed a negative correlation between monthly fuel price adjustments and the financial performance of petroleum companies in Zambia. Global oil price volatility, exchange rate fluctuations, and high transportation costs due to import reliance significantly impacted revenue and profit margins. Concerns regarding the transparency and predictability of the ERB's pricing mechanisms were evident. Respondents advocated for more stable and predictable pricing models, such as indexed pricing, to mitigate volatility. The study also highlighted the need for a shift from monthly to quarterly fuel price reviews to balance OMC operational stability and consumer price predictability. Game theory principles, particularly Nash equilibrium, offered insights into reflecting strategic interactions among market players. Despite the ERB's efforts to address affordability and inflation, dissatisfaction with its ability to balance stakeholder interests was prevalent. A more flexible and adaptive regulatory approach, informed by strategic interactions and market realities, was recommended to enhance industry resilience and sustainability.

Recommendations

To enhance fuel pricing stability and regulatory effectiveness in Zambia, the following recommendations are made:

i) Implement a Quarterly Fuel Price Review Model: Transition from monthly to quarterly reviews to provide a more stable pricing environment, balancing the needs of OMCs and consumers. This will allow for better planning and reduce volatility.

ii) Implement predictive pricing models: Utilize historical data, global oil price trends, and exchange rate forecasts to provide three-month forecasts, enabling better planning for petroleum companies.

iii) Establish a price stabilization fund: Create a fund, supported by government reserves and development partners, to cushion against global oil price shocks.

iv) Enhance transparency: Publish detailed monthly reports explaining the factors influencing price adjustments.

v) Diversify oil supply sources: Negotiate agreements with regional suppliers to reduce transportation costs and import reliance.

vi) Adopt an adaptive pricing framework: Replace the current model with a framework tied to macroeconomic indicators, such as inflation and exchange rates.

vii) Conduct regular stakeholder consultations: Establish quarterly forums in-

volving petroleum companies, consumer groups, and government representatives to ensure inclusive decision-making.

Acknowledgements

The authors thank all contributors to this study, with particular appreciation for the respondents from the OMCs and ERB.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Asian Development Bank ADB (2022). *Fuel Subsidies and Their Impact on the Economy*.

Boyes, W., & Melvin, M. (2012). *Microeconomics* (9th ed.). Houghton Mifflin Harcourt.

Chanda, T., & Mulenga, M. (2016). Impact of Frequent Price Adjustments on Profit Margins in Zambia's Petroleum Sector. *Journal of Petroleum Economics, 8,* 45-58.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). Sage Publications.

Economic Policy Research Institute EPRI (2022). *The Impact of Rising Fuel Prices on the Manufacturing Sector in Zambia*.

Energy Regulation Board ERB (2020). *Annual Report*. Energy Regulation Board.

Energy Regulation Board ERB (2021). *Fuel Price Adjustment Report*. Energy Regulation Board.

Energy Regulation Board ERB (2023). *Petroleum Industry Overview*. Energy Regulation Board.

Fowler, F. J. (2014). *Survey Research Methods* (5th ed.). Sage Publications.

Imenda, S. (2014). Is There a Conceptual Difference between Theoretical and Conceptual Frameworks? *Journal of Social Sciences, 38,* 185-195. https://doi.org/10.1080/09718923.2014.11893249

International Energy Agency (2022). *The Global Impact of Oil Price Volatility*.

Israel, M., & Hay, I. (2006). *Research Ethics for Social Scientists*. Sage Publications. https://doi.org/10.4135/9781849209779

Johnson, L., Smith, R., & Harris, M. (2018). Global Comparative Analysis of Petroleum Price Adjustments and Profitability. *Energy Economics Journal, 12,* 98-110.

Kasonde, P., & Banda, C. (2015). The Competitiveness of Zambia's Petroleum Pricing Mechanisms. *Zambian Journal of Economic Policy, 6,* 66-79.

Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the Craft of Qualitative Research Interviewing* (2nd ed.). Sage Publications.

Mulenga, B., & Chisanga, J. (2012). Efficiency and Competitiveness in the Zambian Petroleum Sector. *Zambia Economic Review, 4,* 31-47.

Ndlovu, T., & Moyo, G. (2017). Price Regulations and Their Impact on Profitability in Zimbabwe's Petroleum Sector. *Journal of African Business, 10,* 87-103.

Omagwa, J., Kihooto, R., & Reardon, T. (2017). Oil Retail Pricing and Controls: A Study on the Effects of Crude Oil Prices and Exchange Rates. *Journal of International Economics, 11,* 79-92.

Osei, P., Mensah, E., & Addo, B. (2018). Government Price Adjustments and Petroleum Company Profitability: Evidence from Ghana. *African Journal of Economics and Management, 9,* 40-55.

Pallant, J. (2020). *SPSS Survival Manual* (7th ed.). McGraw-Hill Education.

Petroleum Insight (2022). *Zambia's Fuel Pricing Review Mechanism*.

Sichone, J., & Phiri, C. (2014). The Role of Transparency and Accountability in Petroleum Pricing in Zambia. *Zambia Journal of Public Policy, 3,* 52-69.

Smith, A., & Johnson, R. (2019). The Impact of Frequent Price Adjustments on Petroleum Companies: A Global Analysis. *Energy Policy and Regulation, 15,* 112-128.

Smith, J., & Doe, A. (2023). Volatility in International Fuel Prices: Impacts of COVID-19 and the Russia-Ukraine Conflict. *SCRIP Journal, 12,* 45-67.

Tashakkori, A., & Teddlie, C. (2010). *Sage Handbook of Mixed Methods in Social & Behavioral Research* (2nd ed.). Sage Publications.

Tavakol, M., & Dennick, R. (2011). Making Sense of Cronbach's Alpha. *International Journal of Medical Education, 2,* 53-55. https://doi.org/10.5116/ijme.4dfb.8dfd

Tembo, J., & Mwamba, T. (2013). Alternative Regulatory Mechanisms for Petroleum Pricing: A Case Study of Zambia. *Zambian Energy Journal, 7,* 36-49.

World Bank (2022). *Zambia Economic Brief: Rising to the Challenge*. World Bank.

Zambia Association of Manufacturers ZAM (2022). *The Impact of Energy Prices on Manufacturing*. Zambia Association of Manufacturers.