

Strategies employed by cross-border traders to mitigate the adverse effects of fuel price volatility

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Abstract

Fuel price volatility represents a major economic challenge for transport-dependent enterprises in developing economies. This study explores strategies employed by cross-border traders to mitigate the adverse effects of fuel price volatility. The study employed a mixed-methods approach using a concurrent triangulation design, combining quantitative data from structured questionnaires administered to 101 traders with qualitative interviews to capture experiential insights. Quantitative findings reveal that fuel price fluctuations significantly increase operational costs and reduce profitability. Approximately 68% of respondents reported that fuel price changes have a very significant effect on transportation costs, while fuel-related expenses accounted for about 10–20% of total operational costs for most traders. Regression analysis confirmed a strong relationship between fuel price fluctuations and trader performance, with fuel price volatility significantly increasing operational costs ($\beta = 0.72$, $p < 0.001$, $R^2 = 0.52$) and negatively affecting profitability ($\beta = -0.65$, $p < 0.001$, $R^2 = 0.48$). Qualitative findings reveal that traders frequently adjust pricing structures, transport routes, and delivery schedules to manage rising fuel costs. The study concludes that fuel price volatility poses a substantial constraint on cross-border trade performance by increasing operational uncertainty and reducing profit margins. The findings highlight the need for policy interventions and institutional support mechanisms to enhance the resilience of small-scale traders operating within fuel-dependent trade systems.

Keywords: Fuel price volatility, Cross-border trade, Operational costs, SME performance

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1. Introduction

Fuel is a critical input in transportation, manufacturing, and agriculture, and its price significantly affects operational costs, particularly for micro, small, and medium enterprises (MSMEs), including cross-border traders. In Zambia, fuel price fluctuations are recurrent, influenced by global oil markets, exchange rate volatility, and domestic taxation policies (Bank of Zambia, 2021).

Historically, Zambia's approaches to fuel pricing have shifted with successive governments. During the UNIP era (1964–1991), the government subsidized fuel to protect consumers, framing fluctuations within a state-control and social welfare context (UNIP manifesto, 1991). The MMD government (post-1991) pursued neoliberal policies, gradually reducing subsidies and allowing market forces to determine fuel prices, emphasizing efficiency and private sector growth (MMD manifesto, 1991). The PF government (from 2011) initially maintained subsidies to cushion consumers but later faced fiscal constraints, balancing social protection with economic stability (PF manifesto, 2011). The UPND emphasized pro-market policies, fiscal discipline, and regulatory oversight, abolishing subsidies to enhance market competition and protect consumers from price manipulation while promoting inclusive economic policies for all, including cross-border traders (UPND manifesto, 2021; ERB reports 2016–2022).

Cross-border trade is a significant component of Zambia's economy. Traders rely on stable fuel prices to maintain profitability and operational consistency. Even with support from institutions like the Zambia Development Agency (ZDA), fuel volatility increases transport costs, reduces profit margins, and limits competitiveness (ZDA, 2020; Chikuba, 2020). Institutional support may enhance skills and market linkages but cannot fully shield traders from macroeconomic shocks.

Fuel price fluctuations also affect institutional performance, forcing organizations to recalibrate budgets, reduce outreach, or adjust logistics, which may compromise efficiency and the achievement of key performance indicators (IMF, 2022). Fuel price volatility is a persistent macroeconomic challenge in Zambia, directly and indirectly affecting transport-dependent businesses, such as cross-border traders of grains and legumes. Despite ZDA's capacity-building programs, traders face rising transportation and logistics costs, shrinking profit margins, and declining market competitiveness. These challenges undermine both business performance and institutional effectiveness in promoting sustainable entrepreneurship. Since December 2021, fuel price volatility has intensified due to the removal of fuel subsidies and the introduction of a 30-day pricing cycle by the Energy Regulation Board (Sefuka and Habaazoka, 2025; see Figure 1).

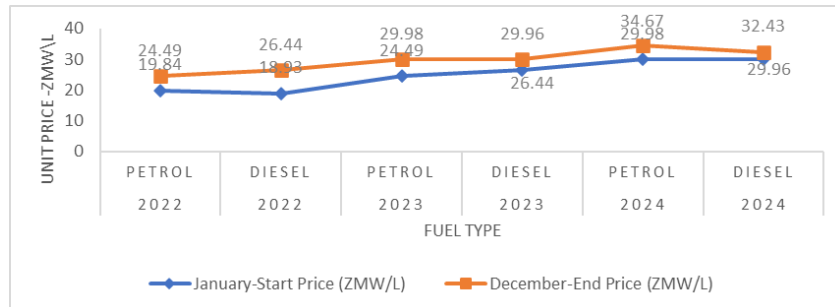


Figure 1: Zambia Fuel Price Volatility (2022–2024)

Source: Filed data, 2026

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Rising fuel prices, driven by global oil market disruptions, currency depreciation, and changes in government subsidies, have increased input costs across sectors, negatively affecting the economy. Cross-border traders, who rely heavily on road transport for agro-products, are particularly impacted (Teece, 2019). Simatele (2021) reported that MSMEs in Lusaka faced an 18% average increase in operating costs due to fuel, with 63% reducing trade volumes during high-price periods. ZIPAR (2022) noted coping strategies such as fewer trips, cheaper transport, higher prices, or scaling down operations, which often hinder long-term business growth and institutional objectives.

Despite ZDA training in business management, financial literacy, and export readiness, traders still struggle to adapt to fuel shocks, indicating a gap between institutional support and economic realities. This underscores the need to examine how fuel price fluctuations affect ZDA-trained cross-border traders and the strategies employed to mitigate these effects.

The purpose of the study was to explore policy strategies to mitigate challenges associated with volatile fuel prices.

2. Literature Review

Fuel price volatility is widely recognized as a significant determinant of operational performance for businesses, particularly micro, small, and medium enterprises (MSMEs). Empirical evidence demonstrates that fluctuations in fuel prices increase operational costs, constrain profitability, and disrupt investment decisions. Aktan and Hussein (2020), in examining the asymmetric effects of oil price uncertainty on corporate investment, report that small firms are disproportionately affected, often delaying or reducing investments when fuel costs rise. This finding is directly relevant to Zambian cross-border traders, many of whom operate as micro or small businesses with limited buffers to absorb cost shocks, highlighting their vulnerability to external price volatility.

Sector-specific analyses reinforce this relationship. Bisma et al. (2020) demonstrate through quantile regression that sectors reliant on transportation and logistics critical for cross-border trade—are particularly sensitive to oil price fluctuations. Higher fuel costs translate into increased transportation expenses, which reduce profit margins and may force traders to modify operational strategies, such as limiting trading frequency or using cheaper, less reliable transport. Fang et al. (2023) extend this understanding to periods of economic stress, showing that oil price volatility exacerbates financial constraints, a finding relevant for small-scale traders who face reduced market confidence during global crises or pandemics.

Institutional support mechanisms are also indirectly affected by fuel price volatility. Chi-Chuan and Chieng-Chang (2019) highlight that oil price shocks influence macroeconomic aggregates including interest rates, inflation, and investment patterns which, in turn, affect the operational success of institutional programs. For organizations like the Zambia Development Agency (ZDA), rising fuel costs may limit the effectiveness of training and capacity-building programs if traders cannot operationalize acquired skills due to prohibitive transport costs or market instability. Sectoral sensitivity is also crucial; Bisma et al. (2020) note that some sectors are less affected under certain conditions, indicating that

institutional programming must consider the unique fuel dependency of target beneficiaries to ensure relevance and applicability.

The literature also illustrates the broader macroeconomic consequences of oil price volatility, particularly for low-income, oil-importing countries. Odhiambo and Akinsola (2020) find that rising oil prices significantly constrain long-term economic growth in Sub-Saharan Africa, emphasizing that higher transport costs and input prices reduce business competitiveness. Adeleke et al. (2018) similarly report output contractions during oil shocks, highlighting that even net oil-importing countries, such as Zambia, face operational stress through increased transportation expenses. Abdulazeez et al. (2020) further underscore that oil price shocks can restrict financing for small businesses, suggesting that cash flow and credit constraints compound the direct cost effects for cross-border traders.

Several studies link commodity prices and fuel costs, highlighting the cascading effects on trade. Kaulu (2021) finds a long-run relationship between crude oil, maize, and copper prices in Zambia, indicating that fuel price fluctuations can indirectly affect both input and sale prices for traders handling agricultural produce. Chikuba (2020) emphasizes the vulnerability of SADC nations to oil price shocks, noting that high transport costs reduce trade competitiveness and limit the adoption of alternative fuels, reinforcing the structural challenges faced by cross-border traders during periods of fuel price volatility.

Collectively, these studies demonstrate that fuel price volatility not only increases operational costs and reduces profitability but also constrains investment, market access, and the effectiveness of institutional support programs. While the literature offers substantial macroeconomic and sectoral insights, there remains a gap in empirical research specifically focusing on cross-border traders in Zambia, particularly regarding how these traders adapt to fuel price fluctuations and how institutional interventions, such as ZDA training, can be optimized to enhance operational resilience. This study seeks to address this gap by examining the effects of fuel price fluctuations on the performance of ZDA-trained cross-border traders in Lusaka District.

3 Research Methodology

This study employed a mixed-methods approach using a concurrent triangulation design, integrating quantitative and qualitative data to provide a comprehensive understanding of the effects of fuel price fluctuations on cross-border traders' operational performance. The concurrent triangulation design allows for simultaneous collection and analysis of numerical and experiential data, ensuring that findings from each method complement and validate the other (Creswell & Plano Clark, 2018).

The target population consisted of cross-border traders in Lusaka District who had received training and support from the Zambia Development Agency (ZDA). The population included traders engaged in agro-products such as grains (maize, beans, rice) and legumes (groundnuts, peas). A sample of 101 traders was selected using purposive sampling, ensuring that participants had direct experience with cross-border trade and were familiar with the operational challenges posed by fuel price fluctuations. Purposive sampling was considered appropriate because it allowed for the inclusion of respondents with rich, relevant experience crucial for both quantitative and qualitative analyses.

Structured Questionnaire and Semi-structured interview guide and Focus Group Discussion guide were the instruments used for the data collection. Quantitative data were collected through face-to-face administration of questionnaires during field visits. Interviews were conducted with 10 key informants representing different product categories (beans, maize, groundnuts, rice, and peas) to ensure sectoral diversity. Two focus group discussions (FGDs) were organized, each consisting of 6–8 participants, to triangulate findings from individual interviews and questionnaires. Data collection adhered to ethical protocols, including informed consent, voluntary participation, and confidentiality of responses.

Descriptive statistics were used to summarize demographic characteristics, trading patterns, and perceptions of fuel price impacts. Linear regression analysis was conducted using SPSS version 28 to examine the relationship between fuel price fluctuations and operational performance indicators operational costs, profitability, and market access. Interview and FGD transcripts were analyzed thematically following Braun and Clarke's (2006) approach. Codes were generated based on recurring themes, including pricing adjustments, logistics strategies, institutional support, and operational resilience. Triangulation of qualitative and quantitative results ensured validity and reliability of findings.

4 Results and Discussion

4.1 Results

Fuel price fluctuations affected the ability to manage the cross-border logistics. Figure 2 shows how fuel price fluctuation affected the ability to manage cross-border logistics. Study results reveal, disrupted supply chain planning 41%, unpredictable pricing 29%, reduced profit margins 20% while reduced competition accounted for 10%.

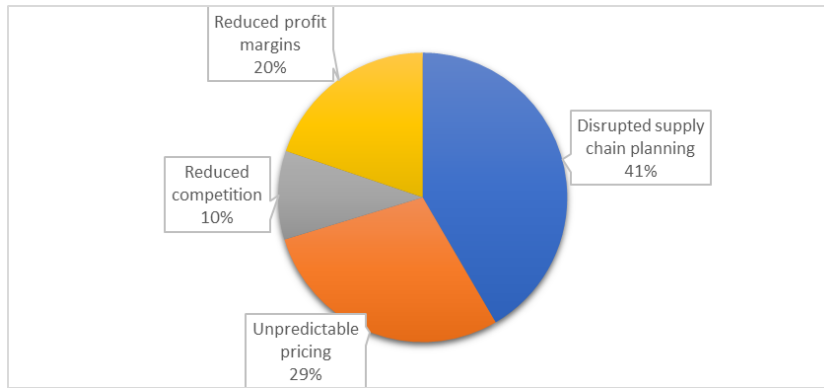


Figure 2: How fuel price fluctuation has affected cross border logistics
Source: Field data (2026)

Due to the challenges mentioned above, the study explored strategies implemented to mitigate the impact of fuel costs on business operations. Results reveal routine optimization software and delivery schedule 42%, long term agreements 26%, collaboration and strategic alliances 19% while outsourcing non-core functions accounted for 13% out of the 101 respondents sampled.

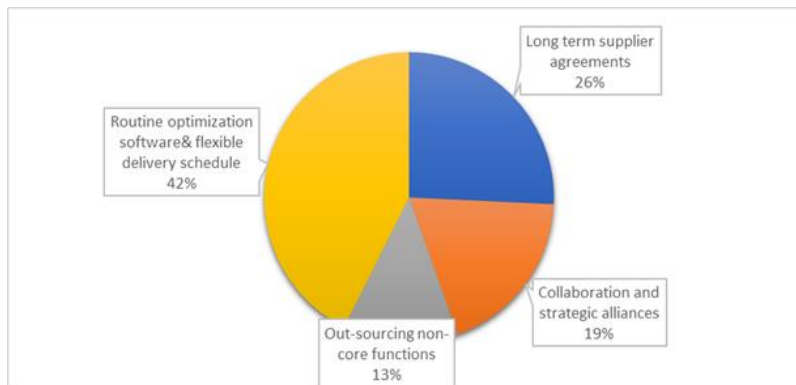


Figure 3: Strategies employed to mitigate the impact
Source: Field data (2026)

Respondents described strategies to manage rising fuel costs in cross-border trade. A 37-year-old male beans exporter said: “We now work with other traders to share truck, it’s cheaper than moving half-empty” (SME 1, Interview). Another noted: “The ZDA training taught us to negotiate long-term contracts with transporters and that has really helped” (SME 2, Interview).

Outsourcing deliveries to full-load transporters was highlighted: “I outsource deliveries to transporters who already have full loads going in my direction” (SME 3, Interview). Collaboration emerged as key: “Collaboration with other traders is the only reason I can still afford to cross the border twice a month” (SME 4, Interview). These strategies collaboration, contract negotiation, outsourcing, and route optimisation help reduce costs, improve efficiency, and sustain operations amid volatile fuel prices.

4.2 Discussion

The study has demonstrated that fuel volatility is a primary driver of cost inflation. These results corroborate international findings by Aktan & Hussein (2020) and Fang et al. (2023), which indicate that small enterprises are highly sensitive to oil price changes due to limited capacity to absorb cost shocks. The verbatim responses reveal the immediacy of fuel price impacts on trip planning, budgeting, and negotiation with transporters, reflecting real-world constraints that quantitative measures alone may not fully capture.

Traders employed multiple strategies to mitigate fuel price shocks, including route optimization, long-term agreements with transporters, collaborative bulk shipping, and outsourcing deliveries. These practices reflect practical applications of resilience theory, suggesting that adaptive capacity is crucial for sustaining operations under external economic stress. ZDA support was rated highly by respondents, with 52% indicating extreme help and 41% very much, particularly in enhancing negotiation skills, logistical planning, and pricing strategies. This confirms that institutional interventions can buffer small enterprises against macroeconomic volatility, consistent with findings by Chikuba (2020) and Abdulazeez et al. (2020). However, the study also notes a gap: ZDA programs indirectly support resilience but lack a formal focus on fuel price volatility, potentially limiting targeted impact.

The study highlights that fuel price fluctuations exert multi-dimensional pressures on cross-border traders, affecting operational costs, profitability, and market access. The findings suggest several policy and practical interventions:

- Targeted Institutional Support: ZDA and other agencies could integrate fuel risk management modules into training programs.
- Collaborative and Innovative Logistics: Encouraging shared transport arrangements and route optimization reduces individual cost exposure.
- Market and Pricing Flexibility: Traders need mechanisms to adjust prices while maintaining customer relationships.
- Government Policy Considerations: Regulatory measures, such as stabilizing fuel pricing or providing subsidies during peak volatility periods, could enhance economic resilience among SMEs.

Therefore, the study reinforces the view that fuel price volatility is not merely a macroeconomic phenomenon but a critical operational challenge that interacts with trader demographics, business strategies, and institutional support. Addressing these issues requires integrated interventions at both the policy and enterprise levels, ensuring that cross-border traders can sustain operations, maintain profitability, and remain competitive in a volatile fuel market.

5 Conclusions and Recommendations

This study explored the effects of fuel price fluctuations on the operational performance of cross-border traders trained by the Zambia Development Agency (ZDA) in Lusaka District. The findings reveal that fuel price volatility is a significant determinant of operational costs, profitability, and market access for these traders. The qualitative evidence underscores that fuel volatility forces traders to adjust pricing frequently, alters delivery schedules, and disrupts cross-border logistics, compelling the adoption of coping strategies such as collaborative transport, route optimization, outsourcing, and long-term transporter agreements. Traders' resilience depends on a combination of adaptive strategies, institutional support, and enabling policy environments. The study highlights the critical need for targeted interventions that integrate fuel volatility considerations into cross-border trade development programs.

Based on the study findings, the following recommendations are proposed:

- Stabilize fuel prices or provide buffers for transport-dependent traders.
- Promote collaborative transport and route optimization to reduce costs.
- Apply flexible pricing strategies to maintain profitability.
- Conduct further research on long-term impacts of fuel price fluctuations and gendered effects in cross-border trade.

Declaration of Competing Interests

The authors declare that they are not aware of any competing financial interests or personal relationships that may have influenced the work described in this document.

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Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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