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Price Liberalization And Supply Chain Efficiency In Nigeria's Downstream Petroleum Sector

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Abstract

This study examines the relationship between price liberalization and supply chain efficiency in Nigeria's downstream petroleum sector. For decades, Nigeria operated a fuel subsidy regime characterized by administered pricing, fiscal strain, and persistent supply distortions. The 2023 subsidy removal marked a structural shift toward market-determined pricing, with potential implications for operational performance within the petroleum distribution network. Drawing on the Resource-Based View (RBV), the study posits that liberalized pricing increases firms' exposure to real cost conditions, thereby intensifying reliance on internal logistics capabilities and resource optimization. Using a cross-sectional survey design, data were collected from 279 stakeholders across Nigeria's downstream petroleum distribution chain. Pearson Product Moment Correlation analysis was employed to assess the relationships between price liberalization and two dimensions of supply chain efficiency: product availability and cost efficiency. The findings reveal a strong positive relationship between price liberalization and product availability ($r = 0.684$, $p < 0.05$) and a moderate-to-strong positive relationship with cost efficiency ($r = 0.643$, $p < 0.05$). The results suggest that market-based pricing reforms are associated with improved operational discipline and enhanced supply chain performance. The study contributes empirical evidence linking pricing reform to firm-level efficiency outcomes in a developing oil-producing economy and offers policy-relevant insights for sustaining efficiency gains under liberalized regimes.

Keywords: Cost efficiency; Fuel subsidy removal; Price liberalization; Product availability; Supply chain efficiency.

Introduction

Nigeria's downstream petroleum sector has historically operated under an extensive fuel subsidy regime and administered pricing framework that shaped market structure, investment incentives, and supply chain performance for decades. As Africa's largest crude oil producer, Nigeria paradoxically relied heavily on imported refined petroleum products due to persistent underperformance of domestic refineries and institutional inefficiencies (Ozili, 2023). To cushion consumers from global oil price volatility, successive governments fixed pump prices below international parity levels and compensated marketers through subsidy payments. While politically expedient, this regime generated profound fiscal, operational, and allocative distortions (International Monetary Fund [IMF], 2022; World Bank, 2022).

Fuel subsidies became one of the largest components of public expenditure in Nigeria, at times exceeding federal allocations to health and education combined (Nigeria Extractive Industries Transparency Initiative [NEITI], 2022). Beyond fiscal strain, regulated pricing weakened market signals essential for efficient resource allocation. Artificially low prices encouraged overconsumption, cross-border smuggling to neighboring countries with higher prices, and rent-seeking behavior within the importation and distribution chain (Eze & Okonkwo, 2019; Olujobi, 2021). Delays in subsidy reimbursements further discouraged private participation and disrupted import schedules, leading to recurrent fuel shortages and prolonged queues at retail outlets. Thus, despite heavy government intervention, product availability remained unstable and distribution costs remained structurally high (Akinola, 2018; Evans et al., 2023).

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From a theoretical standpoint, administered pricing systems distort the informational role of prices in coordinating supply and demand. Neoclassical price theory posits that market-determined prices enhance allocative efficiency by signaling scarcity and incentivizing optimal production and distribution decisions (Stiglitz, 2015). In the Nigerian context, however, regulated pricing suppressed these signals, creating misalignment between domestic demand, import volumes, and logistical planning. Consequently, supply chain inefficiencies manifested in stockouts, high demurrage costs at ports, excessive reliance on road haulage, and underinvestment in storage infrastructure (Agbonifo, 2021; Shinde, 2025).

The transition toward price liberalization represents a structural shift in the governance of Nigeria's downstream petroleum sector; particularly following major reform episodes culminating in the 2023 subsidy removal. Price liberalization entails the removal of state-imposed price ceilings and the alignment of domestic petroleum prices with international benchmarks, exchange rate movements, and actual distribution costs (Evans et al., 2023). The reform is expected to restore price signals, incentivize private investment, reduce arbitrage opportunities, and enhance operational efficiency across the supply chain. Early policy analyses suggest that liberalized pricing improves cost recovery, strengthens inventory planning, and reduces distortions associated with subsidy claims (Adamu & Darma, 2020; Akpan & Akpan, 2022).

However, while the macroeconomic rationale for subsidy removal is well established, less empirical attention has been devoted to its operational consequences at the firm and supply chain level. Specifically, there remains limited quantitative evidence on whether price liberalization translates into measurable improvements in product availability and cost efficiency within Nigeria's downstream petroleum distribution network. Existing studies (Abiola, 2024; Akamike & Okonkwo, 2024) largely focus on fiscal sustainability, inflationary impacts, and welfare implications, leaving a gap in understanding how pricing reform reshapes logistical performance and operational resource deployment.

This study thus addresses that gap by isolating price liberalization as the central reform variable and examining its relationship with two critical dimensions of supply chain efficiency: product availability and cost efficiency. Drawing on the Resource-Based View (Barney, 1991), the study argues that once subsidy distortions are removed, downstream firms must rely on internal capabilities, logistics management, storage infrastructure, procurement planning, and distribution optimization, to remain competitive. In a liberalized environment, firms unable to manage these resources efficiently are more likely to experience higher costs and stockouts, while capable firms achieve improved availability and lower distribution costs (Akinola, 2018; Shinde, 2025). Accordingly, the primary objective of this paper is to examine the relationship between price liberalization and supply chain efficiency in Nigeria's downstream petroleum sector. Specifically, the study seeks to:

i. Investigate the relationship between price liberalization and product availability.

ii. Examine the relationship between price liberalization and cost efficiency in petroleum distribution.

By empirically linking pricing reform to operational supply chain outcomes, this study contributes to the literature on energy sector reform in developing economies and provides policy-relevant evidence on whether liberalization enhances efficiency beyond its fiscal implications.

Literature Review

Price Liberalization

Price liberalization refers to the removal of government-imposed price controls to allow market forces of supply and demand to determine commodity prices. In the context of petroleum markets, it involves aligning domestic fuel prices with international benchmarks, exchange rates, and actual distribution costs (Akpan & Akpan, 2022). Liberalization is often implemented as part of broader structural adjustment reforms aimed at improving allocative efficiency and encouraging private sector participation (Greve & Lay, 2023).

From a theoretical perspective, liberalized pricing restores the signaling function of prices. According to neoclassical economic theory, prices coordinate economic activity by reflecting scarcity and marginal cost conditions (Stiglitz, 2015). When prices are artificially suppressed, producers face distorted incentives, investment decisions become misaligned with market realities, and supply responses weaken. In petroleum-

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dependent economies, such distortions can discourage refining investment, impair logistics planning, and reduce storage and distribution efficiency (Kojima, 2013; Ozili, 2023).

Empirical studies (Hassan et al., 2025; Odey, 2024) suggest that price liberalization tends to improve cost recovery and enhance market entry, particularly in energy markets previously dominated by state monopolies. However, the operational implications of liberalization, especially its impact on supply chain performance, remain underexplored in many developing economies, including Nigeria (Olujobi, 2021).

Fuel Subsidy Economics

Fuel subsidies are government interventions designed to lower consumer prices below market equilibrium levels. They are often justified on equity grounds, particularly in countries where energy constitutes a significant share of household expenditure (Coady et al., 2019). However, economic theory highlights multiple inefficiencies associated with universal fuel subsidies. First, subsidies create fiscal burdens that crowd out productive public expenditure. Second, they encourage overconsumption and reduce incentives for efficiency improvements. Third, they generate arbitrage opportunities and smuggling in border regions where domestic prices differ substantially from neighboring countries (Olujobi, 2021; Ozili, 2023; Usman et al., 2024).

In Nigeria, fuel subsidies have historically imposed substantial fiscal costs while failing to guarantee consistent product availability. Delayed reimbursement mechanisms and opaque claims processes weakened private sector participation and disrupted import scheduling (Eze & Okonkwo, 2019; Ozili, 2023). Consequently, despite heavy government spending, fuel shortages and distribution inefficiencies persisted.

Economic literature (Coady et al., 2019; Shinde, 2025) increasingly argues that subsidy removal improves fiscal sustainability and restores proper price signals. Yet, most studies focus on macroeconomic outcomes such as inflation, public debt, and welfare redistribution, with limited attention to firm-level or supply chain-level operational consequences. This creates a critical empirical gap regarding how subsidy removal affects logistics performance and distribution cost structures.

Liberalization in Developing Economies

Energy market liberalization in developing economies has produced mixed outcomes. In countries such as Indonesia and India, gradual subsidy reform combined with regulatory strengthening improved investment flows and reduced supply disruptions (Greve & Lay, 2023). Conversely, poorly sequenced reforms in some African economies resulted in price volatility without corresponding efficiency gains.

The success of liberalization depends largely on institutional capacity, infrastructure quality, and firm-level capabilities. Where market institutions are weak, liberalization alone may not automatically generate efficiency improvements (Rodrik, 2008). Instead, firms must possess adequate logistical resources, managerial competence, and access to capital to respond effectively to price signals.

In sub-Saharan Africa, evidence suggests that deregulation enhances private participation but may also increase short-term price volatility (Akpan & Akpan, 2022). However, there remains limited empirical investigation into how liberalized pricing affects downstream petroleum distribution efficiency, particularly in large oil-producing but import-dependent economies like Nigeria. Thus, while the macroeconomic case for liberalization is well documented, the micro-operational implications remain insufficiently examined. This study contributes by focusing specifically on downstream supply chain outcomes rather than aggregate economic indicators.

Supply Chain Efficiency Theory

Supply chain efficiency refers to the ability of a distribution network to deliver products at minimal cost while maintaining high levels of availability and service performance (Christopher, 2016; Janvier-James, 2012). In petroleum distribution systems, efficiency is typically evaluated through indicators such as inventory turnover, transportation cost management, stockout frequency, and lead-time reliability. From a Resource-Based View (RBV) perspective, supply chain performance depends on firm-specific capabilities that are valuable, rare,

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inimitable, and organizationally embedded (Barney, 1991). In a regulated pricing regime, firms may rely on government guarantees and subsidy reimbursements to sustain operations. However, under liberalized pricing, firms must optimize procurement planning, storage capacity utilization, and transportation networks to maintain competitiveness.

Price liberalization may therefore alter the strategic importance of internal logistics capabilities. When firms bear full cost exposure, incentives to minimize demurrage charges, reduce haulage inefficiencies, and improve depot coordination increase. As a result, product availability may improve due to more accurate inventory planning, while cost efficiency may rise due to tighter resource management. Despite theoretical expectations, empirical evidence linking price liberalization to measurable supply chain efficiency outcomes remains sparse in the Nigerian petroleum sector. Existing research has primarily examined deregulation from fiscal or political economy perspectives (Ozili, 2023; Olujobi, 2021). There is limited quantitative analysis assessing whether liberalized pricing correlates with improvements in product availability and cost efficiency.

The literature establishes that:

- Fuel subsidies distort price signals and strain fiscal resources.
- Liberalization restores market pricing mechanisms.
- Supply chain efficiency depends on firm-level capabilities.

However, few studies empirically examine whether price liberalization translates into operational efficiency gains within downstream petroleum supply chains in Nigeria (). This study bridges that gap by quantitatively examining the relationship between price liberalization and two core dimensions of supply chain efficiency: product availability and cost efficiency. The current study moves beyond macroeconomic analysis to explore how structural pricing reform influences firm-level operational outcomes.

Resource-Based View (RBV)

The Resource-Based View (RBV) provides the primary theoretical foundation for this study. RBV posits that firms achieve sustained performance advantages when they possess resources and capabilities that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Unlike industry-structure approaches that emphasize external market conditions, RBV focuses on internal organizational capabilities as the primary drivers of performance differentials.

In regulated environments, particularly under subsidy regimes, firm-level efficiency may be partially insulated from competitive pressures. Government-fixed prices and subsidy reimbursements can reduce the strategic necessity for cost optimization and operational innovation. Under such conditions, firms may survive despite inefficient logistics structures because pricing distortions buffer operational weaknesses. Empirical evidence from Nigeria's downstream petroleum sector suggests that deregulation policies expose structural inefficiencies that were previously masked under regulated pricing frameworks (Nwachukwu & Egwuonwu, 2020).

However, price liberalization alters this dynamic fundamentally. When fuel prices reflect actual import costs, exchange rate movements, and distribution expenses, firms become fully exposed to cost realities. Profitability is no longer sustained through subsidy claims but through operational efficiency. Studies examining downstream deregulation in Nigeria show that cost efficiency and competitive responsiveness improve when pricing mechanisms are market-driven (Fagbemi & Adesina, 2021; Giwa & Lawal, 2021). Consequently, internal capabilities such as inventory management systems, transportation coordination, depot infrastructure, and procurement planning become critical strategic assets. Evidence further indicates that market competition under liberalized pricing enhances supply chain performance and operational discipline among petroleum marketers (Michael & Adeleke, 2020).

From an RBV perspective, liberalization increases the strategic value of supply chain capabilities. Firms possessing superior logistics coordination, storage optimization, and cost-control mechanisms are better positioned to ensure product availability while minimizing distribution costs (Fagbemi & Adesina, 2021).

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Conversely, firms lacking such capabilities may experience stockouts, high demurrage charges, and elevated transportation expenses, particularly in periods of price and exchange rate volatility. While macroeconomic studies such as Gbenga (2025) emphasize aggregate economic adjustments following subsidy removal, firm-level efficiency outcomes depend largely on internal resource deployment rather than policy change alone. Thus, price liberalization may function as an environmental trigger that reactivates competitive capability deployment within the downstream petroleum sector. It shifts the basis of performance from state protection to firm-level resource efficiency.

Accordingly, this study conceptualizes supply chain efficiency along two dimensions:

- **Product availability:** the consistent presence of petroleum products across distribution outlets without stockouts.
- **Cost efficiency:** the ability to minimize distribution and logistics costs relative to operational output.

Grounded in RBV, the study proposes that:

***H_{01}*:** Price liberalization has no significant association with product availability.

***H_{02}*:** Price liberalization has no significant association with cost efficiency.

Methodology

This study adopts a cross-sectional survey design to examine the relationship between price liberalization and supply chain efficiency in Nigeria's downstream petroleum sector. A cross-sectional approach is appropriate for assessing relationships among variables at a specific point in time and is widely used in organizational and supply chain research (Creswell & Creswell, 2018). The design allows for the collection of perceptual and operational data from industry participants directly involved in petroleum distribution activities.

The study population comprised stakeholders within Nigeria's downstream petroleum distribution network, including depot managers, logistics coordinators, petroleum marketers, transport supervisors, and retail station operators. Using structured survey instruments, data were collected from 279 respondents actively engaged in downstream petroleum operations. The sample size is considered adequate for correlation-based statistical analysis and aligns with recommended thresholds for behavioral and management research (Hair et al., 2019).

Primary data were collected using a structured questionnaire designed to measure:

- Perceived extent of price liberalization impact
- Product availability performance
- Cost efficiency performance

Items were measured using a Likert-scale format to capture respondents' evaluations of operational changes following pricing reform. Content validity was ensured through expert review and alignment with established supply chain performance indicators (Christopher, 2016). Reliability was assessed using internal consistency measures prior to hypothesis testing.

The study employed the Pearson Product Moment Correlation Coefficient (PPMCC) to examine the strength and direction of relationships between price liberalization and the two dimensions of supply chain efficiency. PPMCC is appropriate for measuring linear relationships between continuous variables and is widely used in management and economic research. The correlation coefficient (r) ranges from −1 to +1, where:

- Positive values indicate direct relationships
- Negative values indicate inverse relationships
- Values closer to ±1 indicate stronger relationships

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Statistical significance was evaluated at the 0.05 level. The choice of correlation analysis is consistent with the study's objective of determining associative relationships rather than establishing causality.

Results

A total of 279 valid responses were analyzed. Respondents comprised depot managers, petroleum marketers, logistics coordinators, transport supervisors, and retail station operators actively engaged in downstream petroleum distribution activities. Preliminary data screening confirmed completeness of responses and suitability for correlation analysis. Reliability analysis conducted prior to hypothesis testing indicated acceptable internal consistency across measurement scales.

The Pearson Product Moment Correlation Coefficient (PPMCC) was employed to examine the relationships between price liberalization and the two dimensions of supply chain efficiency: product availability and cost efficiency. The results are presented in Table 1.

Table 1: Correlation Matrix

Variables	Price Liberalization	Product Availability	Cost Efficiency
Price Liberalization	1.000		
Product Availability	0.684*	1.000	
Cost Efficiency	0.643*	0.711*	1.000

*Correlation is significant at the 0.05 level (2-tailed).
N = 279

Hypothesis One

***H_{01}*:** Price liberalization has no significant association with product availability.

The analysis reveals a strong positive correlation between price liberalization and product availability ($r = 0.684$, $p < 0.05$). The magnitude of the coefficient indicates a substantial linear relationship. Since the probability value is below the 0.05 significance threshold, the null hypothesis is rejected. The result suggests that higher levels of price liberalization are associated with improved product availability within Nigeria's downstream petroleum distribution network.

Hypothesis Two

***H_{02}*:** Price liberalization has no significant association with cost efficiency.

The findings indicate a moderate-to-strong positive correlation between price liberalization and cost efficiency ($r = 0.643$, $p < 0.05$). The relationship is statistically significant at the 5 percent level. Consequently, the null hypothesis is rejected. The result implies that increased price liberalization is associated with improved cost efficiency in petroleum distribution operations.

The empirical analysis demonstrates that price liberalization is positively and significantly associated with both dimensions of supply chain efficiency examined in this study. The relationship is stronger for product availability ($r = 0.684$) than for cost efficiency ($r = 0.643$), suggesting that pricing reform may have a more pronounced immediate effect on inventory availability and distribution continuity than on cost optimization mechanisms.

Overall, the results provide statistical support for the argument that market-based pricing reforms are linked to measurable improvements in downstream petroleum supply chain performance.

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Implications of the Study

This study generates theoretical, managerial, and policy implications.

Theoretical Implications: The findings extend the application of the Resource-Based View beyond traditional competitive strategy contexts into energy sector reform analysis. By demonstrating that price liberalization is positively associated with product availability and cost efficiency, the study positions liberalization as an environmental trigger that activates internal capability deployment. It shows that pricing reform alone does not create efficiency; rather, it intensifies the strategic value of firm-level logistics and operational resources. This enriches reform literature by integrating macro-level policy change with micro-level capability theory.

Managerial Implications: For petroleum marketers and depot operators, the results underscore the importance of strengthening internal logistics systems, inventory planning mechanisms, transportation coordination, and cost-control structures. In a liberalized pricing environment, firms that fail to optimize these operational capabilities risk stockouts and elevated distribution costs. Conversely, firms with strong supply chain competencies are better positioned to sustain product availability and maintain competitive margins.

Policy Implications: For policymakers, the results indicate that subsidy removal can generate operational efficiency gains, but such gains depend on institutional support systems. Exchange rate stability, port infrastructure improvements, transparent regulatory oversight, and predictable policy communication remain essential to sustaining efficiency improvements under liberalized pricing. Liberalization without supportive infrastructure may limit the full realization of efficiency benefits.

Conclusion

This study investigated the relationship between price liberalization and supply chain efficiency in Nigeria's downstream petroleum sector. Against the backdrop of prolonged fuel subsidy distortions and the recent transition to market-based pricing, the study empirically examined whether liberalization is associated with improvements in product availability and cost efficiency. The findings reveal statistically significant positive relationships between price liberalization and both dimensions of supply chain efficiency. The stronger association observed with product availability suggests that pricing reform may immediately improve inventory planning and distribution continuity. The positive relationship with cost efficiency indicates enhanced operational discipline under increased cost exposure.

Grounded in the Resource-Based View, the study concludes that liberalization shifts the basis of performance from state-backed price guarantees to firm-level operational capabilities. Price reform, therefore, functions as a structural catalyst that compels firms to optimize logistics resources and improve distribution management. However, sustained efficiency gains require complementary institutional stability and infrastructure support. Overall, the study moves beyond macro-fiscal debates on subsidy removal and provides empirical evidence that pricing reform is linked to measurable supply chain performance outcomes within a developing oil-producing economy.

Recommendations

Based on the findings, the study recommends the following:

Strengthening Logistics Infrastructure: Government and private stakeholders should invest in storage facilities, pipeline networks, and multimodal transport systems to reduce distribution bottlenecks and reliance on road haulage.

Enhancing Exchange Rate Stability: Since import costs remain sensitive to foreign exchange fluctuations, macroeconomic stability is crucial for sustaining cost efficiency under liberalized pricing.

Improving Regulatory Transparency: Clear and predictable regulatory frameworks should be maintained to reduce uncertainty and encourage private sector investment in downstream distribution networks.

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Capacity Development for Downstream Firms: Petroleum marketers should prioritize training in inventory optimization, demand forecasting, and logistics management to enhance operational performance.

Encouraging Competitive Market Entry: Policies that lower entry barriers while maintaining quality standards can promote healthy competition and further stimulate efficiency improvements.

Suggestions for Future Studies

While this study provides valuable empirical evidence, several avenues remain open for further investigation:

Longitudinal Analysis: Future research could adopt panel data designs to compare supply chain performance before and after subsidy removal, thereby strengthening causal inference.

Comparative Cross-Country Studies: Comparative analyses across oil-producing African economies could assess whether similar efficiency patterns emerge under liberalization.

Structural Equation Modeling (SEM): Future studies may explore mediating mechanisms, such as operational autonomy or investment intensity, to better explain how price liberalization influences supply chain efficiency.

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