International Journal of Innovative Finance and Economics Research 14(3):219-224, July-Sept, 2026
© SEAHI PUBLICATIONS, 2026 www.seahipublications.org ISSN: 2467-8473

DOI:10.5281/zenodo.21820874

Effect Of Petroleum Subsidy Withdrawal On Railway Transportation Performance In Nigeria (A Vector Error Correction Model Approach, 2000–2024)

Abdulazeez Adeyinka ADEGBOLA[1] &Sabiu Bariki SANI[2]

[1]Department of Economics, Faculty of Social Sciences, University of Abuja, Abuja, Nigeria
abdulazeezadegbola4@gmail.com[1] bariki.sabiu@uniabuja.edu.ng[2]

ABSTRACT
The research covered the impact of petroleum subsidy withdrawal on railway transportation performance in Nigeria for the period 2000 to 2024. Using annual time-series data on fuel price, railway revenue, passenger traffic, freight traffic, government investment in railways, and gross domestic product, the study employed the Vector Error Correction Model (VECM), Johansen cointegration test, Granger causality analysis, impulse response functions, and variance decomposition techniques. The Johansen cointegration test confirmed the existence of a long-run equilibrium relationship among the variables. VECM results showed that government investment in railway infrastructure had a significant positive short-run effect on railway revenue, while fuel price shocks produced weak immediate effects but generated positive responses in railway utilization over the medium and long run. Granger causality findings revealed that GDP and government investment are the primary drivers of railway revenue, while railway revenue in turn stimulates both passenger and freight activity. Variance decomposition further indicated that GDP dominates the long-run variation in railway revenue, accounting for over 98% of forecast error variance by the tenth period. In conclusion, petroleum subsidy withdrawal exerts a positive but indirect long-run influence on railway transportation performance in Nigeria, and its benefits are best realized when supported by sustained public investment, improved railway infrastructure, and macroeconomic growth. The study recommends increased government spending on rail infrastructure, channelling subsidy savings into railway development, and the promotion of modal shift from road to rail transportation.
Keywords: Petroleum subsidy withdrawal, Railway transportation, VECM, Nigeria, Fuel price, Government investment

INTRODUCTION
Petroleum products play a pivotal role in the socio-economic development of oil-dependent developing economies such as Nigeria, where energy consumption remains heavily reliant on fossil fuels (Idowu et al., 2025). To cushion citizens against market volatility, successive governments maintained subsidised pump prices for Premium Motor Spirit (PMS), aiming to reduce the cost of living and sustain mobility, industrial activity, and household energy access, although the policy has long been criticised for its fiscal burden, disbursement inefficiencies, and limited reach to the intended population (Akinteye, 2025; Adamolekun, 2025). Beyond pricing and fiscal considerations, Nigeria's continued reliance on oil extraction has also been linked to environmental degradation and livelihood challenges in oil-producing

communities, particularly across the Niger Delta region (Sani & Magaji, 2024; Abubakar, et all, 2016). The eventual withdrawal of the subsidy has raised transportation costs, with rural households experiencing disrupted mobility and reduced small-scale economic activity (Abdullahi & Tukur, 2025), and urban dwellers facing reduced access to essential services as fuel costs rise (Udofia, Ataide, & Udofia, 2025). Sani (2014b) similarly found that changes in petroleum prices arising from subsidy withdrawal significantly influence GDP, inflation, and unemployment in Nigeria, underscoring the far-reaching macroeconomic consequences of the policy (Bariki, Matthew & Ismail, 2025).

Transportation is among the sectors most exposed to fuel price shocks. Railway transport, valued as a low-cost, high-capacity alternative to road haulage for both passenger and freight movement, is directly affected by changes in operating costs, fare structures, and service frequency arising from subsidy reform (Garkoyeba, Dauda, & Samaila, 2025; Oyeyemi, Osoja, Fadipe, & Olasokan, 2025). These studies demonstrate that while subsidy removal may be economically justified from a fiscal perspective, it produces notable short-term hardships for citizens, especially in transport-dependent sectors. This is consistent with earlier evidence suggesting that even a gradual approach to subsidy withdrawal can generate measurable effects on Nigeria's broader economic growth trajectory, beyond the immediate hardships experienced by transport-dependent households (Sani, 2014b). Existing empirical work, however, has concentrated on road transport, household welfare, and macroeconomic outcomes of subsidy removal (Ogboru & Akinyotu, 2025), leaving the railway sub-sector's revenue, passenger, and freight dynamics comparatively unexamined despite its strategic importance to national development and its potential to absorb demand shifted away from road transport following subsidy withdrawal (Aliyu, Ijoko, & Rafatu, 2025; Sabiu, Ajayi & Ismail, 2025). This reinforces earlier research on downstream oil sector deregulation, which similarly linked market-oriented reforms to broader macroeconomic growth outcomes, suggesting that subsidy-related policy shifts carry implications well beyond the energy sector itself (Bariki, Akhigbe & Ismail, 2025; Sani & Kouhy, 2014). This concern echoes Sani (2013), who had earlier shown, using a VAR model, that deregulation-induced petroleum price changes were a major source of variation in GDP, inflation, and unemployment in Nigeria, even before the sector's later reform episodes.

This gap matters because savings from subsidy removal could, in principle, be reinvested into infrastructure and social services in ways that strengthen railway performance and support a broader modal shift from road to rail. The extent to which this potential materialises, however, remains an empirical question. This study therefore examines the effect of petroleum subsidy withdrawal, proxied by pump price movements, on railway transportation performance in Nigeria between 2000 and 2024, with a focus on railway revenue, passenger traffic, and freight traffic, and their relationship with government investment in railways and economic growth.

MATERIALS AND METHODS

Research Design and Data Sources

The study adopts an ex-post facto, quantitative time-series research design suited to analysing a policy event, fuel subsidy withdrawal, that had already occurred and could not be experimentally manipulated. Annual secondary data covering 2000–2024 (24 observations) were obtained from the National Bureau of Statistics, the Central Bank of Nigeria Statistical Bulletin, and Nigerian Railway Corporation Annual Reports and Statistical Digests. Six variables were used: Railway Revenue (RVN, ₦), Fuel Price (FSP, ₦/litre of PMS, proxy for subsidy withdrawal), Passenger Traffic (PSG, number of passengers carried), Freight Traffic (FRT, metric tonnes), Government Investment in Railways (INV, ₦), and Gross Domestic Product (GDP, constant ₦) as a macroeconomic control.

Model Specification

Guided by price transmission theory, railway transportation performance (RTP) was specified as a function of fuel price, government investment, and economic activity: $RTP_t = f(FSP_t, INV_t, GDP_t)$. Railway revenue was further modelled as a function of fuel price, passenger traffic, freight traffic,

government investment, and GDP, with an error correction term incorporated once cointegration among the variables was established, allowing the model to capture both short-run adjustment and long-run equilibrium.

Estimation Technique

Descriptive statistics were first computed, followed by Augmented Dickey-Fuller (ADF) unit root tests and lag-length selection using the LR, FPE, AIC, SC, and HQ criteria. The Johansen cointegration test was then applied to test for long-run equilibrium relationships, and, given evidence of cointegration, a Vector Error Correction Model (VECM) was estimated. VEC Granger causality/block exogeneity Wald tests, impulse response functions, and forecast error variance decomposition were used to establish, respectively, the direction of causality, the dynamic response of the system to shocks, and the relative importance of each variable. Model adequacy was assessed using the VEC residual serial correlation LM test, residual plots, the Jarque-Bera normality test, and the inverse roots of the AR characteristic polynomial. All estimations were carried out in EViews 12.

RESULTS AND DISCUSSION

Descriptive statistics for the six study variables are presented in Table 1.

Table 1: Descriptive Statistics of Study Variables

Variable	Mean	Std. Dev.	Skewness	Kurtosis	J-B Prob.
RVN (₦'million)	13,395.38	8,215.69	0.02	1.77	0.470
PSG (passengers)	3,330,097	2,513,058	2.03	8.31	0.000
INV (₦'million)	35,943,007	24,092,506	-0.23	1.85	0.467
GDP (₦'billion)	51,832.37	16,976.26	-0.20	1.60	0.347
FSP (₦/litre)	118.38	120.23	3.11	13.55	0.000
FRT (tonnes)	160,413.5	144,007.7	2.81	11.92	0.000

Source: EViews 12 output

Government investment recorded the highest mean value, followed by passenger traffic, freight traffic, GDP, railway revenue, and fuel price. PSG, FSP, and FRT are positively skewed and leptokurtic, indicating heavy-tailed distributions prone to outliers, while RVN, INV, and GDP approximate normality, a conclusion confirmed by the Jarque-Bera test ($p > 0.05$) for these three variables; normality is rejected for PSG, FSP, and FRT ($p = 0.000$), reflecting considerable volatility in passenger traffic, fuel pricing, and freight movement over the study period.

Table 2: Augmented Dickey-Fuller Unit Root Test

Variable	ADF Statistic	5% Critical Value	Order of Integration
GDP	-6.640	-1.957	I(1)
PSG	-7.378	-3.005	I(1)
INV	-22.450	-3.052	I(1)
RVN	-5.549	-3.052	I(1)
FRT	-4.627	-1.958	I(1)
FSP	2.046	-1.957	I(1)

Source: EViews 12 output

All six variables were non-stationary at level but became stationary after first differencing, confirming that each is integrated of order one, I(1), and satisfying the precondition for Johansen cointegration testing. Lag-length selection criteria (LR, FPE, AIC, SC, and HQ) unanimously selected lag one as optimal.

Table 3: Johansen Cointegration Test (Trace)

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Prob.
None	203.63	95.75	0.000
At most 1	133.18	69.82	0.000
At most 2	79.71	47.86	0.000
At most 3	52.19	29.80	0.000
At most 4	23.81	15.49	0.003
At most 5	3.04	3.84	0.082

Source: EViews 12 output

The trace statistic rejects the null hypothesis of no cointegration through "at most four" cointegrating equations but fails to reject at "at most five," confirming five cointegrating vectors among GDP, PSG, INV, RVN, FRT, and FSP. This establishes a stable long-run equilibrium relationship linking fuel pricing, railway transportation indicators, government investment, and economic growth, and justifies the estimation of a VECM.

The VECM error correction terms for the railway revenue equation were negative and statistically significant, confirming that short-run deviations from equilibrium are self-correcting. Among the short-run dynamics, only lagged government investment exerted a significant positive effect on railway revenue ($t = 3.20$); lagged fuel price, GDP, passenger traffic, and freight traffic were not significant at the 5% level. Table 4 summarises the significant VEC Granger causality linkages detected among the variables.

Table 4: Selected Significant VEC Granger Causality Results

Direction of Causality	Chi-sq	Prob.
GDP → RVN	4.243	0.039
INV → RVN	10.229	0.001
RVN → PSG	5.911	0.015
RVN → FRT	3.878	0.049
FRT → PSG	41.119	0.000
FRT → INV	10.603	0.001
FSP → GDP	4.573	0.033
GDP → FSP	38.607	0.000

Source: EViews 12 output

GDP and government investment significantly Granger-cause railway revenue, while railway revenue in turn Granger-causes passenger and freight traffic, pointing to a mutually reinforcing relationship between railway financial performance and service utilisation. Fuel price and GDP display significant bidirectional causality, reflecting the interconnection between energy pricing and macroeconomic activity, although fuel price does not directly Granger-cause railway revenue. Impulse response analysis showed that a one-standard-deviation shock to fuel price produced a subdued initial response in railway revenue, passenger traffic, and freight traffic, with positive responses emerging only in the medium to long run, consistent with a gradual modal shift toward rail as fuel costs rise.

Table 5: Variance Decomposition of Railway Revenue (%)

Period	RVN (own)	GDP	PSG	INV	FRT	FSP
1	77.62	13.32	6.73	2.33	0.00	0.00
3	58.04	21.93	3.35	3.30	0.08	13.31
5	1.67	95.95	0.26	0.34	0.02	1.75
10	0.24	98.17	0.09	0.22	0.02	1.25

Source: EViews 12 output

Variance decomposition confirms that railway revenue is initially driven by its own innovations (77.6% in period one) but that GDP rapidly becomes the dominant source of variation, accounting for over 98% of forecast error variance by period ten, while government investment, passenger traffic, freight traffic,

and fuel price collectively explain less than 2%. Diagnostic tests indicated residual serial correlation and departure from normality, attributable to the small sample size (n = 24) typical of annual macro-sectoral series, although the inverse roots of the AR characteristic polynomial confirmed that the VECM is dynamically stable, supporting cautious interpretation of the long-run results.

Overall, these results indicate that petroleum subsidy withdrawal, proxied by rising PMS prices, does not exert an immediate, statistically significant effect on railway revenue. Its influence instead operates mainly through the long-run equilibrium relationship confirmed by cointegration, and its potential benefits for the railway sector are conditional on complementary government investment and sustained economic growth, both of which emerged as the dominant short- and long-run drivers of railway performance respectively. This is consistent with infrastructure-led growth theory and suggests that subsidy reform alone cannot substitute for direct investment in rail capacity.

CONCLUSION

Petroleum subsidy withdrawal, proxied by fuel price, has no significant short-run effect on railway transportation performance in Nigeria, but it forms part of a stable long-run relationship with railway revenue, passenger and freight traffic, government investment, and GDP. Government investment and economic growth are the principal drivers of railway sector performance in both the short and long run. Realising the transport benefits of subsidy withdrawal therefore requires that subsidy savings be channelled into railway infrastructure and complemented by sustained macroeconomic growth, rather than relying on fuel price adjustment alone.

REFERENCES

Abdullahi, M., & Tukur, B. (2025). Effects of fuel subsidy removal on rural household transportation costs in Kaduna State, Nigeria. Nigerian Journal of Transport and Development Studies, 8(1), 21–38.

Abubakar, A. (2025). Fuel subsidy removal in Nigeria: A comparative macroeconomic policy analysis. Journal of Economic Policy and Development, 12(2), 45–63.

Abubakar, M.Y., Ahmad,S. S., Sani, S. B. & Jinjiri, A.Y. (2016) Analysis of the impact of oil Revenue on the Nigerian economy. *IOSR Journal of Economics and Finance* 7 (4), 10-21

Adamolekun, T. (2025). Social and economic consequences of Nigeria's oil subsidy removal: Communication challenges and alternative energy discourse. Journal of Public Policy and Governance, 14(1), 75–91.

Akinteye, A. (2025). Fuel subsidy removal and national development in Nigeria. International Journal of Development Studies, 11(2), 56–72.

Aliyu, M., Ijoko, A., & Rafatu, S. (2025). Crude oil prices, exchange rate and foreign reserves in Nigeria: A nonlinear ARDL approach. Journal of African Economic Studies, 15(1), 101–124.

Bariki, S. B., Matthew, T. P. & Ismail, Y. (2025) Impact of International Trade On Economic Development In Nigeria. *International Journal of Innovative Development and Policy Studies* 13(3):189-204. doi:10.5281/zenodo.17201955

Bariki, S. S., Akhigbe, M. A., & Ismail, Y., (2025) Impact Of Oil Spillage On Climate Change In Nigeria. *International Journal of Innovative Human Ecology & Nature Studies* 13(4):12-20, doi:10.5281/zenodo.17420131

Garkoyeba, U., Dauda, A., & Samaila, M. (2025). Effect of fuel subsidy removal on transportation systems in Jalingo Metropolis, Taraba State. Journal of Transportation Policy and Management, 9(2), 44–59.

Idowu, A., Okeke, C., & Sixtus, E. (2025). Economic implications of oil subsidy removal in Nigeria. Journal of Economic and Social Policy, 18(1), 61–80.

Ogboru, I., & Akinyotu, T. (2025). Fuel subsidy removal, family income and household sustainability in Ondo City, Nigeria. Journal of Development Economics and Policy Studies, 13(1), 52–68.

Oyeyemi, O., Osoja, T., Fadipe, O., & Olasokan, A. (2025). Fuel subsidy removal and transportation sector performance in Nigeria. Journal of Transportation Economics and Policy, 16(2), 77–96.

Sabiu, S. B., Ajayi, H. E. & Ismail, Y. (2025) Effect of Petroleum Subsidy Withdrawal On Employment in Gwagwalada, FCT, *Abuja. International Journal of Innovative Finance and Economics Research,* 13(3)507-521, Doi:10.5281/zenodo.17162614

Sabiu, S. B., Magaji, S. (2024) Effect of Oil Exploration and Climatic Change on the Niger Delta Region of Nigeria. *Journal of Development and Society* 6 (1), 36-49

Sani, S.B. (2013). Effect of deregulation of downstream oil sector on selected macroeconomic variables in Nigeria. Paper presented at the Annual Paris Business and Social Science Research Conference, Paris, France.

Sani, S.B. (2014a). Downstream oil market deregulation and subsidisation: A comparative analysis. International Journal of Economics and Finance, 6(10), 56–69.

Sani, S.B. (2014b). Effect of gradual oil subsidy withdrawal on Nigeria's economic growth. European Journal of Business and Management, 6(31), 123–132.

Sani, S.B., & Kouhy, R. (2014). Downstream oil sector deregulation and economic growth in Nigeria. International Journal of Energy Economics and Policy, 4(4), 564–572.

Sani, S.B., & Magaji, S. (2024). Oil exploration, climate change and livelihood sustainability in the Niger Delta region of Nigeria. African Journal of Environmental Studies, 11(1), 34–50.

Sule, M., Ahmed, A. I., Sabiu, S. B., & Yunusa, A. A.(2024) From Deforestation to Pollution: Unravelling Environmental Challenge in Nigeria and Pakistan. *International Journal of Social Science and Management* 4 (2), 805-814

Udofia, E. P., Ataide, M. E., & Udofia, E. A. (2025). Fuel subsidy removal and residents' wellbeing in Uyo Metropolis, Nigeria. Journal of Social and Development Studies, 12(2), 83–99.