Effect of Value-Added Tax on the Economic Performance of the Downstream Petroleum Energy Sector in Kenya

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ABSTRACT

The issue of Value Added Tax (VAT) on petroleum products has emerged as an important fiscal and market question in Kenya due to the effect of the price of fuels on transport, production, and household welfare. This article analyzed the impact of VAT on the economic health of the downstream petroleum energy industry in Kenya, using consumption of motor gasoline premium, light diesel oil, and illuminating kerosene as indicators of industry performance. The study was based on the Economic efficiency theory of taxation and employed secondary time series data for the quarterly period between 2006 and 2023. A descriptive and explanatory design was used, and the Autoregressive Distributed Lag methodology was used to estimate short-run and long-run relationships. The article narrowed down the analysis of the original multivariate petroleum-tax model to the VAT results, but it retained the excise duty, the Petroleum Development Levy, inflation, the exchange rate, and Murban crude oil prices as covariates. The bounds tests indicated level relationships for all three product models. At the 5% significance level, VAT had no significant short-run effect on gasoline or diesel consumption, but the lagged VAT policy shock significantly reduced kerosene consumption (coefficient = -0.1329, p = .0193). VAT was statistically insignificant in the long run for gasoline, diesel, and kerosene. Granger-causality results further showed that the VAT policy shock predicted kerosene consumption (p = .0053) but not gasoline or diesel consumption. The results provide evidence that a uniform VAT policy can have heterogeneous effects on the market for petroleum products. Changes in Petroleum VAT should be predictable, product-sensitive, and come with a measure of protection and cleaner-energy alternatives for price-sensitive households.

Keywords: Downstream Petroleum Sector; Economic Performance; Kenya; Petroleum Consumption; Tax Policy; Value Added Tax

I. INTRODUCTION

Petroleum taxation sits at the intersection of revenue mobilization, energy affordability, and sector efficiency in Kenya. Petroleum products support transport, industrial production, trade, and household energy use, while Kenya remains dependent on imported petroleum and is therefore exposed to international price and exchange-rate movements (Kiplagat et al., 2011). Recent sector statistics continue to show the importance of petroleum supply, demand, prices, and market performance to national energy planning (Energy and Petroleum Regulatory Authority [EPRA], 2024). VAT is especially important because it is an ad valorem tax that enters the tax-inclusive retail price and can transmit policy changes directly to consumers. This makes VAT design central to the economic performance of the downstream petroleum market.

There has been a significant shift in the policy of Kenya's petroleum VAT regime. VAT on petroleum products took effect in September 2018, and the rate that applied to petroleum products was subsequently 8% before the Finance Act, 2023 removed the special 8% rate from 1 July 2023, leaving petroleum products subject to the 16% general rate (Kenya Revenue Authority [KRA], 2018, n.d.). These changes are important because VAT can affect the price households and firms ultimately pay for fuel, which could affect demand for and use of fuel, operating costs, and the quantity of product transferred through downstream supply chains. The effect of VAT also depends on how it is implemented, taxpayers' compliance, the structure of the market, and the nature of taxpayers and consumers, as demonstrated by the experiences of various broader VAT systems (Brockmeyer et al., 2024). The impact of VAT on the economy should be examined based on the observed changes in the market.

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Not all petroleum products are likely to have the same fuel-demand response. There is evidence from around the world that consumers can be more sensitive to tax changes than to similar non-tax price changes, and that environmental taxes may lead to a decrease in energy use under certain market conditions and demand elasticities (Bashir et al., 2021; Li et al., 2014). The same Kenya household evidence also shows that energy products vary in price and consumption elasticity, and that households use a mixture of energy products, rather than switching from one fuel to another (Ngui et al., 2011). They indicate that a uniform policy on value-added tax may have different impacts on the prices of gasoline, diesel, and kerosene. An analysis of a specific product is more informative than a general statement on petroleum taxation.

This article separates out the VAT from the overall petroleum tax and looks at the effect of VAT on downstream petroleum use. It keeps the same study period and econometric specification as the original study, and therefore the article reports estimates drawn from the original study, instead of building a new model ex post facto. The analysis focuses on a focused account of the relationship between VAT and the performance of the petroleum market in Kenya.

1.1 Statement of the Problem

Kenya has undergone a dramatic shift in its VAT policy in a fairly brief timeframe, especially when it comes to petroleum products. The impacts of the roll-out of VAT on fuels in 2018 and its restoration to the 16% general rate in 2023 made the importance of tax-induced price changes on petroleum products even more significant, as fuel costs cascade through transport, production, and household budgets (KRA, 2018, n.d.). Meanwhile, public opposition to fossil-fuel taxes is strong in East Africa, and new data indicate that respondents in Kenya oppose fossil-fuel tax instruments especially strongly (Harring et al., 2024). The tax policy question is not just about revenue, but about the efficiency and social sustainability of the market effects of the VAT. This creates a need for evidence on the product-level consequences of VAT.

There are no existing studies that comprehensively address the tax policy question for the downstream petroleum market in Kenya. A study by Kamande (2021) provides a legal and policy critique of the introduction of petroleum VAT in Kenya, but the analysis does not estimate short-run and long-run effects on actual fuel consumption. Research from other contexts reveals that taxation can lower energy consumption and economic activity, but many provide an overall energy tax, carbon goal, firm results, or developed economy, not an importing African market (Bashir et al., 2021; Puican Rodríguez al., 2024; Teixidó et al., 2024). Demand studies from Kenya can be helpful in providing evidence of household fuel responsiveness, but were not specifically carried out to measure the impact of the 2018 VAT policy shock on major downstream products (Ngui et al., 2011). The other empirical gap is whether VAT has had a significant impact on the economic performance of these three markets for gasoline, diesel, and kerosene over time in Kenya.

1.2 Research Objective

The objective of the study was to determine the impact of Value Added Tax on petroleum products on the economic performance of the downstream petroleum energy sector in Kenya.

1.3 Research Hypothesis

$H0_1$: Value Added Tax on petroleum products has no statistically significant impact on the economic performance of the downstream petroleum energy sector in Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Framework: Economic Efficiency Theory of Taxation

This study examines petroleum VAT using the lens of Economic Efficiency Theory of Taxation. The theory of taxation assumes that there shall be an increase in required public revenue with a minimum of distortion in production, consumption, investment, and welfare. In the public-finance context, a tax is less efficient if the behavioral changes it induces lead to unplanned deadweight loss, or if they shift economic activity away from an alternative that would otherwise be economically efficient (Stiglitz & Rosengard, 2015). VAT affects the price of petroleum products by increasing the taxed price, and can decrease the demand for them in cases where the demand is elastic. The theory predicts that the efficiency cost of VAT will differ according to the elasticity and substitution possibilities of each petroleum product.

The theory is especially important for a downstream petroleum market, where consumers are near the point of VAT in the retail price, rather than the upstream producers. Empirical fuel-tax research corroborates the relevance of behavioral response, as evidenced by Li et al. (2014), who demonstrate that gasoline demand is responsive to fuel taxes, and Bashir et al. (2021), in a study of 31 OECD countries, reporting that environmental taxes hurt energy use across all OECD economies. However, there is also a need for caution with the efficiency framework, as a tax can

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raise revenue without being equitably distributed. Existing empirical evidence also demonstrates that in reality, VAT administration can deviate from being neutral, particularly in low-income countries (Brockmeyer et al., 2024). This theory directs this study towards statistical significance and the distribution of effects across fuel markets.

2.2 Empirical Review

Empirical evidence of the economic impact of VAT has demonstrated that the impact of VAT is dependent on the context and its implementation. Research by Brockmeyer et al. (2024) examined administrative VAT data in 11 countries and reported discrepancies in VAT design and implementation, particularly in lower-income economies. Their evidence suggests that VAT can generate revenue and can lead to implementation challenges and differential effects, but not specifically to petroleum products or fuel demand. This limitation means there is a need for sector-specific testing before it is assumed that VAT is neutral in practice.

Energy-sector evidence also suggests a negative relationship between taxation and economic activity. Using time-series data for the energy sector in Peru, Puican Rodríguez et al. (2024) found that net taxation depressed sectoral economic activity, whereas tax refunds had a positive impact. The setting of developing countries and the econometric design are relevant, but the result is aggregate sector activity, and the tax measure does not separate petroleum VAT. The study did not answer the product-level question in Kenya but affirmed the current research.

The consensus of fuel-tax studies is that taxes can affect demand, but they can generate mixed effects on products and users. A study by Li et al. (2014) reported higher impacts from gasoline-tax adjustments than from similar tax-exclusive price adjustments, and Bashir et al. (2021) linked environmental taxes to reduced energy use in OECD countries. A natural experiment in Portugal also revealed varying gas and diesel reactions and cross-border diesel changes following a fuel tax increase (Teixidó et al., 2024). The settings and tax instruments are different from Kenya, but they demonstrate that fuel categories should not be considered to be behaviorally the same.

Kenyan data offer a more specific context, but leave the relation between VAT and performance under-scrutinized. Research by Kamande (2021) raised issues with the design of the 8% petroleum VAT, including legal, compliance, and policy problems, but did not make consumption estimates. Investigation by Ngui et al. (2011) demonstrated that demand for kerosene was inelastic, and fuel stacking was prevalent among households, suggesting that there was a limited amount of substitution among fuels. A study by Harring et al. (2024) also found low public acceptance of fuel taxes in Kenya. These studies represent a confirmation of distributional and behavioral issues, but do not quantify dynamic effects on the prices for gasoline, diesel, and kerosene at a national level from the change in the VAT rate on fuel over the quarter.

The literature reviewed indicates that the implications of tax-induced price signals are important, even if there are conflicting views on the magnitude and duration of effects. Studies of energy use and taxes across countries typically show decreases in energy use post-taxation, while Kenyan studies highlight the uncertainty in policy, the heterogeneous nature of energy demand, and a lack of substitution. Little is available in Kenya in terms of national time-series product-specific evidence, and existing evidence is largely based on household surveys, legal analysis, panel models, or aggregate indicators. To bridge the gap, the present study uses separate ARDL models for gasoline, diesel, and kerosene, while keeping the same fiscal and macroeconomic controls used in the original study. This design is different from the nature of the individual product markets that are observed, because it distinguishes broad petroleum-tax claims from the actual behavior of the individual product markets.

2.3 Conceptual Review and Framework

The conceptual framework relates the independent variable, to be considered the value-added tax (VAT), while the dependent variable is the performance of downstream petroleum. The petroleum VAT policy indicator is used to represent VAT, and sector performance is proxied by the natural log of consumption volumes of motor gasoline premium, light diesel oil, and illuminating kerosene. The mechanism is that VAT becomes part of the tax-inclusive retail price, which affects affordability, and it can either increase or decrease the quantity demanded and the volume traded in the downstream market. The excise duty burden, petroleum development levy burden, inflation, the KES/USD exchange rate, and Murban crude oil prices are also control variables in the estimated model due to the fact that they also influence petroleum demand. The framework distinguishes the VAT relationship from the taxation of petroleum consumption, which is influenced by several other factors.

The framework provides a structure for the hypothesis test and the interpretation of the results for the product level. A negative VAT coefficient that is statistically significant would suggest that the policy shock had a negative effect on consumption, thus limiting market throughput, while the coefficient would be statistically insignificant, implying that the policy shock had limited measurable response beyond what the other factors in the model suggest. Variations among gasoline, diesel, and kerosene would suggest that demand sensitivity is not the same for all sectors, but is heterogeneous. Table 1 provides a summary of the conceptual relationship.

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Table 1

Conceptual Framework for the VAT–Downstream Petroleum Performance Relationship

Independent Variable	→	**Dependent Variable**
Value Added Tax (VAT) • Petroleum VAT policy shock/burden		Economic performance of the downstream petroleum sector • Log consumption volume: gasoline, diesel, kerosene
Control variables: Excise duty burden; Petroleum Development Levy burden; Consumer Price Index; KES/USD exchange rate; Murban crude oil price		

III. METHODOLOGY

3.1 Research Design

The study adopted a descriptive and explanatory research design for the evaluation of the VAT-performance relationship over time. The descriptive part provided a summary of the behavior of consumption of petroleum and the indicator of the VAT policy, and the explanatory part evaluated whether the petroleum consumption changes related to the VAT were statistically correlated with the consumption of the other relevant variables. A non-experimental time-series design was the most appropriate because the researcher could not change the tax policy and market outcomes. The design allowed for an empirical evaluation of the association, the dynamic adjustment, and the temporal precedence based on nationally observed data.

3.2 Study Area

The study area was Kenya, and the unit of market analysis was the national downstream petroleum sector. Kenya is a petroleum-importing economy where downstream market activity is meaningful, as transport and productive uses are dependent on gasoline, diesel, and kerosene, and household energy consumption is on kerosene. EPRA is a regulatory body for the petroleum industry and provides statistics on sector trends, such as supply, demand, prices, competition, and other petroleum market indicators (EPRA, 2024). The national scope was appropriate since petroleum tax policy affects the nation, and it was aimed at quantifying effects at the market level instead of the firm level.

3.3 Target Population

The target population comprised quarterly observations of the target variables in the three markets for petroleum products selected for the study for the years 2006 to 2023. The products chosen were motor gasoline premium, light diesel oil, and illuminating kerosene, which were chosen because they were major products for transport, industry, and domestic use, and because they had sufficiently continuous data over the study period. Data were observed each quarter for 72 observations for each of the models. The population was subdivided into time periods and product series, without referring to human respondents.

3.4 Sampling and Sample Size

The study employed a census of quarterly observations available, instead of probability sampling. The study used all 72 quarters (2006Q1 to 2023Q4) for each product series, following the data quality procedures outlined in the study. The approach avoided loss of information, since only a relatively small sample of the time series is being sampled, and was suitable for an ARDL framework, which applies to relatively small samples when the variables are integrated at I(0) and I(1) instead of I(2) (Menegaki, 2019; Pesaran et al., 2001). The entire available time series of quarterly data for each of the three product-specific models was considered to be the analytical sample.

3.5 Data Collection Instruments and Procedures

This study was based on secondary data, employing a structured data-extraction procedure instead of a respondent questionnaire. Among the macroeconomic sources, tax-policy information was obtained from the Kenya Revenue Authority (KRA), and petroleum price and consumption series from EPRA and the Kenya National Bureau of Statistics (KNBS) were used. Additionally, inflation, the exchange rate, and Murban crude oil prices were included in the analysis to reflect the impact of macro-economic and international market considerations. Official sources were given priority because they offer a consistent national series that minimizes the potential for differences in measurements when the data comes from different private sources. Quarterly variables were extracted, aligned by period, and then verified for completeness for estimation.

3.6 Data Analysis

Descriptive statistics, correlation analysis, unit-root tests, ARDL estimation, diagnostics, and Granger-causality analysis were used in analyzing the data. The volume of consumption was transformed into natural logarithms, whereas the VAT indicator was kept in its original form. The Augmented Dickey-Fuller test indicated that

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all of the variables were not stationary of order one, I(1), which met ARDL requirements (Kripfganz & Schneider, 2023; Menegaki, 2019; Pesaran et al., 2001). The Akaike Information Criterion was used to evaluate the optimal lags. The article reports the values of the VAT coefficients from the original multivariate ARDL specifications to maintain consistency with the study.

The ARDL approach was employed to identify short-run dynamics from long-run level relationships. Cointegration was tested using bounds tests, and the error-correction representation was used to evaluate short-run adjustment and direction of movement towards or away from equilibrium. The set of covariates included excise duty burden, petroleum development levy burden, inflation, exchange rate, and Murban crude oil price to maintain the original model and avoid omitted-variable bias. As per time-series diagnostics, residual serial correlation, heteroscedasticity, functional form, and stability were checked with the help of the Breusch-Godfrey, ARCH, Ramsey RESET, CUSUM, and CUSUMSQ procedures. A predictive-precedence test was then carried out using Granger causality tests to determine if the VAT policy indicator could predict future petroleum consumption.

3.7 Ethical Considerations

This research was conducted and analyzed based on aggregated secondary economic data, and no human subjects were involved in the research. Ethical protection was focused on the proper use of data, the correct recording of official statistics, the proper reference to sources, and the maintenance of the original estimated results. The study was conducted as part of the institutional research requirements, which included the appropriate national research documentation. There was no individual confidential data collected or reported for this study.

IV. FINDINGS & DISCUSSION

4.1 Findings

The preliminary tests were in favor of the product-specific ARDL framework and revealed the different behavior of the three fuel markets. The VAT indicator was stationary at level, consumption became stationary after first differencing, and bounds F-statistics exceeded the upper bounds for gasoline (5.7840), diesel (4.1198), and kerosene (7.6880), as indicated in Table 2. Correlations were positive for gasoline (r = .6581) and diesel (r = .5768) but strongly negative for kerosene (r = -.8172), as shown in Table 3. These correlations were descriptive, and the regression analysis showed whether VAT was still significant with the controls and dynamics added.

Table 2

Summary of Unit Root and ARDL Bounds Test Results

Petroleum Product	VAT Order of Integration	Consumption Order of Integration	Bounds F-Statistic	5% Lower Bound I(0)	5% Upper Bound I(1)	Decision
Gasoline	I(0)	I(1)	5.7840	2.27	3.28	Cointegration exists
Diesel	I(0)	I(1)	4.1198	2.27	3.28	Cointegration exists
Kerosene	I(0)	I(1)	7.6880	2.17	3.21	Cointegration exists

Source: Research data (2026).

Table 3

Summary of VAT results by petroleum product

Product	Correlation (r)	Short-run VAT result	Long-run VAT result	VAT → consumption Granger p	Decision at 5%
Gasoline	.6581	No significant VAT response retained in selected ECM	0.0578 (p = .9263)	.8330	No significant effect
Diesel	.5768	0.0521 (p = .0611)	-5.7403 (p = .9263)	.6034	No significant effect
Kerosene	-.8172	Lagged: -0.1329 (p = .0193)	-0.1728 (p = .5165)	.0053	Significant negative short-run effect

Statistical significance is evaluated at α = .05. Source: Research data (2026).

Gasoline results indicate that there is little evidence of a significant effect of VAT on consumption in the study period. A short-run error-correction model was selected, but it failed to find any evidence of a VAT response, and the long-run coefficient was 0.0578 (p = .9263). The Granger test of the model was also not significant for

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predicting gasoline consumption (p = .8330), as shown in Table 3. While other studies document more robust responses to gasoline taxes (Li et al., 2014), the Kenyan gasoline evidence fails to reject the VAT null hypothesis at the 5% level.

The diesel results also indicate limited sensitivity to VAT at the standard 5% significance level. The short-run coefficient was 0.0521 with p = .0611 (not significant at alpha = .05), and the estimated long-run coefficient was -5.7403 with p = .9263 (also not significant at alpha = .05). The p-value for VAT to diesel in the Granger-causality test was .6034, which is not statistically significant. The results indicate that besides the VAT policy shock, other factors such as productive or diesel needs and other cost factors played a significant role in the demand for diesel in Kenya. Also, the result underlines the importance of differentiating between statistical significance and the sign of the coefficient.

Kerosene had the most noticeable effect on VAT and was quite different from the transport fuels. The contemporaneous short-run VAT change was insignificant, but the one-quarter lag of the VAT policy shock was negative and statistically significant (coefficient = -0.1329, p = .0193), indicating a delayed reduction in kerosene consumption after the policy change. The sign of the long-run VAT coefficient was negative but not statistically significant (-0.1728, p = .5165), and the Granger-causality test for kerosene consumption was significant at p = .0053. The kerosene error-correction term also had a negative and significant coefficient of -0.1878 (p < .001), suggesting that approximately 18.8% of the disequilibrium was corrected per quarter, as shown in Table 4. The results suggest a significant short-run market reaction, but not a statistically significant long-run VAT effect.

The difference in products is of economic importance as it demonstrates that a single VAT can lead to different outcomes in the market. The Kenyan household research results point to the possibility that households' reactions are influenced by income, necessity, and availability of substitutes, and not just by the tax label per se (Ngui et al., 2011). However, recent evidence from East Africa also suggests that the level of public acceptance of fuel taxes remains low in Kenya, which continues to be an important element of the political sustainability of fuel tax reform for distribution and affordability (Harring et al., 2024). Meanwhile, there is a lack of strong long-run VAT elasticities, which serves as a warning against using VAT as a lasting demand-management policy. The evidence as a whole points to a different response to petroleum VAT than a single sector-wide response.

Table 4

Selected dynamic-model diagnostics relevant to VAT interpretation

Product	ARDL bounds F-statistic	Error-correction term	Interpretive implication
Gasoline	5.7840	0.0253 (p < .001)	Bounds evidence of a level relationship, but positive ECT does not indicate convergence.
Diesel	4.1198	0.0011 (p < .001)	Bounds evidence of a level relationship, but positive ECT does not indicate convergence.
Kerosene	7.6880	-0.1878 (p < .001)	Stable convergence; about 18.8% of disequilibrium corrected per quarter.

Source: Research data (2026).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study concludes that value added tax has heterogeneous effects on the economic performance of Kenya's downstream petroleum markets. VAT was not significant in the short term on gasoline or diesel consumption at the 5% level of significance, and it did not have a significant effect in the long term on any of the three products. In the short run, however, kerosene was the exception in that the lagged VAT policy shock had a negative impact on consumption and appeared to be predictive of the shock in the Granger-causality test. The negative and significant kerosene error-correction term further showed a stable adjustment process that was not evident in the gasoline and diesel models. These results do not reject the null hypothesis for gasoline and diesel, but do reject the null hypothesis for the short-run kerosene equation.

These conclusions also suggest that petroleum VAT is not a single instrument to control long-run fuel demand, but rather a revenue instrument. Taxes that fail to account for the product-specific demand conditions can have higher short-run welfare costs for the consumers of more sensitive fuels, and have little measurable behavioral effect on transport fuels. The economic-efficiency goal is better achieved when the need for revenues is matched by affordability and substitution options, and predictable market reaction. A product-sensitive approach provides a more solid foundation for petroleum VAT policy.

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5.2 Recommendations

The reforms in petroleum VAT should be gradual, predictable, and product-specific welfare impacts should be assessed in advance. In the case of fuels consumed by price-sensitive households, such as kerosene, the government should consider measures to alleviate the impact of VAT changes or introduce social-protection measures to offset the impact of the VAT change. This protection should be carefully targeted to tackle vulnerability without also revitalizing large and ill-targeted fuel subsidies. The ultimate goal should be to ensure that key energy requirements are met without compromising the integrity of the VAT system.

In addition, policymakers should implement petroleum VAT measures alongside viable options to reduce reliance on fossil fuels. Investments in sustainable public transport, better household-energy options and more energy-efficient technologies can increase the scope of substitution and lower the welfare loss due to future tax changes. Product-level datasets should be transparent and accessible to tax authorities and EPRA to allow for the evaluation of the effects of changes in tax rates in near real time relative to consumption, prices and distributional outcomes. Future research should consider using observations after 2023 and explore the impact of the 16% VAT regime on a longer-term basis as households and firms make further adjustments.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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