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Refined Petroleum Entrepôt Trade and Import Dynamics on Economic Growth in Kenya

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Abstract

This study examined the relationship between refined petroleum trade and economic growth in Kenya over the period 1994 to 2024, with particular attention to imports and entrepôt trade, represented by petroleum exports. Kenya does not have a functional refinery; it depends heavily on imported refined petroleum for both domestic consumption and re-export to neighbouring and landlocked countries. Kenya's dependence on imported refined petroleum, while enabling regional trade leadership, simultaneously exposes the economy to external shocks that may dampen growth. The challenge is to determine whether petroleum trade dynamics act as a net accelerator or constraint on Kenya's economic growth. However, this aspect has not been extensively explored. Using a time-series design and based on the Neoclassical Theory of Growth, this study structured gross domestic product (GDP) growth as a function of the growth rates of labour, the capital stock, manufacturing value-added, and refined petroleum imports and exports. After confirming a long-run relationship among the variables, the Autoregressive Distributed Lag (ARDL) model was estimated using annual time-series data from the World Bank, the Kenya Economic Surveys, and the Observatory of Economic Complexity (OEC). Results indicated that the growth of refined petroleum exports was an important determinant of long-run growth, though its short-run effect was negative, suggesting that export activity may have constrained domestic production. In contrast, the growth of refined petroleum imports exhibited no measurable effect on economic growth in either the short or long run. Among control variables in the analysis, the physical capital stock growth rate emerged as the most influential driver of GDP expansion, while labour growth was negligible, reflecting Kenya's slowing population growth and limited year-to-year labour force expansion. These findings underscore the importance of capital accumulation and export dynamics in sustaining Kenya's long-term growth trajectory, while highlighting structural vulnerabilities in the short run. Policy implications highlight the need to strengthen Kenya's refined petroleum export capacity by addressing trade infrastructure gaps, regional regulatory barriers, and exposure to volatile oil markets. Enhancing the value chain through diversification, logistics improvements, and support for domestic trading firms can maximise growth from entrepôt trade. Reducing import dependence requires promoting hybrid and electric vehicles, operationalising domestic refining, and diversifying energy sources.

Keywords: *Refined Petroleum, Entrepôt Trade, Import Dynamics, Economic Growth, Kenya*

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1.1 Background of the Study

As delineated in Sustainable Development Goal 8, the central aim of every economy is to realise and perpetuate growth that is both sustainable and inclusive, thereby guaranteeing comprehensive and effective employment, as well as dignified work for all individuals by the year 2030 (United Nations, 2015).To this end, economies need to adopt policies that enhance economic growth and development, improve living standards, increase operational efficiency, and increase their capacity to generate wealth. Figure 1 shows the fluctuations in global economic growth over the last four decades.

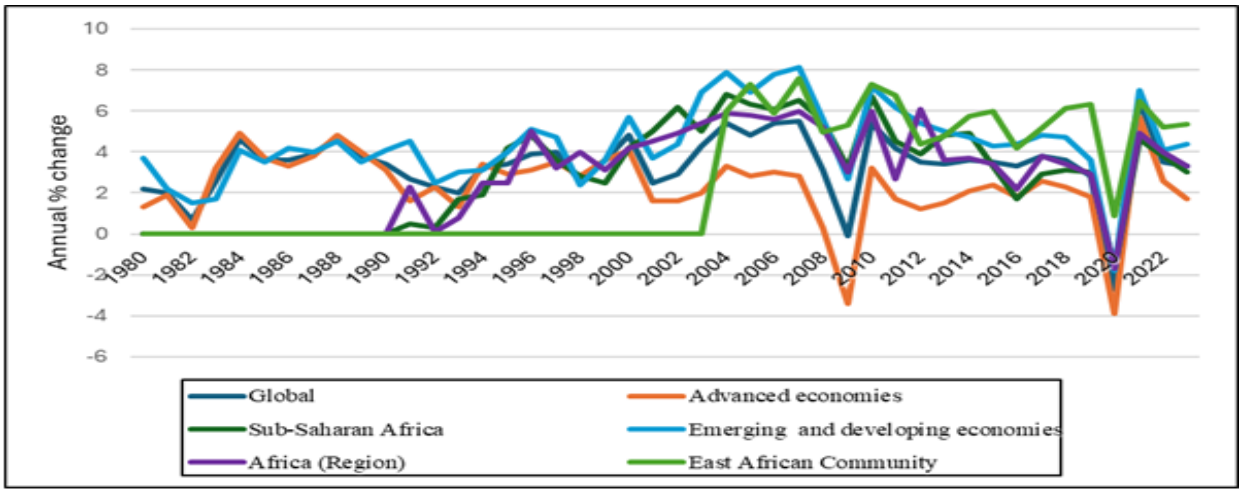

Figure 1: Growth of Real Gross Domestic Product (Change in Percentage Per Year)

Figure 1 highlights strong growth in the 1980s, a significant decline during the 2008 financial crisis, and a recovery in the 2010s that fell short of pre-crisis levels. Advanced economies exhibited a boom-and-bust pattern, showing robust growth in the 1980s and late 1990s but suffering declines in the early 2000s and again in 2020. In contrast, emerging and developing economies experienced relatively higher volatility, with notable fluctuations and recovery periods. Africa's economy saw robust growth in the 1990s and steady growth in the 2000s, but has since entered a downtrend. The Sub-Saharan region followed a similar pattern but with more volatility. The East African Community, after a period of stagnation from 1977 to 1999, attributed to the regional body's dissolution, witnessed rapid growth in the 2000s, resilience during the 2008 crisis, but faced challenges due to COVID-19 before rebounding in 2021.

Countries around the world face various challenges in achieving sustainable economic growth, including resource dependency, high debt levels, trade barriers, inadequate infrastructure, global pandemics, climate change, corruption, political instability, and wealth inequality. These issues create market uncertainty, hinder investment, and disrupt global supply chains. Effective resource allocation, technological advancements, capital accumulation, labour force growth, and productivity improvements are key factors that influence global economic growth. Petroleum plays a crucial role in this context, driven by population growth and urbanisation, which increases the demand for oil products. The petroleum trade helps countries generate revenue for development projects, enhance public services, and create jobs. Additionally, petroleum exports can stabilise currencies and help nations manage external debt, as seen with Norway's sovereign wealth fund (Khadan & Baxter, 2018; Zapukhlyak & Ivashchuk, 2024).

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Figure 2 shows a consistent increase in world exports, rising from 40 million barrels per day in 1992 to a peak of 77.074 million barrels per day in 2018, with a recovery noted in 2021 following a dip in 2020 due to the COVID-19 pandemic. In the OECD Americas, exports were stable until 2005, then steadily increased, surpassing 10 million barrels per day by 2017 and reaching 14.507 million barrels per day by 2022. Conversely, OECD Europe's exports were generally flat, crossing the ten-million mark only once in 2017. The OECD Asia Pacific region remained consistently below 10 million barrels per day throughout the period. In contrast, the Middle East maintained high export levels, while Africa's exports stayed below 10 million barrels per day, showing steady growth with some fluctuations, particularly impacted by the COVID-19 pandemic in 2020.

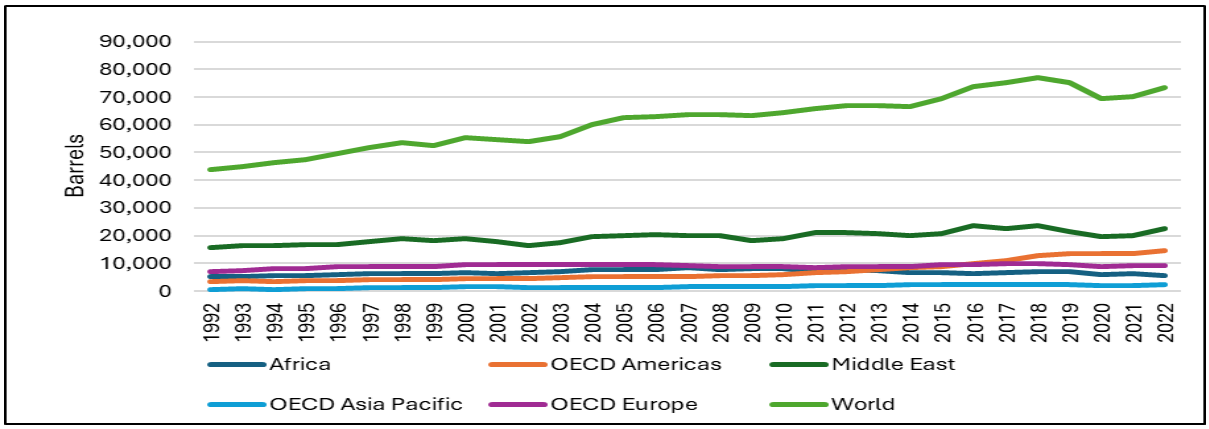

Figure 2: Global crude oil and petroleum product exports (1,000 b/d)

Figure 3 shows significant trends in global crude oil and petroleum product imports from 1992 to 2022, highlighting a rise from 43.758 million barrels per day to 72.758 million barrels per day, despite a sharp decline in 2020 due to the COVID-19 pandemic. In the OECD Americas, imports peaked in 2005, while OECD Europe showed steady growth until the COVID-19 pandemic impacted levels in 2020. The OECD Asia Pacific region's imports remained stable, with minor fluctuations, and Middle Eastern imports were generally lower than those of other regions. In 2022, international trade in refined petroleum experienced a revival, becoming the second-most-traded commodity globally, according to the Observatory of Economic Complexity (OEC), with trade value increasing by 45.8% to USD 1.08 trillion. Major exporters included the U.S., Russia, and the Emirates, with the U.S. and Singapore among the top importers. Africa remained a net importer of refined petroleum, with Nigeria the largest importer, while Algeria led petroleum exports. Kenya and Tanzania were the leading importers of refined petroleum in East Africa, with Kenya's imports making up 21.2% and Tanzania's 23.4% of their total imports. Additionally, Kenya, Rwanda, and Tanzania are the top exporters of refined petroleum within the East African Community.

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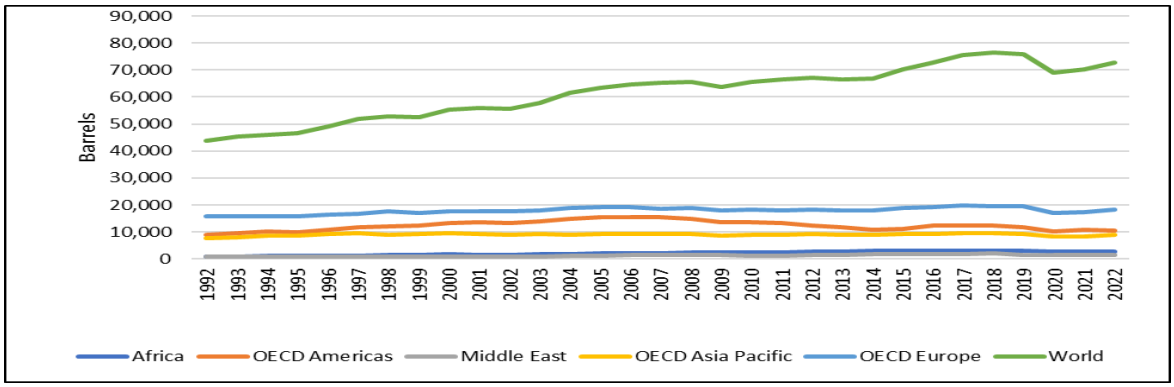

Figure 3: Global crude oil and petroleum product imports (1,000 b/d)

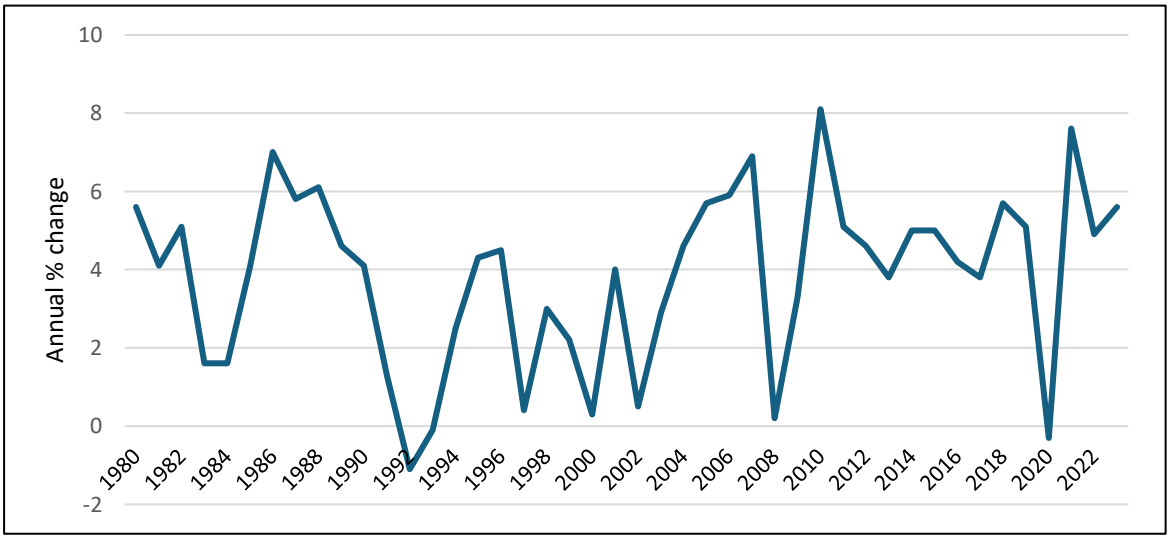

Figure 4: Kenya's Real Gross Domestic Product Growth (% Change Per Year)

Figure 4 shows how Kenya's economic growth fluctuated over the three decades from 1980 to 2022. This can be attributed to various factors, including political events, global economic conditions, and domestic policy decisions (BTI Transformation Index,2022; Machogu, 2025). Significant growth periods occurred in 1996, 2007, 2010, and 2021, while notable downturns took place in 2008 and 2020, largely due to the global financial crisis and the COVID-19 pandemic, respectively. Over the years, the Kenyan government has implemented various policies to stimulate economic growth, especially between 2002 and 2007, through stabilisation efforts and foreign investments. Infrastructure development projects, such as the Standard Gauge Railway, bridges, and the expansion of the road network, aimed to enhance connectivity and reduce costs. Export promotion initiatives included creating Export Processing Zones (EPZs) with incentives and signing trade agreements such as the African Growth and Opportunity Act and the African Continental Free Trade Area (AfCFTA). The 2019 National ICT Policy aimed to increase ICT's contribution to GDP by 10% come 2030. Additionally, the government invested in agriculture to ensure food security and in efforts to achieve universal health coverage, thereby fortifying a productive workforce.

The draft National Petroleum Policy outlined strategies for exploring and commercialising Kenya's petroleum resources. Despite being a net importer and having operated without a functioning refinery since 2013, Kenya managed to import and export refined petroleum under the Petroleum Act of 2019. In the 2021/2022 financial year, Kenya's petroleum imports

increased by 12% due to improved mobility post-COVID-19, while exports declined (Energy and Petroleum Regulatory Authority, 2022). This emphasised the importance of understanding the role of refined petroleum in Kenya's economic growth amid ongoing challenges, including poverty and infrastructure gaps.

1.2 Statement of the Problem

Kenya's economy is critically dependent on refined petroleum, which underpins energy consumption, industrial production, and trade competitiveness. Despite this essentiality, Kenya relies almost entirely on imported refined petroleum to meet domestic demand. This dependence exposes the country to external price shocks, foreign exchange volatility, and supply chain disruptions. At the same time, Kenya functions as a re-export hub for landlocked neighbours such as Uganda, Rwanda, and South Sudan, amplifying its strategic role in regional energy security and trade integration. Kenya's heavy reliance on imported refined petroleum, coupled with its role as a re-export hub for neighbouring countries, creates structural vulnerabilities in energy security, trade balance, and macroeconomic stability, including sustained economic growth. As sustained economic growth is the main objective of monetary policy in Kenya, this duality raises critical questions about whether petroleum dependence accelerates or undermines Kenya's long-term growth trajectory. This notwithstanding, the economic impact of refined petroleum trade remained unexplored. Hence, this study sought to provide analysis of refined petroleum's role, particularly its imports and entrepôt trade, in driving Kenya's economic growth.

1.3 Research Objectives

The primary objective of this study was to determine the dynamics of refined petroleum entrepôt trade and imports on economic growth in Kenya. Specific objectives were:

i. Establish the effect of the entrepôt trade of refined petroleum on economic growth in Kenya.

ii. Determine the effect of the imports of refined petroleum on economic growth in Kenya.

2.0 Literature Review

The section presents the theoretical and empirical literature employed by this study.

2.1 Theoretical Literature

The theoretical literature of this study comprised the Entrepôt Trade Model, the Theory of Absolute Advantage, the Comparative Advantage Theory, and the New Trade Theory. The Entrepôt Trade Model as recently advanced by the likes of Ganapati et al. (2024) illustrates the importance of trading hubs in international trade by enabling the import, storage, processing, and re-exportation of goods. Historically significant cities like Venice, Alexandria, and Constantinople exemplify this role. The model provides a framework for analysing Kenya's refined petroleum entrepôt trade, emphasising that these refined petroleum exports are essentially re-exports of imported refined petroleum and are significant for revenue generation.

The Theory of Absolute Advantage suggests that countries can maximise their benefits in the global market by specialising in the production of goods and services in which they hold a clear advantage. This theory provided an avenue for this study to explore the nature of the effects of

refined petroleum entrepôt trade and refined petroleum imports on Kenya's economic growth, building on the viewpoint that Kenya's strategic geographic position, regional infrastructure endowment, and the advantages of participating in international trade are key. Comparative Advantage Theory asserts that a nation can benefit from transnational trade in specialised provisions for which they have lower opportunity costs; thus, trade can still be advantageous if each participant focuses on their strengths. This theory implies that, despite closing its only refinery in 2013, Kenya could leverage its strategic location and infrastructure, such as the Kenya Pipeline Company, to export refined petroleum to East and Central Africa, thereby enhancing revenue generation and economic development.

The Neoclassical Growth Theory suggests that long-term economic growth is driven by factors such as capital accumulation, labour growth, and technological advancements. From the perspective of Kenya, this theory implies that imports, particularly refined petroleum, can act as a valuable capital input. By utilising these imports effectively, production and export capabilities can be enhanced, ultimately contributing to economic growth. The New Trade Theory builds on the concept of comparative advantage by incorporating factors like imperfect competition and economies of scale. It views firms as operating either as monopolies or oligopolies, and thereby in a position to set prices and differentiate products, capitalising on economies of scale and favourable locations. This suggests that Kenya could utilise its infrastructure and expertise to become a regional hub for refined petroleum distribution, attract trade, and stimulate economic growth.

2.2 Empirical Literature

Trade variables, particularly imports and exports, are critical drivers of global economic growth as they facilitate specialisation, technology transfer, capacity utilisation, knowledge spillovers, industrialisation, and overall productivity (Rahman, Barua, & Rana, 2019; Prakash & Chand, 2022). Despite their importance, research focusing on the effects of refined petroleum re-exportation on national growth is limited, since re-exports are often aggregated with domestic exports in official statistics. Empirical studies across diverse contexts provide mixed evidence on the relative impact of imports versus exports. Wolde-Rufael (2008) demonstrated a long-term positive and significant link between petroleum imports and economic growth in Cyprus, highlighting the necessity of energy security and import diversification. Conversely, Enu and Hagan (2013) found that in Ghana, exports positively influenced GDP growth while imports had a significant negative effect, suggesting that policy emphasis on export promotion and import substitution is essential for economic expansion.

Similar patterns emerge in Southern Africa, where Nyasulu (2013) observed that exports were a significant determinant of Malawi's economic performance, while imports exhibited a negative but non-significant effect, reinforcing the export-led growth hypothesis. In the Kenyan context, Maina (2015) reported a robust positive correlation between both exports and imports and GDP, with imports exerting a stronger influence on domestic output. Altaee et al. (2016) extended this analysis to Saudi Arabia, revealing that gross capital formation and exports positively influenced GDP in both the short and long term, whereas imports consistently contributed negatively. Alkhateeb et al. (2016) similarly found that exports generated stronger long-term growth feedback effects, with imports affecting both immediate and future GDP outcomes, while Bakari and Mabrouki (2017) highlighted the moderating influence of political stability and geographic location on Panama's trade-growth relationship.

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Further evidence from the Middle East and Asia underscores the dominant role of exports in promoting growth. Kalaitzi and Cleeve (2018) demonstrated that in the UAE, manufactured exports drove both short- and long-term GDP growth more effectively than primary exports, with imports exerting less influence. Sultan and Haque (2018) confirmed that in Saudi Arabia, oil exports positively affected economic growth across temporal dimensions, whereas imports had a minor negative effect. Khayati (2019) reported that in Bahrain, all types of exports significantly promoted growth, while labour and imports exerted negative effects, underscoring the primacy of export-led mechanisms in resource-dependent economies. Okyere and Jilu (2020) observed in Ghana that increased imports negatively affected growth, whereas exports maintained a strong positive causal link.

Recent studies from Indonesia and Somalia further reinforce these dynamics. Anggoro (2022) found that in Indonesia, oil and gas exports positively influenced both short- and long-term economic growth, while imports had a negative impact. Ali et al. (2018) demonstrated in Somalia that exports significantly enhanced growth, while imports had only marginal effects, and bidirectional causality existed between imports and exports. Collectively, these studies illustrate a consistent global pattern: exports tend to support long-term economic expansion, while imports often pose a short-term constraint, highlighting the importance of strategic trade policies and resource allocation to optimise the benefits of international trade for sustained growth.

3.0 Research Methodology

Utilising a time series research design and yearly time-series data sourced from the World Bank, Kenya Economic Surveys, the Observatory of Economic Complexity and the Federal Reserve Bank of St. Louis, this study was grounded in the Neoclassical Theory of Growth. This theory, as developed by Robert Solow, emphasises that economic growth results from the accumulation of capital, labour growth, and technological advancement. The study's empirical model in the functional form is:

$$G_t = f(CS_t, E_t, RX_t, RM_t, MO_t) + \mathcal{E}$$

The model is fully expressed as:

$$G_t = \beta_0 + \beta_1(CS_t) + \beta_2(E_t) + \beta_3(RX_t) + \beta_4(RM_t) + \beta_5(MO_t) + \mathcal{E}$$

In this model, G stands for GDP growth, β_0 denotes the constant term, β_1 to β_5 represent coefficients associated with the respective exogenous variables, E is the labour growth, CS is the capital stock growth, MO for manufacturing value-added output growth, RM for refined petroleum imports growth, RX for refined petroleum exports growth, and the subscript (t) denotes period t. All the variables were measured using their annual percentage growth rates. This study used the ARDL bounds testing approach to validate the model and ARDL method before estimation, effectively capturing both long-run and short-run dynamics among the variables. This approach provides a comprehensive understanding of how these variables influence GDP growth.

4.0 Findings and Discussion

This section presents and discusses the empirical findings.

4.1 Descriptive Statistics of Data

Table 1 outlines focal variables' descriptive statistics.

Table 1: Descriptive Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
GDP growth rate (%)	3.79	2.62	-8.08	6.92
Capital stock growth rate (%)	3.82	2.50	-7.30	6.93
Labour growth rate (%)	6.50	3.41	-4.06	18.30
Refined petroleum import growth rate (%)	27.66	83.31	-61.89	283.07
Refined petroleum export growth rate (%)	6.58	43.46	-63.79	181.73
Manufacturing value-Added output growth rate (%)	2.67	2.81	-2.32	8.21

Over the period from 1994 to 2024, the average GDP growth rate was 3.79 per cent, with a standard deviation of 2.62 per cent, a minimum of -8.08 per cent, and a maximum of 6.93 per cent. The mean capital stock growth rate was 3.82 per cent, with the standard deviation at 2.50 per cent. The minimum rate of growth was -7.30 per cent, while the maximum was 6.93 per cent. Labour growth rate averaged 6.50 per cent. It had a standard deviation of 3.41 per cent. The minimum was -4.06 per cent, and the maximum was 18.30 per cent. The mean refined petroleum export growth rate was 6.58 per cent with a standard deviation of 43.56 per cent, a minimum of -63.79 per cent, and a maximum value of 181.73 per cent. Refined petroleum imports grew by a 27.66 per cent means rate. The minimum rate of growth was -61.89 per cent, while the maximum reached 283.07 per cent. The standard deviation was 83.31 per cent. The mean growth rate in manufacturing value-added output was 2.67 per cent. The standard deviation stood at 2.81 per cent. The minimum growth rate was -2.32 per cent, while the maximum was 8.21 per cent.

4.2 Stationarity Test

The Augmented Dickey-Fuller test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test were applied to evaluate the stationarity of the time series and determine the order of integration for the variables involved.

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Table 2: ADF Test Results at Levels

Variable	No Constant		With or Without Drift		With Drift	
	Test Statistics	Critical Values	Test Statistics	Critical Values	Test Statistics	Critical Values
GDP growth rate*	-1.954	-1.95	-3.975	-3.58	-4.046	-1.701
Capital stock growth rate*	-3.664	-1.95	-3.815	-3.58	-3.882	-1.701
Labour growth rate**	-1.845	-1.95	-6.153	-3.58	-3.648	-1.701
Refined petroleum export growth rate*	-6.471	-1.95	-7.673	-3.58	-7.433	-1.701
Refined petroleum import growth rate*	-5.314	-1.95	-5.265	-3.58	-5.351	-1.701
Manufacturing value-added output growth rate*	-2.494	-1.95	-4.254	-3.58	-4.058	-1.701

From the ADF results in Table 2, the rates of GDP growth, capital stock growth, refined petroleum exports growth, refined petroleum imports growth, and manufacturing value-added output were stationary at levels. Only labour growth was not stationary at levels, but became stationary after first differencing.

Table 3: KPSS Stationarity Test Results

Variable	Test Statistic	Critical Value	Conclusion
GDP growth rate	0.167	0.146	Non-stationary
Capital stock growth rate	0.135	0.146	Stationary
Labour growth rate	0.0879	0.146	Stationary
Manufacturing value-added output growth rate	0.0721	0.146	Stationary
Refined petroleum export growth rate	0.0433	0.146	Stationary
Refined petroleum import growth rate	0.0444	0.146	Stationary
After first differencing			
GDP growth rate	0.0522	0.146	Stationary

The growth rates of labour, capital stock, refined petroleum exports, refined petroleum imports, and manufacturing value-added output were stationary at levels. In contrast, the GDP growth rate was not stationary at levels, but became stationary after first differencing.

4.3 Cointegration Test

The ARDL Bounds Test evaluated the existence of long-run relationships among the variables.

Table 4: Results for the ARDL Bounds Test

Significance Level	I(1) Upper Bound
10% (L_1)	3.35
5% (L_05)	3.79
2.5% (L_025)	4.18
1% (L_01)	4.68
F Statistic	4.028

The F-statistic (4.028) exceeded the 3.79 I (1) upper bound at the 5% significance. This confirmed cointegration, indicating a long-term relationship among the variables and prompting the application of the Autoregressive Distributed Lag model.

4.4 Test for Normality

The normality assumption of the regression residuals was assessed using the Shapiro-Wilk test, which is particularly effective in detecting deviations from normality in small to moderate-sized economic datasets. A normal distribution of residuals is essential to ensure the validity of hypothesis testing and confidence intervals in regression analysis.

Table 5: Shapiro-Wilk Normality Test Results

Variable	Test Statistic (W)	p-value
Regression Residuals	0.9642	0.0799

The p-value of 0.0799 exceeds the 0.05 significance threshold, indicating no evidence to reject the null hypothesis (H_0) of normality. Consequently, the residuals can be considered normally distributed, supporting the reliability of subsequent regression inferences.

4.5 Heteroskedasticity

The Breusch-Pagan test was employed to examine whether the variance of the regression residuals depended on the values of the independent variables. This test evaluates whether heteroskedasticity exists, which could bias standard errors and affect the reliability of statistical inference.

Table 6: Results for Heteroskedasticity Test

Component	Value
chi2(1)	1.23
Prob > chi2	0.2672

The p-value of 0.2672 exceeds the 0.05 significance threshold, indicating no evidence to reject the null hypothesis (H_0) of homoscedasticity. Therefore, the residuals exhibit constant variance, confirming that the regression estimates are reliable and the standard errors are valid.

4.6 Test for Autocorrelation

Autocorrelation in the regression residuals was assessed using the Breusch-Godfrey LM test. This test is robust for detecting higher-order autocorrelation and remains valid even when

lagged dependent variables are included as regressors, ensuring the reliability of regression inference.

Table 7: Breusch-Godfrey Autocorrelation Test Results

Lags (p)	chi2	df	Prob > chi2
1	0.161	1	0.6887

The p-value of 0.6887 exceeds the 0.05 significance threshold, indicating no evidence to reject the null hypothesis (H_0) of no autocorrelation. This confirms that residuals are independently distributed, supporting the validity of the regression model.

4.7 Test for Multicollinearity

Multicollinearity among the independent variables was assessed using pairwise correlation coefficients. High correlations between explanatory variables can distort regression estimates, inflate standard errors, and undermine statistical inference. The computed correlations for all variables are presented in Table 8.

Table 8: Pairwise Correlation Matrix

Variable	Capital Stock	Manufacturing	Labour Growth	Refined Petroleum Exports	Refined Petroleum Imports
Capital Stock Growth	1.0000	0.4158	0.3924	0.0101	0.0031
Manufacturing Growth	0.4158	1.0000	-0.0553	-0.0162	-0.1680
Labour Growth	0.3924	-0.0553	1.0000	0.0861	0.1032
Refined Petroleum Exports	0.0101	-0.0162	0.0861	1.0000	0.0271
Refined Petroleum Imports	0.0031	-0.1680	0.1032	0.0271	1.0000

All pairwise correlation coefficients were below 0.8, indicating the absence of severe multicollinearity. This confirms that the independent variables are sufficiently distinct and suitable for inclusion in the regression model.

4.8 Model Stability Test

The CUSUM of Squares (CUSUMSQ) test was used to evaluate the stability of variance in this regression model. The CUSUMSQ line stayed within the confidence bounds, demonstrating the model's reliability and no structural instability at a 5% significance level. Figure 5 shows these results.

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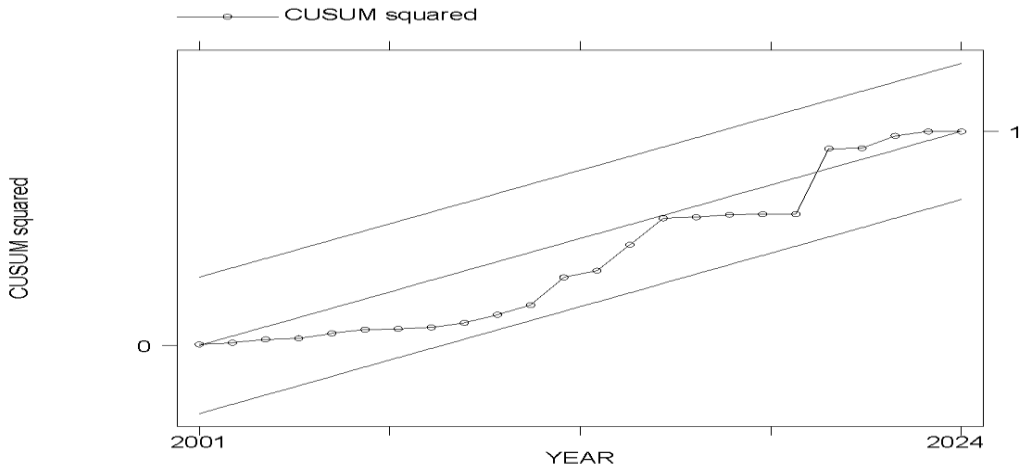

Figure 5: Model Stability Test Results

4.9 Model Specification Check

The results of the Ramsey RESET test employed indicated that the regression model was correctly specified. With a p-value of 0.0080, which is greater than 0.05, there was no significant evidence of missing variables or misspecification.

4.10 Regression Results

The ARDL approach was utilised to regress the GDP growth rate on the capital stock growth rate, labour growth rate, refined petroleum export and import growth rates, and manufacturing value-added output growth rate to achieve the objectives of the study.

Table 9: ARDL Estimation

Variable	Coefficient	Std. error	t	p-value	95% confidence interval	
GDP growth rate lag 1	-0.5674	0.1705	-3.33	0.004	-0.9289	-0.2059
			Long Run			
Labour growth rate	0.111	0.18511	0.60	0.557	-0.2814	0.5034
Capital stock growth rate	0.3516	0.06117	5.75	0.000	0.2219	0.4813
Refined petroleum export growth rate	0.018	0.00982	1.81	0.090	-0.003069	0.0386
Refined petroleum import growth rate	-8.53e-07	0.0037058	-0.00	1.000	-0.0079	0.0079
Manufacturing value-added output growth rate	-0.3063	0.1361	-2.25	0.039	-0.5949	-0.0178
			Short Run			
GDP growth rate Lag 1	0.2362	0.2113	1.12	0.280	-0.2117	0.6840
GDP growth Lag 2	-0.2017	0.0785	-2.57	0.021	-0.3680	-0.0353
Capital stock growth rate immediate	0.0632	0.0472	1.34	0.200	-0.0369	0.1633
Capital stock growth rate lag 1	-0.1143	0.0540	-2.12	0.050	-0.2288	0.0002
Refined petroleum export growth rate immediate	-0.0123	0.0047	-2.64	0.018	-0.0222	-0.0024
Constant	1.5585	0.8895	1.75	0.099	-0.3273	3.4442

The model demonstrated high explanatory power, with an R-squared of 0.965, indicating that the included variables accounted for approximately 96.5% of the variation in GDP growth.

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4.10.1 Short Run Dynamics

The Error Correction Term (ADJ coefficient) was -0.5674. This coefficient was negative and highly significant (at 1% level), validating long-run cointegration and satisfying the theoretical criterion for a stable return to equilibrium. The -0.5674 coefficient implied a relatively rapid adjustment; in any period, 56.74% of the preceding year's discrepancy from the long-term equilibrium was adjusted within that period. This suggested that the system was resilient, with shocks being absorbed and the economy returning to its long-run growth path in approximately 1.76 years (1/0.5674). The first lag of the GDP growth rate had a coefficient of 0.2362, which was not significant at the five per cent level. While the positive sign indicated growth momentum, the lack of significance showed that past growth did not reliably predict current changes, aligning with Hausmann et al. (2005)'s findings that the accelerations of growth are usually very erratic. The second GDP growth rate lag coefficient was -0.2017, which was significant at five per cent, indicating a one-percentage-point increase in growth two periods prior led to a 0.20 per cent decrease in current growth. This pointed to mean reversion, in which past growth diminishes current performance, aligning with the Real Business Cycle theory, which holds that economies fluctuate around a long-term trend. The immediate growth rate coefficient for capital stock was 0.0632, which was not significant at five per cent. While its positive sign aligns with neoclassical growth theory, the insignificance suggests contemporaneous capital formation had no measurable impact on economic performance initially.

The first lag coefficient for capital stock growth was -0.1143, statistically significant at the five per cent level, indicating that a one per cent increase in prior capital stock growth resulted in a 0.1143 per cent decrease in current GDP growth, supporting Kydland and Prescott's (1982) Time-to-Build theory. This suggests short-term reallocations during capital accumulation can hinder output growth in the early stages. The coefficient for the immediate growth rate of refined petroleum exports was -0.0123, which was significant at the five per cent level. This indicated that a one-percentage-point increase in the growth rate of refined petroleum exports contemporaneously resulted in a 0.0123 per cent decrease in the GDP growth rate, assuming other variables remained constant. This finding suggested that sudden increases in refined petroleum export trade may hinder short-term economic growth, potentially due to external volatility or supply-side constraints. The coefficient of the constant term was 1.5585, which was significant at the ten per cent level, indicating an autonomous annual growth rate of 1.5585%. This suggested that the economy experienced positive growth even without short-term increases in explanatory variables, aligning with Hall and Jones (1999), who stated that social infrastructure and Total Factor Productivity are essential for steady-state growth.

4.10.2 Long Run Dynamics

The growth rate of capital stock exhibited a positive coefficient of 0.3516, which was statistically significant at the 1 per cent level. This coefficient indicated that a one percentage-point increase in the capital stock resulted in a 0.3516 percentage-point rise in the GDP growth rate over the long term, holding other variables constant. The positive correlation between capital stock growth and economic growth aligns with neoclassical growth theory and the production function. The growth rate of refined petroleum exports, serving as a proxy for refined petroleum entrepôt trade, exhibited a coefficient of 0.018, which was statistically significant at the ten per cent level. This coefficient suggested that, with other variables held constant, a one percentage-point increase in the growth of refined petroleum exports resulted in a long-term increase in GDP growth of 0.018 percentage points. This finding confirmed that

the growth rate of refined petroleum exports played a notable role in determining the economic growth rate. The positive effect of the growth rate of refined petroleum exports was consistent with the export-side findings of Altaee et al. (2016), Khayati (2019), and Okyere (2020). The positive relationship between the growth of refined petroleum exports and economic growth is consistent with the export-led growth hypothesis, as articulated by Kalaitzi and Cleeve (2017), which posits that exports stimulate economic growth. The relatively modest magnitude of this relationship was, in a way, reflective of the structure of Kenya's economy, in which refined petroleum exports constituted a minor share of GDP. This suggests that the growth benefits of exports primarily operate through indirect mechanisms, such as technology transfer and competitive pressures, rather than direct demand effects.

The growth rate of refined petroleum imports had a negative coefficient that was not statistically significant at the five per cent level. This finding indicates an absence of a relationship between the growth rate of refined petroleum imports and the economic growth rate. The negative impact of imports on economic growth aligned with the findings of the analyses conducted by Altaee et al. (2016), Khayati (2019), and Okyere (2020). The manufacturing value-added output growth rate had a significant negative coefficient of -0.3063, indicating that a one per cent increase in manufacturing value-added output growth led to a 0.3063 per cent decline in long-term GDP growth, holding all other factors constant. This negative influence was consistent with findings from Edward and Ngasamiaku (2022) and Xue et al. (2021), with the latter noting that manufacturing negatively affected economies in Europe and Central Asia, while the former observed that Tanzania's economy contradicted Kaldor’s first law, showing that economic growth drives manufacturing growth instead. The labour growth rate coefficient was 0.111, which was positive but lacked statistical significance at the five per cent level. This positive coefficient contrasts with Khayati (2019)'s negative association, highlighting the complexity of labour's influence on economic growth and the potential role of contextual factors.

5.0 Conclusions

Firstly, it can be concluded that throughout the study period, the growth rate of refined petroleum exports was a marginally significant determinant of Kenya's long-term economic growth rate. However, in the short term, a negative relationship was observed, suggesting that the exportation of refined petroleum from Kenya may have had detrimental effects on domestic production and, consequently, on the economic growth rate. Secondly, it can be concluded that the growth rate of refined petroleum imports was not a significant factor in determining the economic growth rate. The findings indicated that the growth rate of refined petroleum imports had no long-term impact on economic growth and was not a factor in the short term. Thirdly, it can be concluded that the capital stock growth rate was the most important variable affecting the growth rate. Although labour is another important variable in the determination of Gross Domestic Product, it can be concluded that its growth rate appeared to play a negligible role in determining economic growth. The growth of capital stock was significantly higher than that of labour over the period. This result could be attributed to the very small growth rate of labour from one year to the next, due to the decelerating population growth rate. These findings suggest that while capital stock is crucial for driving economic growth, the limited growth in labour stemming from population dynamics may hinder overall GDP progress.

6.0 Policy Recommendations

To support sustainable economic growth, Kenya should prioritise the optimisation of refined petroleum exports and imports by addressing structural barriers, enhancing trade logistics, and

diversifying into higher-value petroleum products. Strengthening the petroleum value chain through incentives for local value-added activities, promoting domestic trading companies, and expanding services such as blending, quality testing, and storage can increase revenue and reduce reliance on volatile global markets. Import reduction strategies should include promoting local assembly of electronic and hybrid vehicles, operationalising the Mombasa refinery most especially once Turkana oil becomes commercially viable, leveraging Kenya's strategic geographic position and existing port infrastructure to serve regional demand, and enhancing manufacturing value-added output with export-oriented activities and technical training. Strategic investments in petroleum-related infrastructure, particularly the Kenya Pipeline Company network and regional transport corridors, coupled with macroeconomic stability, secure property rights, financial market development, and foreign investment, are essential for optimising the sector's efficiency. Effective public investment management, including streamlined procurement, public-private partnerships, and infrastructure bonds, will further ensure that resources are utilised efficiently, supporting long-term growth and competitiveness.

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