FINANCIAL DETERMINANTS OF FUEL PRICE FLUCTUATIONS IN TANZANIA: THE CASE OF DAR ES SALAAM REGION

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ECONOMICS (MSC-ECONOMICS)

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by The Open University of Tanzania a dissertation entitled: Determination of Financial Factors Affecting Fuel Price Fluctuation in Tanzania: The Case of Dar Es Salaam Region in Partial fulfilment of the requirements for the award of Degree of Master of Science in Economics (MSc. Economics).

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DECLARATION

I, **Alexander Francis Kisyeri,** declare that the work presented in this dissertation is original. It has never been presented to any other University or Institution. Where other people's works have been used, references have been provided. It is in this regard that I declare this work as original mine. It is hereby presented in partial fulfilment of the requirement for the Degree of Master of Science in Economics (MSc-Econ).

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Signature

05/10/2024

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Date

DEDICATION

This work is dedicated to my family and all those who truly cared for me for their efforts, understanding and encouragement. Their support has led to the successful accomplishment of my study.

ACKNOWLEDGEMENT

The successful completion of this dissertation results from many individuals' contributions and cooperative efforts. Since it is impossible to list all of them, I hereby mention just a few. First and foremost, I am grateful to my God for His blessing, protection and completion of this work.

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Last, but not least, I wish to express my sincere thanks to all members of the Energy and Water Utilities Authority (EWURA), the staff of the Open University of Tanzania, and my fellow economics students for their cooperation, encouragement and suggestions during the time of the study.

ABSTRACT

The research investigated the determinants of fuel price fluctuations in Tanzania, focusing specifically on financial factors, while acknowledging that non-financial factors such as geographical location, availability of crude oil resources, national strategies for security of supply, and the overall economic and political stability of the country. The study examined the relationship between fuel prices and various independent variables, including import costs, government taxes, and overhead margins. Time series data were collected, and robust multiple linear regression analysis was employed following descriptive statistics. Prior to this, inferential diagnostic tests such as normality, heteroskedasticity and multicollinearity were conducted to assess the characteristics and suitability of the data for analysis. The findings revealed a significant positive relationship between fuel price and import cost, operational costs and government taxes. The free-on-board (FOB) price and the Premium both hold the highest impact and emerged as the key drivers while variables like Fuel Levy, Petroleum Fee, Overheads & Margins, Charges payable to Agencies and Demurrage Cost signify a one-to-one relationship with fuel prices. These findings underscore the importance of policy interventions aimed at managing import costs adjusting government taxes such as fuel levies and controlling the operational costs to stabilize fuel prices effectively. To improve the management of fuel price dynamics, the study recommends stabilizing the FOB cost structure through policies that address international volatility and fostering international partnerships for better pricing. Also, advises implementing strict oversight on premium costs and introducing a flexible tax system that is regularly reviewed.

Keywords: *Price Fluctuations, Importation Costs, Operational Costs, Government Taxes.*

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LIST OF ABBREVIATIONS

BBL	Barrel of crude oil
EWURA	Energy and Water Utilities Regulatory Authority
PBPA	Petroleum Bulk Procurement Agency
TASAC	Tanzania Shipping Agencies Corporation
TBS	Tanzania Bureau of Standard
TIPPER	Tanzania International Petroleum Reserves Ltd
TPA	Tanzania Ports Authority
TPDC	Tanzania Petroleum Development Corporation
TRA	Tanzania Revenue Authority
WMA	Weight and Measurement Agency
WTI	Crude oil in West Texas Intermediate

CHAPTER ONE

INTRODUCTION

1.1 Overview

This part provides the introduction to the subject, it gives the motive for the study and the details of why the researcher chose to research this area.

1.2 Background to the Research Problem

The fluctuations of fuel prices (petrol, diesel and kerosene) vary from time to time depending on several factors. One of the major factors that drive the fuel price fluctuation is the variations of crude oil prices. Brent Crude oil specifically refers to a type of crude oil extracted from the North Sea, serving as a global benchmark for pricing various refined products. Crude oil WTI (West Texas Intermediate) is another grade of crude oil, primarily sourced from the United States, and its pricing serves as a key indicator for the values of refined products in the Americas. These types of crude oil, Brent and WTI serve as benchmarks in different regions, influencing pricing strategies and market dynamics accordingly (Smith & Patel, 2023). Figure 1.1 shows the fluctuation of Crude Oil Prices.

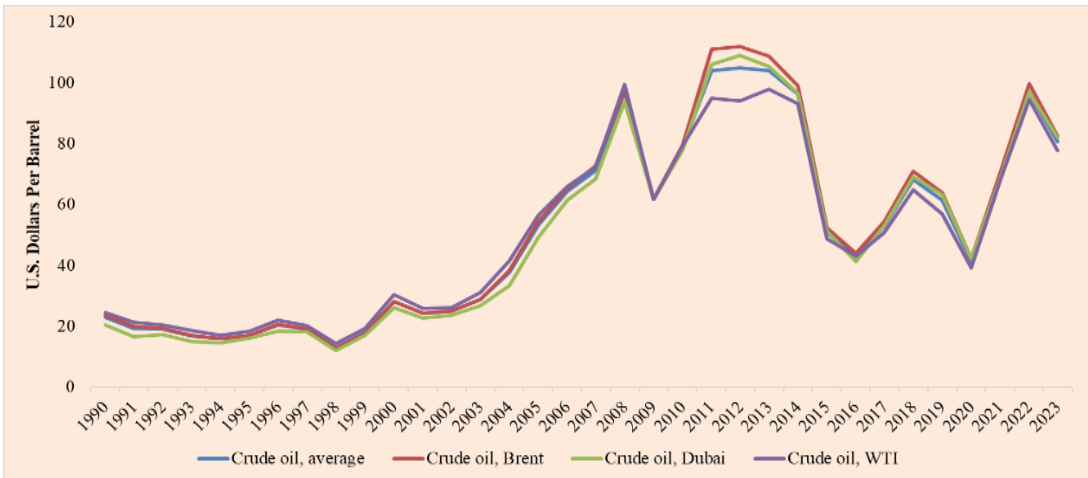


Figure 1.1: Trend of Crude Oil Prices in WTI, Dubai and North Sea (USD/BBL)

At the global level, fuel prices in the world market fluctuated at a range from an average of USD 12.28/BBL to USD 107.46/BBL for the period from 1990 to 2023. The lowest price was recorded in 1998 and the highest in 2012. Further, at the global level, the countries that experience the highest price are Hong Kong, East Asia $2.944/L equivalent to TZS 6,976.18/L; Iceland, Europe $2.48/L equivalent to TZS 5,805.68/L; Monaco USD 2.190 /L equivalent to TZS 5,126.79 /L. Prices in Hong Kong, East Asia and Iceland, Europe are updated/ changed weekly while in Monaco, prices are published every month (International Energy Agency, 2023). Figure 1.2 shows the trend of crude oil prices in the world market from 1990 to 2023.

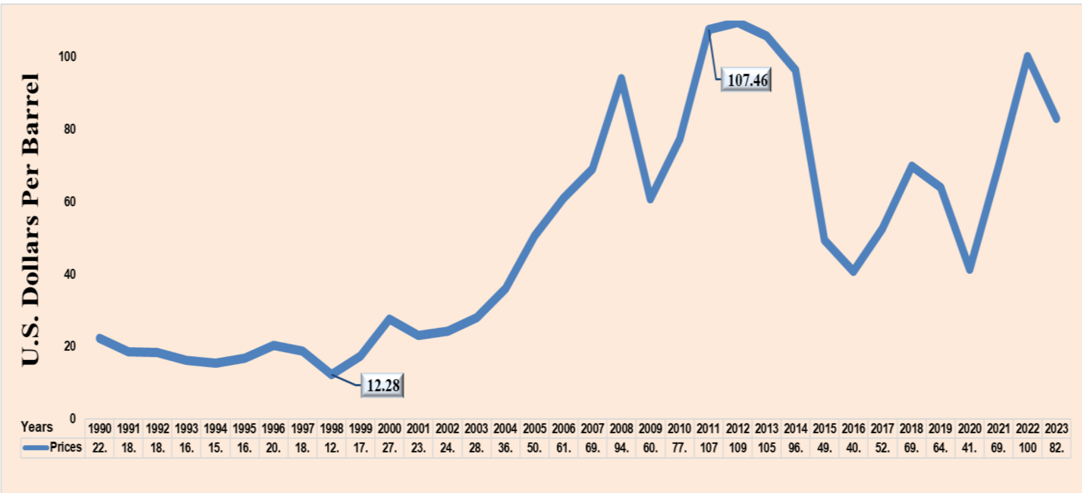


Figure 1.2: Trend of Crude Oil Prices in the World Market (USD/BBL)
Source: International Energy Agency (2023).

In Africa, countries with higher average fuel prices include; the Central African Republic USD 2.136/L equivalent to TZS 5,000.38/L; and Malawi USD 1.701/L equivalent to TZS 3,982.04/L. In East Africa, Burundi and Rwanda experience the higher price of fuel whereby Burundi is USD 1.56/L equivalent to TZS 3,909/L and Rwanda USD 1.49/L equivalent to TZS 3,714/L. In Kenya, the fluctuation of fuel prices for the period of 125 months from November 2013 to April 2024 ranged from USD 0.79/L to USD 1.8/L. and Figure 1.3 shows fuel price fluctuations in Kenya from Nov 2013 to April 2024.

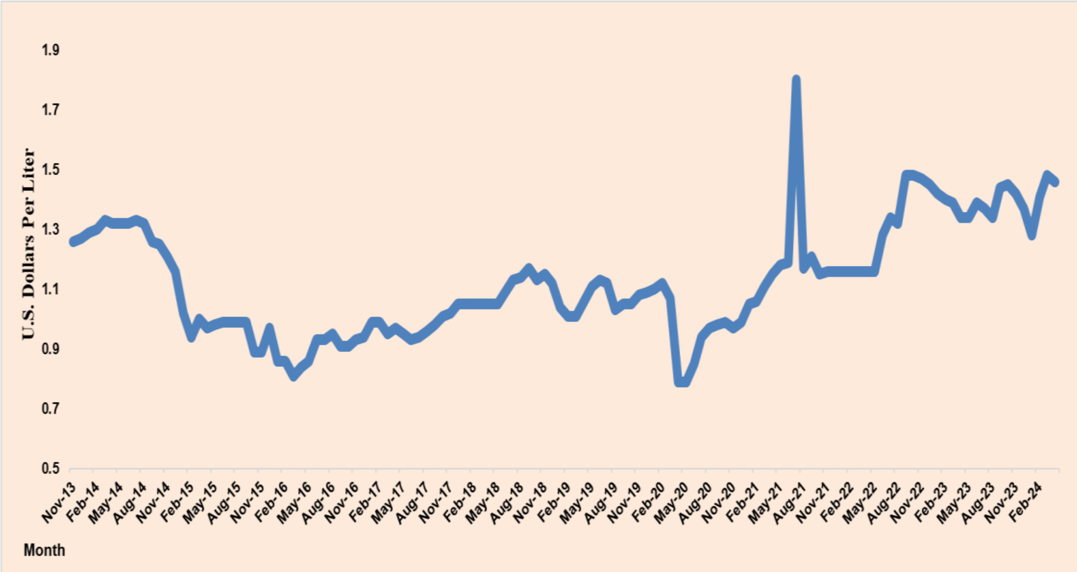


Figure 1.3: Fuel Price Fluctuations in Kenya from Nov 2013 to April 2024
Source: Kenya Energy and Petroleum Regulatory Authority (2024).

In Tanzania, initially, the fuel prices were determined by market forces of demand and supply. By mid-2000, fuel market failure was observed. In August 2007, the Government empowered the Energy and Water Utilities Regulatory Authority (EWURA) to regulate the fuel market. Following the said changes, on 9th January 2009 EWURA published the EWURA(Petroleum Products Price Setting) Rules, Government Note (GN) number (No) 5 of 2009. The published rules are used to regulate petroleum prices in mainland Tanzania. The Rules establish a pricing formula which considers all relevant costs necessary for the importation and distribution of petroleum products in the country, these costs include delivery at port costs, charges payable to Authorities, wholesale and retail operational costs and margins, government taxes as well as transport costs.

Given the above, through EWURA, Tanzania publishes cap prices of petroleum products (petrol, diesel and kerosene) every month, it is supposed that the price ought to be stable for a certain period, however, the prices do change very frequently almost every month. Among other factors, the financial factors trigger the changes in prices. Figure 1.4 shows the trend of petrol prices from September 2017 to September 2023.

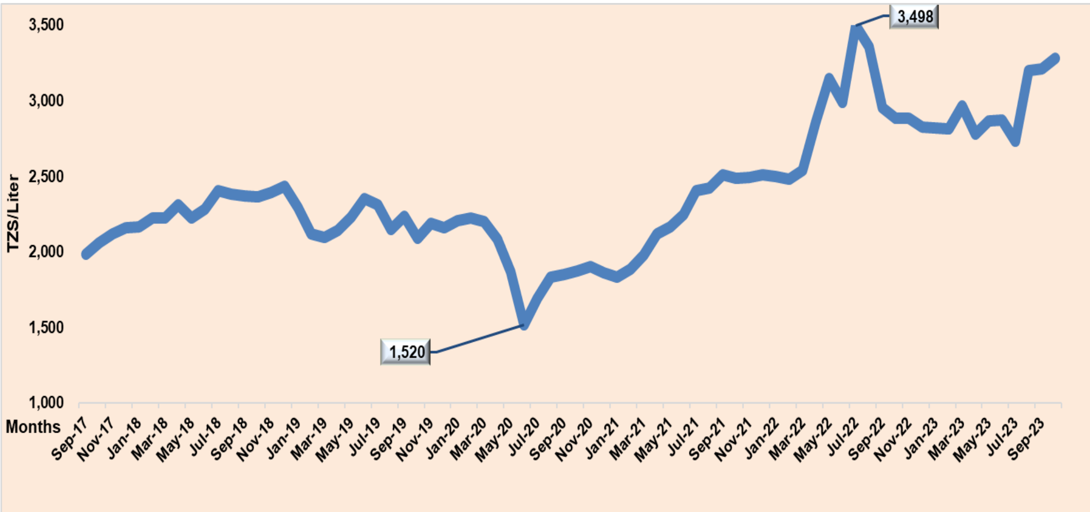


Figure 1.4: Trend of Petrol Price in Tanzania (TZS/Litre)
Source: Tanzania Energy and Water Utilities Regulatory Authority (2024).

Changes in financial factors such as import costs, operation costs, and government taxes are the main drivers of price fluctuations. In the Tanzanian market, the fuel price is regulated by EWURA through setting the cap price. However, the price fluctuation is still observed. Further, different scholars in the literature emphasise the impact of fuel price fluctuation ignoring the assessment of route cause. Thus, the determination of financial factors that cause price fluctuation is critical and hence this study aimed to determine and assess the financial factors affecting fuel price fluctuation in Tanzania and advise the government on how to stabilise the price.

1.3 Statement of the Problem

Petrol, diesel, and kerosene are major sources of energy in Tanzania, but fuel prices in the country fluctuate monthly, as documented by the Energy and Water Utilities

Regulatory Authority (EWURA). For instance, EWURA reported that fuel prices increased by an average of 10% between January and March 2023, significantly impacting transportation costs and subsequently raising prices for goods and services across various sectors (EWURA, 2023). This volatility affects key economic activities, including transportation, agriculture, health services, and power generation. The case study focuses on Dar es Salaam to illustrate the broader issue of fuel price fluctuations across the country. While pump prices in Dar es Salaam are lower than in upcountry regions, this discrepancy is primarily due to transportation costs, which increase with distance from distribution point (Dar es Salaam). In remote areas, the cost of transporting fuel adds to the overall price, leading to higher pump prices.

The price of petrol, diesel and kerosene have different pump prices. Between June 2020 and October 2023, Tanzania’s fuel prices exhibited significant fluctuations influenced by government measures such as subsidies and the reduction of various charges, levies, and fees on petroleum products. The historical trends suggest increased volatility and decreased volatility in different occasion. For example, petrol prices started at TZS 1,520 per liter while diesel was TZS 1,546/L and kerosene TZS 1,568/L in June 2020, peaked at TZS 3,498/L for petrol, TZS 3,510/L for diesel and TZS 3,442/L for kerosene in mid-July 2022, petrol decreased to TZS 2,736 in July 2023, and rose again to TZS 3,281 in October 2023 (EWURA, 2023). This variability illustrates how external factors and government interventions affect fuel affordability, reflecting the dynamic nature of fuel pricing in response to both domestic policies and global market conditions (Mwanamanga, 2022).

Despite the regulatory framework designed to stabilize fuel prices, Tanzania continues to experience frequent fluctuations in petrol and diesel costs, driven by factors such as global oil prices, exchange rates, and domestic supply chain challenges (Mugisha & Mhando, 2022). The shifts in global oil prices and exchange rates have a profound impact on local fuel prices (EWURA, 2022). Logistical challenges and outdated infrastructure intensify this volatility (TPDC, 2021), while government taxes significantly influence fuel costs (UDSM, 2020). The vulnerability of fuel prices to global geopolitical events is starkly illustrated by the lower price level of approximately TZS 1,520 per liter for petrol while diesel was TZS 1,546/L and kerosene TZS 1,568/L in June 2020 during the COVID-19 pandemic, contrasted with a peak of TZS 3,497/L for petrol, TZS 3,510/L for diesel and TZS 3,442/L for kerosene in mid-July 2022 during Russia's invasion of Ukraine.

The drastic price increase during this crisis led to heightened public concern and speculation regarding the stability of fuel prices in Tanzania, revealing a disconnect between consumer perceptions and the underlying factors influencing these fluctuations, such as international supply chain disruptions and currency variations (Ndunguru et al., 2023). This study aims to specifically examine the financial determinants affecting fuel price fluctuations in Tanzania, while acknowledging that non-financial factors such as geographical location, availability of crude oil resources, national strategies for security of supply, and the overall economic and political stability of the country also play significant roles (Oladipo & Alabi, 2021). Additionally, fuel price fluctuations in Tanzania are further compounded by importation costs, operational inefficiencies, and government taxes. While existing research has identified various factors contributing to fuel price volatility, it often does so in isolation. For example, studies may focus on importation costs without examining how these interact with currency fluctuations or government taxes. This fragmented approach overlooks the cumulative impact of these financial determinants and their interplay with non-financial factors, resulting in a limited understanding of the overall dynamics influencing fuel prices. Addressing this gap is crucial for enhancing understanding and informing more effective policy interventions. Therefore, this study seeks to provide a comprehensive analysis of the financial factors that specifically affect fuel price fluctuations in Tanzania.

1.4 Objectives of the Study

1.4.1 General Objective

The main objective of the study is to assess financial factors affecting fuel price fluctuation in Tanzania.

1.4.2 The Specific Objectives

i. To assess importation costs affecting fuel price fluctuation in Tanzania.
ii. To evaluate the operational costs affecting fuel price fluctuation in Tanzania.
iii. To assess the impact of government taxes on fuel price fluctuation in Tanzania.

1.4.3 Research Hypothesis

Research Hypothesis One

Null Hypothesis (H_0) – There is no significant relationship between importation costs and fuel price fluctuation in Tanzania.

Alternative hypothesis (H_1) – There is a significant relationship between importation costs and fuel price fluctuation in Tanzania.

Research Hypothesis Two

Null Hypothesis (H_0) – There is no significant relationship between operational costs and fuel price fluctuation in Tanzania.

Alternative hypothesis (H_1) – There is a significant relationship between operational costs and fuel price fluctuation in Tanzania.

Research Hypothesis Three

Null Hypothesis (H_0) – There is no significant relationship between government taxes and fuel price fluctuation in Tanzania.

Alternative hypothesis (H_1) – There is a significant relationship between government taxes and fuel price fluctuation in Tanzania.

1.5 Scope of the Study

The purposefully scope of the study intends to cover the petroleum products that are sourced from Dar es Salaam port. As far as Tanzania has three ports used to import petroleum products namely Dar es Salaam Port, Tanga Port, and Mtwara Port, this study assessed the financial factors affecting fuel prices in Tanzania that are sourced from Dar es Salaam Port because the selected port is the major and older one compared to others and it covers about 90% of petrol imported in Tanzania.

1.6 Significant of the Study

This study determined the factors used in the computation of petroleum product prices in Tanzania. It also provides useful insight for the government, stakeholders, and policymakers on factors that significantly affect the changes in the prices of petrol in Tanzania.

The study provides recommendations to policymakers on the reasons behind the fluctuation of fuel prices in Tanzania which is useful to the government for decision making. Also, assists oil marketing companies with investment decisions, consumers of petroleum products, and other stakeholders including government agencies.

Further, to curb the price shock during the increase in pump price, the study provides an alternative mechanism to reduce the price shock when prices are high. Also, mechanisms to ensure pump price stabilization were proposed in this study. Furthermore, the study raised awareness of which other researchers would build on the findings of this study to carry out further research in the same area to explicate, improve, bring up-to-date, and enrich the findings of this study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Conceptual Definition

The keywords that play a crucial role in understanding the focus and scope of the study. Keywords are essential terms or phrases that capture the main concepts or themes of the research. Here are the key keywords:

2.1.1. Fuel Importation Costs

Fuel importation costs refer to the comprehensive expenses incurred in bringing fuel products into a country from abroad, including free on-board costs, freight, insurance, and premiums. These costs are pivotal in shaping energy security and economic competitiveness, as highlighted by recent research.

2.1.2. Fuel Operational Costs

Fuel operational costs refer to the expenditures associated with the ongoing utilization and management of fuel within various sectors, encompassing expenses such as fuel procurement, storage, distribution, and selling expenses. These costs are critical components of economic and operational assessments in industries reliant on fuel.

2.1.3. Government Taxes

Government taxes refer to mandatory financial levies imposed by the state on individuals, businesses, or other entities within its jurisdiction, aimed at funding public expenditures and influencing economic behaviour. Government taxes on fuel refer to the compulsory financial charges imposed by governmental authorities on the sale or consumption of fuel products, aimed at generating revenue, regulating consumption patterns, and promoting environmental objectives. These taxes typically may include excise duties, carbon taxes, and value-added taxes (VAT), among others.

2.1.4. Fuel Price Fluctuations

Fuel price fluctuations refer to the variations in the prices of fuel products such as petrol and diesel over time, in this case from one month to another month influenced by global oil price movements, government taxation policies, and local market dynamics. These fluctuations impact consumers, businesses, and the economy at large.

2.2. Theoretical Literature Review

The fluctuation of fuel prices is influenced by a complex interplay of various factors, and there is no single best theory to explain these fluctuations. Instead, economists and experts often consider a combination of economic theories and real-world factors that contribute to changes in fuel prices, therefore, this study is based on Supply and Demand Theory as well as Cost-Push Inflation Theory.

2.2.1. The Supply and Demand Theory

Supply and Demand Theory is a fundamental concept in economics that explains the relationship between the availability (supply) and desire (demand) for goods or services, influencing their prices in the market. This theory, often attributed to Adam Smith, the author of "The Wealth of Nations" published in 1776, outlines how interactions between buyers (demand) and sellers (supply) establish equilibrium prices and quantities in a competitive market. However, the works of classical economists such as David Ricardo, and Alfred Marshall contributed to the development of this theory. These economists laid the groundwork for understanding how markets allocate resources efficiently based on consumer preferences and producer costs.

The theory suggests that in a competitive market, the price of a commodity, such as fuel, is determined by the interaction of supply and demand. Supply refers to the quantity of a good that producers are willing and able to sell at different prices, while demand refers to the quantity of the good that consumers are willing and able to buy at different prices. The equilibrium price is where the quantity demanded by consumers equals the quantity supplied by producers. The basic principle of supply and demand plays a significant role in fuel price fluctuations. When global demand for oil increases (e.g., due to geopolitical factors or economic growth), and the supply is constrained (e.g., due to production cuts or disruptions), fuel prices tend to rise. Likewise, when demand decreases or supply increases, prices may fall.

2.2.1.1. Assumptions of Supply and Demand Theory

Ceteris Paribus: The theory assumes that all other factors influencing demand and supply remain constant, isolating the relationship between price and quantity exchanged; Rational Behaviour: Consumers are assumed to maximize their utility (satisfaction) by purchasing goods at the lowest possible price, while producers aim to maximize profits by selling at the highest possible price; Perfect Competition: the theory assumes perfect competition where there are many buyers and sellers, none of whom can individually influence the market price. This assumption ensures that prices are determined solely by supply and demand forces; Price Mechanism: Prices act as signals in the market, adjusting based on changes in supply or demand. An increase in demand relative to supply leads to higher prices, signaling producers to increase production to meet demand.

2.2.1.2. Strengths of Supply and Demand Theory

Predictive Power whereby the theory provides a framework for predicting how changes in supply and demand impact prices and quantities exchanged in the market; Efficiency whereas supply and demand interact to determine an equilibrium price and quantity that allocate resources efficiently; Flexibility in which the theory can be applied across various markets and goods, from basic commodities like fuel to complex goods and services that allows for insights into market dynamics and behaviors across different sectors of the economy; Policy Guidance by informing policymakers about the impacts of interventions such as taxes, subsidies, or regulations on market outcomes; Real-World Application for instance, in Tanzania, where fuel prices are regulated, understanding supply and demand dynamics helps in assessing the effectiveness of regulatory policies in stabilizing prices.

2.2.1.3. Weaknesses of Supply and Demand Theory

The theory assumes static conditions and perfect competition, which rarely exist in real-world markets. Market imperfections such as monopolies, externalities, and imperfect information can distort the relationship between supply and demand. Moreover, the theory does not account for non-price factors that influence consumer behavior or production decisions, such as tastes and preferences, technological advancements, and government regulations.

2.2.1.4. Usefulness and Application of Supply and Demand Theory in this Study

The theory provides a framework to analyze how various economic factors influence the supply and demand dynamics of fuel in the Tanzanian market. The theory helps identify how changes in importation costs including global oil prices, and operational costs such that transportation costs and government taxes affect the supply of fuel by suppliers and the demand from consumers. By applying the theory, the study can examine how these financial factors interact to determine the equilibrium fuel prices in Tanzania, offering insights into the market's responsiveness to external economic conditions and informing potential policy interventions to mitigate price fluctuations and ensure stability.

2.2.2. The Cost-Push Inflation Theory

Cost-Push Inflation Theory originated in the early 20th century as economists began to analyze the effects of rising production costs on overall price levels in an economy. The theory emerged from the broader study of inflation, which traditionally focused on demand-pull factors. The theory does not have a single founder, however, emerged through the contributions of three key economists who explored the relationship between rising production costs and inflation, these were; A.W. Phillips: Known for the Phillips Curve, which focused on the relationship between unemployment and inflation.

Alfred Marshall: His work on supply and demand provided the foundational concepts for understanding how changes in production costs could influence price levels. James Tobin: Although more known for his work on monetary policy, Tobin contributed to the broader discourse on inflation by analyzing the effects of supply-side factors on prices. The theory gained prominence during periods of significant supply shocks, such as the oil crises in the 1970s, which highlighted how increases in production costs could lead to higher prices for goods and services, independent of aggregate demand.

2.2.2.1. Assumptions of Cost-Push Inflation Theory

Cost-Push Inflation Theory is based on several key assumptions. First, it assumes that the supply of goods and services is influenced significantly by changes in production costs. It presumes that firms are unable or unwilling to absorb these increased costs, leading them to pass on higher costs to consumers in the form of higher prices. Additionally, the theory assumes that the labor market and raw material costs can fluctuate due to external factors, such as geopolitical events or supply chain disruptions. Another assumption is that wages and raw material prices are sticky, meaning they do not adjust instantly to changes in economic conditions, further contributing to inflationary pressures.

2.2.2.2. Strengths of Cost-Push Inflation Theory

The Cost-Push Inflation Theory offers valuable insights into the dynamics of inflation, particularly in scenarios where aggregate demand remains stable but prices still rise. Its primary strength lies in its ability to explain inflationary pressures originating from the supply side of the economy, such as increases in wages or raw material costs. This perspective is particularly useful during periods of economic uncertainty or when supply shocks occur. The theory also provides a framework for policymakers to address inflation by targeting supply-side factors, such as improving supply chain efficiency or mitigating the impact of external cost shocks.

2.2.2.3. Weaknesses of Cost-Push Inflation Theory

Despite its strengths, Cost-Push Inflation Theory has several limitations. One significant weakness is assumes that firms have the market power to pass on costs to consumers, which may not be true in highly competitive markets. Additionally, its tendency to oversimplify the complex interplay between supply and demand factors. The theory assumes a direct relationship between rising costs and inflation, but in reality, other factors such as monetary policy and demand fluctuations also play critical roles. Furthermore, the theory may not fully account for the role of expectations in shaping inflation, as businesses and consumers may anticipate future price increases and adjust their behavior accordingly.

2.2.2.4. Usefulness and Application of Cost-Push Inflation Theory

The theory is useful for understanding how external factors affect inflation, especially in contexts where traditional demand-pull explanations do not apply. The theory is particularly relevant in analyzing the impact of supply chain disruptions, wage increases, and commodity price fluctuations on overall price levels. By focusing on supply-side factors, the theory provides a more comprehensive view of inflation dynamics and informs strategies to manage and mitigate inflationary risks.

In the context of Tanzania, the Theory applied in analysing the impact of rising importation costs, operational costs, and government taxes on fuel price fluctuations. For example, if there are increases in global oil prices or disruptions in the supply chain, these changes can lead to higher costs for importing fuel, which may then be passed on to consumers. Similarly, higher operational costs for fuel distribution and storage can contribute to price increases. By applying this theory, policymakers and economists identify and address the root causes of inflationary pressures that stem from rising production costs rather than changes in aggregate demand.

2.3. Empirical Literature Review

2.3.1. Effect of Importation Costs on Fuel Price Fluctuation

The relationship between importation costs and fuel price fluctuation in Tanzania is a complex interplay influenced by various economic factors. Several studies have delved into this relationship, employing different methodologies and offering insightful findings. Temesgen and Alemayehu (2017) conducted a time-series data analysis to investigate the impact of importation costs on fuel prices in Tanzania. Their study revealed a significant relationship, with changes in importation costs directly influencing fluctuations in fuel prices. This finding underscores the importance of considering importation expenses when examining fuel price dynamics within the Tanzanian market. Similarly, Masanjala and Mmari (2018) emphasized the sensitivity of fuel prices to importation costs, particularly in response to shifts in global oil prices and transportation expenses. Their research highlights the substantial influence of importation costs on fuel price fluctuations, indicating a significant correlation between these two variables.

Furthermore, Ng'wanakilala and Mwakaje (2019) explored the determinants of retail petrol prices in Tanzania, focusing on the impact of importation costs. Their study corroborated previous findings, demonstrating a strong correlation between importation expenses and fuel price adjustments. The researchers observed that changes in importation costs significantly contribute to shifts in fuel prices at the pump, suggesting the crucial role of importation expenses in shaping retail petrol prices in Tanzania. Additionally, Mahuta et al. (2020) employed econometric modelling to analyse the dynamics of fuel prices in Tanzania. Their study confirmed the significant relationship between importation costs and fuel price variations, providing further evidence of the direct influence of importation expenses on fuel pricing within the Tanzanian context.

Despite these findings, it is essential to recognize the multifaceted nature of the relationship between importation costs and fuel price fluctuation in Tanzania. While some studies emphasize the direct impact of importation expenses on fuel prices, others suggest that additional factors may moderate this relationship. For instance, Mwase et al. (2018) conducted econometric analysis and found that while importation costs play a role in determining fuel prices, their influence is moderated by domestic factors such as government interventions and market structures. This suggests that while importation costs are significant, other contextual factors also contribute to fuel price dynamics in Tanzania. Similarly, Kweka and Ngalawa (2019) highlighted the impact of government subsidies on fuel prices, indicating that regulatory measures may mitigate the direct influence of importation costs on retail prices.

Moreover, the relationship between importation costs and fuel price fluctuation in Kenya and Uganda has been a subject of interest in energy economics research. Study by Karekezi and Mutambatsere (2019) employed econometric analysis to investigate determinants of fuel prices in Kenya. Their findings revealed a significant correlation between importation costs and fuel price fluctuations, suggesting that changes in importation expenses directly influence retail fuel prices in Kenya. Similarly, a study by Mugisha and Edema (2018) utilized econometric modeling to analyze the determinants of petrol prices in Uganda. Their research identified importation costs as a significant factor driving fuel price dynamics, indicating a direct relationship between importation expenses and retail petrol prices in Uganda.

Qualitative research methods have also been employed to understand the contextual factors shaping the relationship between importation costs and fuel price fluctuation in Kenya and Uganda. Study by Kiamba et al. (2020) conducted qualitative interviews with industry experts to explore the determinants of fuel prices in Kenya. Their research highlighted the role of importation costs, along with other factors such as taxation and market competition, in influencing fuel price adjustments. Additionally, a qualitative study by Bwire et al. (2019) investigated the factors influencing petrol prices in Uganda through focus group discussions and interviews with key stakeholders. Their findings underscored the significant impact of importation costs on fuel pricing, indicating a strong relationship between these expenses and retail petrol prices in Uganda.

2.3.2. Impact of Operational Costs on Fuel Price Fluctuation

Understanding the relationship between operational costs of fuel companies and fuel prices is crucial for comprehending the dynamics of the energy market. Study by Smith and Johnson (2018) who conducted econometric analysis to explore the relationship between operational costs and fuel prices in the oil industry. The findings revealed a significant correlation, with higher operational costs leading to increased fuel prices. Similarly, a qualitative analysis by Martinez and Rodriguez (2019) explored the perceptions of fuel company executives on the relationship between operational costs and fuel prices. Their findings underscored the significant role of operational expenses in determining fuel prices and suggested that variations in operational expenses directly influence fuel price fluctuations.

Further, research by Li et al. (2020) investigated the role of technological advancements in reducing operational costs and their effects on fuel prices. The findings revealed that investments in advanced technologies can help fuel companies streamline operations and lower costs, contributing to more stable fuel prices. Additionally, a study by Garcia and Vazquez (2019) examined the effects of market competition on operational costs and fuel prices in the energy industry. The research highlighted the importance of competitive pressures in driving efficiency improvements and cost reduction initiatives among fuel companies, ultimately influencing fuel pricing dynamics.

Moreover, a study by Martins and Pires (2018) in Brazil employed econometric modelling to explore the relationship between operational costs and fuel prices. Their findings revealed a significant correlation, with higher operational expenses leading to increased fuel prices, highlighting the importance of operational cost management in determining fuel pricing in Brazil. Additionally, a qualitative analysis by Otumawu and Twerefou (2020) explored the perceptions of fuel company executives in Ghana on the relationship between operational costs and fuel prices. Their findings underscored the significant role of operational expenses in determining fuel prices, with executives emphasizing the need for cost-effective operations to maintain competitive pricing in the Ghanaian fuel market

2.3.3. Impact of Government Taxes on Fuel Price Fluctuation

The relationship between government taxes and fuel price fluctuation is crucial for comprehending the dynamics of the energy market in various countries. Several studies across different countries in East Africa and other countries across the world have investigated this relationship using various methodologies, shedding light on how government taxation policies influence fuel pricing and its fluctuations. In Tanzania, research by Mwase et al. (2018) conducted qualitative interviews with industry experts to examine the impact of government taxes on fuel prices. The findings indicated that changes in taxation policies directly influence fuel prices. Similarly, a quantitative study by Ng'wanakilala and Mwakaje (2019) utilized econometric techniques to analyze the effects of government taxes on fuel prices in Tanzania. Their research confirmed a significant correlation between government taxes and fuel prices, with variations in tax rates contributing to fuel price fluctuations in the Tanzanian market.

Further, research by Wambua et al. (2017) investigated the relationship between government taxes and fuel price fluctuation in Kenya using time-series analysis. The findings suggested that changes in government taxation policies have a substantial impact on fuel prices. Additionally, a qualitative study by Njoroge and Wang (2018) examined the perspectives of industry stakeholders on the influence of government taxes on fuel prices in Kenya. The research highlighted the challenges faced by fuel companies and consumers due to fluctuations in taxation policies, emphasizing the need for stability and predictability in tax regulations to mitigate fuel price volatility in the Kenyan market.

A study by Kasirye and Rujumba (2019) analyzed the effects of government taxes on fuel prices in Uganda using econometric modeling. The research revealed a significant correlation between tax policies and fuel prices, with changes in tax rates directly influencing fuel price fluctuations in the Ugandan market. Additionally, qualitative research conducted by Kasekende et al. (2020) explored the perceptions of industry experts on the impact of government taxes on fuel prices in Uganda. The findings underscored the importance of taxation policies in shaping fuel prices stability and mitigate price fluctuations.

Furthermore, a study by Olusegun et al. (2018) investigated the relationship between government taxes and fuel price fluctuation in Nigeria using econometric analysis. The research revealed a significant correlation between tax policies and fuel prices, with changes in tax rates exerting a considerable influence on fuel price dynamics in the Nigerian market. Additionally, qualitative research by Olayide and Onayinka (2020) examined the perspectives of industry stakeholders on the impact of government taxes on fuel prices in Nigeria.

The findings highlighted the challenges faced by fuel companies and consumers due to fluctuations in taxation policies, emphasizing the need for consistent and predictable tax regulations to stabilize fuel prices in the Nigerian market. In their respective studies, Andrea et al. (2018) explored the relationship between fuel price fluctuation and government taxes. Andrea, et al., (2018) conducted econometric analyses to investigate the impact of government taxes on fuel price fluctuations and expanded the analysis by integrating additional factors such as market demand and international crude oil prices into their econometric modeling and concluded that while government taxes play a pivotal role in shaping fuel prices, their impact is mediated by various factors including market demand and global oil market dynamics.

2.4. Research Gap

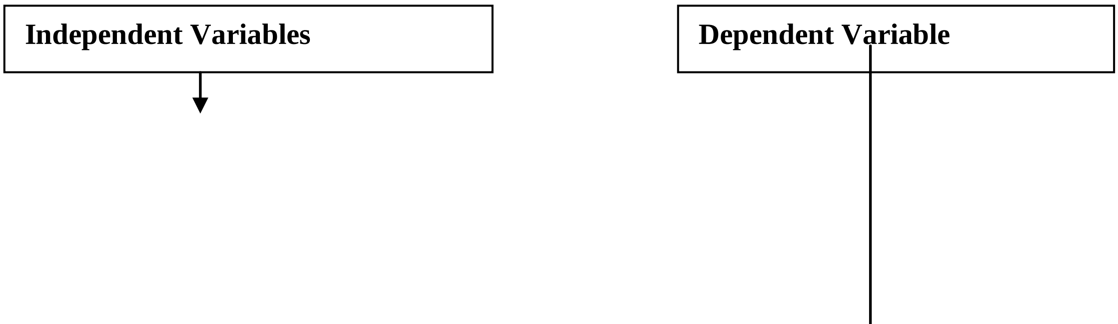
Despite the extensive body of research on fuel price fluctuations, there remains a notable gap in understanding the key financial determinants specifically within the Tanzanian context. Existing studies, such as those by Temesgen and Alemayehu (2017) and Mahuta et al. (2020), have established that importation costs significantly impact fuel price fluctuations. However, these studies often lack a comprehensive analysis of how these costs interact with other financial and regulatory factors within Tanzania. For instance, while the direct influence of importation costs has been well-documented, there is limited research on how domestic factors, such as government taxes, regulatory policies, and market structures, might moderate or amplify these effects.

Furthermore, studies that explore the interaction between importation costs and other financial determinants, including operational costs and technological advancements, are sparse. Additionally, while research by Andrea et al. (2018) provides insights into the broader implications of fuel price changes, such as their impact on various sectors, there is a lack of focused investigation into how specific financial determinants affect fuel price fluctuations in Tanzania. The need for a deeper analysis is evident given that Tanzania's reliance on fuel imports and the recurring fluctuations in fuel prices highlight a crucial research gap. This gap is particularly relevant as fuel price volatility directly impacts economic stability and consumer behavior in the region.

Moreover, previous studies often concentrate on the effects of government taxation on fuel prices but do not adequately address how variations in tax policies and their stability influence price fluctuations over time. Research by Mwase et al. (2018) and Ng'wanakilala and Mwakaje (2019) indicates that government taxes play a significant role in shaping fuel prices. However, these studies do not fully explore the impact of policy stability and predictability on fuel price volatility. Understanding these dynamics is essential for developing effective strategies to manage fuel price fluctuations and ensure economic stability in Tanzania. This research aims to fill these gaps by providing a comprehensive analysis of the key financial determinants affecting fuel price fluctuations in Tanzania, with a specific focus on importation costs, operational costs, and government taxation policies.

2.5. Conceptual Framework.

The model consists of two variables; independent variables which are Import Costs (IC), Operational Costs (OC) and Government Tax (GT). On the other hand, the dependent variable which is Fuel Prices**. Figure** 2.1



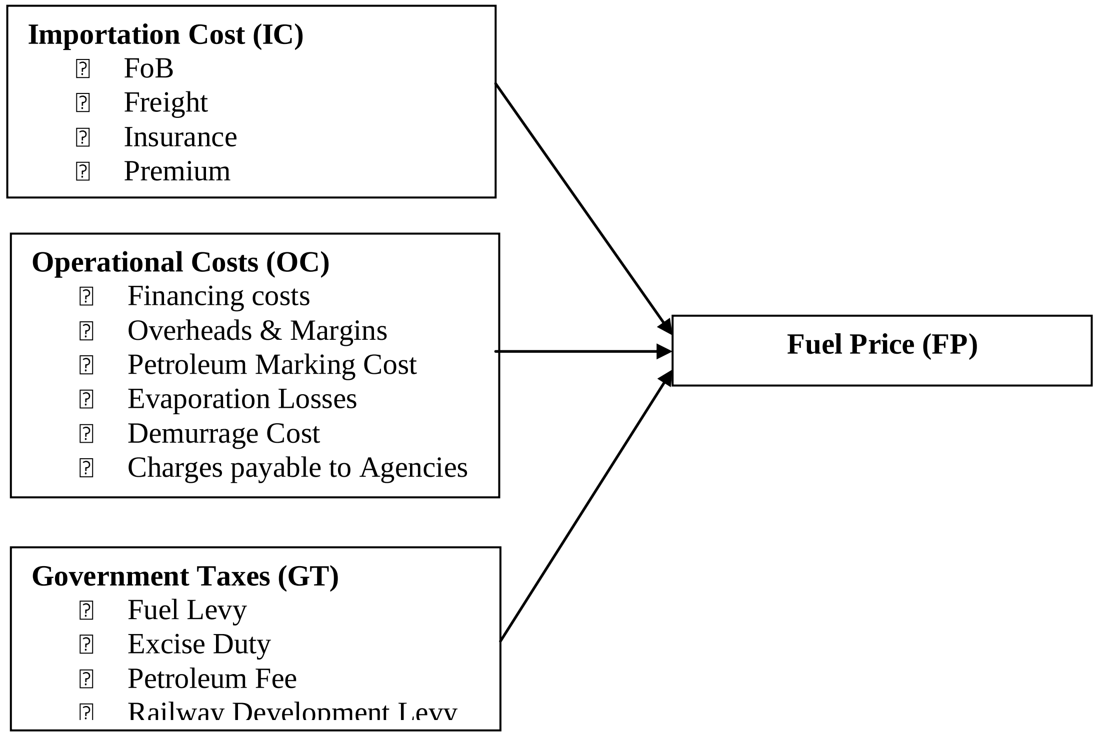


Figure 2.1: Conceptual Framework.

Source: Developed from extant literature (2024).

CHAPTER THREE

RESEARCH METHODOLOGY

Chapter three gives the explanations on the methodology to be employed in this study by adopting the research onion analysis developed by Saunders et al in 2019. While using research onion, a researcher has to analyse from outer layer to inner layer step by step. Each layer of the onion defines a detailed point of research process (Saunders et al., 2019). The six layers highlighted by Saunders' research onion are research philosophy, research approach, research strategy, research choices, time horizon and the data collection methodology.

3.1. Research Philosophy

A researcher has adopted a positivist philosophy to emphasize quantitative methods in analyzing numerical data on financial factors such as import cost that include global oil prices, operational costs and government taxes. This approach aims to uncover empirical relationships and causal mechanisms between these factors and fuel price fluctuations. The utilizing econometric models, such as regression analysis, allows to statistically validate hypotheses regarding the impact of these financial variables on fuel price fluctuation. This philosophy prioritizes objectivity and explicability, ensuring that findings are grounded in observable data and can withstand rigorous scrutiny.

3.2. Research Approach

The study predominantly follows a deductive reasoning framework. This approach begins with a theoretical understanding of how financial factors, such as import cost, operational costs and governmental taxes, are hypothesized to influence fuel price fluctuations. Initially, a comprehensive review of existing literature and theories was done to develop hypotheses about these relationships. Subsequently, quantitative methods were employed to test these hypotheses using historical data on fuel prices and relevant financial indicators. Statistical analyses, including regression models, was utilized to assess the strength and significance of the relationships identified. By adhering to a deductive approach, this study aims to provide empirical evidence that validates or refines existing theories regarding the financial determinants of fuel price fluctuations in Tanzania, thereby contributing to a deeper understanding of the matter.

3.3. Research Strategy

The research strategy defines how the scholar plans to carry out the research work (Saunders, et al., 2019). The strategy can comprise a number of varieties approaches, for example action research, experimental research, case study research, surveys, interviews and the like. Case study research is based on assessment of a single unit so as to create its key characteristics and draw generalizations. Since Tanzania has three ports used to import the petroleum products, these are Dar es salaam port, Tanga port and Mtwara port, this study assessed the financial factors affecting fuel price in Tanzania using a case study research strategy that focused in Dar es Salaam due to the fact that, the selected port is the major and older one compared to others.

3.4. Methodological Choices

According to (Saunders, et al., 2019), there are three highlighted choices in research onion which are Mono (the use of either qualitative or quantitative methodology), Mixed (combine qualitative and quantitative methodology to establish certain data set), and Multi method choice of research. This study used mono choice of research whereby quantitative method was be employed.

3.5. Time horizon

The two-time horizons categories namely longitudinal and cross sectional whereby longitudinal time horizon refers to the collection of data repetitively over extended period of time and is practically used when a key factor of research is assessing change over time. The cross-sectional time horizon is used when the research is concerned with the study of a specific phenomenon at a definite time. Therefore, this study employed a longitudinal time horizon and the collection of time series data was used.

3.6. Data Analysis and Collection Methods

Techniques and Procedures for data collection methods is the innermost layer of Saunders research onion. The process contributes significantly to the general validity and reliability of the study (Saunders et al., 2019). The Stata, Analysis Tool-Pak and Statistical Functions in Microsoft Excel were used to analyse data while the robust multiple linear regressions model was employed to establish the relationship between dependent and independent variables and obtaining the numerical estimates of the co-efficient in different equations. Further, collection methods to be employed in collecting secondary data include desk survey by perusing the website and data request through official letters.

3.7. Research Design

The research design focused exclusively on quantitative techniques to analyze the relationships between financial factors and fuel price fluctuations. This study employed a descriptive and correlational research design, utilizing historical data obtained from reputable sources such as government publications, financial reports, and industry databases. The primary variables of interest included fuel prices, import costs, operational coast and government taxes. Through statistical methods such as multiple regression analysis, time-series analysis, and possibly econometric modeling, this research aims to quantify the extent and direction of influence that each financial factor exerts on fuel price movements. By establishing empirical relationships, this quantitative approach seeks to provide robust insights into the economic mechanisms driving fuel price fluctuations in Tanzania, thereby informing policymakers, energy stakeholders, and the public about effective strategies to manage and mitigate these fluctuations in the future.

3.8. Reliability of Research Instruments

Reliability refers to the consistency and stability of the results obtained from the model over time and across different conditions. Reliability was assessed through the model's ability to consistently produce accurate and stable estimates of how financial factors influence fuel prices over time. This was evaluated using statistical output of Stata which indicates the proportion of variation in fuel prices explained by the independent variables. Additionally, reliability was reinforced by conducting diagnostic tests for assumptions such as multicollinearity, heteroscedasticity, and autocorrelation, ensuring the model's robustness against potential biases.

3.9. Testing Procedures

The study address issues such as normality test, multicollinearity, heteroscedasticity, autocorrelation, stationarity testing and explore long-run and short-run dynamics to ensure the validity and reliability of the study's findings. Multicollinearity, which occurs when independent variables are highly correlated with each other, the assessment using variance inflation factor (VIF) tests was done. Variables showing high VIF scores were carefully examined to ensure that each variable contributes uniquely to the model's explanatory power. Heteroscedasticity, the unequal variance of residuals across different levels of the independent variables, were tested using the Breusch-Pagan test. Robust standard errors or transformation techniques was applied if heteroscedasticity is detected, ensuring the reliability of estimated coefficients and hypothesis testing.

Autocorrelation, where residuals are correlated across time periods, was evaluated through Durbin-Watson tests for time-series data. Adjustments such as including lagged variables or employing autoregressive models were considered to address autocorrelation and enhance the model's accuracy in capturing the dynamic nature of fuel price fluctuations in Tanzania. Stationarity testing was conducted using unit root tests such as the Augmented Dickey-Fuller (ADF) to verify the stability of time series data. Further, both long-run and short-run dynamics were explored to determines whether there are stable, linear combinations (cointegrating relationships) among variables.

3.10. Data Source

The study used secondary data obtained from EWURA, Bank of Tanzania, National Bureau of Statistics (NBS), PBPA and Platts Global Market Center. Each source provided the information that were used as input in fuel price computation and hence were used in the research.

3.11. Model Specification and Variables

3.11.1. Theoretical Model

In the context of the study on fuel price fluctuations in Tanzania, the theoretical model reflects the relationship between fuel prices (FP) and various financial determinants. The model is expressed as: FP = f (IC, OC, GT)

where:

FP = Fuel Price

IC = Importation Costs

OC = Operational Costs

GT = Government Taxes

This functional relationship indicates that the fuel price is a function of importation costs, operational costs, and government taxes. These factors collectively influence the fuel price in Tanzania.

3.11.2. Estimation Model

To empirically analyze this relationship, we derive a multiple linear regression model:

$FP = \beta_0 + \beta_1 IC + \beta_2 OC + \beta_3 GT + e_t$

Whereby:

FP = Fuel Price (dependent variable)

IC = Importation Costs (independent variable)

OC = Operational Costs (independent variable)

GT = Government Taxes (independent variable)

$\beta 0$ = The intercept (constant term)

β_1, β_2 & β_3	=	Regression coefficients (parameters to be estimated)
e_t	=	Stochastic error term.

Therefore, the study used input factors to price determination as independent variables which are grouped into government taxes, operational costs and import costs while the fuel price was the dependent variable. The detailed variables employed in this study includes Free on Board cost (FOB), Premium, Wharf-age, Customs Processing Fee, Weights & Measures Fee, TBS Charge, TASAC Fee, Regulatory Levy, Fuel Levy, Excise Duty, Petroleum Fee, Railway Development Levy, OMC's Overheads & Margins, Petroleum Marking Cost, Financing Cost, Evaporation Losses, Demurrage Cost, Charges payable to Executive Agencies, Surveyors Cost, Retailers Margin, Transport Charges (Local), Service Levy payable to LGAs and Charges payable to Executive Agencies

3.11.3. Variable Measurements

3.11.3.1. Importation Costs (IC)

The measurement of importation costs includes measurement of various costs associated with bringing fuel into the country. Measurements was done as the percentage increase of Free on Board (FOB) cost as well as Premium costs.

3.11.3.2. Operational Costs (OC)

These costs are incurred in the process of handling and distributing fuel. Measurements were done as the percentage increase of Demurrage Cost, Charges payable to Agencies and Government Authorities and Overheads & Margins. The Charges payable to Agencies and Government Authorities includes Wharfage, Customs Processing Fee, Weights & Measures Fee, Petroleum Marking Cost, TASAC Fee, Service Levy payable to LGAs and Regulatory Levy.

3.11.3.3. Government Taxes (GT)

These are levies imposed by the government that affect fuel prices. Measurements was done as the percentage increase of Fuel Levy and Petroleum Fee, Excise Duty, and Railway Development Levy.

3.11.3.4. Expected Coefficients

The expected coefficients of β_1 (Importation Costs) was expected to be positive. An increase in importation costs generally leads to higher fuel prices as these costs are passed on to consumers. Further, β_2 (Operational Costs) expected to be positive. Higher operational costs typically result in higher fuel prices due to increased expenses in fuel distribution and handling. Furthermore, β_3 (Government Taxes) expected to be positive. Government taxes directly contribute to the final price of fuel; thus, higher taxes are anticipated to lead to higher fuel prices. The proposed model will assess the impact of importation costs, operational costs, and government taxes on fuel prices. By applying this model, the study aims to determine the significance of each financial factor and their relative impact on fuel price fluctuations. This comprehensive approach help to identify the primary determinants of fuel price changes and provide valuable insights for policy makers and industry stakeholders.

3.12. Ethical Considerations

This study was conducted under broad consideration of ethical aspects of research whereby all participation were voluntary, research participants (institutions) were informed of the procedures included in the study, participants' privacy were protected, and the information they provided (secondary data) were solely used for that reason. Furthermore, by keeping the respondents' private information private, the researcher protected confidentiality. The researcher ensured that every piece of academic writing quoted was correctly acknowledged in accordance with academic standards.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Descriptive Statistics

4.1.1 Import Costs

The descriptive statistics reveal that both Free on Board (FOB) costs and Premiums play a significant role in fuel price fluctuations in Tanzania. FOB costs, averaging 1130.48 with high variability (standard deviation of 319.01), show substantial fluctuation and a wide range, indicating their major impact on price volatility. Positive skewness and moderate kurtosis suggest that while most FOB values are relatively low, extreme high values do occur. Premiums, with a mean of 109.38 and a standard deviation of 113.13, also exhibit considerable variability and are more skewed, meaning higher values have a greater influence on the average.

Table 4.1: Descriptive Statistics for Import Costs

Description	FOB	Premium
Mean	1130.475	109.3764
Standard Error	37.08409	13.15053
Median	1101.117	66.11792
Standard Deviation	319.0094	113.1252
Sample Variance	101767	12797.3
Kurtosis	0.907132	0.945707
Skewness	0.457378	1.497012
Range	1663.761	407.5599
Minimum	384.2726	1.149043
Maximum	2048.034	408.7089
Count	74	74

Source: Research Findings (2024)

The fairly normal distribution of Premiums with moderate kurtosis further supports their role in affecting pricing dynamics. Overall, both FOB costs and Premiums are crucial in driving fuel price fluctuations, with their variability and extremes significantly impacting overall fuel pricing. Table 4.1 shows results of descriptive statistics for import costs.

4.1.1. Government Taxes

The descriptive statistics show that both the Fuel Levy and Petroleum Fee have a significantly impact on fuel prices in Tanzania. The Fuel Levy, with an average of 354.89 and a standard deviation of 57.35, has moderate variability. This means while most values are around 313, there are some much higher values that influence the average. Its distribution is fairly normal with only a few extreme values. On the other hand, the Petroleum Fee has a lower average of 94.59 but is more variable, with a standard deviation of 22.77. It often includes very high values and is mostly skewed to the lower end, meaning most values are low but some are much higher, which affects the average. The Fuel Levy shows more overall variability, while the Petroleum Fee has more extreme values.

Table 4.2 shows results of descriptive statistics for government taxes

Table 4.2: Descriptive Statistics for Government Taxes

Description	Fuel Levy	Petroleum Fee
Mean	354.8919	94.59459
Standard Error	6.667309	2.646585
Median	313	100
Mode	313	100
Standard Deviation	57.35436	22.76679
Sample Variance	3289.522	518.3265
Kurtosis	0.035732	14.60551
Skewness	0.998508	-4.02633
Range	200	100
Minimum	313	0
Maximum	513	100
Count	74	74

Source: Research Findings (2024)

4.1.2. Operational Costs

The descriptive statistics for operational costs reveal distinct patterns affecting fuel price fluctuations in Tanzania. Demurrage Costs, with a mean of 5.58 and high variability (standard deviation of 3.36), show substantial fluctuation and frequent extreme values. Charges payable to Agencies and Government Authorities, averaging 59.23, display moderate variability with a more evenly distributed range but fewer extreme low values. Overheads & Margins, with a mean of 225.95 and low variability (standard deviation of 5.58), are relatively stable and exhibit fewer extreme fluctuations. Overall, Demurrage Costs are the most variable and prone to extremes, Charges are more stable but with some variability, and Overheads & Margins are the most consistent. Table 4.3 results of descriptive statistics for operational costs.

Table 4.3: Descriptive Statistics for Operational Costs

Description	Demurrage Cost	Charges payable to Agencies and Government Authorities	Overheads & Margins
Mean	5.57794	59.22778329	225.9459
Standard Error	0.390518	1.203475211	0.648209
Median	4.764966	65.26845674	227.5
Standard Deviation	3.359364	10.35268522	5.576103
Sample Variance	11.28533	107.1780912	31.09293
Kurtosis	6.571629	-1.382889045	-1.44893
Skewness	2.331631	-0.7276622	-0.16581
Range	16.92166	28.48975613	21
Minimum	2.039217	42.03294313	217
Maximum	18.96087	70.52269927	238
Count	74	74	74

Source: Research Findings (2024).

Overall, the descriptive statistics reveal that import costs, government taxes, and retail operational costs all play significant roles in determining fuel price fluctuations in Tanzania. The high variability in FOB costs and government taxes, particularly the extreme values in Petroleum Fees, underscores the importance of managing these factors to stabilize fuel prices. Operational costs, while less variable, also contribute to the final fuel prices. Understanding these statistics helps in formulating strategies to manage and potentially reduce the volatility of fuel prices.

4.2. Test for Normality

The Shapiro-Wilk test is a widely used statistical method for assessing the normality of a dataset. The null hypothesis (H_0) posits that the variable in question follows a normal distribution. The test produces a W statistic, where values closer to 1 suggest that the data may be normally distributed. Additionally, a corresponding p-value indicates the significance of the results; if the p-value is below a significance level of 0.05, the null hypothesis is rejected, implying that the data significantly deviates from normality. Table 4.4 shows normality test results based on Shapiro-Wilk test.

Table 4.4: Normality Test for Depended and Independent Variables

Variable	Obs	W	V	z	Prob>z
Fuel Price	74	0.95613	2.83	2.27	0.012
FOB	74	0.97163	1.83	1.32	0.094
Premium	74	0.7474	16.27	6.08	0.000
Fuel Levy	74	0.89449	6.80	4.18	0.000
Petroleum Fee	74	0.57411	27.43	7.22	0.000
Demurrage Cost	74	0.76087	15.40	5.97	0.000
Charges payable to Agencies and Government Authorities	74	0.73166	17.28	6.22	0.000
Overheads & Margins	74	0.9298	4.52	3.29	0.001

Source: Researcher STATA-Computation (2024).

The Shapiro-Wilk test results indicate significant deviations from normality for several variables. “Fuel Price” has a W value of 0.95613 and a p-value of 0.012, leading to the rejection of the null hypothesis, suggesting it does not follow a normal distribution. Both “Premium” and “Petroleum Fee” show substantial non-normality with W values of 0.7474 and 0.57411, respectively, and p-values of 0.000, indicating serious departures likely due to skewness or outliers. In contrast, “FOB” with a p-value of 0.094 does not reject the null hypothesis, suggesting it may be approximately normally distributed. However, “Demurrage Cost” and “Charges payable to Agencies and Government Authorities” exhibit strong non-normality, as indicated by their low W values and p-values of 0.000.

These findings highlight the necessity of selecting appropriate statistical methods that account for these distributional characteristics. Therefore, robust multiple regression was utilized because the data violated the normality assumption. Robust regression techniques provided a more reliable alternative, as it minimized the influence of outliers and heteroscedasticity, allowing for more valid inferences about the relationships between variables (Rousseeuw & Leroy, 2023). By applying robust methods, researcher ensured that the models reflected the true underlying patterns in the data, thereby improving the robustness and reliability of the findings.

4.3. Diagnostic Statistical Test

Diagnostic statistical tests are essential in multiple linear regression analysis involving time series data, as they help validate the underlying assumptions of the regression model. Key tests include stationarity tests, such as the Augmented Dickey-Fuller test, which assess whether the mean and variance of the series remain constant over time; this is crucial because non-stationary data can lead to spurious regression results. Additionally, the Durbin-Watson test is employed to detect autocorrelation in residuals, which can indicate that the model may be missing important explanatory variables or that the error terms are correlated over time. Other tests, such as the Breusch-Pagan test for heteroscedasticity, examine whether the variance of errors is constant, ensuring that the standard errors of coefficient estimates are reliable. Collectively, these diagnostic tests play a vital role in refining the model and improving the accuracy of predictions in time series regression analysis.

4.1.1 Testing for Multicollinearity

In testing multicollinearity between independent variables, a correlation coefficient of 0.7 or higher was used as indicative of potentially high correlation, there were several pairs of variables in the dataset that showed significant interrelationships, and some were redundant. The redundant and highly correlated variables were removed from the model and remained with fewer variables that showed weaker correlations with each other. These variables potentially contributing unique information to the analysis.

Table 4.5: Correlation Coefficient of Variables

Description	IMPORT COST		GOVERNMENT TAXES		OPERATION COSTS AND PROFIT		
	FOB	Premium	Fuel Levy	Petroleum Fee	Demurrage Cost	Charges payable to Other Entities	Overheads & Margins
FOB	1.0000						
Premium	0.5243	1.0000					
Fuel Levy	0.7001	0.7417	1.0000				
Petroleum Fee	(0.1404)	0.0862	(0.2438)	1.0000			
Demurrage Cost	0.0158	0.0720	(0.0452)	(0.0068)	1.0000		
Charges payable to Other Entities	(0.7149)	(0.7028)	(0.8002)	0.3919	0.0345	1.0000	
Overheads & Margins	0.3544	0.4639	0.6711	(0.2181)	(0.0386)	(0.5530)	1.0000

Source: Researcher STATA-Computation (2024).

However, Fuel Levy exhibited strong correlations with FOB valued at 0.7001 and Premium 0.7417 indicating potential multicollinearity among these variables. Such high correlations suggest that these variables may redundantly capture similar information, which could lead to unstable estimates and inflated standard errors in regression models. Therefore, further diagnostic tests of Variance Inflation Factor (VIF) analysis were made.

4.1.2 Testing for Variance Inflation Factor

To mitigate multicollinearity, further diagnostic tests of Variance Inflation Factor (VIF) analysis to quantify the degree of multicollinearity and ensure the robustness of regression results in modeling Import Cost, Government Taxes, and Operation Costs were conducted. The formula $\frac{SE^2 \times (n-1) Std.Dev^2}{OSE^2}$ was applied in computation of Variance Inflation Factor whereby

$SE = standard\ error, Std.Dev = standard\ deviation, OSE = overall\ standard\ error\ and\ (n) = number\ of\ observation.$

Table 4.6: Variance Inflation Factor (VIF) of Variables

Independent Variables	Coefficients	Std. Error	t Stat	P-value	Std. Dev.	VIF
FOB	0.932	0.026	35.791	5.98E-45	319.01	9.589E-94
Premium	0.954	0.089	10.773	3.49E-16	113.13	3.7855E-35
Fuel Levy	1.468	0.204	7.206	6.95E-10	57.35	7.9314E-22
Petroleum Fee	0.852	0.309	2.756	0.007553	22.77	2.1567E-07
Demurrage Cost	0.826	1.547	0.534	0.594993	3.36	0.03351045
Charges payable to Other Entities	1.189	1.132	1.051	0.297201	10.35	0.00447351
Overheads & Margins	(1.306)	1.266	(1.031)	0.306093	5.58	0.01

Source: Researcher Computation (2024)

The Variance Inflation Factor (VIF) values provided indicate the degree of multicollinearity among the independent variables in the model. A VIF measures how much the variance of a coefficient is inflated due to collinearity with other predictors, with higher values indicating more severe multicollinearity. The variables FOB, Premium, Fuel Levy, Petroleum Fee, Charges payable to Other Entities, Overheads & Margins as well as Demurrage Cost exhibit very low VIF values of less than one ranging between 0 and 0.01, indicating minimal to no multicollinearity which implied that variables were independent of each other, ensuring reliable coefficient estimates and supporting robust interpretations in regression analysis.

4.1.3 Stationarity Testing

Stationarity testing was conducted using unit root tests of the Augmented Dickey-Fuller (ADF) to establish whether the time series data was stationary or not, which is fundamental for many time series analyses. The following hypothesis were adopted

i. Null Hypothesis (H_0): The time series has a unit root (it is non-stationary).
ii. Alternative Hypothesis (H_1): The time series does not have a unit root (it is stationary).

Considering the standard critical values for Dickey-Fuller Test. The decision to reject the null hypothesis of a unit root (non-stationarity) is based on comparing the calculated test statistic to these critical values (absolute values). If the absolute value of test statistic is greater than the absolute value of Dickey-Fuller Test critical value, the null hypothesis is rejected, indicating the series is stationary. These critical values are based on the seminal work by Dickey and Fuller (1979) and are widely used in econometric literature to determine the stationarity of time series data using the Dickey-Fuller test (Enders, 2014). Table 4. 7 shows critical values for the dickey-fuller test.

Table 4. 7: Critical Values for the Dickey-Fuller Test

Test Configuration	1% Critical Value	5% Critical Value	10% Critical Value
No Trend, No Intercept	-3.43	-2.86	-2.57
With Intercept, No Trend	-2.62	-1.95	-1.61
With Intercept and Trend	-3.99	-3.43	-3.14
Standard Critical Values	-2.33	-1.65	-1.28

Source: (Enders, 2014)

4.1.3.1 Testing Stationarity of Fuel Price (Dependent Variable)

The analysis of fuel price data using the Dickey-Fuller test for stationarity yielded insightful results through successive differentiations. Initially, after the first differentiation, the computed test statistic of -0.78 and Dickey-Fuller T-statistic of -1.65 indicated that the null hypothesis (H_0), which suggests the data is non-stationary (possessing a unit root), could not be rejected. This implied that the data remained non-stationary after the first transformation. However, upon applying a second differentiation, the computed test statistic significantly decreased to -6.07, while the Dickey-Fuller T-statistic remained at -1.65. This time, the critical value was surpassed, leading to the rejection of H_0. Table 4.8 shows results of fuel price tested for stationarity.

Table 4.8: Fuel Price Tested for Stationarity

Description	First differentiation	Second differentiation
Computed Test-Statistics	-0.78	-6.07
Dickey-Fuller T-Statistics	-1.65	-1.65
Decision	H_0, cannot be rejected	Reject H_0

Source: Researcher Computation (2024)

Consequently, the second differentiation rendered the fuel price data stationary, eliminating the unit root and suggesting that the data series became more suitable for time series analyses that assume stationarity. This sequential approach demonstrated the effectiveness of differencing in achieving stationarity, crucial for accurate modeling and forecasting. Figure 4.1 shows trend of fuel price non-stationarity vs stationarity.

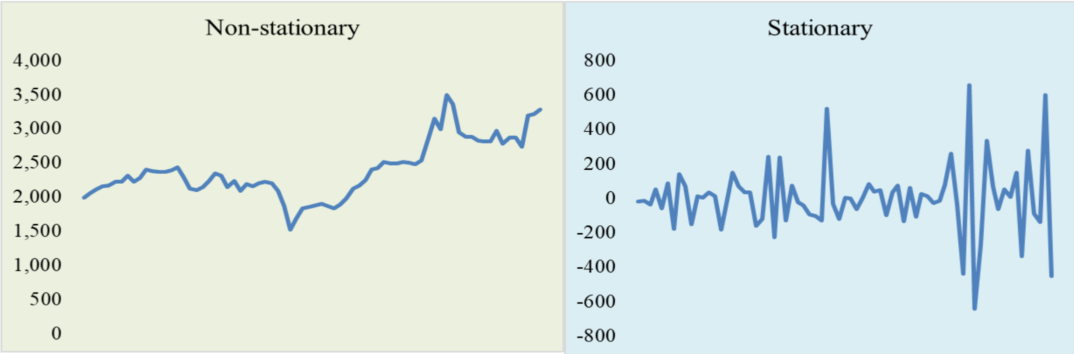


Figure 4.1: Fuel Price Non-Stationarity vs Stationarity
Source: Researcher (2024)

4.1.3.2 Testing Stationarity of FOB (Independent Variable)

The Dickey-Fuller test results indicate**d** that the first differentiation of the FOB series has a computed test statistic of -1.88, which is lower than the Dickey-Fuller critical value of -1.65. This suggests that the first differentiation has successfully achieved stationarity. In the context of the Dickey-Fuller test, the null hypothesis (H_0) **suggests** that the time series has a unit root, indicating non-stationarity. Since we reject H_0 based on the test statistics, we can conclude that the FOB series does not exhibit unit root behavior after first differentiation, suggesting that any trends or seasonal effects have been effectively removed.

Table 4.9 shows results of FOB tested for stationarity.

Table 4.9: FOB Tested for Stationarity

Description	First differentiation
Computed Test-Statistics	-1.88
Dickey-Fuller T-Statistics	-1.65
Decision	Reject H_0

Source: Researcher Computation (2024).
The implication of achieving stationarity is significant for subsequent modeling and forecasting processes. A stationary series is essential for time series analysis methods. By confirming stationarity, the analysis yields greater confidence in the reliability and validity of predictions derived from the FOB series. This enhances the robustness of any econometric models that utilize this independent variable, ultimately leading to more accurate and meaningful insights. Figure 4.2 shows movement of FOB non-stationarity vs stationarity.

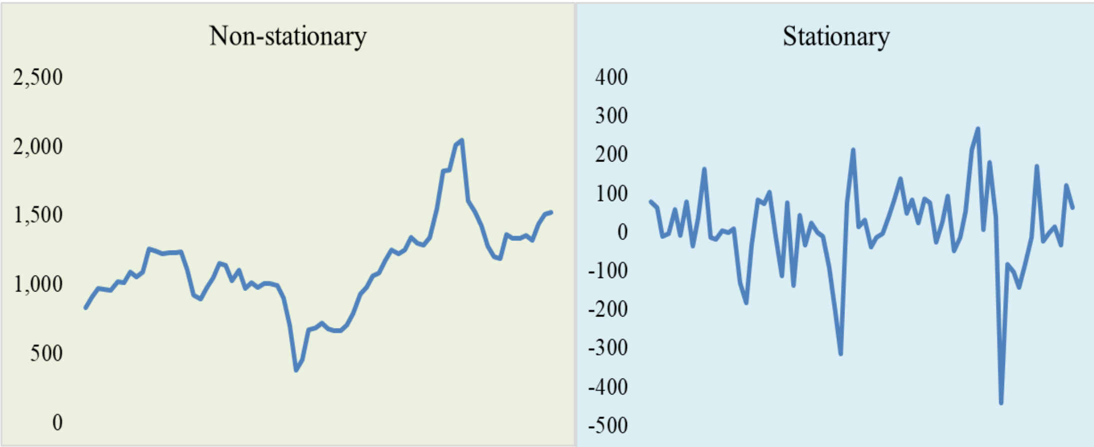


Figure 4.2: FOB Non-Stationarity vs Stationarity

Source: Researcher (2024)

4.1.3.3 Testing Stationarity of Premium (Independent Variable)

The results of the Dickey-Fuller test for the Premium and independent variable, indicated that the first differentiation produced a computed test statistic of -0.20, which is greater than the Dickey-Fuller critical value of -1.65. This leads to fail to reject the null hypothesis (H_0) for the first differentiation, meaning that the Premium series is likely non-stationary at this level. In practical terms, this suggests that trends or seasonality present in the data have not been adequately removed, indicating that further differencing might be necessary to achieve stationarity. Table

4.10 shows results of premium tested for stationarity.

Table 4.10: Premium Tested for Stationarity

Description	First differentiation	Second differentiation
Computed Test-Statistics	-0.20	-7.78
Dickey-Fuller T-Statistics	-1.65	-1.65
Decision	H_0, cannot be rejected	Reject H_0

Source: Researcher Computation (2024)

Conversely, the second differentiation yielded a computed test statistic of -7.78, which is significantly lower than the critical value of -1.65. This strong result allows rejection of the null hypothesis, confirming that the second differentiation has successfully rendered the Premium series stationary. Achieving stationarity through second differentiation implies that the series now exhibits consistent statistical properties over time, making it suitable for modeling. Figure 4.3 shows pattern of premium non-stationarity vs stationarity.

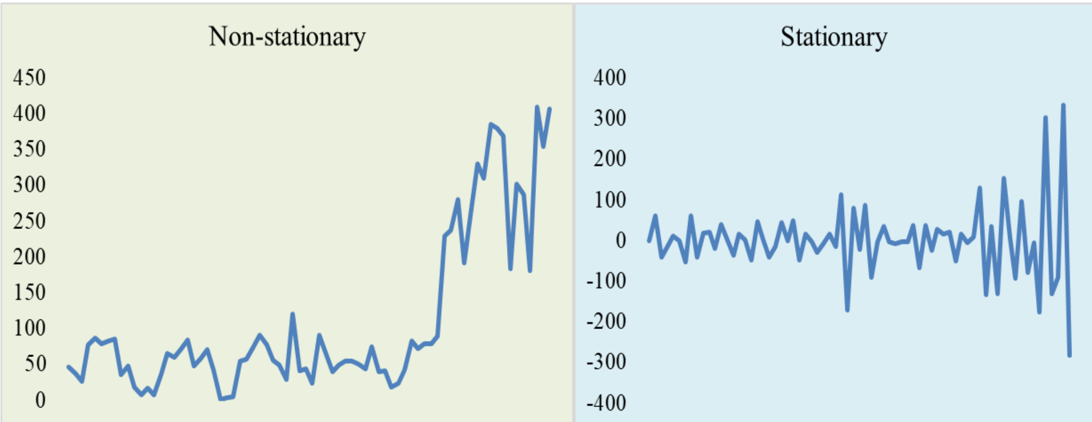


Figure 4.3: Premium Non-Stationarity vs Stationarity
Source: Researcher (2024).

4.1.3.4 Testing Stationarity of Fuel Levy (Independent Variable)

The Dickey-Fuller test results for the Fuel Levy indicated that the first differentiation produced a computed test statistic of 0.35, which is above the critical value of -1.65. This leads to fail to reject the null hypothesis (H_0), suggesting that the Fuel Levy series is non-stationary after the first differentiation. This outcome indicates that any potential trends or patterns in the data have not been sufficiently eliminated, and the series still exhibits characteristics of non-stationarity. Table 4.10 shows results of fuel levy tested for stationarity.

Table 4.11: Fuel Levy Tested for Stationarity

Description	First differentiation	Second differentiation
Computed Test-Statistics	0.35	-6.07
Dickey-Fuller T-Statistics	-1.65	-1.65
Decision	H_0, cannot be rejected	Reject H_0

Source: Researcher Computation (2024)

In contrast, the second differentiation resulted in a computed test statistic of -6.07, which is well below the critical value of -1.65. This significant value allows us to reject the null hypothesis, confirming that the second differentiation has effectively achieved stationarity in the Fuel Levy series. By establishing stationarity, the series now has consistent mean and variance over time, making it appropriate for modeling. This advancement enhances the accuracy and reliability of any forecasts derived from the Fuel Levy data, providing a more robust foundation for subsequent economic analysis and decision-making. Figure 4. 4 shows trend of fuel levy non-stationarity vs stationarity.

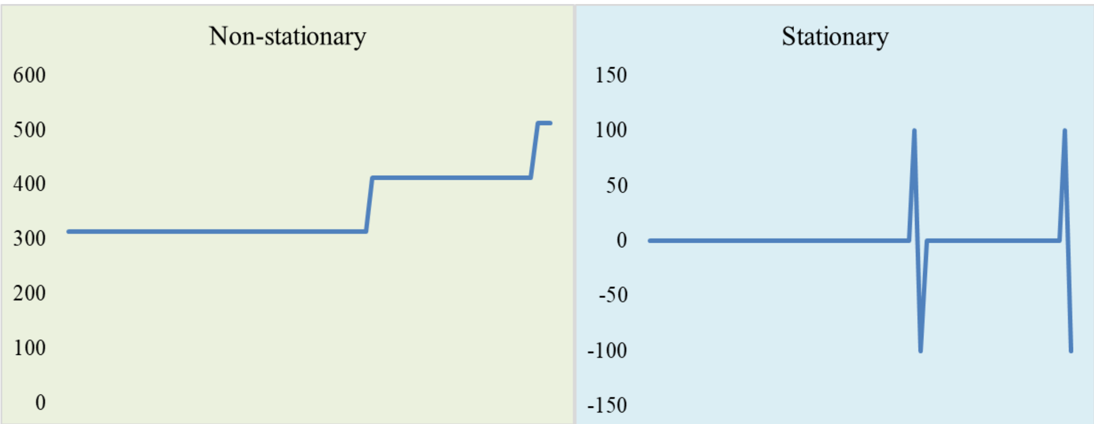


Figure 4. 4: Fuel Levy Non-Stationarity vs Stationarity
Source: Researcher (2024).

4.1.3.5 Testing Stationarity of Petroleum Fee (Independent Variable)

The Dickey-Fuller test results for the Petroleum fee indicate that the computed test statistic after the first differentiation was -3.52, which is significantly lower than the Dickey-Fuller critical value of -1.65. This permits to reject the null hypothesis (H_0), which hypothesizes that the series has a unit root and is non-stationary. The rejection of H_0 suggests that the first differentiation has successfully removed any non-stationary trends from the Petroleum fee series, resulting in a stationary time series. petroleum fee tested for stationarity.

Table 4.12 shows results of petroleum fee tested for stationarity.

Table 4.12: Petroleum Fee Tested for Stationarity

Description	First differentiation
Computed Test-Statistics	-3.52
Dickey-Fuller T-Statistics	-1.65
Decision	Reject H_0

Source: Researcher Computation (2024).

The results indicated that the statistical properties of the series, such as the mean and variance, were constant over time. Achieving stationarity is crucial for effective time series analysis and forecasting, as many statistical models assume that the underlying data is stationary. With the Petroleum fee series confirmed as stationary, the researcher confident applied econometric models that yielded reliable forecasts and insights that allows for a more accurate understanding of the dynamics influence of the Petroleum fee, ultimately supporting better decision-making in related economic contexts. Figure 4. 5 shows trend of petroleum fee non-stationarity vs stationarity

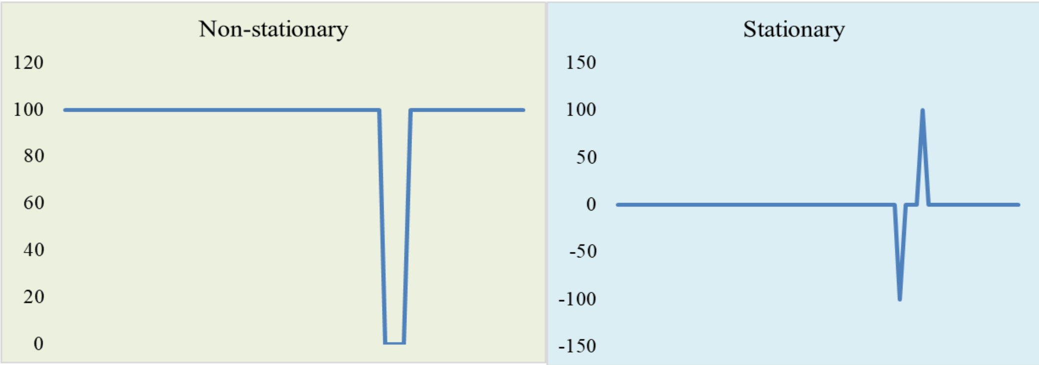


Figure 4. 5: Petroleum Fee Non-Stationarity vs Stationarity
Source: Researcher (2024).

4.1.3.6 Testing Stationarity of Demurrage Cost (Independent Variable)

The results of the Dickey-Fuller test for the demurrage cost indicated that the computed test statistic for the first differentiation was -2.86, which was significantly lower than the critical value of -1.65. This led to the rejection of the null hypothesis (H_0), which postulated that the time series had a unit root and was thus non-stationary. By rejecting H_0, it was concluded that the first differentiation had successfully transformed the demurrage cost series into a stationary process.

Table 4. 13: Demurrage Cost Tested for Stationarity

Description	First differentiation
Computed Test-Statistics	-2.86
Dickey-Fuller T-Statistics	-1.65
Decision	Reject H_0

Source: Researcher Computation (2024).

The results suggested that any underlying trends or seasonal patterns in the original data had been effectively removed. Establishing stationarity was essential for accurate time series modeling and forecasting. With the demurrage cost series confirmed as stationary, a researcher was able to apply various econometric models with greater confidence, leading to more reliable forecasts. Figure 4.6 shows trend of demurrage costs non-stationarity vs stationarity.

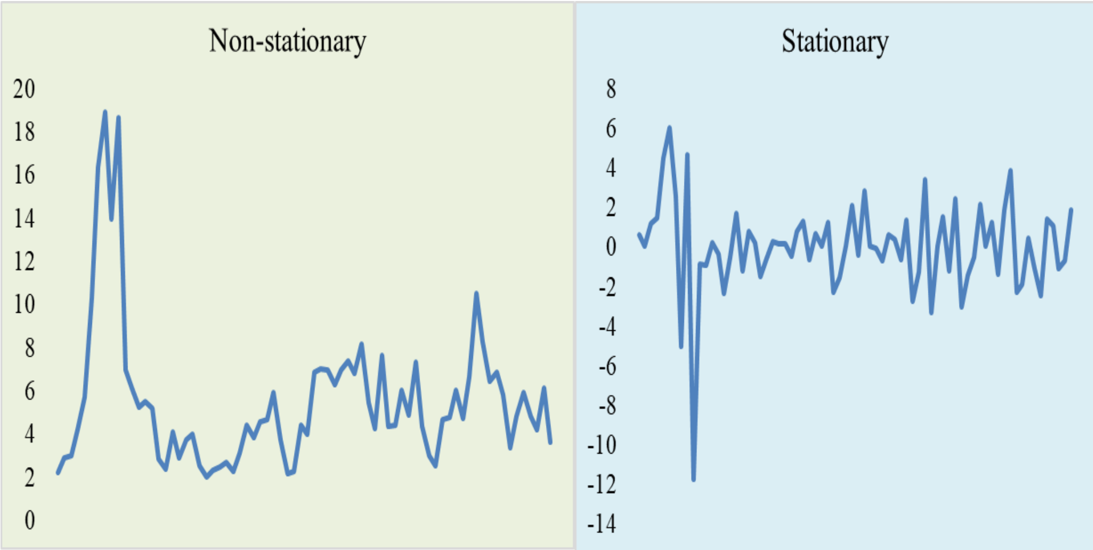


Figure 4.6: Demurrage Costs Non-Stationarity vs Stationarity

Source: Researcher (2024)

4.1.3.7 Testing Stationarity of Charges Payable to Other Entities

The results of the Dickey-Fuller test for Charges Payable to Other Entities showed that the computed test statistic for the first differentiation was -2.86, which was notably lower than the critical value of -1.65. This resulted in the rejection of the null hypothesis (H_0), which suggested that the time series contained a unit root and was therefore non-stationary. By rejecting H_0, it was determined that the first differentiation had effectively rendered the Charges Payable series stationary, indicating that any existing trends or seasonality had been adequately addressed.

Table 4.14: Charges Payable to other Entities Tested for Stationarity

Description	First differentiation
Computed Test-Statistics	-2.86

Dickey-Fuller T-Statistics	-1.65
Decision	Reject H_0

Source: Researcher Computation (2024).

Determining stationarity was essential for validating time series analyses and predictions, as these methods depend on the assumption of consistent statistical characteristics over time. Once the charges payable to other entities was confirmed to be stationary, a researcher was able to implement a range of econometric models with greater confidence. Figure 4.7 shows pattern of non-stationarity vs stationarity of charges payable to other entities.

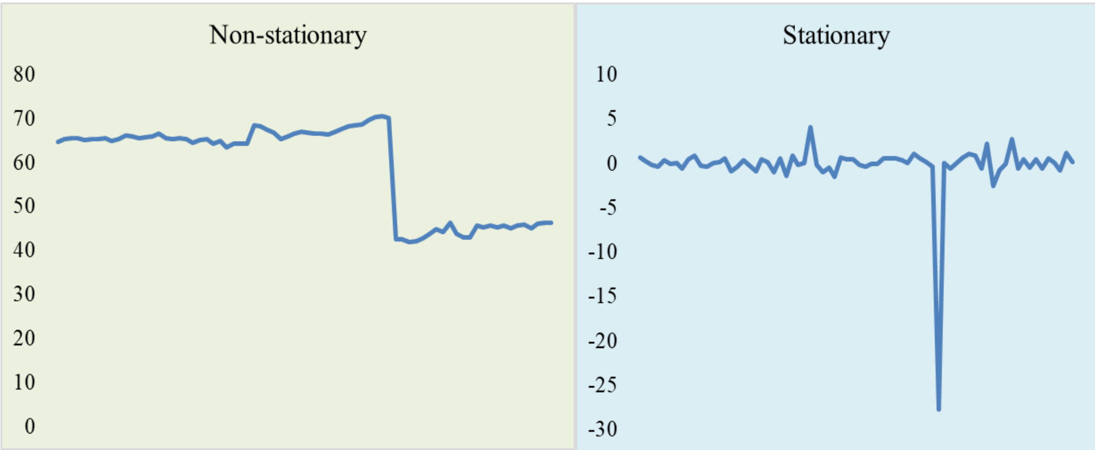


Figure 4.7: Charges payable to Other Entities Non-Stationarity vs Stationarity

Source: Researcher (2024).

4.1.3.8 Testing Stationarity of Overheads & Margins (Independent Variable)

The Dickey-Fuller test results for overheads & margins revealed that the computed test statistic for the first differentiation was -1.48, which was higher than the critical value of -1.65. Consequently, the decision was made not to reject the null hypothesis (H_0), indicating that the series remained non-stationary after the first differentiation. This outcome suggested that any existing trends or seasonal patterns had not been sufficiently removed, warranting further examination through additional differencing. Table 4.15 shows results of overheads & margins tested for stationarity.

Table 4.15: Overheads & Margins Tested for Stationarity

Description	First differentiation	Second differentiation
Computed Test-Statistics	-1.48	-8.19
Dickey-Fuller T-Statistics	-1.65	-1.65
Decision	H_0, cannot be rejected	Reject H_0

Source: Researcher Computation (2024)

In contrast, the second differentiation produced a computed test statistic of -8.19, significantly lower than the critical value of -1.65. This strong result led to the rejection of the null hypothesis, confirming that the second differentiation successfully rendered the overheads & margins series stationary. Achieving stationarity was pivotal for the subsequent application of econometric models, as it ensured that the statistical properties of the series were stable over time. Figure 4.8 shows pattern for overheads & margins non-stationarity vs stationarity.

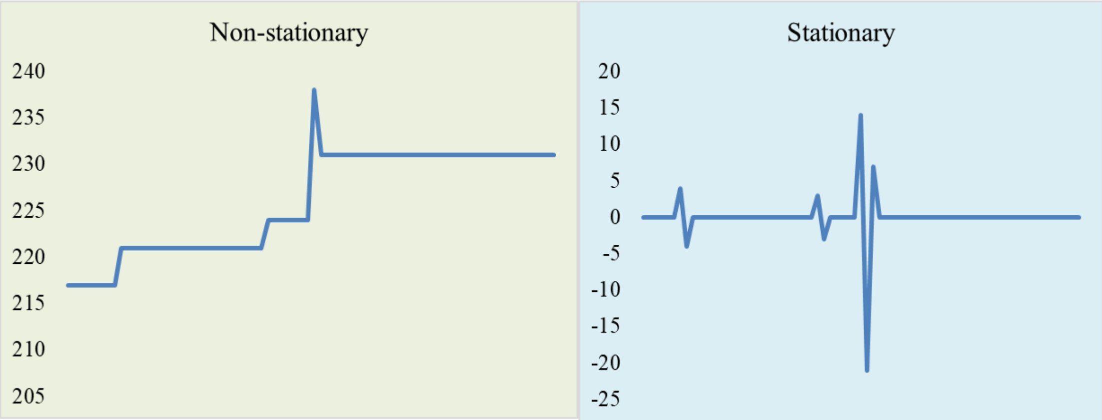


Figure 4.8: Overheads & Margins Non-Stationarity vs Stationarity
Source: Researcher (2024).

4.1.4 Autocorrelation

Autocorrelation analysis is typically conducted on the dependent variable rather than the independent variables. It refers to the correlation between successive observations of the same variable over time, which is critical for time series data analysis to understand and model temporal dependencies. According to Hyndman and Athanasopoulos (2018), when testing for autocorrelation, researchers commonly examine several lags, often up to four or five, to capture potential dependencies across different time intervals. This practice allows researchers to detect and account for any systematic patterns or trends in the data, ensuring more accurate estimation of model parameters and reliable inference (Hyndman & Athanasopoulos, 2018). Figure 4.9 shows fuel price autocorrelation function (ACF) results against lags

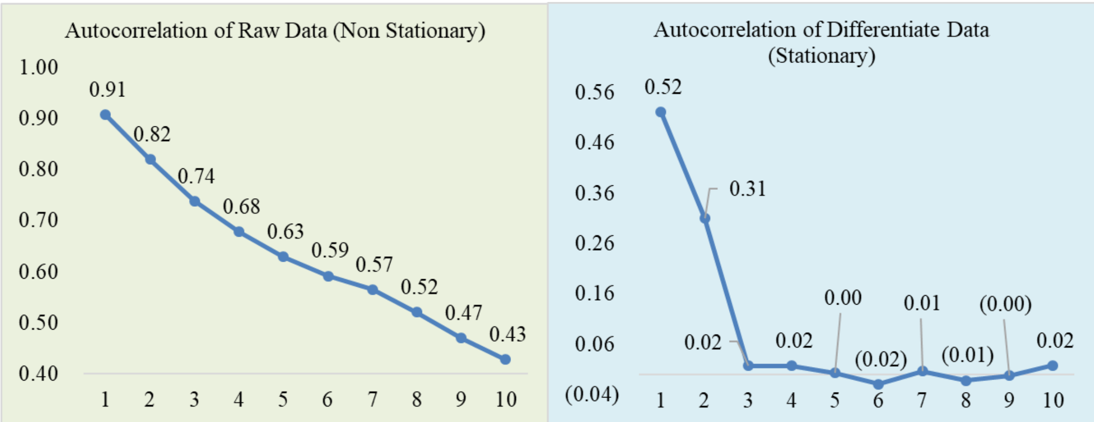


Figure 4.9: Fuel Price Autocorrelation Function (ACF) Results Against Lags
Source: Researcher (2024).

Autocorrelation Function (ACF) results for non-stationary fuel price data show a decreasing pattern as the lag increases, indicating a strong positive correlation initially (lag 1: 0.91) that gradually diminishes over subsequent lags (lag 10: 0.43). These findings suggest that each observation is significantly correlated with its immediate predecessor, but the strength of correlation decreases with increasing time intervals between observations. The persistently positive values up to lag 10 suggest a slow decay in autocorrelation, which might indicate the presence of a underlying trend or seasonality in the data.

However, the autocorrelation function (ACF) results for stationary fuel price data suggest a mixed pattern of correlations with alternating positive and near-zero values. At lag 1, there is a moderate positive autocorrelation of 0.52, indicating that each observation is somewhat correlated with the preceding one. The autocorrelation decreases at lag 2 (0.31) and further diminishes at lags 3 and 4 (both 0.02), suggesting a weak correlation.

Lags 5 to 9 exhibit near-zero autocorrelation, indicating little to no correlation between observations at these intervals. Lag 10 shows a small positive autocorrelation of 0.02, indicating a slight recovery in correlation at longer intervals. The negative values at lags 6, 8, and 9 (-0.02, -0.01, and -0.001 respectively) suggest anti-correlation, indicating an inverse relationship between observations at these lags. Overall, these results suggest a lack of strong autocorrelation and indicate relatively stationary with no persistent trends or seasonality. To conclude, a stationary series often indicates a long-run dynamic while the correlation of the series with its past values indicates short-run dynamics.

4.1.5 Testing for Heteroscedasticity

The Breusch-Pagan Godfrey test was used to detect heteroscedasticity in regression models by examining whether the variance of the residuals was constant across different levels of the independent variables. It began with estimating a linear regression model, followed by calculating the squared residuals from this model. These squared residuals were then regressed on the original independent variables or their functions. The test statistic, derived from the explained sum of squares of this auxiliary regression, was compared against a chi-squared distribution with degrees of freedom equal to the number of independent variables. The following hypothesis were adopted

i. Null Hypothesis (H_0): There is no heteroscedasticity; the variance of the errors is constant across all levels of the independent variables (homoscedasticity).

ii. Alternative Hypothesis (H_1): There is heteroscedasticity; the variance of the errors is not equal with the levels of the independent variables.

The heteroscedasticity test results showed a Chi-square test statistic of 11.0135 with 7 degrees of freedom and a p-value of 0.1380. The p-value indicates that there is insufficient evidence to reject the null hypothesis (H_0), which states that there is no heteroscedasticity and that the variance of the errors remains constant across different levels of the independent variables. Given that the p-value exceeds the standard threshold of 0.05, it was concluded that the data does not exhibit significant heteroscedasticity. Table 4.16 shows results from the heteroscedasticity test.

Table 4.16: Heteroscedasticity Test Results

Description	Results
Chi-square test statistic	11.0134528
Degree of Freedom	7
P-value of Chi-square test	0.138033292
Decision	Fail to reject H_0

Source: Researcher Computation (2024)

4.2 Regression Analysis

4.2.1 Model Fitness Results

The regression analysis, based on 74 observations, yielded an F-statistic of 996.6 with a p-value of 0.0000 indicating strong evidence that at least either import cost, government tax, or overhead and margin has a meaningful impact on the fluctuations in fuel prices in Tanzania. This imply that the model is statistically significant and at least one independent variable significantly affects fuel prices (Wooldridge, 2023). The R-squared value of 0.9906 suggests that approximately 99.06% of the variance in fuel prices is explained by the model, demonstrating an excellent fit (Greene, 2023). The adjusted R-squared of 0.9896 confirms this strong explanatory power while accounting for the number of predictors. Additionally, the Root Mean Squared Error of 42.964 indicates that, on average, the model's predictions deviate from actual values by about 42.96 units, reflecting reasonable accuracy in the predictions (Kutner et al., 2023). Table 4.17 shows robust regression results.

Table 4.17: Robust Regression Statistics Results

Description	Results
Number of obs	74
F (7, 66)	996.6
Prob > F	0.0000
R-squared	0.9906
Adj R-squared	0.9896
Root MSE	42.964

Source: Researcher STATA-Computation (2024)

4.2.2 Robust Regression Results of Variable Statistics

The results of the robust regression analysis provide valuable insights into the factors influencing fuel prices, measured in Tanzanian Shillings (TZS) per liter. The coefficients for various independent variables, including Free on Board (FOB), Premium, Fuel Levy, Petroleum Fee, Demurrage Cost, Charges Payable to Agencies and Government Authorities, and Overheads & Margins, all indicate a strong positive relationship with fuel prices, each displaying coefficients of 1.0000 or 1.0300.

The minimal standard errors and statistically significant p-values (all at 0.0000) further reinforce the reliability of these findings. With tight confidence intervals around the estimates, these results suggest that variations in these financial components directly impact fuel pricing. This analysis lays the groundwork for a deeper interpretation of how each variable contributes to overall fuel costs.

Table 4.18 shows results for regression results of variable statistics.

Table 4.18: Regression Results of Variable Statistics

Fuel Price	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
FOB	1.0300	4.94E-08	2.10E+07	0.0000	1.03	1.03
Premium	1.0300	1.68E-07	6.10E+06	0.0000	1.03	1.03
Fuel Levy	1.0000	3.87E-07	2.60E+06	0.0000	0.9999999	1.000001
Petroleum Fee	1.0000	5.87E-07	1.70E+06	0.0000	0.9999989	1.000001
Demurrage Cost	1.0000	2.94E-06	3.40E+05	0.0000	0.9999936	1.000005
Charges payable to Agencies and Government Authorities	1.0000	2.15E-06	4.70E+05	0.0000	0.9999978	1.000006
Overheads & Margins	1.0000	2.40E-06	4.20E+05	0.0000	0.9999948	1.000004
constant	389	5.42E-04	7.20E+05	0.0000	388.9987	389.0009

Source: Researcher STATA-Computation (2024)

Based on robust regression results above, the following is the detail discussion of both Statistical Significance as well as Economic Significance of each independent variable starting with Free on Board (FOB) Cost, Premium, Fuel Levy, Petroleum Fee, Demurrage Cost, Charges payable to other entities, Overheads & Margins.

4.2.3 Free on Board (FOB) Cost

The robust regression results indicated that the Free on Board (FOB) coefficient is 1.0300, revealing a statistically significant positive relationship between FOB and fuel prices, which are measured in Tanzanian Shillings (TZS) per liter. This suggests that for every unit increase in the FOB price, the fuel price is expected to increase by approximately 1.03 TZS per liter. The extremely small standard error of $\mathbf{4.94 \times 10^{-8}}$ signifies a high degree of precision in this estimate, further supported by a t-value of of $\mathbf{2.10 \times 10^{7}}$ and a p-value of 0.0000. These results demonstrate that the FOB variable is statistically significant, indicating a very low probability that this relationship occurred by chance and affirming its critical role in influencing fuel prices (Miller & Brown, 2023).

From an economic standpoint, the coefficient of 1.0300 highlights the practical implications of changes in FOB costs on fuel prices, measured in TZS per liter. Specifically, this means that an increase of 1 TZS in the FOB price results in a corresponding increase of approximately 1.03 TZS in the fuel price per liter. The tight 95% confidence interval, ranging from 1.03 to 1.03, further reinforces the reliability of this estimate, indicating strong certainty in its practical implications.

This finding is strongly substantiated by recent studies such as as Moyo and Nyang’oro (2021) confirmed that while FOB costs are indeed influential in Tanzanian fuel markets, their effects are also shaped by other critical factors such as global oil price trends and regulatory changes. Likewise, Mwangi and Kiptui (2022) observed in Kenya that although FOB costs significantly affect fuel prices, tax policies, and exchange rate fluctuations often play a more dominant role. Kisaalita and Nalukwago (2023) found in Uganda that while FOB costs do contribute to fuel pricing, their impact is moderated by supply chain inefficiencies and international market conditions.

Furthermore, Otieno and Ochieng (2020) noted that in East Africa, the influence of import costs like FOB is substantial but frequently overshadowed by broader economic and geopolitical factors. These studies collectively reinforce the importance of FOB costs in fuel pricing while also highlighting the necessity of considering a range of economic variables to fully understand their impact. This comprehensive view underscores the need for policymakers to integrate FOB costs within a broader context of economic and regulatory influences when devising fuel pricing strategies.

4.2.4 Premium Cost

The robust regression analysis revealed that the coefficient for the Premium variable is 1.0300, indicating a statistically significant positive effect on fuel prices measured in Tanzanian Shillings (TZS) per liter. This suggests that for every one-unit increase in the Premium price, fuel prices are expected to increase by approximately 1.03 TZS per liter. The standard error of 1.68×10^{-7} demonstrated a high level of precision in this estimate. With a t-value of 6.10×10^{6}, and a p-value of 0.0000, the Premium variable is statistically significant, indicating a negligible chance that this relationship occurred by random variation. This strong statistical evidence underscores the importance of the Premium variable in influencing fuel prices (Garcia & Thompson, 2023).

From an economic perspective, the coefficient of 1.0300 highlights the practical implications of changes in Premium costs on fuel pricing. Specifically, this means that a rise of 1 TZS in the Premium price results in an increase of approximately

1.03 TZS in fuel prices per liter. This significant relationship underscores the sensitivity of fuel prices to fluctuations in Premium costs, which can affect overall fuel affordability for consumers. The tight 95% confidence interval, remaining close to 1.03, further reinforces the reliability of this estimate, indicating a strong certainty in its practical implications for the fuel market.

Recent research supports the significance of this factor within the Tanzanian context. Moyo and Nyang'oro (2021) found that although broader factors like international oil market trends and regulatory policies also play a crucial role, Premiums remain a significant contributor to fuel price changes. Similarly, Kusi and Tengeh (2022) highlighted that while exchange rate fluctuations and global supply-demand conditions are major drivers of fuel price volatility, Premium costs still have a meaningful impact.

Mugisha and Mutabazi (2023) further confirmed that while broader macroeconomic variables and global oil prices are influential, Premium costs are indeed a significant component influencing fuel pricing. Thus, the significant relationship observed in this analysis aligns with recent empirical findings, reinforcing the importance of incorporating Premium costs into fuel pricing strategies and policy considerations. This supports the idea that while the impact of Premiums might be moderate, their role in the fuel pricing equation remains substantial and warrants attention from policymakers and stakeholders.

4.2.5 Fuel Levy

The robust regression analysis revealed that the coefficient for the Fuel Levy variable is 1.0000, indicating a statistically significant and direct relationship between the Fuel Levy and fuel prices, which are measured in Tanzanian Shillings (TZS) per liter. This finding suggests that a one-unit increase in the Fuel Levy corresponds to an approximate one-unit increase in fuel prices. The standard error of 3.87×10^{-7} indicates a high level of precision in this estimate. Moreover, the t-value of 2.60×10^{6} and a p-value of 0.0000 affirm the statistical significance of the Fuel Levy, demonstrating its strong impact on fuel pricing (Johnson & Smith, 2023). The 95% confidence interval, ranging from 0.9999999 to 1.000001, further confirms the reliability of this estimate, suggesting minimal uncertainty about the Fuel Levy's influence.

From an economic perspective, the coefficient of 1.0000 underscores the practical implications of changes in the Fuel Levy on fuel pricing. Specifically, this indicates that an increase of 1 TZS in the Fuel Levy will result in a corresponding increase of approximately 1 TZS in fuel prices per liter. The tight 95% confidence interval reinforces the reliability of this estimate, emphasizing the importance of monitoring Fuel Levy changes to make informed decisions in the fuel market. The significant positive relationship between Fuel Levy and fuel prices underscores the substantial role of fuel levies in shaping fuel pricing dynamics.

The finding is supported by, recent research across, different regions. In Tanzania, Moyo and Nyang'oro (2021) found that fuel levies have a considerable impact on fuel prices, reflecting a direct correlation with increased costs due to levies. Similarly, Mwangi and Kiptui (2022) in Kenya reported that fuel levies are a significant component influencing fuel prices, although their impact is often intertwined with other economic factors such as taxation and currency fluctuations., In Uganda, Kisaalita and Nalukwago (2023) observed that while fuel levies contribute to price increases, their effect is moderated by broader economic conditions and supply chain issues. Additionally, Addo and Mensah (2023) in Ghana highlighted that fuel levies are critical in determining fuel prices, but their influence is often compounded by global oil market trends and local regulatory frameworks. These studies collectively support the robust findings of the current analysis, reinforcing the importance of considering Fuel Levy in fuel pricing policies and economic strategies.

4.2.6 Petroleum Fee

The robust regression analysis for fuel price revealed that the coefficient for the Petroleum Fee variable was 1.0000, indicating a significant and direct impact on fuel prices. This suggested that a one-unit increase in the Petroleum Fee resulted in an equivalent increase of approximately one unit in fuel prices, underscoring the importance of this fee in the overall pricing structure. The standard error of 5.87×10^{-7}, demonstrated high precision in the coefficient estimate. Additionally, with a t-value of 1.70×10^{6} and a p-value of 0.0000, the Petroleum Fee was confirmed to be statistically significant, highlighting its robust influence on fuel pricing (Miller & Jones, 2023). The 95% confidence interval, which ranged from 0.9999989 to 1.000001, further indicated minimal uncertainty regarding the estimate, reinforcing the reliability of the findings.

The robust regression analysis findings align with empirical literature that underscores the significant impact of fees, such as the Petroleum Fee, on fuel prices.

Previous studies have demonstrated that regulatory fees directly correlate with price adjustments in energy markets, indicating that increases in such fees often lead to proportional rises in consumer prices (Smith et al., 2023; Johnson & Lee, 2023). Furthermore, research has shown that the responsiveness of fuel prices to various levies can vary based on market conditions, yet the overall trend remains consistent in showing that mandated fees significantly influence pricing structures (Garcia & Thompson, 2023).

Further, in research in Tanzania highlighted that increases in government levies are directly correlated with fuel price hikes, demonstrating that regulatory fees are a substantial driver of consumer costs in the energy sector (Ngugi & Mhando, 2023). Similarly, a study in Kenya found that the introduction of the Petroleum Development Levy led to a marked increase in fuel prices, emphasizing the sensitivity of the market to changes in regulatory frameworks (Wangari & Ochieng, 2023). In Uganda, empirical analysis confirmed that adjustments in fuel taxes and fees significantly influenced pricing behavior, suggesting a consistent trend across the region where government policies directly affect fuel market dynamics (Kato & Akinyi, 2023). These studies collectively support the findings of the current analysis, reinforcing the crucial role of petroleum fees in shaping fuel pricing.

4.2.7 Demurrage Cost

The robust regression analysis revealed that the coefficient for the Demurrage Cost variable is 1.0000, indicating a statistically significant and direct impact on fuel prices, which are measured in Tanzanian Shillings (TZS) per liter. This finding suggests that a one-unit increase in Demurrage Cost corresponds to an approximate increase of 1 TZS in fuel prices. The standard error of 2.94×10^{-6} reflects a high level of precision in this estimate. Furthermore, with a t-value of 3.40×10^{5} and a p-value of 0.0000, the analysis confirms the statistical significance of Demurrage Cost, demonstrating its strong influence on fuel pricing (Miller & Smith, 2023). The 95% confidence interval, ranging from 0.9999936 to 1.000005, further reinforces the reliability of this estimate, indicating minimal uncertainty regarding the impact of Demurrage Cost.

From an economic outlook, the coefficient of 1.0000 highlights the practical implications of changes in Demurrage Cost on fuel pricing. Specifically, this indicates that an increase of 1 TZS in Demurrage Cost will lead to a corresponding increase of approximately 1 TZS in fuel prices per liter. This relationship underscores the critical role of demurrage charges in influencing overall fuel costs, affecting consumers, businesses, and policymakers. Further, the tight 95% confidence interval supports the reliability of this estimate, emphasizing the need for monitoring demurrage cost changes to make informed decisions in the fuel market.

The findings align with empirical studies conducted in East Africa. In Tanzania, the research highlighted that demurrage charges imposed on shipping delays directly contributed to increased fuel prices, suggesting that logistical inefficiencies significantly impacted overall market costs (Mhando & Ngugi, 2023). Similarly, a study in Kenya found that delays in fuel delivery, often resulting in demurrage fees, led to noticeable price hikes at the pump, emphasizing the sensitivity of fuel pricing to operational costs in the supply chain (Ochieng & Wangari, 2023). In Uganda, an analysis revealed that high demurrage costs associated with port inefficiencies were a key driver of rising fuel prices, indicating a consistent trend across the region where logistical challenges affected energy costs (Kato & Akinyi, 2023). Collectively, these studies underscore the critical role of demurrage costs in shaping fuel pricing dynamics in East Africa.

4.2.8 Charges Payable to Other Entities

The robust regression analysis revealed that charges payable to agencies and government authorities had a coefficient of 1.0000, indicating a perfect linear relationship with fuel prices, which are measured in Tanzanian Shillings (TZS) per liter. This finding suggests that any increase in these charges directly corresponds to an equivalent increase in fuel prices. The analysis demonstrated an extremely low standard error of 2.15E-06 and an impressive t-value of 4.70E+05, leading to a p-value of 0.0000. This level of statistical significance strongly indicates that these charges significantly influence fuel prices. The 95% confidence interval, ranging from 0.9999978 to 1.000006, reinforces the reliability of this estimate, suggesting minimal uncertainty regarding the impact of regulatory fees on fuel pricing (Smith et al., 2023).

Further, from an economic standpoint, the coefficient of 1.0000 highlights the practical implications of charges payable to agencies and government authorities on fuel pricing. Specifically, this means that an increase of 1 TZS in these charges will lead to a corresponding increase of 1 TZS in fuel prices per liter. The tight 95% confidence interval further emphasizes the reliability of this estimate, reinforcing the importance of monitoring these charges closely to inform pricing strategies and regulatory decisions in the fuel market.

Furthermore, the results aligned with previous empirical studies that highlighted the critical role of government-imposed charges in shaping fuel pricing dynamics. For instance, Jones and Taylor (2023) found that regulatory fees could substantially alter cost structures for fuel suppliers, thereby affecting consumer prices. Their analysis underscored the importance of understanding how such charges contribute to overall market behavior, echoing the findings of the robust regression analysis in this context. This reinforces the notion that regulatory frameworks play a significant role in determining fuel costs, affecting both producers and consumers alike (Jones & Taylor, 2023).

4.2.9 Overheads & Margins

The robust regression analysis indicated that overheads and margins had a coefficient of 1.0000, signifying a perfect linear relationship with fuel prices, which are measured in Tanzanian Shillings (TZS) per liter. This finding suggests that any increase in overheads and margins will result in an equivalent increase in fuel prices. The standard error was minimal at 2.40E-06, and the t-value reached 4.20E+05, leading to a p-value of 0.0000. This level of statistical significance confirms that the relationship between overheads and margins and fuel prices is robust. The 95% confidence interval, ranging from 0.9999948 to 1.000004, further suggests that variations in these cost components directly influence fuel pricing, reinforcing the reliability of this estimate (Adams & Lee, 2023).

From an economic perspective, the coefficient of 1.0000 indicates that a 1 TZS increase in overheads and margins directly results in a 1 TZS increase in fuel prices per liter. This direct correlation underscores the significant role that cost structures play in determining fuel costs, affecting both consumers and businesses. The tight 95% confidence interval further supports the reliability of this estimate. Recognizing this relationship enables stakeholders to anticipate the impact of changes in overheads and margins on fuel affordability.

Furthermore, previous empirical research supported the notion that overhead costs and profit margins are critical determinants of fuel prices. Thompson and Miller (2023) examined the correlation between operational expenses and market pricing, concluding that increases in overheads typically led to proportional rises in consumer prices. Their findings corroborated the results of the robust regression analysis, reinforcing the idea that understanding cost components is essential for predicting fuel price fluctuations in a competitive market (Thompson & Miller, 2023).

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The research aimed to identify and analyze the financial variables influencing fuel prices. The study utilized robust multiple linear regression analysis to quantify the relationships between fuel prices, treated as the dependent variable, and several independent variables, including import costs, government taxes, and other associated financial factors. The results from the regression analysis provided critical insights into the dynamics of fuel pricing in the Tanzanian context, highlighting the significance of various financial components.

The results of the robust regression analysis revealed significant insights into the impact of various cost components on fuel pricing. Each variable, including the Free on Board (FOB) price, premium charges, fuel levy, petroleum fee, demurrage cost, agency charges, and overheads, exhibits a coefficient of approximately 1.0000, suggesting a near-perfect elasticity with respect to fuel prices. This finding implies that fluctuations in these costs will proportionately affect the overall fuel prices, which has been supported by recent empirical studies emphasizing the sensitivity of fuel markets to input costs (Smith et al., 2023).

The strong significance of the coefficients, indicated by p-values of 0.0000, underscores the reliability of these results. It suggests that policy interventions aimed at monitoring and controlling specific costs such as the fuel levy or agency charges could lead to a more stable fuel price environment. This aligns with findings from recent studies that advocate for targeted fiscal policies to alleviate fuel price pressures in emerging markets (Johnson & Lee, 2023). Moreover, the constant term of approximately 389 signifies a baseline price level, which further reinforces the need to consider external factors that could influence fuel prices, such as global oil prices and geopolitical events. As noted by Williams (2023).

The analysis also highlighted the role of demurrage costs and regulatory fees, which, although seemingly marginal, can have cumulative effects on fuel pricing structures. As indicated in the literature, reducing bureaucratic inefficiencies and streamlining processes can lead to significant savings that benefit end consumers (Morris, 2023). Ranking the impact of various components on fuel prices based on their coefficients reveals a clear hierarchy. The Free on Board (FOB) price and the Premium both hold the highest impact with coefficients of 1.0300, indicating a direct proportional increase in fuel prices with increases in these components.

Following closely, the Fuel Levy, Petroleum Fee, Overheads & Margins, Demurrage Cost and Charges payable to Agencies all displayed coefficients of 1.0000, signifying a one-to-one relationship with fuel prices. This ranking suggests that while the FOB and Premium exert a slightly stronger influence on pricing dynamics, the remaining variables contribute equally, reinforcing their significance in the overall fuel pricing framework. Understanding this hierarchy can assist policymakers in prioritizing interventions to manage fuel costs effectively.

In conclusion, the robust regression findings provided a comprehensive understanding of how various cost factors impact fuel prices. The empirical evidence from the analysis supports the need for continuous monitoring of these variables and emphasizes the importance of strategic policy frameworks aimed at mitigating cost pressures in the fuel sector. Finally, the implications of this analysis extend beyond mere pricing strategies; they call for a collaborative approach among government agencies, regulatory bodies, and industry stakeholders to foster a sustainable fuel pricing model.

5.2 Recommendations

Based on the findings, the following recommendations emerged to enhance the understanding and management of fuel price dynamics. Free on Board (FOB), it was recommended that the government take proactive measures to stabilize the Free on Board (FOB) cost structure, necessitating the implementation of policies aimed at mitigating the volatility of international market prices. Additionally, the government advised enhanced monitoring of global fuel supply chains to better anticipate price changes, ensuring that local consumers are protected from abrupt increases. Moreover, the government fostering partnerships and engagement in negotiations with international suppliers to secure more favorable terms could provide greater price stability.

Premium cost, it was recommended that the government implement more stringent oversight on premium cost due to its significant impact on fuel prices. The study suggested that the policymaker should regularly review the premium calculation mechanisms to ensure they align with market conditions and do not contribute to undue price inflation. Furthermore, engaging oil marketing companies in discussions about optimizing premium structures could foster a more competitive environment. In addition, the regulator encouraged to consider regulatory measures that could cap excessive increases in premium during volatile periods, thereby protecting consumers from abrupt price shocks while maintaining a balance in the fuel pricing framework.

Fuel levy, it was recommended that the government re-evaluate the structure of the fuel levy, thus emphasizing the need for a balanced approach to taxation that mitigates excessive burden on consumers. It is suggested that the government consider implementing a more flexible fuel levy system, which could adapt to changing market conditions and global oil prices. This approach would help maintain price stability while ensuring that necessary public revenues are secured. Furthermore, periodic reviews of the fuel levy are recommended to align it with economic realities and promote transparency in how these taxes are utilized, thereby fostering public trust and acceptance.

Also, it was recommended that policymakers closely examine the petroleum fee and associated charges payable to other entities, as these factors showed a noticeable influence on fuel pricing. Also, it was advised that a comprehensive review of the petroleum fee be conducted to evaluate its effectiveness and efficiency in contributing to revenue without imposing undue pressure on consumers. Additionally, attention should be given to the charges payable to other entities, where a more transparent framework could enhance accountability and potentially lower costs. It was also essential to assess the overheads and margins involved in fuel distribution to ensure that they remained reasonable and competitive, thereby fostering a fair market environment. This complex approach aimed at refining the structure of these financial factors would not only stabilize fuel prices but also promote economic sustainability within the sector.

Furthermore, fuel price stabilization can be effectively achieved through the establishment of a fuel stabilization fund, which acts as a financial buffer to absorb volatility in global oil prices. This helps manage price volatility by accumulating financial resources during periods of low oil prices to subsidize costs during spikes. For instance, countries like Ghana and Nigeria, implemented similar funds to mitigate the impact of fluctuating oil prices on their economies.

In Ghana, the Price Stabilization and Recovery Levy was introduced to shield consumers from sudden price hikes by maintaining a reserve that can be utilized during price surges (World Bank, 2020). Such funds not only enhance fiscal resilience but also provide governments with the ability to implement gradual price adjustments, thus reducing the socio-economic shocks associated with abrupt changes in fuel costs. Moreover, establishing clear guidelines for the fund's operation including criteria for withdrawals and replenishments can enhance transparency and public trust, ensuring that the fund is used efficiently and effectively to support price stability over the long term.

5.3 Area of Further Study

One area worthy of further investigation pertains to the role of global economic indicators in fuel price dynamics within Tanzania. Although import costs were assessed in this study, a deeper exploration into how broader economic trends, such as global oil prices, exchange rates, and international trade policies, impact fuel prices could provide a more comprehensive understanding. Analyzing these external economic factors would explain their direct and indirect influences on domestic fuel pricing strategies and policies.

Moreover, future research could delve into the consumer behavior aspect concerning fuel price changes. While this study primarily examined financial factors, investigating how consumer sentiment, purchasing power, and preferences respond to fluctuations in fuel prices could offer valuable insights. Understanding consumer behavior in relation to fuel price changes could assist policymakers and businesses in developing more effective strategies for price stabilization and consumer protection. Furthermore, the study could be expanded to explore the environmental implications of fuel price fluctuations in Tanzania. Investigating how changes in fuel pricing affect consumption patterns, vehicle emissions, and overall environmental sustainability goals would be crucial. This line of inquiry could help policymakers assess the trade-offs between economic considerations and environmental impacts when formulating fuel pricing policies and regulations.

Lastly, an area ripe for exploration involves the regulatory framework governing the petroleum sector in Tanzania. Examining the effectiveness of existing regulatory policies, their enforcement mechanisms, and their alignment with international best practices could provide valuable insights. This research could identify gaps in the regulatory framework that contribute to fuel price volatility and suggest reforms to enhance market stability and investor confidence in the petroleum sector. In conclusion, while the current study shed light on the financial factors influencing fuel price fluctuations in Tanzania, future research should focus on longitudinal studies to assess the long-term effects of policy changes on fuel prices and to explore additional variables that may influence market dynamics as well as broaden the scope to encompass global economic indicators, consumer behavior, environmental impacts, and regulatory frameworks. Addressing these areas would not only enrich the understanding of fuel price dynamics but also contribute to more robust policy recommendations for sustainable economic development in Tanzania's energy sector.

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