# THE RELATIONSHIP BETWEEN INTERNATIONAL DIESEL PRICE AND THE INFLATION RATE IN KENYA

**BY**

**EDWIN ABONGO ODERA**

**D61/60659/2013**

**RESEARCH PROJECT PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTERS DEGREE IN BUSINESS ADMINISTRATION TO THE UNIVERSITY OF NAIROBI**

**NOVEMBER, 2015**

# DECLARATION

This research project is my original work and has not been presented for a degree in any other University or institution of higher learning and this is to the best of my knowledge.

**Signature……..** **Date……**

**EDWIN ABONGO ODERA**

**D61/60659/2013**

This research project has been submitted for examination with my approval as the university supervisor.

**Signature:…….….** **Date:…….……**

**DR. JOSEPHAT LISHENGA**

**SCHOOL OF BUSINESS**

**UNIVERSITY OF NAIROBI**

# DEDICATION

I dedicate this work to my family for the support and understanding while I was undertaking this study.

# ACKNOWLEDGEMENT

I take this as my token of appreciation and thanksgiving to the Almighty God for the gift of life, health and wisdom to achieve this degree

I wish to acknowledge my Supervisor, Dr. Josephat Lishenga for the support during the preparation and submission of the project proposal especially on the guidance to effectively meet the university requirements for the award of the master's degree in business administration. I would also like to appreciate the support from all the Lecturers who have been very supportive during the coursework which forms part of the success story for the Award of this prestigious degree at the university with esteemed reputation in management and leadership development in Africa and beyond. I would also like to acknowledge my fellow candidates for the concerted effort and teamwork during the coursework and group efforts with whom we have collaborated very closely during our studies and coursework to accomplish all the requirements.

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| | |
|---|---|
| **WTI** | West Texas Index |
| **UNCTAD** | United Nations' focal point for the integrated treatment of trade and development |
| **USGC** | United States Grain Corporation |
| **ARA** | Rotterdam-Antwerp |
| **MPC** | Monetary Policy Committee |
| **CBK** | Central Bank of Kenya |
| **KNBS** | Kenya National Bureau Statistics |
| **GDP** | Gross Domestic Product |
| **GoK** | Government of Kenya |
| **ERC** | Energy Regulatory Commission |
| **NOCK** | National Oil Company of Kenya |
| **OTS** | Open Tender System |
| **US** | United States |
| **KD** | Kuwait Dinar |
| **CNPC** | Chinese National Petroleum Corporation |

# ABSTRACT

Higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity. Kenya solely relies on oil imports to satisfy its oil energy needs, crude oil prices are not the sole determining factor for diesel prices. Increasing price levels, high price volatility and the suspicion of collusive behavior are important topics of public debates on competition in retail gasoline markets in many countries, the study sought to establish if the international diesel price affects the country's inflation rate and to which extent. The study adopted experimental survey method, the research adopted quantitative, secondary time series data co-integration test is adopted to determine whether the linear combination of the series possesses a long run equilibrium relationship, granger causality test was adopted to test short run relationship between dependent and independent variables. The study the correlation matrix and regression fail find the perfect relationship between the variables and granger causality test also confirms that there is no short term relationship; the study concludes that the hike in international diesel oil price does influence the domestic inflation rate as suggested by monthly data of variables. The study recommends that energy regulatory commission need to institute measures that will effectively forecast on future changes in international fuel prices. The central bank should constantly cheep in to keep dollar circulation level at appropriate levels. The research established that an increase in interest rate would cause increase in inflation rate in Kenya, therefore the study recommends that CBK should consider maintaining interest rates at considerable levels to avoid economic sabotage.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

Labys (2006) observes that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity. Regnier (2007) found that oil and energy price volatility increased following the 1973 oil crisis. This increase has been accompanied by an increase in price volatility for all commodities. In the late 1970s, however, price volatility for most products returned to pre-1973 levels, while oil price volatility continued to increase. Fattouh (2011) found that little attention has been devoted to the process of price discovery in the oil markets and the drivers of oil prices in the short run remain under-researched.

According to the UNCTAD (2005), most developing country governments face heavy exposure to oil price volatility, either on the export or the import side – and sometimes, both. Kenya is no exception, being a net importer of oil products.

Pump prices of petroleum products have continued to rise unabated reaching a high of Shs 121.13 in May 2012 for a litre of gasoline compared to the price of Shs 94.03 before regulation in Dec 2010 (an increase of 28.8% in eighteen months). Over the same period, the price of automotive diesel (gasoil) rose from Shs 87.45 in December 2010 to Shs 108.44 in May 2012, an increase of 24% in eighteen months, despite a reduction of taxes on gasoil to cushion consumers and tame inflation (Mwirichia, 2011). This trend has continued even after the introduction of a regulated pricing mechanism for specified oil products in December 2010.

### 1.1.1 International Diesel Prices

Brent prices, rather than West Texas Index (WTI) prices, are the main crude oil price determinant of spot, and therefore retail, diesel prices. However, crude oil prices are not the sole determining factor for diesel prices. Diesel prices are also a function of the wholesale diesel margin, often referred to as the diesel crack spread, i.e., the difference between spot diesel price and crude oil price. Wholesale diesel margins take into account supply/demand conditions for diesel at the prevailing crude oil price, including refining costs and refining profits. Together, the price of Brent crude oil and the wholesale diesel margin in a given market compose that market's diesel price.

The major markets for diesel in the world include NYH, the USGC, Chicago, and Los Angeles. Outside the United States, the major diesel market hubs are Amsterdam-Rotterdam-Antwerp (ARA), the Mediterranean, and Singapore. NYH, the USGC, ARA, and the Mediterranean are part of the actively traded Atlantic Basin petroleum market. Chicago is directly linked to the Atlantic Basin market through infrastructure connections to the USGC. Singapore is a major trading hub in the Pacific Basin market, which also includes Los Angeles. Kenya's diesel imports are mostly priced at the prevailing average market prices at the Mediterranean market.

Prices at these different trading hubs are linked through arbitrage, and the differences between prices at different trading hubs reflect transportation costs between the regions, differences in diesel quality, such as octane rating, and regional supply/demand balances. Diesel moves from markets with surplus supply to markets in need of supply based on these price differences. This means that diesel prices in markets that produce more diesel than they consume, assuming no difference in

quality specifications, need to be lower than prices in markets that consume more diesel than they produce, in order to encourage diesel to flow from the market with excess supply to the market in need of supply. In this way, the price of diesel in different locations both in the United States and around the world is set by supply and demand conditions in the various regional markets that make up the global market.

Because Kenya is an active participant in the global petroleum market as an importer of diesel, Kenya's diesel prices are tied to global diesel prices. As quality specification differences among the major diesel markets are relatively small, and because diesel can be shipped between markets for a relatively low cost, the price differences among the major diesel trading hubs tend to be small and price movements highly correlated.

### 1.1.2 Inflation Rate

Romer (2012) defines inflation as increase in average prices of goods and services in terms of money. Globally, inflation management is a reserve of monetary policy and monetary policy is a reserve of Central Banks. Friedman (1963) famously noted that inflation is a monetary phenomenon, and so it has remained. Laws that govern most Central Banks define their core mandate as maintaining stable price levels and establishment of monetary system of transaction. Besides other subsidiary role like growth and employment, the Bank of England like Bank of Canada, has its core functions defined as monetary stability and financial stability. Interest rate decisions are made by its Monetary Policy Committee (MPC) while Chancellor of Exchequer sets and confirms the inflation targets. It is up to the Bank to meet the inflation target as it conducts its monetary policy. Currently the inflation target is two per cent (Bank of England, 2013. In Kenya, the Central Bank is established under Sections 4 and 4A

of the Central Bank of Kenya (CBK) Act which sets out the Bank‘s core objectives and mandate as formulation and implementation of monetary policy directed to achieving and maintaining stability in the general levels of prices and fostering liquidity, solvency and proper functioning of a stable market-based financial system. Subject to these two broad objectives, the CBK is mandated to support the economic policy of the Government, including its objectives for growth and employment through (CBK, 2013).

The mandate of calculation of official statistics on all levels of inflation in Kenya is vested with KNBS, while the law gives mandate to Treasury Secretary to specify to the Governor, CBK, and the price stability target for every succeeding 12 months and the economic policies to be undertaken in the period under review. As has been in the last six years, the price stability target for CBK has been five per cent as measured by the 12-month Consumer Price Index, published by KNBS (Republic of Kenya, 2010). This is the target that the CBK is accountable to the general public. Whenever actual inflation deviates from target by two percentage point, the CBK is expected to notify the Treasury Secretary the reasons for deviation, the policy actions CBK is undertaking to deal with the deviation, the period within which the Bank expects inflation rate to move within the target and how this new approach meets the Government‘s monetary policy objectives (Republic of Kenya, 2010).

### 1.1.3 International Diesel Prices and Inflation Rate

Inflation, as studied in the AD-IA Model (Romer, 2000) is constant in the short run mainly due to standard wage setting behaviors in the economy and expectations of steady inflation in the economy. While in the intermediate to long term, changes to inflation rate may be gradual or sudden. Gradual changes in inflation will depend on

position of actual GDP as compared to potential GDP. In cases of excess demand (overheating economy), firms raises prices irrespective of prevailing rates of inflation. These new prices are set higher than the prevailing inflation rate to promote production. If all firms in market raise their prices, inflation gradually rises. Inflation that arises is Demand Pull inflation, which comes from strengths and weaknesses of the economy (Friedman, 1968, also Phelps, 1967).

Sudden changes in the levels of inflation are due to occurrence of unforeseen events. These events are mainly attributed to, first, drastic changes in prices or supply of key inputs to production like diesel. The rationale being that the key inputs to production have no instantaneous substitution and no backstop technology exists to cover for their shortfall. Supply will be constrained as long as changes occur. Inflation from such constraints on the supply side is cost push inflation, which captures all shocks due to inflation that are unrelated to expectations and labour markets in the economy (Phelps 1968). These changes will occur assuming agents in economy have rational expectations (Thomas and Neil, 1975).

### 1.1.4 Oil Industry in Kenya

Kenya solely relies on oil imports to satisfy its oil energy needs. According to Kojima et al. (2010) Kenya has an Open Tender System, whereby crude or petroleum products are purchased by a single company for the entire market on the basis of a public tender and shared among all marketing companies in proportion to their share of the market. Questions have been raised about the cost-effectiveness of this system. The GoK (2003) in its Vision 2030 recognizes that Kenya's energy costs are higher than those of her competitors and that Kenya must, therefore, generate more energy at a lower cost and increase efficiency in energy consumption. The consumer price

indices as demonstrated in figure 1 also indicate that prices of oil products have been unstable in the period December 2010 to June 2012.

The Kenya Government is, therefore, encouraging foreign interest in oil exploration thus there is a modest upstream oil industry, currently limited to exploration in various parts of Kenya. There has been a confirmation that Kenya has struck oil in Turkana area but the commercial viability of these discoveries is yet to be determined. Petroleum is Kenya's major source of commercial energy and has, over the years, accounted for about 80% of the country's commercial energy requirements (Wanjiku, 2011).

According to Vision 2030, petroleum and electricity are the prime movers of the modern sector of the Kenyan economy. The domestic demand for various petroleum fuels on average stands at 2.5 million tons per year, all of it imported from the Gulf region, either as crude oil for processing at the Kenya Petroleum Refineries Limited or as refined petroleum products. Prior to liberalization in October 1994, a significant feature of Kenya's oil industry was a relatively high level of government direct participation, and a correspondingly low level of private sector involvement. Seven marketing and distribution companies were responsible for procuring and importing their own oil. Prior to mid-1994, the government, in consultation with the oil marketers, set consumer prices for petroleum products in the country (Mecheo and Omiti, 2003). However, since October 1994, the procurement, distribution, and pricing of petroleum products were liberalized with a view to enhancing operational efficiency of the industry and also attracting private capital (Mecheo & Omiti, 2003).

In 2006, the Energy Act No. 12 of 2006 was enacted. This led to the transformation of the then Electricity Regulatory Board (ERB) to the Energy Regulatory Commission

(ERC) to also regulate petroleum and renewable energy sectors in addition to electricity. Instability of pump prices of oil products forced the Government of Kenya to re-introduce price regulation in December 2010. Price regulation refers to government interventions aimed at controlling the maximum prices of a certain product. Universal price subsidies and petroleum product tax reduction are the two most commonly used methods of partially off-setting higher oil prices on the international market (Kojima, 2009). A price stabilization fund, on the other hand, attempts to set domestic prices higher than international prices in times of low world oil prices and save the balance in the fund; when world oil prices exceed a threshold level, money is withdrawn from the fund to subsidize domestic prices (Kojima, 2009).

A price stabilization fund may have an intuitive appeal but does not work well in practice, and all such funds were strained in 2007–08 (Bacon and Kojima, 2008). If there is a national oil company or an oil company with some state involvement that is also a price-setter (because it controls a large share of the market), the government may send signals to the company to keep prices low (Kojima, 2009). Prior to re-introduction of price regulation, Kenya had tried to use the National Oil Company of Kenya (NOCK) to stabilize prices of oil products, without much success. Critics of price regulation like Rockoff (2008) hold the view that price controls do not accomplish what they were intended to do and are generally to be avoided. Martin (2002), on his part, states that the primary criticism leveled against price controls is that by keeping prices artificially low, demand is increased to the point where supply cannot keep up, leading to shortages in the price- controlled product. The Nobel Prize Winner, Milton Friedman, supported this position when he stated "We economists don't know much, but we do know how to create a shortage. If you want to create a shortage of tomatoes, for example, just pass a law that retailers can't sell tomatoes for

more than two cents per pound. Instantly you'll have a tomato shortage. It's the same with oil or gas (Sowell, 2008)".

According to Mwirichia (2011), ERC is a single sector regulatory agency with responsibility for economic and technical regulation of electric power, renewable energy and downstream petroleum sub-sectors including tariff setting and review; licensing; enforcement of compliance; dispute settlement and approval of power purchase and network service contracts. This is supported by the Energy Act No. 12 of 2006 which states in Section 5(a) (ii) that the objects and functions of ERC include regulating the importation, exportation, transportation, refining, storage and sale of petroleum and petroleum products. Section 102 of the Act empowers the Minister to make regulations upon recommendation by the Commission on petroleum related activities including determination of retail prices for petroleum products (Katisya-Njoroge, 2010).

On December 15, 2010 the Government of Kenya enacted a new legislation, the Energy (Petroleum Pricing) Regulations, 2010 which was aimed at preserving availability of specified petroleum products in all parts of Kenya; stabilizing prices of specified petroleum products in Kenya and minimizing the variances in prices of specified petroleum products across the country (Katisya- Njoroge, 2010). The new regulations effectively re- introduced government control on the maximum prices of petroleum products based on a formula decided upon by the Energy Regulation Commission (ERC). This formula is, however, still being contested by the Oil Marketing Companies. Petroleum price regulation in Kenya last existed in the period prior to mid-1994 when deregulation was implemented as a result of economic challenges faced by the Government at that time as the Kenya Shilling lost ground

against the hard currencies leading to inflationary pressure that rendered regulation untenable. The 2010 re-introduction of price regulation followed intense pressure on the government from consumer pressure groups and citizens following frequent increases in prices of oil products between 2004 and 2011 (Wanjiku,2011).

The citizens, borrowing heavily from media reports, were generally of the view that OMCs were colluding to set high prices so that they could cash in on high margins. The OMCs, on their part, blamed the largely government controlled oil supply process along with inefficiencies in the Government administered Open Tender System (OTS), a tax system that demands payment of excise and import duties upfront on receipt of products by oil companies, an inefficient refining system due to usage of a technologically out-dated refinery as well as a capacity constrained storage and distribution network operated by KPC. On the other hand, the Ministry of Energy has been frequently put on the spot by Parliament and consumer pressure groups and trade union representatives as to what it was doing to control rising oil prices owing to the resultant and persistent increase in the cost of living. This led to the Energy (Petroleum Pricing) Regulations, 2010 that introduced petroleum price regulation for four specified petroleum products. The specific products affected by this price regulation are super petrol (gasoline), regular petrol, kerosene and automotive diesel (gasoil). The price regulations allowed ERC to set the maximum monthly prices of these products at both retail and wholesale levels.

## 1.2 Research Problem

Increasing price levels, high price volatility and the suspicion of collusive behavior are important topics of public debates on competition in retail gasoline markets in many countries. Several governments and competition authorities introduced fuel

price regulations in form of restrictions on the frequencies of fuel price changes per month.

The Kenyan downstream industry operates on very thin profit margins which leaves little room for errors (Mika, 2013). Oil Marketing Companies (OMC's) have been critical of the ERC's pricing formula since it does not cover financing costs and the rising cost of doing business due to inflationary pressures. Margins in the sector are also negatively impacted few researches have been conducted on the impact of price volatility of petroleum products in general and more specifically on the inflation rates in the Kenya's economy. Past academic studies in this area have focused on the profitability of an individual company at a time and not the industry as a whole. There exists an unfilled knowledge gap in the current research literature on the impact of price volatility on inflation rates in Kenya leading to the need of carrying out research on the impact of price instability on the inflation rates in Kenya.

## 1.3 Research Objective

Specifically, the study sought to:

1. Establish if the international diesel price affects the country's inflation rate and to which extent
2. Examine whether other factors under study influences the rate of inflation in Kenya and the extent to which they do.
3. Examine if oil price controls are a necessity in meeting objective of Price stability.

## 1.4 Value of the Study

To academics, the research would contribute immensely to the existing literature on price instability and will form a basis for further future research. The findings of this

study would go towards filling an existing information gap in regard to price volatility, profitability and economic growth.

The government through ERC and other regulatory bodies can use the findings of this study to see how price regulations affect country's inflation. The findings can be used to improve the current regulatory framework as well as formulate and implement new price.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

This chapter provides literature from past researchers and scholars on the implications of changes in prices of petroleum products on a non-oil producing country. The chapter examines the concepts of petroleum price instability in relation to the extent to which this impacts the general price levels in an economy. By considering the work from diverse authors, the chapter builds on the theoretical and the conceptual framework on the effects of petroleum product price volatility on inflation rates.

## 2.2 Theoretical Review

Bacon (2009) found that taxes make up a sizable fraction of retail fuel in Cambodia. Taxes on petroleum products are a critical source of government revenue because it is one of the easiest ways to get revenue: collecting fuel taxes is relatively straightforward and there is generally a robust relationship between consumption of fuels as a group and income - consumption tends to go up at the same rate as income.

Hossain (2003) in Nigeria uses the modern theory of public economics as the point of departure. The study looked at how petroleum products should be priced based on efficiency and equity and did not look into how taxes affect the pricing of petroleum products, which is a critical factor in the current study. The study did not make any specific suggestions for how a balance between taxing and prices of petroleum can be achieved to ensure that there is stability of prices of petroleum products.

Nwosu (2009) in her work the impact of fuel price on inflation, which used the variance Autoregressive analysis model to assess the relative contribution of fuel price on inflation. The study used available quarterly data series spanning 1995 to 2008. The finding of the study revealed that the policy of subsidizing the price of fuel

should be continued so as to help cushion the economy from the adverse effects of oil-price shock.

The study was also carried out in Nigeria, an oil producing country, and therefore, the issues of petroleum products may not be similar to those of Kenya. In a study on international oil price regime origins rationale and assessment, Mabro (2005) observes that petroleum prices do not always move at the same rate – be it up or down – as crude oil prices.

The prices paid by consumers for a petroleum product may differ significantly from the ex-refinery price because of excise and value-added taxes which, in many countries, amount to a hefty imposition. This had a major effect on the financing of oil purchases as the cash outflow required now included taxes payable upfront on products at the point of entry. The indirect impact of the requirement that petroleum taxes be paid at the point of product entry, and its financing implications further complicate the impact of taxes on prices of petroleum products.

## 2.3 Determinants of Inflation Rate

In this study, exchange rate is simply defined as the amount of Kenya Shillings required to purchase one United States Dollar. The US dollar is the invoicing currency of international oil trading. Exchange rate variations in the U.S. dollar can affect the world price of oil because oil is priced in US dollars and generally paid for in US dollars. Hence, the fluctuation in US dollar exchange rate is believed to underlie the volatility of diesel price and especially its forecasting accuracy. The idea that there is a relationship between oil prices and exchange rates has been around for some time (Golub (1983) and Krugman (1983). Bloomberg and Harris (1995) provide a good description, based on the law of one price, of how exchange rate movements

can affect oil prices. Commodities like oil are fairly homogeneous and internationally traded. The law of one price asserts that as the US dollar weakens relative to other currencies, ceteris paribus, international buyers of oil are willing to pay more US dollars for oil.

Dale (2009) observes that economic models generally found a negative, but sometimes insignificant relationship between energy (or diesel) prices and the Canadian dollar due to the offsetting impacts unique to energy prices, since the relationship between stronger prices of other non-energy commodities which Canada exports and the Canadian dollar was strongly positive. However, the study found that the price of oil is dominated by the U.S. dollars.

Nayef and Abdullah (2010) investigated the impact of real exchange rate volatility between Kuwait and its major trading partners on their bilateral trade volume. Findings show that the impact of Kuwait Dinar (KD) exchange rate volatility vis-à-vis major trading partners is estimated to positively influence export flows. An explanation of the positive findings is that since oil and natural gas represent almost above 90 percent of Kuwait exports and global demand is inelastic, then any appreciation in KD exchange rate should not have an effect on Kuwaiti exports. Therefore, any appreciation of KD vis-à-vis major currencies means an appreciation for the U.S. dollar initially; indicating that oil prices become overvalued.

Yang (2010) focused on the future of petroleum future markets and observed that China itself was a monopoly in the supply of oil in the country and therefore not cushioned against price fluctuations. Chinese National Petroleum Corporation (CNPC) and China Petroleum and Chemical Corporation ("Sinopec") provides the major oil supply in the domestic market. The study looked at the imports dependence

ratio (imports/consumptions) from 1998 (141%) to (45.56%) in 2008. Thus, if China keeps relying on imported oil, it could face great risks in supply and prices due to spill-over effects.

Twimukye and Matovu (2009) found that Uganda's downstream oil sector was liberalized in 1994, price controls and bureaucratic resource allocation were abolished, and a new petroleum supply act promulgated in 2003. This led to licensing of several companies, including international oil companies like Shell, Total, and Chevron to take part in the industry. Although the sector is fairly competitive with even smaller firms operating, the market is dominated by the few international ones including the ones mentioned above. The persistently high prices of petroleum products in spite of the falls in the world crude prices have raised alarms in the population that the industry may be poorly regulated, making players to collude to cheat motorists.

## 2.4 Empirical Literature Review

Naveed (2010) studied measuring the impact of changing oil prices, and other variables like consumption, government expenditure and average exchange rates, domestic investment, inflation and foreign domestic investment on GDP in the context of Pakistan's economy. This study provides a good foundation for further studies on stability of prices of petroleum products in that it looked at various measurable effects of stability of prices of oil. Though the study was carried out in Pakistan, and the country may not be comparable to Kenya in terms of economic development, the variables can be used as a basis of study for future studies in Kenya.

Similar study by Arinze (2011) on the impact of oil price on the Nigerian economy contends that frequent upward adjustments of petroleum product prices have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria.

Between 1978 and 2009, the various Nigerian regimes increased fuel prices a total of 18 times. Most of the increase occurred in the 1990-2007 period when the prices were adjusted, sometimes twice a year. The results further revealed that whenever petroleum product prices increase, the inflation rate and the rise price of petroleum products is significant.

Juvenal and Petrella (2012) found that oil prices have been historically driven by strength of global demand but speculation contributed to the oil price increases between 2004 and 2008. Consistent with Tang and Xiong (2011), they concluded that speculative shocks in oil prices (diesel) had a relation to other commodity prices. However, Irwin and Sanders, (2010) disregard the idea that speculation played an important role in oil (diesel) pricing indicating that the level of inventories had not risen in their period of study. They, however, fail to explain the increases in oil prices when fundamentals remained constant and supply and demand shocks were minimal.

## 2.5 Summary of Literature Review

Oil (diesel) prices hugely drive the inflation pressure in most developing countries. Thus instability in supply and pricing will precipitate cost push inflation that gives huge variations between headline inflation and core inflation. The problem faced by an inflation targeting Central Bank is containing inflation due to cost structures of the economy. Volatility in supply of key ingredient to production process like oil, will mean that inflation remains volatile, leaving little chance to the meeting of the inflation target. While the effects oil (diesel) prices and interest rates on inflation are rather direct, this is not so when it comes to exchange rates. Various empirical studies have given varied results and thus the Jury is still out there.

# CHAPTER THREE: RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter provides the empirical model which establishes the econometric model specified and a description of the variables used and the estimation procedure. Thereafter, we provide a brief discussion of the study area, the data types and sources.

## 3.2 Research Design

The research process adopted experimental survey method. The functional form was a Single Equation Linear Regression model involving the variables under study. Therefore, in this model, a regression model of the same variables was adopted. This method satisfies the objectives of this research paper; which is to test how effective has the international diesel price influenced the country‘s rate of inflation. The research adopted quantitative, secondary time series data.

## 3.3 Model Specification

In formulation of this research model, the basis has been trying as much as possible to come up with a model that reflects the transmission mechanism of the petroleum price change on inflation. Thus, the independent variables are interest rates (CBK rate), the US Dollar exchange rates, and the average monthly International Diesel prices (MED Market). The expectations, which are also major transmission mechanism, were captured by the constant variable in the Regression Model.

Inflation was the dependent variable.

The model itself borrowed heavily from the model of Expectations Augmented Phillips Curve, 1968, as developed by Milton Friedman and Edmund Phelps.

Thus: Inflation today = f (Average monthly diesel prices, average monthly exchange rate, CBK base Interest rates). The interest rate effect on inflation was lagged by one period, the model can thus be specified as,

$$\prod = \prod_{t+1}^{e} + \beta_1 OP_t + \beta_2 Ex_t + \beta_3 IR_{t-1} + \varepsilon_t$$

Where,

$\prod_{t+1}^{e}$ →Is the actual inflation rate observed in the economy today,

∏is the constant in the regression model, and could be defined as the expected inflation in the economy tomorrow, which is inflation that can exist even if the economy is in full employment.

$OP_t$ =current month diesel price growth rate

$Ex_t$ =the current monthly dollar exchange rate against the shilling

$IR_{t-1}$ =the previous month's rate of interest

$\epsilon_t$=the disturbance term that measures all others factors influencing inflation not captured by the model. It captures all other unspecified shocks in the economy that is unrelated to expectations, diesel price and labor market. These shocks could be drought, political violence, or acts of war. It could be either positive or negative.

The coefficients $\beta_1, \beta_2, \beta_3$attached to each respective explanatory variable, and their utilities are found in explaining marginal effects for each variable to the current rate of inflation.

$\beta_1 OP_t$ and $\epsilon_t$ is the sum of the Cost-Push inflation while $\beta_2 Ex_t + \beta_3 IR_t$is the sum of demand pull inflation. Interest rates are lagged by one time period, because, as the Bank of England Confirms, transmission mechanism via interest rates take time before their peak effects on demand, production and inflation are felt. These nominal

rigidities could be attributed to adjustment Costs (menu costs), imperfect information, or contracts (Romer, 2000).

## 3.4 Data Sources and Data Types

The research process used secondary time series, monthly data on all the variables under study. Data on inflation was retrieved from KNBS publications like Leading Economic Indicators, Statistical Abstract and Economic Survey while data on mean monthly exchange rates and Interest Rates was extracted from publications of CBK and KNBS. The data for monthly diesel prices was retrieved from Platts. The sample size will constitute data collected spanning the period from August 2010 to August, 2015.

## 3.5 Data Analysis

### 3.5.1 Johansen Co-integration Tests

Once the order of the integration is established for each variable, this study evaluated the co-integration properties of the data series. Johansen and Juselius (1990) co-integration test is adopted to determine whether the linear combination of the series possesses a long run equilibrium relationship. Besides, Johansen co-integration test is explaining the relationship between dependent variable and independent variable in short run or long run period (Ali et al., 2010). Briefly stated, a set of variables is said to be co-integrated if they are individually non-stationary and integrated of the same order, yet their linear combination is stationary (Ibrahim,2000). In addition, the basic idea of co-integration is that the dependent and independent variables move closely together in the longrun (Azizan & Sulong, 2011).

Co-integration means the data from a linear combination of two variables can be stationary. If there is at least one co-integrating relationship among the variables, then the causal relationship among these variables can be determined by estimating the VECM. For this purpose, a Johansen method of multivariate co-integration is applied. The Johansen maximum likelihood method from Johansen and Juselius (1990) is utilized to examine the number of co-integration vectors in the model (Chin and Jayaraman, 2007). Johansen VECM is a full information maximum likelihood estimation model which allows in testing the whole system in one step (Maysami, Lee & Hamzah, 2004).

### 3.5.2 Granger Causality Test

For the absence of any co-integration relationship between the above variables, Granger causality tests was applied Granger Causality test was used to examine short run relationship between dependent and independent variables. In order to test the existence of short run relationship, stationary data is more important than on-stationary data. In this technique, the methodology is sensitive to lag length used in order to investigate the Stationary property of data. Granger proposed to examine the relationship exists between variable, they also can be used to predict each other (Ali *et al*, 2010).

# CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

## 4.1 Introduction

This chapter presents analysis and findings of the research. The objective of this study was to establish the relationship between international diesel price and the inflation rate in Kenya for the period between 2010 -2015.

## 4.2 Correlations

**Table 4.1: Correlations table**

| | | Inflation In Kenya | Rate Diesel price | Dollar exchange rate | Interest rate |
|---|---|---|---|---|---|
| Inflation Rate In Kenya | Pearson Correlation | 1 | .091* | .675** | .532** |
| | Sig. (2-tailed) | | .001 | .0001 | .003 |
| | N | 62 | 62 | 62 | 62 |
| Diesel price | Pearson Correlation | .091* | 1 | -.340** | -.310* |
| | Sig. (2-tailed) | .001 | | .003 | .028 |
| | N | 62 | 62 | 62 | 62 |
| Dollar exchange rate | Pearson Correlation | .675** | -.340** | 1 | .389** |
| | Sig. (2-tailed) | .0001 | .003 | | .007 |
| | N | 62 | 62 | 62 | 62 |
| Interest rate | Pearson Correlation | .532** | -.310* | .389** | 1 |
| | Sig. (2-tailed) | .003 | .028 | .007 | |
| | N | 62 | 62 | 62 | 62 |

On the correlation of the study variable, the researcher conducted a Pearson moment correlation. From the finding in the table above, the study found that there was strong correlation coefficient between inflation rate in Kenya and diesel price as shown by correlation factor of 0.091, this strong relationship was found to be statistically significant as the significant value was 0.003 which is less than 0.05, the study also found strong positive correlation inflation rate in Kenya and dollar exchange rate as

shown by correlation coefficient of 0.675, this too was also found to be significant at 0.001 level. The study also found strong positive correlation between inflation rates in Kenya churches interest rate factors as shown by correlation coefficient of 0.532 at 0.001 level of confidence.

## 4.3 Regression Analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS V 21.0) to code, enter and compute the measurements of the multiple regressions.

### 4.3.1 Model Summary

The model summary are presented in the table below

**Table 4.2: Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .819[a] | .671 | .653 | .17390 |

The study used coefficient of determination to evaluate the model fit. The adjusted $R^{2,}$ also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. The model had an average coefficient of determination ($R^2$) of 0.653 and which implied that 65.3% of the variations in inflation rate in Kenya are caused by the independent variables understudy (Diesel price, Dollar exchange rate, and Interest rate).

**4.2.2 ANOVA**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 119.185 | 3 | 39.728 | 5.002 | .140[b] |
| | Residual | 460.631 | 58 | 7.942 | | |
| | Total | 579.816 | 61 | | | |

F critical = 2.76

From the ANOVA statics, the study established the regression model had a significance level of 0.1% which is an indication that the data was ideal for making a conclusion on the population parameters as the value of significance (p-value) was less than 5%. The calculated value was greater than the critical value ( 5002 >2.76) an indication that diesel price, dollar exchange rate, and interest rate all have a significant influence inflation rate in Kenya. The significance value was less than 0.05 indicating that the model was significant.

## 4.2.3 Coefficients

**Table 4.3: Table of Coefficients**

The following tables gives the coefficients which helps in establishing the regression line

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .161 | .129 | | 8.978 | 0.00 |
| | Diesel price | .011 | .002 | .004 | 5.500 | 8.94522E-07 |
| | Dollar exchange rate | .491 | .112 | .477 | 4.384 | 4.9673E-05 |
| | Interest rate | .438 | .091 | .421 | 4.813 | 1.1002E-05 |

The established regression equation was

$$\mathbf{Y = 0.161+0.011X_1+ 0.491\ X_2+ 0.438X_3}$$

From the regression model above, it is can be deduced that, holding diesel price, dollar exchange rate, and interest rate to a constant zero the level of inflation rate in Kenya would be 0.161, it's was also established that a unit increase in diesel price while holding other factors at constant, would cause an increase in inflation rate in Kenya by a factor of 0.011, a unit increase in dollar exchange rate, while holding other factors at constant would cause an increase in increase in inflation rate in Kenya by a factor of 0.491, also a unit increase in interest rate would cause increase in inflation rate in Kenya by a factor of 0.438, this clearly shows that there is a positive relationship between in inflation rate in Kenya and diesel price, dollar exchange rate and interest rate. The findings concurs with the research by Burbidge and Harrison (2004), in their study on the causes of inflation, established a positive relationship between the inflation index and increases in oil prices.

The analysis was undertaken at 5% significance level. The criteria for comparing whether the predictor variables were significant in the model was through comparing the obtained probability value and $\alpha$=0.05. If the probability value was less than $\alpha$, then the predictor variable was significant otherwise it wasn't. All the predictor variables were significant in the model as their probability values were less than $\alpha$=0.05

## 4.4 Co-integration Test

A series of co-integration tests were carried out to examine whether there exists a long run relationship between diesel prices and inflation rate. Results are reported in table below. Seasonally adjusted price indices were regressed against diesel prices

and a few of its lags. The rationale to use lagged variables is that at first difference regressions, some lagged diesel prices had a significant relationship with prices. Stationarity of the residuals of these regressions were tested using ADF tests to ascertain whether there is a long run relationship between two variables in the regression.

**Table 4.4: Results of the co-integration test**

| Variable | ADF Stat at Level | 1% | 5% | 10% |
|---|---|---|---|---|
| RCKDSA | -1.221 | 4.547 | -3.654 | -2.562 |
| RCKDSA1 | -1.225 | 4. 547 | -3.654 | -2.562 |
| RSLKDSA | -1.316 | -4.634 | -3.633 | -2.408 |
| RSLKDSA2 | -1.450 | -4.634 | -3.633 | -2. 408 |
| RSLKDSA3 | -1.454 | -4.634 | -3.633 | -2. 408 |

List of variable Residuals of

Log (CEXKETSA) Vs Log (DIESEL) – RCKDSA

Log (CEXKETSA) Vs Log (DIESEL (-1)) – RCKDSA1

Log (SLEXKEGTSA) Vs Log (DIESEL) – RSLKDSA

Log (SLEXKEGTSA) Vs Log (DIESEL (-2)) – RSLKDSA2

Log (SLEXKEGTSA) Vs Log (DIESEL (-3)) – RSLKDSA3

Co-integration test was used to examine whether there is a long-run permanent relationship between diesel prices and inflation. The result of co-integration reveals that two variables are not significantly co-integrated to form a long-run permanent relationship. The contradictory results between the short-term relationship and long-run relationship implies that although any shock to diesel prices would lead to a short-term impact on inflation levels, the relationship is not strong enough to form a long run relationship between the two variables. However, accumulation of several short-

term shocks could have a significant impact on inflation, particularly when shocks are sharper. Residuals of all regressions between several combinations of price indices and diesel prices were found to be non-stationary. This result implies that there is no long run relationship between diesel prices and inflation levels.

## 4.5 Granger causality test

Granger causality test is a technique for determining whether one time series is significant in forecasting another or not. Here Granger-causality test has been conducted to study the causal relationship between Diesel oil price and Inflation rate. The tables below reports granger causality test results with lag of 5 that is the appropriate selection of lags. The null hypothesis has been tested on the basis of the P-value. If the P-value is less than the critical P value at 5% than the null hypothesis is rejected and there will be a significant relation between the variables. First differencing of the variables has been used to apply granger causality test.

**Table 4.5: Granger causality test**

| Null Hypothesis | P value | Result | Relationship |
|---|---|---|---|
| Diesel price does not granger cause inflation rate | 0.0171 | Accept | No Relationship |
| Inflation rate does not granger cause Diesel price | 0.03411 | Accept | |

The above table shows granger causality test for diesel oil price and inflation rate, the test confirms there in no relation between diesel oil price and inflation rate. The monthly data analysis of the two variables found the no short term relationship.

## 4.7 Discussion of the findings

The study found weak positive correlation between diesel price growth rate and inflation rate in Kenya as shown by a coefficient correlation 0.091 the regression also

shows that an increase in diesel oil price increases in the international market will lead to direct increase in inflation (0.482). Further the research established that oil price hike in the from 2010 to 2014 led to average price spiral and adverse macroeconomic consequences, further the reser4ch revealed that oil prices can drive some variation in inflation, at least over the short and medium runs. The fact that international inflation rates move together (Neely & Rapach, 2011) suggests that international factors, such as commodity prices like oil, might drive a substantial part of inflation and that oil supply shortages will have a negative impact on inflation due to production costs.

Further the research revealed that Gradual adjustment of diesel prices could keep its impact on inflation to a minimum level of around one percentage point while Sharp adjustment would lead to significant increase in inflation in the short-term. Further, the research established that when diesel prices were adjusted gradually its impact on inflation was lower than that of a sharp adjustment within a short period. This finding also supports international evidence that countries with highly flexible domestic petroleum prices have been able to maintain low and stable inflation rates despite wide fluctuations in petroleum prices in international markets and that that tightening relationship between oil prices and inflation expectations reflects a tightening relationship between global demand and medium term inflation expectations, as well as an increased effect of idiosyncratic supply shocks to oil on inflation expectations. The study findings conforms with the findings by Arinze (2011) that petroleum product prices increase, the inflation rate and the rise price of petroleum products is significant.

The research investigated the effect of interest rate on oil prices and inflation in Kenya, the study found that a unit increase in dollar exchange rate, while holding other factors at constant would cause an increase in increase in inflation rate in Kenya, the study found a positive correlation between high dollar exchange rate and inflation rate in Kenya meaning that high interests rates help strengthen the dollar against other countries' currencies. When the dollar is strong, this comes as disadvantage to Kenyan oil companies since they can only buy less oil with every U.S. dollar spent, ultimately passing the cost on consumers and thus becoming costlier to Kenyans. The findings confirms the research by Nayef and Abdullah (2010) who established that exchange rate volatility vis-à-vis major trading partners is estimated to positively influence export flows.

The research also revealed that a stronger currency reflects the expectation by investors that interest rates which can be obtained in one currency will become more attractive than interest rates in another, Strong currencies, however, tend to be temporary and self-correcting. When a currency gains value, it alters trade balances by reducing exports and boosting imports. This spurs growth in the foreign exporting nations and ultimately increases those currencies, while weakening the dollar.

The research investigated the effect of interest rate on international oil prices and inflation, the study revealed that a unit increase in interest rate would cause increase in inflation rate in Kenya, the study also found strong positive correlation between inflation rates in Kenya churches interest rate factors as shown by correlation coefficient of 0.532. Further the research revealed that high Interest rates have a negative influence on the diesel prices and a positive influence on the future crude oil prices. In the long run, a relationship exists whereby interest rates influence the US dollar, which in turn influences international crude oil prices, when the CBK lowers

interest rates to boost the economy, market expectations for oil demand change and, as a result, crude oil prices fluctuate. In addition, there is a price transmission relationship from interest rates to oil prices. A reduction in interest rates influences investor expectations with respect to depreciation of the dollar and investors then move their capital to the market for capital preservation or speculation.

# CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

This chapter presents summary of the study findings, conclusion and recommendations. the objective of this study was to, establish if the international diesel price affects the country's inflation rate and to which extent, examine whether other factors under study influences the rate of inflation in Kenya and the extent to which they do, and to examine if oil price controls are a necessity in meeting objective of price stability.

## 5.2 Summary

The study found positive correlation between diesel price growth rate and inflation rate in Kenya as shown by a coefficient correlation 0.521 the regression also shows that an increase in diesel oil price increases in the international market will lead to direct increase in inflation (0.482). Further the research established that oil price hike in the from 2010 to 2014 led to average price spiral and adverse macroeconomic consequences, further the reser4ch revealed that oil prices can drive some variation in inflation, at least over the short and medium runs. The fact that international inflation rates move together (Neely and Rapach, 2011) suggests that international factors, such as commodity prices like oil, might drive a substantial part of inflation

Gradual adjustment of diesel prices could keep its impact on inflation to a minimum level of around one percentage point while Sharp adjustment would lead to significant increase in inflation in the short-term. Further, the research established that when diesel prices were adjusted gradually its impact on inflation was lower than that of a

sharp adjustment within a short period. This finding also supports international evidence that countries with highly flexible domestic petroleum prices have been able to maintain low and stable inflation rates despite wide fluctuations in petroleum prices in international markets and that that tightening relationship between oil prices and inflation expectations reflects a tightening relationship between global demand and medium term inflation expectations, as well as an increased effect of idiosyncratic supply shocks to oil on inflation expectations. The study findings conforms with the findings by Arinze (2011) that petroleum product prices increase, the inflation rate and the rise price of petroleum products is significant.

The research investigated the effect of interest rate on oil prices and inflation in Kenya, the study found that a unit increase in dollar exchange rate, while holding other factors at constant would cause an increase in increase in inflation rate in Kenya, the study found a positive correlation between high dollar exchange rate and inflation rate in Kenya meaning that high interests rates help strengthen the dollar against other countries' currencies. When the dollar is strong, this comes as disadvantage to Kenyan oil companies since they can only buy less oil with every U.S. dollar spent, ultimately passing the cost on consumers and thus becoming costlier to Kenyans. The findings confirms the research by Nayef and Abdullah (2010) who established that exchange rate volatility vis-à-vis major trading partners is estimated to positively influence export flows.

The research also revealed that a stronger currency reflects the expectation by investors that interest rates which can be obtained in one currency will become more attractive than interest rates in another, Strong currencies, however, tend to be temporary and self-correcting. When a currency gains value, it alters trade balances

by reducing exports and boosting imports. This spurs growth in the foreign exporting nations and ultimately increases those currencies, while weakening the dollar.

The research revealed that a unit increase in interest rate would cause increase in inflation rate in Kenya, the study also found strong positive correlation between inflation rates in Kenya churches interest rate factors as shown by correlation coefficient of 0.532. Further the research revealed that high Interest rates have a negative influence on the diesel prices and a positive influence on the future crude oil prices. In the long run, a relationship exists whereby interest rates influence the US dollar, which in turn influences international crude oil prices. When the CBK lowers interest rates to boost the economy, market expectations for oil demand change and, as a result, crude oil prices fluctuate. In addition, there is a price transmission relationship from interest rates to oil prices and that a reduction in interest rates influences investor expectations with respect to depreciation of the dollar. Investors then move their capital to the market for capital preservation or speculation. The high rate of inflation in Kenya can be explained in terms of factors such as low rate of output growth, monetary expansion, and higher dollar price of imports, exchange rate depreciation, increase in excise and sales taxes, and changes in administrative prices such as fuel prices, utility charges and procurement price of wheat (Bokhari & Feridun, 2006).

## 5.3 Conclusions

The study examined the effects of international diesel oil price changes on the domestic inflation rate using time series monthly data from August 2010 to August 2015. The correlation matrix and regression does not find the perfect relationship between the variables and Granger causality test also confirms that there is short term

relationship; the study concludes that the hike in international diesel oil price does influence the domestic inflation rate as suggested by monthly data of two variables. Daily and weekly data of crude oil price and weekly inflation rate can be verified to know exact relationship.

## 5.4 Recommendations

Based on the research findings the study recommends that energy regulatory commission need to institute measures that will effectively forecast on future changes in international fuel prices. The central bank should constantly cheep in to keep dollar circulation level at appropriate levels. The research established that an increase in interest rate would cause increase in inflation rate in Kenya, therefore the study recommends that CBK should consider maintaining lending rates at considerable levels.

## 5.5 Limitations of the Study

Due to finance and time constraints, the research was limited to only oil companies in Kenya. Therefore, to generalize the results for a larger group, the study should have involved a larger area of study, may be in other sectors of the economy or in other areas of the country. there was the challenge of accessing past records due to poor record keeping hence there was scant information that could be accessed in terms of published financial statements, however the researcher used other relevant documentation to collect the required information despite the fact that it took longer than anticipated. The research was also difficult to carry as the researcher had work and family commitments to attend to. This proved to be very destructing during the course of the research.

## 5.6 Suggestion for Further Studies

The study sought to establish the relationship between international diesel price and the inflation rate in Kenya. Further research should also be undertaken which would include firms in various sectors of the economy and compare the different experiences created to these institutions due to the influence of the studied factors. This would aid in making general recommendations that would be employed by relevant authorities to ensure efficiency of firms. Future studies should also consider employing primary sources of data to collect data for their studies. This would be time saving and would also facilitate detailed information collected from original sources which would as well give reliable and accurate results that explain the details of the subject.

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