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# Effect of Regulatory Components on Volatility of Petroleum Pump Prices in Kenya

Johnson Munyua Odongo Kodongo John Ntoiti
Jomo Kenyatta University of Agriculture and Technology (JKUAT), Nairobi CBD Centre, Box 62000 - 00200, Nairobi, Kenya

**Abstract**
Volatility of petroleum pump prices in Kenya has continually affected its economic growth. Almost all other sectors of the economy growth rely on the petroleum products and therefore its instability in price leads to poor planning of other sectors. Expected profits by the companies who planned when the prices were favourable becomes affected leading to losses. Those who do not incur losses results to increasing the prices of goods and services making the costs of living increase and therefore lowering the social economic growth. This paper is an extract from the completed research on drivers of instability in prices of petroleum products in Kenya (Munyua & Ragui, 2013). The main objective is to find out how the regulatory component affects the volatility of petroleum oil prices in Kenya.
**Keywords:** Price regulation, Volatility, Pump prices, Petroleum products

## 1. Introduction:

The prices of regulated petroleum products in Kenya have been a cause of major public outcry for a long time. This has led to search of different strategies to stabilise owing to the importance of petroleum products for growth of the country (Munyua & Ragui, 2013). Just prior to introduction of price regulation, various stakeholders had expressed strong views that the then retail prices of petroleum products in Kenya were too high and unjustified (Mwirichia, 2011). The period after December 2010 when pump price regulation was re-introduced is important for this study as a key objective of regulation was price stabilization.

According to Pirog (2005), oil is an international commodity whose ownership and ultimate destination is determined by market forces once it leaves the producing country and no country can effectively isolate itself from changes elsewhere in the market, nor is it likely that any nation can take actions that do not indirectly affect other nations. This observation is important when considering the effect of price regulation on local prices of petroleum products. Fattouh (2011) noted that little attention has been devoted to the process of price discovery in the oil markets and the factors affecting oil price stabilization remain under-researched. Further, UNCTAD (2005) observed that developing country Governments face heavy exposure to oil price volatility, either on the export or the import side – and sometimes, both.

Nduru (2009) sought to justify need for price controls and argued that the post deregulation retail prices of petroleum products in Kenya did not follow the changes in international oil prices. The Kenyan parliament, in December 2010, re-introduced a price capping formula through the Energy (petroleum Pricing) Regulations, 2010 whose main objective was to stabilize prices of petroleum products. Prices of petroleum products in Kenya have been volatile and reached a high of Kshs 121.13 in May 2012 for a litre of gasoline compared to the price of Kshs 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 Kshs 87.45 in December 2010 to Kshs 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 compares well with the observation by Watkins (2006) that since 1986, the Price Index for oil products has been more volatile than for other commodities.

## 2. Theoretical Review

This study is anchored on two theories that have been used to explain the effect of regulation on volatility oil prices.

### 2.1 Informal Approach Theory

The informal approach analyses oil price behavior within a specific economic and political context. Slaibi, Duane and Daouk (2006) found that though previous work on crude oil price modelling had generally focused on two theoretical approaches, either the peak oil theory of optimal control analysis of pricing of a declining resource, or OPEC as a partial monopolist setting oil prices to maximize net present value, and neither had been wholly satisfactory. Boll (2005) supports this by stating that the price of oil bears no relation to the scarcity of oil in the ground or to the cost of getting it out of the ground. Further discussions advanced by Boll (2005), Slaibi et al (2006), Chermak and Patrick (2002), Krautkaemer (1998), Barnett and Morse (1963) and Smith (1979) critically look at the over-reliance to Hotelling theory and Peak Oil theory.

According to Juvenal and Petrella, (2012), dramatic developments have taken place in the oil market over the last ten years such that oil prices cannot be said to be just driven by supply and demand as in the past. Tang

 

and Xiong (2011) go further and point out that a speculative component may be behind the recent boom in oil prices. Fattouh (2007) however recognized that although the informal approach is essential to understanding current and past developments in the oil market, it could only provide a cursory view about how the oil market and oil prices might develop in the future. The informal approach theory is relevant to this study in that factors that determine volatility of prices of oil products in Kenya are likely to be diverse and go beyond elasticities and reserves.

### 2.2 Price-cap Regulation Theory

According to Hertog (2010) there are two broad traditions with respect to the economic theories of regulation. The first tradition assumes that regulators have sufficient information and enforcement powers to effectively promote the public interest. This tradition also assumes that regulators are benevolent and aim to pursue the public interest. Economic theories that proceed from these assumptions are therefore often called 'public interest theories of regulation'. Another tradition in the economic studies of regulation proceeds from different assumptions. Regulators do not have sufficient information with respect to cost, demand, quality and other dimensions of firm behavior. They can therefore only imperfectly, if at all, promote the public interest when controlling firms or societal activities.

Price-cap regulation is an innovation in regulatory policy that was developed in the 1980s and has been applied around the world. According to Cowan (2002), the general problem is that a firm with partial or complete market power must be regulated to prevent it from abusing its dominant position through excessive pricing.

The key feature of a price cap is that the price level is not responsive to anything. Price-cap regulation (PCR) in practice is, of course, not as straightforward as simple theory would suggest. In particular price caps do not last indefinitely and are thus usually temporary measures to curb excesses for a period. The Energy Regulatory Commission uses price cap regulation in its attempt to regulate and control prices of petroleum products in Kenya. This theory therefore advised the study in relation to regulation as an independent variable. However, critics of regulation such as Joskow and Noll, (1981) are of the view that economic research has demonstrated convincingly that price and entry regulation based on the research on transportation, and oil and natural-gas production creates economic inefficiencies.

## 3. Conceptual Framework

A conceptual framework is a construct in which each concept plays an integral role. Smith (2004) defines a conceptual framework as framework that is structured from a set of broad ideas and theories that help a researcher to properly identify the problem they are looking at frame their questions and find suitable literature. The conceptual framework for this study is shown as figure 1.

## 4. Empirical Review

In a study that looked at the relationship between petroleum taxes and world prices in Cambodia Bacon and Kojima (2008), found that taxes make up a sizable fraction of retail fuel. Taxes on petroleum products are a critical source of government revenue for Cambodia because taxing fuel is one of the easiest ways to get revenue: collecting fuel taxes is relatively straight forward 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. Though this study gives some insights as to tax as one of the factors contributing to volatility of prices of petroleum products, it does not comprehensively show us how that relationship comes about. Taylor and Doren (2005), for example, concluded that despite moral issues involved, government efforts to take excess profits from oil companies either through price controls or taxes have proven to be futile exercises which fail to reduce prices but only manage to reduce supply, increase imports and impose steep costs on the economy as a whole. However, unlike in Cambodia, petroleum tax regime in Kenya is mostly based on a specific tax amount per litre, therefore is not ad valorem. It is recommended that a study be carried out on the relationship between taxes and volatility of petroleum products putting into considerations the contributions of theory and having an elaborate method of data collection.

According to Taylor and Doren (2005), proponents of intervention contend that gasoline markets are not competitive (with some accusing producers of price collusion), that fat profit margins induce little more supply than might otherwise be induced by healthy but "reasonable" profit margins, and that the gasoline profits are largely unanticipated and unearned. Taylor and Doren (2005) concluded that due to intervention or government regulation, oil companies reap very large profits at the expense of consumers. This conclusion needs to be further researched on in Kenya given that in 2012, two of the four major oil marketers reported huge losses despite a regulated pricing mechanism for petroleum products in Kenya.

A study on taxation and pricing of petroleum products in developing countries by Hossain, (2003) used the modern theory of public economics as the point of departure. The paper outlined a basic principle for setting taxes and/or prices of commodities based on two criteria, efficiency and equity. The paper showed that for petroleum products, the basic principles needs modification in the presence of various externalities and market

 

imperfections in a setting where the instruments to address externalities and imperfections are limited.

In a study on international oil price regime origins rationale and assessment, Mabro (2005) observed 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. For example, in Kenya, the study found that Premium and Regular Gasoline and Gasoil are heavily taxed products in Kenya. The Kenya Revenue Authority introduced a tax rule that oil marketing companies (OMCs) pay duty for products up front effective August 1, 2005. This simply meant that OMCs would be required to pay taxes at the point of product entry: upon receipt of products from vessels or refinery in Mombasa. 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.

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 &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. The methodology applied by the ERC was to have a price capping formula with an aim to eliminate high prices being set by oil marketers driven by profit maximization goals.

Few governments are able to withstand the pressure to use or increase fiscal measures to lower prices (Kojima, 2009). As a result, some countries that moved to automatic price adjustment mechanisms years ago suspended price adjustment and bore financial losses. In West Africa, for example, four of five countries studied engaged in price smoothing during the run-up to international prices from 2007 through mid-2008 (Bacon & Kojima, 2008); only Senegal maintained a consistent automatic adjustment process. The other four countries, Burkina Faso, Côte d'Ivoire, Mali, and Niger, suspended automatic price adjustment based on a clearly defined import parity structure.

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 levelled 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.

Taylor and Doren (2005) examined these different arguments with particular attention to retail gasoline markets and found the arguments supporting price control to be generally unpersuasive. They concluded that both economic theory and past experience suggest that aggressive price controls and windfall profits taxes will harm consumers by creating fuel shortages and reducing investment in new supply. This view is supported by Martin, (2002) who pointed out that once controls were removed, prices would immediately increase, which could temporarily shock the economic system.

From this literature review, it is clear that opinion is divided on what causes volatility of oil prices whether under regulated or deregulated oil pricing mechanisms. For premium, regular and gasoil fuel grades, regulatory components (taxes, oil profit margins and allowed losses) form a major fixed component of the price as they account for about 50% of the total price. However, 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 as a regulatory factor on pump prices of petroleum products and needs to be studied.

Notably Mabro (2005) focused on oil price regimes, origins and assessment and, though the study gives the reader useful insights as to the effects of taxes on price volatility, it does not comprehensively look into the issue. The study lacks clarity in terms of the source of data on the relationship between Kenyan tax system and taxes on petroleum product and volatility of the prices of the same products. This is a major concern and studies should be carried out to cover this gap. In addition, the study relies entirely on literature review. This may not give the current status of petroleum products prices volatility and the factors that affect the prices. It is important to make sure that the methodology used in a study like this fulfills the requirements of scientific research and provides a clear picture to the reader of the issues under study.

The study carried out thorough review of literature on prices of petroleum products from 2004-2008 provides useful insights for the current study on oil marketing companies and dealer profit margins as a factor influencing the volatility of oil prices in Uganda. However, a closer look at literature review reveals that though this could be true, the study does not provide empirical data to support this argument. The reader then can only speculate that it is very likely that the lack of fair competition has allowed all oil companies to collude to set high prices in order to keep their profit margins as high as possible.

 

In a study leaning against oil price controls , Taylor and Doren (2005) observed that proponents of regulated pricing of oil products contend that gasoline markets are not competitive; that fat profit margins induce little more supply than might otherwise be induced by healthy but "reasonable" profit margins, and that gasoline profits are largely unanticipated and unearned. This contradicts studies by proponents of oil controls such as Twimukye and Matovu (2009) who are of the view that oil marketing companies are reaping very large profits at the expense of consumers. Similar opinions by oil consumers and interest groups in the Kenya Oil Market led to re-introduction of regulated prices of oil markets in 2010 after persistent increases in prices of oil products were experienced between 2008 and 2010.

In a study on Indian's petroleum sector refined product pricing and refinery investment, Kieran and Dagmar (2010) provided a holistic examination of pricing and investment dynamics in India's downstream petroleum sector. The study focused on the ability of key downstream companies to meet rapidly growing Indian product demand, and the prospective emergence of India as major global refined product exporter, an outcome with considerable potential implications for the evolution of global and regional product markets. The study ended with an examination of product market pricing and observes that petroleum pricing policy is entirely unsustainable in its current form.

The study observed that in order to lessen the burden of dealing with petroleum prices, the Government of India, besides reduction of taxes, was looking into the issue of oil spillage as a factor affecting the volatility of oil prices in the region. This was being looked at in terms of the capacity of the country to have the right storage and distribution facilities to avoid oil losses. According to Kieran and Dagmar (2010) the major issue affecting the pricing of petroleum products is that of taxes. However, the authors observed that the government was exploring the issue of oil spillage as a factor affecting petroleum prices, but admitted that data on the same was minimal. This implied that there was a possibility that oil losses through spillages and operational factors lead to volatility in oil prices though the subject had not been explored.

## 5. Research Methodology

### 5.1 Research Design

Causal research design was used to measure what impact a specific change had on existing norms and assumptions. Most social scientists seek causal explanations that reflect tests of hypotheses. Causal effect occurs when variation in one phenomenon, an independent variable, leads to or results, on average, in variation in another phenomenon, the dependent variable (Bachman, 2007).Causal research is an investigative act which helps to identify the relationship between two variables and determines which variable might be causing certain behavior in the variable being explained.

### 5.2 Research Population

The population of this study comprised of the 65 licensed oil marketing companies as listed on Appendix IV, 600 independent oil dealers, one petroleum lobby group (PIEA), one regulator (ERC), Kenya Pipeline Company, Kenya Petroleum Refineries Limited, National Oil Company of Kenya and Ministry of Energy and Petroleum all of whom play different roles in the Petroleum industry of the Energy sector in Kenya. The population of this study comprised of the 65 licensed oil marketing companies as listed on Appendix IV, 600 independent oil dealers, one petroleum lobby group (PIEA), one regulator (ERC), Kenya Pipeline Company, Kenya Petroleum Refineries Limited, National Oil Company of Kenya and Ministry of Energy and Petroleum all of whom play different roles in the Petroleum industry of the Energy sector in Kenya. The population was as shown on table 1.

### 5.3 Sampling Technique

The sampling technique to be followed in this study was stratified random sampling. Stratified random sampling is a sampling technique that involves the division of a population into smaller groups known as strata. In stratified random sampling, the strata are formed based on members' shared attributes or characteristics. A random sample from each stratum was taken in a number proportional to the stratum's size when compared to the population. These subsets of the strata are then pooled to form a random sample. From the population on table 1, a total of 96 respondents were sampled as shown on table 2.

### 5.4 Data Collection Tool

A self-administered questionnaire and face-to-face standardized interview schedules were the two principal tools of primary data collection. The choice to use questionnaires was based on the fact that they can be sent to a large number of people and thus save the researcher time and money. Secondary data was obtained mostly from the relevant internet sites including ERC website for monthly published price press releases and world oil price data, tax rates from KRA websites, exchange rates and interest rates from CBK web sites.

 

### 5.5 Pilot Testing

Creswell (2003) states that the size of a sample to be used for pilot testing varies depending on the time, cost and practicability, but would tend to be between 5-10 per cent of that of the main survey. The exercise targeted at least one respondent from each stratum by discretion and sampled up to 10 respondents. These respondents did not participate in the final research and therefore the findings of the study were free of redundancy.

### 5.6 Data Analysis

The model used in this study was comparable to the one used by King, Deng and Metz (2012). Using an econometric model, the study regressed the monthly percentage change in the ERC pump prices on a set of variables, identified from the literature, that typically explain movements in the retail prices of petroleum products. The model takes the form at time t:

$Yt = \beta 0 + \beta 4(REG)\ t + \mu$

Where, Yt denoted the average percentage change in price of a particular oil product in a given month t, REG is a vector of Regulatory Costs. In addition, determinants of volatility in oil prices that were not specifically covered were considered under the random error term (μ).

At time t-1, the model takes the form:

$Yt\text{-}1 = \beta 0 + \beta 4(REG)\ t\text{-}1 + \mu$

This model form is important as Granger causality test was developed for analysis of the effect of one time series on another one, thus each test is between two time series (Bahadori & Liu, 2012). In this study, the test was between cause and effect of price changes between any two periods, thus any two months. This model was extended to different time frames divided into months as prices are revised on a monthly basis in Kenya and started with the most recent month as t and going back by referring to the immediate past month as t-1, t-2 and so on. The impact of the various drivers were then tested by comparing the price fluctuations between each two subsequent time periods and the components or drivers that led to such volatility in prices analyzed to establish their effect.

The econometric analysis examined separately the individual role played by each factor determining volatility of oil prices in the period December 2010 to June 2015 following a pattern similar to that applied by King et al (2012) except that the latter examined daily price change factors, while this study examined drivers of monthly price changes in Kenya. The monthly approach was advised by the fact that the price regulator (ERC) determines prices valid for a month unlike in the world stage where daily price changes are applied. December 2010 was selected as the start period because it coincides with the time when price cap regulations were introduced in Kenya by ERC. The study period was considered adequate to help arrive at conclusions that can be applied over longer periods as it comprised of 55 months of regulated pricing and hence trends can be developed.

The study followed Granger causality analysis to model the relationship between the explanatory variables and a response variable by fitting a non-linear equation to observed data. Every value of the independent variable (REG) was associated with a value of the dependent variable Y. The regression line described how the mean response changes with the explanatory variable. The observed value for Y varied about their means and was assumed to have the same standard deviation. The fitted values (REG) estimated the parameters of the population regression line. Since the observed values for Y may vary about their means, the multiple regression model included an error term **μ** for this variation. The error term **μ** in a regression model captures the effect of factors that have not been included in the model.

This study employed Granger causality tests to analyze the lead and lag relations among oil prices in a multivariate system. Granger causality analysis (GCA) is a method for investigating whether one time series can correctly forecast another (Granger, 1969).The Granger causality requires a prior knowledge about the maximum lag and is suitable for time series studies (Bahadori & Liu, 2012).

Tests for stationarity were also performed in line with the approach taken by King et al (2012). According to Challis and Kitney (1991) Stationarity, is defined as a quality of a process in which the statistical parameters (mean and standard deviation) of the process do not change with time. The most important property of a stationary process is that the auto-correlation function (ACF) depends on lag alone and does not change with the time at which the function was calculated.

Correlations between the independent variables were also tested in the same way as in a recent study (Chen, Hamilton, Thomason, Gotlib, Saad & Cox, 2009) that use signed path coefficients to perform t-test at group level statistics. King et al (2012) also employed Granger causality tests to analyze the lead and lag relations among oil prices in a multivariate system and estimate a vector error correction model (VECM). The VECM approach is preferred because it allows the researcher to perform a long-run analysis. However, Büyükşahin and Harris (2011) combine it with the Autoregressive Distributed Lag (ARDL) approach. The final step was to run Granger causality tests using stationary variables and draw inferences.

## 6. Research Findings

The number of questionnaires, administered to all the respondents, was 150. A total of 115 questionnaires were

 

properly filled and returned by respondents. This represented an overall response success rate of 77%. Babbie (2004) also asserted that return rates of 50% are acceptable to analyze and publish, 60% is good and 70% is very good.

### 6.1 Reliability Tests

Using Cronbach's Coefficient Alpha test on regulatory costs, a coefficient of 0.784 was found as shown on table 3. These results corroborate findings by Saunders, Lewis and Thornhill (2009) and Christensen, Johnson and Turner (2011) who stated that scales of 0.7 and above, indicate satisfactory reliability. Based on these recommendations, the statements under the regulatory costs variable of this study were concluded to have adequate internal consistency, therefore, reliable for the analysis and generalization on the population.

### 6.2 Sampling Adequacy

To examine whether the data collected was adequate and appropriate for inferential statistical tests such as the factor analysis, regression analysis and other statistical tests, two main tests were performed namely; Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Barlett's Test of Sphericity. For a data set to be regarded as adequate and appropriate for statistical analysis, the value of KMO should be greater than 0.5 (Field, 2000).

Findings in table 4 showed that the KMO statistic was 0.743 which was significantly high; that is greater than the critical level of significance of the test of 0.05 (Field, 2000). In addition to the KMO test, the Bartlett's Test of Sphericity was also highly significant (Chi-square = 128.636 with 6 degree of freedom, at $p < 0.05$). The results of the KMO and Bartlett's Test are summarized in table 4. These results provide an excellent justification for further statistical analysis to be conducted.

### 6.3 Unit Root Tests

Unit root testing using the Augmented Dickey-Fuller (ADF) approach was conducted in order to establish whether the data set was stationary. The key objective in testing for stationarity was to ensure that the variables revert back to their mean even when there are shocks. The variables were first tested for stationarity at levels using the data set as collected. The variables were found to be non-stationary as their p-values were greater than the critical p-value of 0.05. These results are displayed in table 5.

Because the tests to be run on the data require the variables to be stationary, the variables were first differenced and a unit root test was then run on the differenced series, consistent with the guide given by Hyndman and Athanasopoulos (2013). The results of these unit root tests after the first difference are indicated in table 6. The p-values reported indicate the variables are stationary after first differencing and indicating that the series was integrated of order one.

The results show that, in all cases, the p-value is below the critical value at 5% level of significance; thus, the study rejected the null hypotheses that the differenced variables had unit roots and accepted the alternate hypothesis that the variables are stationary. This result meant that after the first difference the variables could now be subjected to granger causality and regression analysis as stationarity had now been established to exist. The null-hypothesis for an ADF test is that the data are non-stationary. So large p-values are indicative of non-stationarity, and small p-values suggest stationarity.

### 6.4 Pairwise Granger Causality Tests

The Granger causality testing is a widely used methodology for inferring the causation between variables in regression analysis (Zhang &Liu, 2014). The study used pairwise granger causality tests to test the null hypotheses that the dependent variable does not Granger-cause an independent variable and vice versa for each of the variables. The study applied the decision rule, as given by Zhang and Liu (2014), that where the value of the F-statistic is low and the probability value (p-value) is high, researchers should reject the null hypothesis and where the F-statistic is high and the probability value is low, researchers should accept the null hypothesis to interpret these results. The results of these tests are displayed in table 7, where changes in regulatory components Granger-cause changes in pump prices but changes in pump prices do not Granger-cause changes in regulatory costs. This unidirectional cause and effect result is expected as indeed regulation is meant to tame pump prices and not vice versa.

### 6.5 Factor Analysis

Factor analysis was conducted after successful testing of validity and reliability using KMO coefficient and cronbach alpha results. Factor analysis was conducted using Principal Components Method (PCM). The extraction of the factors followed the Kaiser Criterion where an eigen value of one or more indicates a unique factor. Total variance analysis indicates that the four statements on regulatory costs can be factored into one factor. The total variance explained by the extracted factor is 61.19% as shown in table 8.

Table 9 shows the factor loadings for regulatory costs. All the statements attracted coefficients of more

 

than 0.4 hence all the statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate.

### 6.6 Descriptive Analysis

The objective of the study was to establish the effect of price regulation on the prices of petroleum products in Kenya. Results on table 10 show that 46.1% of the respondents disagreed that taxes on petroleum products affect volatility in pump prices, 59.4% disagreed that profit margins on oil products cause volatility in pump prices, 39.1% disagreed that oil losses affect volatility of pump prices and 60.9% agreed that government protection affects volatility of pump prices. The mean score for this section was 2.93 which indicates that majority of the respondents disagreed that regulatory costs affect the volatility of oil prices.

### 6.7 Relationship between Regulatory costs and Oil Pump Prices

Table 11 shows the correlation results which indicate that there was a positive and significant relationship between regulatory costs and oil prices. This was evidenced by the p-value of 0.000 which is less than that of critical value (0.05).

### 6.8 Overall Model Estimation

The overall model significance was presented in table 12. An F-statistic of 47.772 indicated that the overall model taking account of all explanatory variables was significant. The findings imply that the explanatory variables were statistically significant in explaining volatility of oil pump prices in Kenya. The results imply that regulatory costs were statistically significant in explaining volatility of pump prices in Kenya.

## 7. Summary of Findings

The objective of the study was to establish the effect of regulatory component on the prices of petroleum products in Kenya. Results of both primary and secondary data analysis indicated that regulatory costs were key drivers of oil prices volatility. This was evidenced by granger causality test results and the responses from the respondents who disagreed that taxes on petroleum products affect volatility in prices of petroleum product prices in Kenya, profit margins on oil products cause volatility in prices of petroleum products in Kenya, oil losses affect volatility of oil prices in Kenya and protection of government controlled oil companies affects volatility of oil prices in Kenya. Regression and correlation results indicated that there was a no significant relationship between regulatory costs and volatility of oil petroleum products. This was, however, attributed to the visible volatility of regulatory costs over the study period and this study observes that a study in a period of more volatility in regulatory costs could indeed arrive at different results. The findings imply that regulatory costs were not statistically significant in explaining volatility of oil pump prices in Kenya for the period of this study.

## 8. Conclusions

The study concluded that regulatory costs were mostly stable and did not cause volatility in pump prices. The study further concluded that the pump pricing of petroleum products in Kenya is volatile and complex, and regulated by more than one government body. Few of the Oil Marketing companies operating in Kenya are well developed with the exception of the four international conglomerates that dominate the sector. The study observed that the oil sector supply chain is very important in ensuring volatility of pump prices of petroleum products.

The study findings indicate that the world witnessed a high volatility of oil prices over the study period (2010 to 2015). Another finding is that Petroleum Taxes comprise a huge component of the oil price of between 30 and 50% depending on international oil pricing and so the government should streamline its taxation regulation to ensure that taxes do not lead to very high prices. The indirect impact of the requirement that petroleum taxes be paid at the point of product entry, and its financing implications further complicates the impact of taxes on prices of petroleum products as this factor was not part of this study.

The study also concludes that since taxes in Kenya are a fixed component of up to Kshs 35 per litre, price trends in Kenya cannot directly follow trends in the world. This means that even if the world prices fell to zero, there would be a fixed tax element in Kenya.

## 9. Recommendations

The study recommends that in order to lessen the burden of dealing with petroleum prices, the government should consider reduction of regulatory costs (petroleum taxes and profit margins) and also look into the issue of oil losses. This should be looked at in terms of the capacity of the country to have adequate storage and distribution facilities to avoid oil losses and to be able to stock enough products in periods when world oil prices are low that are then released to the market in periods when oil prices are high thus creating a stabilization effect.

The government should streamline its taxation regulation to ensure that excise and value-added taxes do not amount to hefty imposition on oil companies who pass the same onto consumers. The indirect impact of the

 

requirement that petroleum taxes be paid at the point of product entry, as its financing implications mainly complicates the impact of taxes on prices of petroleum products.

With the current fuel price regulation, oil marketing companies' and dealers' margins are guaranteed. However, the government in collaboration with oil marketing companies needs to check whether ERC's pricing formula caters for all applicable costs. This will determine whether lack of price volatility in Kenya is due to an ineffective pricing formula as the study found that changes in pump prices in Kenya are not fully aligned to international price trends.

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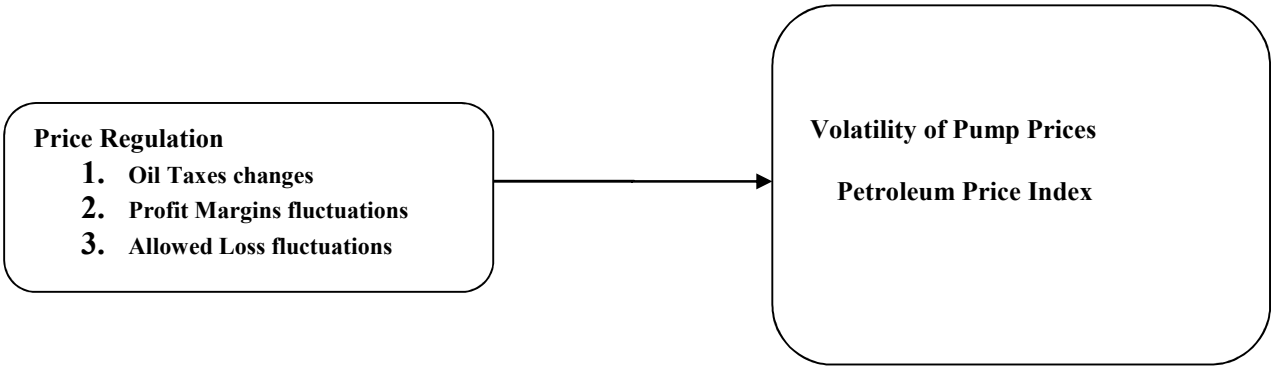


**Figure 1: Conceptual Framework**

**Table 1: Population**

| Category | Target respondents | Target Population | % of Total Population |
|---|---|---|---|
| **OMCs** | Supply & Sales Managers | 65 | 9.490 |
| **Oil Dealers** | Dealers & Managers | 600 | 87.590 |
| **ERC** | Regulatory Officials | 1 | 0.146 |
| **NOCK** | Supply & Sales Managers | 1 | 0.146 |
| **MOEP** | Office of the Permanent Secretary Head of Oil Sector | 6 | 0.876 |
| **KPC** | Supply & Distribution Managers | 6 | 0.876 |
| **KPRL** | Supply & Distribution Manager | 5 | 0.730 |
| **PIEA** | Managing Director | 1 | 0.146 |
| **Total** | | **685** | **100.000** |

Source: Ministry of Energy (2013)

 

**Table 2: Sample Size**

| Category | Target | Sample |
|---|---|---|
| **OMCs** | General Managers | 10 |
| | Supply/Distribution Managers | 10 |
| | Finance Managers | 10 |
| **Oil Dealerships** | Oil Dealers | 60 |
| **ERC** | Regulatory Officers | 1 |
| **NOCK** | Supply/Distribution Managers | 1 |
| **MOEP** | Ministry Officials | 1 |
| **KPC** | Supply /Distribution Manager | 1 |
| **KPRL** | Supply/Distribution Manager | 1 |
| **PIEA** | General Manager | 1 |
| **Total** | | **96** |

**Table 3: Reliability Test for Regulatory costs**

| Variable | Regulatory costs |
|---|---|
| Cronbach's Alpha | 0.784 |
| N of Items | 4 |

**Table 4: Regulatory costs KMO Sampling Adequacy &Bartlett's Sphericity Tests**

| | |
|---|---|
| Kaiser-Meyer-Olkin Measure | 0.743 |
| Bartlett's Chi- Square | 128.636 |
| Bartlett's df | 6 |
| Bartlett's Sig. | 0.000 |

**Table 5: Unit Root Test for Variables at levels**

| Null Hypothesis | T-Statistic | Prob.* |
|---|---|---|
| Price Regulation Factors have a unit Root | -1.55 | 0.50 |

**Table 6: Unit Root Test Results for Variables after First Differencing**

| Null Hypothesis | Observations | t-Statistic | p-value | Result |
|---|---|---|---|---|
| First difference regulatory components have a unit root | 52 | -7.739 | 0.000 | Stationary |

**Table 7: Pairwise Granger Causality Tests**

| Null Hypothesis: | F-Statistic | Prob. | Decision |
|---|---|---|---|
| Regulatory costs do not Granger-cause pump prices | 4.793 | 0.01 | Reject Ho |
| Pump prices do not Granger-cause Regulatory costs | 1.061 | 0.35 | Accept Ho |

**Table 8: Regulatory costs Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.448 | 61.19 | 61.19 | 2.448 | 61.19 | 61.19 |
| 2 | 0.703 | 17.568 | 78.758 | | | |
| 3 | 0.503 | 12.571 | 91.33 | | | |
| 4 | 0.347 | 8.67 | 100 | | | |

Extraction Method: Principal Component Analysis.

**Table 9: Factor Loading for Regulatory costs**

| Statement | Factor Loading |
|---|---|
| Taxes on petroleum products cause volatility and/or affect volatility of prices of petroleum product prices in Kenya | 0.785 |
| Profit margins on oil products cause volatility and/or affect volatility of petroleum products prices in Kenya | 0.855 |
| Oil losses cause volatility and/or affect volatility of oil prices in Kenya | 0.757 |
| Protection of government controlled oil companies cause volatility and/or affect volatility of oil prices in Kenya | 0.726 |

Extraction Method: Principal Component Analysis.

 

**Table 10: Regulatory costs Descriptive Analysis**

| Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Likert Mean |
|---|---|---|---|---|---|---|
| Taxes on petroleum products cause volatility and/or affect volatility of oil pump prices | 13.9% | 32.2% | 8.7% | 26.1% | 19.1% | 3.04 |
| Profit margins on oil products cause volatility and/or affect volatility of oil pump prices | 22.5% | 36.9% | 16.2% | 19.8% | 4.5% | 2.47 |
| Oil losses cause volatility and/or affect volatility of oil pump prices | 10.4% | 28.7% | 25.2% | 24.3% | 11.3% | 2.97 |
| Protection of government controlled oil companies causes volatility and/or affects volatility of oil pump prices | 18.2% | 8.2% | 12.7% | 52.7% | 8.2% | 3.25 |
| Average | 16.3% | 26.5% | 15.7% | 30.7% | 10.8% | 2.93 |

**Table 11: Relationship between Regulatory costs and Oil Prices**

| Variable | | Average Prices | Regulatory costs |
|---|---|---|---|
| Average Prices | Pearson Correlation | 1 | |
| | Sig. (2-tailed) | | |
| Regulatory costs | Pearson Correlation | 0.501 | 1 |
| | Sig. (2-tailed) | 0.000 | |

**Table 12: Overall Model Estimation**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | 55.363 | 3.631 | | 15.249 | .000 |
| | Regulatory Costs | -.618 | 1.253 | -.051 | -.494 | .623 |

| F | Sig. | R | R Square |
|---|---|---|---|
| 47.772 | .000[b] | .829[a] | .687 |

a. Predictors: (Constant), Regulatory Costs