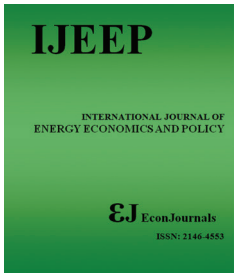


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2015, 5(2), 540-549.

Fuel Subsidy Reform and Environmental Quality in Nigeria

Opeyemi Akinyemi[1]*, Philip O. Alege[1], Oluseyi O. Ajayi[2], Lloyd Amaghionyeodiwe[3], Adeyemi A. Ogundipe[1]

[1]Department of Economics and Development Studies, Covenant University, Ota, Ogun State, Nigeria, [2]Department of Mechanical Engineering, Covenant University, Ota, Ogun State, Nigeria, [3]Department of Accounting and Finance, York College, City University of New York, New York, USA. *Email: opeyemi.akinyemi@covenantuniversity.edu.ng

ABSTRACT

The study examines the existence of a long run effect of fuel subsidy reform on environmental quality in Nigeria for the period of 1970-2012 using the Johansen and the Engle–Granger two step co-integration procedure techniques. The study developed a three case scenarios including: (i) A case of subsidy payment, (ii) a case of effective subsidy and, (iii) a case of no subsidy payment. Findings from the study supported evidence of a long run sustainable equilibrium model. Also, our estimation results showed that the first and the last case scenario do not significantly influence environmental quality. This implies that subsidy payment in Nigeria does not enhance access and consumption of liquid fuel. On the other hand, the interaction of sound regulatory framework with subsidy payment (the case of effective subsidy) significantly exerts a responsive influence on environmental quality.

Keywords: Subsidy Reform, Environmental Quality, Climate Change, Johansen Cointegration
JEL Classifications: H23, Q51, Q54

1. INTRODUCTION

Energy is an integral component of any economy's growth and development. It serves as a key input for production, cooking, heating, refrigerating vaccines in hospitals and propelling engines in cars and industries. Industries and households require energy to enhance overall economic growth and development. Nigeria is blessed with abundance of energy resources ranging from crude oil to natural gas. Since the discovery of oil in 1953, oil had been a major source of revenue for the government (Isihak and Akpan, 2012). Oil accounted for more than 90% of exports in Nigeria, contributed about 40% to gross domestic product (GDP), forms 95% of foreign exchange earnings and 70% of government revenues (Ezirim et al., 2010). The important role and contribution of energy to the economy thus makes energy access an important objective to be achieved by governments. Government attempts to do this primarily by regulating energy prices so as to absorb the shock of rises in international oil prices for households. In Nigeria and most oil-producing countries, the energy sector is regulated by government through controls over pricing, supply and investment (Nwachukwu and Chike, 2011). The abundance of energy resources in oil-producing countries makes government introduce energy subsidies as a means for redistribution of wealth.

Petroleum subsidies were introduced in Nigeria in the 1960s to ensure overall increase in social welfare aimed at assisting the poor to utilize resource advantages of the country (Isihak and Akpan, 2012). It was essentially in the form of implicit subsidies where the demand and supply is subjected to a subsidy and price fixing effect (Adagunodo, 2013). Since its establishment in 2003, the Petroleum Products Pricing Regulatory Agency calculates the amount of subsidies to be paid to importers. This subsidy represents the difference that government pays between domestic fuel pump price and the international fuel price, after calculating for landing cost, distribution cost, and others. The objectives of this fuel subsidy as a policy ranges from economic objectives such as the strengthening of industrial growth and expanding domestic consumption; to welfare objectives such as expansion of energy access for poor households and then to political considerations in terms of distribution of oil rents in resource endowed countries. However, despite these objectives, energy subsidies have some negative effects on the economy. In addition to being wasteful and inefficient, they also frustrate efforts at tackling climate change. In

Nigeria for instance, fuel subsidies distort the market, encourage smuggling activities, hinder investment plans in the energy sector and enhance corrupt practices.

These negative consequences coupled with the fact that they often do not achieve the objectives they are set for, has led to global efforts to eliminate or reform these subsidies. The realization that these subsidy payments are not sustainable in the long run, inhibit adequate investment in the energy sector and hinders efforts at tackling climate change made different countries to begin conscious efforts at reforming fuel subsidies. The unsustainable argument of fuel subsidy originates from the decline in oil revenue for many oil-producing countries due to falling international price and the increase in the price for refined fuel. According to Isihak and Akpan (2012), subsidies in 2006 was US$2.03 billion (1.4% of GDP) with GDP of US$112.25 billion, increased to US$2.3 billion (1.3% of GDP) with a GDP of US$145.43 billion in 2007 and rose significantly to US$5.37 billion in 2010 with a GDP of US$169.48 billion which Adenikinju (2009) attributed to rising oil price, depreciating exchange rate and increasing demand. This and a number of other issues have led to conscious efforts worldwide to reassess the subsidy issue. This is evident in reform efforts of many regions such as the Arab, Middle East and North Africa, Asia, the Organisation for Economic Co-operation and Development (OECD), International Energy Agency (IEA), International Monetary Fund (IMF) and the World Bank (IEA, 2011; Lin and Jiang, 2011; Fattouh and El-katiri, 2012; Anand et al., 2013).

Efforts at addressing this issue of subsidies have been on its adequate reform. Consequently, different countries have taken steps at reforming the structure and nature of energy subsidies, especially oil-exporting countries. Nigeria is one of these countries. Others include Saudi Arabia, Indonesia, China, and so on. Nigeria's President, Goodluck Jonathan, announced on January 01, 2012 the removal of fuel subsidies owing to some of the negative effects of fuel subsidies as highlighted above. This translated to an increase in fuel pump prices from ₦65 to ₦140. That decision was, however, met with stiff opposition and resistance, especially from the civil society, non-governmental organizations and organized labor unions. The 2 weeks nationwide protest that followed the announcement resulted in the Federal Government reversing the policy to a partial removal. This brought the fuel price down to ₦95 from ₦140. In addition to this, the government instituted the Subsidy Reinvestment and Empowerment Program (SURE-P) to provide programmes and facilities that will serve as social safety net for poor households who were most vulnerable to the policy change. The SURE-P programme was designed to utilize the funds saved from subsidy payment in infrastructural development projects. This includes improved road networks, railway system, mass transit, skill acquisition, employment generation, transfer payments, and so on.

Given the debate generated by the call for the reform of fuel subsidies, there had been attempts at examining how these energy subsidies impact the economy. The aim had been essentially on educating the citizens on the urgent need to reform the nature of these subsidies. These impacts are often assessed based on the economic, social (welfare) and environmental implications. The economic cost considers the fiscal burden of large and increasing subsidy payment on the economy. There is evidence suggesting that about US$750 billions of public funds are being spent every year to support the consumption and production of fossil fuels (IEA, OPEC, OECD, World Bank Joint Report, 2010). These large payments divert economic resources from priority sectors such as health, education and infrastructure. The social dimension analyses how the reform of fuel subsidy impacts the welfare and income level of poor households, especially as subsidies are targeted at protecting them from international oil price shocks. The reform of fuel subsidies thus always elicit concerns on how poor households would be affected. There is the political economy of fuel subsidies that considers the politics that surrounds the introduction of subsidies and the opposition that follows the removal. The understanding of this dimension of fuel subsidy is essential but is not the focus of this study.

The third impact of fuel subsidy is the environmental consequences. This examines how subsidies targeted at fossil fuel impacts environmental quality. Fossil fuel is classified by OECD as an environmentally harmful subsidy which deteriorates the environment thereby reducing the environmental quality. Increasing greenhouse gas (GHG) emissions coupled with the need to curb climate change impact, has led to the renewed and increasing efforts at examining some existing policies that may seek to encourage the production or consumption of fuel subsidy in any form (Koplow and Dernbach, 2001). This is because these policies can hamper efforts at tackling environmental problems such as global warming and climate change. Subsidizing energy prices makes fuel cheaper, more of it is consumed and this deteriorates the environment through increased emission of GHG. As pointed out by Koplow and Dernbach (2001), subsidy on fossil fuel is estimated to contribute more than 90% of gross GHG emissions. In the same way, Jones (2011) asserted that a conservative estimate of about US$550 billion of fuel subsidy in major developing countries in 2008 was found to raise global GHG emission by 5-10%. Also, fuel subsidy contributes to damaging the environment through its effect on marginal investment in new capacity (Holton, 2012). This is because they are considered obstacles to green investment and development of efficient low-carbon economy. This is supported by Porter (2002), Pearce (2002) and Morgan (2007) which suggests that subsidies targeted at traditional energy sources hinders investment in new cleaner technology. This tends to lock in existing technology and repress the commercialization and development of renewable energy such as wind and solar energy.

This concern about how fuel subsidy may hamper efforts at tackling climate change, made researchers to seek to assess the level of emissions capable of being reduced from the reform of fuel subsidies. This is in terms of viewing the policy a tool for the mitigation of climate change. There is a consensus that emissions will be curtailed if fuel subsidy is adequately reformed. However, many of these studies are for developed countries and other emerging economies. This study will attempt to answer the find out if this relationship exists empirically for Nigeria. In other words, it will examine the existence of long run relationship between fuel subsidy and environmental quality in Nigeria and possibly the direction of causality. It will seek to answer the question; does fossil fuel subsidy promotes deterioration of the environment?

The outline of the paper will be as follows: section two examines issues in the literature; section three presents some stylized facts; section four discusses the methodology and results while section five is the conclusion and recommendation.

2. BRIEF OVERVIEW OF LITERATURE

In empirical literature, subsidies could be producer or consumer subsidies. Subsidies aimed at consumers are generally intended to keep fossil-fuel prices low, in order to stimulate certain sectors of the economy or alleviate poverty, by expanding the population's access to energy (Sanders and Schneider, 2000; Morgan, 2007). These subsidies usually take the form of price controls and can involve large price gaps. While subsidies aimed at producers generally keep costs of production lower or increase revenues, their effect is to keep marginal producers in the business (Sanders and Schneider, 2000). These subsidies can also be motivated by the desire to reduce import dependency (European Environment Agency, 2005). Production subsidies are more common in developed countries while consumer subsidies are prevalent in developing and oil-producing countries.

A considerable number of studies have analyzed the issues of petroleum pricing and how it significantly impacts the economy especially the economic and welfare consequences (Birol et al. (1995); Iwayemi and Adenikinju (1996); Gupta et al. (2002); Hossain (2003); UNEP (2003); Coady et al., (2006); Adenikiju (2009); Ellis (2010); IEA, OPEC, OECD and World Bank (2010); Widodo et al., (2012); Adenikinju and Omenka (2013); Davis (2013); Anand et al. (2013); Abraham, (2013); Siddig et al., (2014) and so on). These studies argued that fuel subsidy distorts market price, results in waste and inefficient level of consumption. It also exerts significant fiscal burden on the economy as large payments that could otherwise be used to develop priority sectors such as education and health care are diverted to service fuel subsidy annually. According to Adagunodo (2013), energy subsidies send false price signal that encourages overuse of resources, hinders he development of substitutes which are more environmentally friendly, discourage private investment in refineries and divert scarce financial resources from other social purposes. Thus, the adequate reform of this form of subsidies will enhance the growth and development of an economy in the long run. The reform might impose economic hardship in the short run but will promote development in the long-term. However studies such as Amegashie (2006) argued that fuel subsidies do not necessarily have to result to wastefulness and inefficiency. The study used economic theory to explain how it can infact lead to enhanced productivity.

In addition to analyzing economic and welfare impact, the environmental consequences are also often assessed. This seeks to identify how fuel subsidy influences environmental quality and promotes its deterioration. Studies centered on the global economy and other countries such as Larsen (1994); Larsen and Shan (1992); OECD (1998); Koplow and Dernbach (2001); Pieters (2002); Porter (2002); Guiyang (2007); Morgan (2007); Shafie-Pour and Farsiabi (2007); Ellis (2010); Koplow (2010); Jones (2011); Holton (2012); Oil Change International (2012); Hong et al. (2013); Whitley (2013), among others attempted to analyze how environmentally harmful subsidies (EHS) such as fossil fuel subsidies in different countries will have significant impact on the environment.

The relationship between energy subsidies and the environment has strong policy implications for government in terms of ensuring environmental sustainability globally. Fossil fuel subsidy represents a unique problem that unites economists and environmentalists (Holton, 2012). In the last few years, policy direction has shifted towards the reform or elimination of subsidies, particularly fossil fuel subsidies. Pieters (2002) opined that the removal or reform of subsidies to improve the environment had been high on the international political agenda since the early nineties while the OECD (2008) report stated that support for the removal of fuel subsidies might lead to significant improvements in environmental quality. The United Nations also included the achievement of environmental sustainability as the seventh goal of the millennium development goals. According to UNEP (2008), the environmental effects of energy subsidies are complex. They can be positive or negative depending on the precise nature of the subsidy and energy source. Subsidies that result in a lower price to end users normally increase the consumption of the respective fuel and thus, inevitably have harmful impacts on the environment. Furthermore, it stated that subsidies, often lead to increased level of consumption and waste, exacerbating the harmful effects of energy use on the environment. As such eliminating EHS must play a central role in national efforts to achieve a long-term transition to a truly sustainable energy system that is secured and clean for the environment.

In two separate studies, Pearce (2002) and Koplow (2009) both concluded that there could be large, long-run environmental costs associated with the subsidies because subsidies for traditional energy sources hamper investment in new cleaner technology and lock in existing technologies. According to Holton (2012), it is important to consider that although removing subsidies would decrease emissions from reduced activity based on fossil-fuel use, increased activity elsewhere could mean the net effect on emissions reductions could be somewhat lower than the direct effect. In line with the potential emissions reductions that could be attained from fossil-fuel subsidy removal, Larsen and Shah (1992) studied world fossil fuel subsidies and global carbon emission. In their study, they used the dynamic general - equilibrium model and 13 non-OECD regions. These are Former Soviet Union, China, Poland, India, South Africa, Czechoslovakia, Mexico, Brazil, Argentina, Venezuela, Indonesia, Saudi Arabia, and Egypt. Their study estimated that world carbon emissions could be reduced by between 5% and 9%. In fact, they concluded that the removal of these subsidies would substantially reduce national carbon emissions in some countries and likewise global carbon emissions by 9%. This is assuming no change in world prices and by 5% accounting for changes in world prices. Welfare gains from subsidy removals worldwide would be more than US$33 billion, assuming no change in world prices, or 15% of total subsidies, even ignoring the benefits from curtailment of GHGs emissions and abatement of local pollution.

Anderson and McKibbin (1997) using the G-Cubed, a dynamic general-equilibrium model of the global economy, asserted that

the gradual removal of production subsidies for coal in the OECD and the removal of distortions to coal markets in developing and transition economies can potentially reduce global emissions of carbon dioxide by up to 8%. This is relative to emissions that otherwise would have been experienced early next century (Anderson and McKibbin, 1997). This environmental gain is achieved with gains in economic efficiency rather than economic costs which represent a win-win outcome for the environment and the economy. The G-Cubed model can take into account possibilities for substitution in production and consumption between products both within and across countries when domestic prices are changed in some or all regions. It assumes the gradual reduction of coal subsidies by 2005 and includes a tax on the environmental damage from coal mining. It considered what would happen if just Western Europe and Japan removed their coal subsidies, if non-OECD countries removed their subsidies and if both OECD and non-OECD countries removed their coal subsidies. It considered terms of trade and international capital movement in its results.

Whitley (2013) investigated the climate impact of fossil fuel subsidies. It posits that these subsidies undermine international efforts at eliminating dangerous change experienced in climatic conditions. This is in addition to the policy failing in benefiting the poor, thus its phase out or reform can create a win-win scenario. This is in terms of eliminating the perverse incentives that drive up carbon emissions, provide a price that will encourage investment in low-carbon energy and reduce pressure on public finances (Whitley, 2013). While Pearse and Finck-Von-Finckenstein (1999) discussed the policy packages for advancing adequate reform of fuel subsidies, Pieters (2008) designed a checklist based on the conditionality of subsidies to support the opinion that removing subsidies could substantially benefit the environment.

In relation to Nigeria, a substantial amount of literature exists on fuel subsidies and its impact on the economy using different methods of analysis. Many of these studies were mainly on the economic and welfare implications of fuel subsidy or its reform in Nigeria. They do not explicitly highlight how fuel subsidy influences environmental quality. For instance, Adenikinju (2000), Iwayemi and Adenikinju (1996), Nwafor et al., (2006), Siddig et al. (2014), among others, using a computable general equilibrium approach, examined petroleum pricing in Nigeria. Other existing study on petroleum products pricing in Nigeria include Adagunodo (2013) who examined petroleum products pricing reform and welfare in Nigeria. Moyo and Songwe (2012) examined the removal of fuel subsidies in Nigeria as an economic necessity and a political dilemma. They concluded that if implemented correctly, the subsidy funds could lead to major development gains for the country. It will also create the space for Nigeria to finally develop refinery capacity and consequently increase its potential revenue from the oil sector and create jobs. Other studies for Nigeria includes Agbedo and Akaan (2012); Balouga (2012); Isihak and Akpan (2012); Oladipo (2012); Onyeizugbe and Onwuka (2012); Onyemaechi (2012); Onyishi et al. (2012); Umar and Umar (2013); Adenikinju and Omenka (2013); Efobi et al. (2013); Ekong and Akpan (2014); Lawal (2014); Nwanne (2014) to mention a few. A few such as Balouga (2012) and Akinwale et al. (2013) assessed the political economy of the removal. However, evidence on the influence of fuel subsidies on the environment is very minimal in Nigeria with the exception of Abraham (2013) that analyses how fuel subsidy policy could be used as a policy for tackling climate change.

3. SOME STYLIZED FACTS

The issue of petroleum product pricing in Nigeria has been a controversial issue as the government tries to increase the prices periodically depending on the government's perception of what the price should be. Over the years, the various regimes in Nigeria at one point in time have tried increasing the pump price of petrol. These attempts had at times, led to extensive public protests and policy reversal in the form of cancellation or reduction of the planned price increases. The trends in petroleum products pricing in Nigeria has a long history and below is an attempt attracting the way governments over the years have removed what it claimed to be subsidies on petroleum products as presented by Adagunodo (2013). The Military Head of State at the time, General Yakubu Gowon increased the fuel price from 6 kobo to 8.45 kobo and in 1976; it was raised to 9 kobo by the late General Muritala's Administration. It then became 15.37 kobo on 1st of October, 1978 and this change was made by General Olusegun Obasanjo. There was another hike on April 20, 1982 when the price became 20 kobo. On March 31, 1986, General Ibrahim Babangida increased pump price of fuel to 39.5 kobo and in April 1988, it was increased to 42 kobo/L. On January 1, 1989, another increase was announced whereby private cars were to pay 60 kobo/L while commercial cars continued paying 42 kobo.

According to Adagunodo (2013), the failure of price discrimination policy led to the announcement of a uniform price of 60 kobo/L on December 19th, 1989. In March 1991, the retail price of fuel was further increased to ₦0.70/L. In November 1993, the pump price became ₦3.25/L and in November 1994 it was raised again to ₦11.00/L. In December 1998, it was increased to ₦30 and again reduced to ₦25. The price was further reduced to ₦22/L on June 2000. On January 1st, 2002, it was again hiked to ₦26/L from ₦22 then increased to ₦40/L on June 23, 2003. There was another increase in price on May 29th, 2004 to N50. This was later increased to ₦65 on August of the same year and hiked to ₦75/L on 27th May, 2007. However, following oppositions, it was reduced to ₦65/L in June 2007. This was sustained till January 1, 2012, when the president announced a new price regime of ₦141/L. After protests in various parts of the country by organized labor and civil societies that led to a shutdown of the economy making the nation loose close to ₦300 billion in the 5 days strike; Government agreed to lower the price to ₦97/L. These fuel price increases and percentage change is presented in Table 1.

Estimating subsidies on energy products (fuel, diesel and kerosene) in Nigeria using the price-gap approach, Isihak and Akpan (2012) observed that subsidies to gasoline (fuel) had the highest amount which runs into billions of US dollars. This is presented in Figure 1. The subsidies on gasoline had been rising steadily for many years, reaching a peak of about US$3 billion in 2010.

Also, it can be observed in Table 2 that Nigeria has the lowest price for fuel in all the selected countries. This further buttresses the point of fuel subsidy opponents that providing subsidies on fuel encourages smuggling activities across the border (countries). These cheaper fuel products are smuggled into surrounding countries where fuel price is higher. Interestingly as pointed out by Isihak and Akpan (2012), Nigeria unlike many of the other countries, despite subsidies, have tax element in their retail price.

Also Figure 2 presents a graphical illustration of subsidy payments and trend of carbon dioxide emission in Nigeria from 1970 to 2010. The graph shows a seemingly co-movement between payments on fuel subsidy during this period and liquid fuel emissions.

Table 1: Trend in fuel prices in Nigeria

Date	Prices	% change
January 1973	0.095	-
September 1978	8.9	8447.2
October 1978	15.5	73.9
April 20 1985	0.20	31.0
March 31, 1986	0.395	97.5
April 10, 1998	0.42	9.0
January 1, 1989	0.40*	43.0
December 19,1989	0.60**	43.0
March 6, 1991	0.70	16.6
November 08, 1993	5.0	614
November 22, 1993	3.25	−35.0
October 2, 1994	15.0	361.5
October 4, 1994	11.0	−26.67
December 20, 1998	25.0	127.0
January 6, 1999	20.0	−20.00
June 1, 2000	30.0	50
June 8, 1999	25.0	−16.67
June 13, 2000	22.0	−12.0
January 1, 2002	26.0	18.2
June 20, 2003	40.0	53.0
July 9, 2003	34.0	−2.40
October 1, 2003	38.59 and 42.00	23.53
May 29, 2004	49.90	16.67
September 2004	53.0	8.16
September 2005	65.0	22.64
May 27, 2007	70.0	7.6
June 2007	65.0	−7.6
January 1, 2012	141.0	116.9
January 8, 2012	97.0	−31.2

Source: Adapted from Adagunodo (2013). *For commercial users and buyers, **For all vehicles

Table 2: Petroleum product prices in selected countries in US$ per liter

Country	Retail fuel price	Price per litre in US$			Tax as percentage of gasoline retail price
		Gasoline	Kerosene	Diesel	
Cameroon+	Ad-hoc	1.07	0.68	1	-
Gabon*	Ad-hoc	0.91	0.48	0.71	43.2
Ghana+	Automatic	0.92	0.69	0.83	47.5
Kenya+	Liberalized	1.04	0.74	0.9	26.6
Nigeria*	Ad-hoc	0.51	0.42	113	None
India+	Ad-hoc	1.04	0.2	0.71	55.1
Philippines+	Automatic	0.73	0.7	0.66	25.9
Russia*	Liberalized	0.62	-	0.6	30.8

Source: Isihak and Akpan (2012). +Net oil importer and *Net oil exporter

4. METHODOLOGY

This section presents the model specification, technique of estimation and sources of data for the study. The theoretical framework for the paper is rooted in the environmental Kuznets curve (EKC) hypothesis which posits that countries will experience environmental degradation at early stages of industrialization when income is rising steadily. However, in later stages of growth, this deterioration of the environment due to increased industrial activity will begin to decrease given that countries now have the necessary income level and capacity to clean up the environment. The model will, therefore within this framework, incorporate subsidies on fuel products into the model to test for the hypothesis that these subsidies significantly impact the environment. In testing this effect hypothesis in Nigeria, the study specified a modified version of the theoretical model of Holton (2012).

The modified model is given as follows:

$$CO_2 = f\left(PCI, PCI^2, PDN, OPN, RRQ, SUB\right) \quad (1)$$

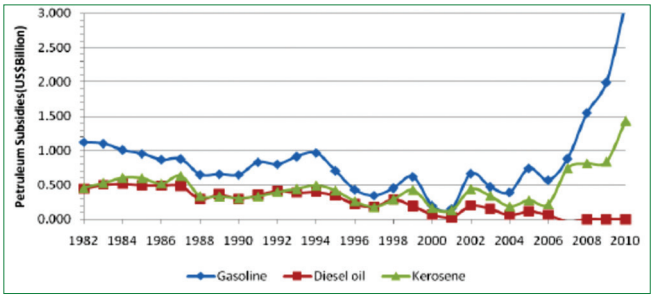
In an econometric form, the model becomes:

$$lnEDG_t = \beta_0 + \beta_1 lnPCI_t + \beta_2\left[ln\left(PCI\right)\right]_t^2 + \beta_3 PDN_t + \beta_4 OPN_t + \beta_5 RRQ_t + \beta_6 SUB_t + \varepsilon_t \quad (2)$$

Where;

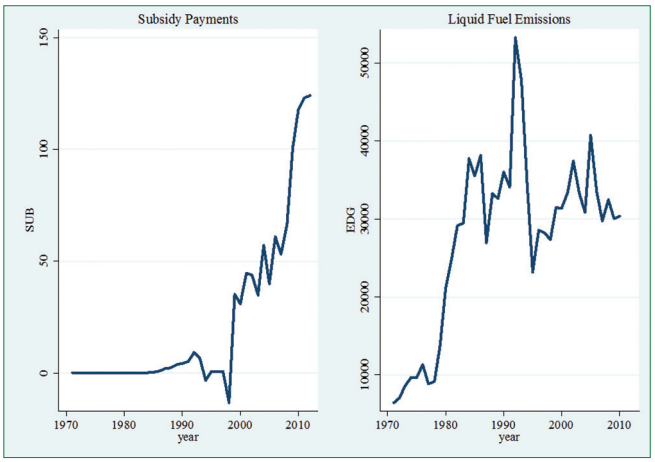
EDG: Emissions from liquid fuel consumption million metric tonnes proxied for measure of environmental damage.

Figure 1: Historical amount of petroleum subsidies in Nigeria (US$ Billion)



Source: Isihak and Akpan (2012)

Figure 2: Trend analysis of fuel subsidy and liquid fuel emissions



PCI: GDP per capita to represent income.
SUB: Fuel price to capture fossil fuel subsidy.
OPN: Trade openness which is the percentage of trade in GDP (X + M)/GDP.
RRQ: Measure of institutional quality.
PDN: Population density.

Income is incorporated in the model given that income plays a role in determining environmental outcomes given the EKC hypothesis (Holton, 2012). The coefficient of income β_1 is expected to be negative as the EKC predicts that income tend to increase environmental damage at lower income levels but starts to decrease at higher income levels. The square of the log of income is due to the fact that growth can increase water and air pollution at initial stages of industrialization but reduces with time given the right institutions. The assumption here is that countries will be able to clean up their environments as they get richer. In the model, the coefficient of interest is the β_3 which is the partial effect of fuel subsidies on environmental quality. The other variables serve as control variables in the model. The coefficient of the squared income is expected negative given the EKC hypothesis such that the pollution curve eventually turns down given the turning point argument (Holton, 2012). The inclusion of institution is because the market does not address externalities by itself, thus the system of government can influence the nature of relationship between subsidies and its impact on the environment hence the inclusion as a control variable (Frankel and Rose, 2005; Holton, 2012). Land area represented by population density is included as a control variable to support the argument that higher population density leads to environmental degradation (Frankel and Rose, 2005).

4.1. Data Sources and Measurement

The data for the study was sourced from the World Development Indicator (WDI) 2013 of the World Bank for the period 1971-2011. The data for the subsidy was a price gap between domestic pump price and international pump price. The data for openness, population density, GDP per capita and liquid fuel emissions were sourced from WDIs while institutional qualities were sourced from World Governance Indicators 2013.

4.2. Technique of Estimation

In an attempt to examine the existence of a long run relationship between fuel subsidies and environmental damage in Nigeria, the study adopts the Johansen co-integration for the technique of estimation. This is done to assess the equilibrium long run relationship in the model and also estimate the error correction mechanism. This will help to obtain the speed of error adjustment in the long run convergence. Finally, the paper test for causality between fuel subsidies and environmental damage to investigate if there is a direction of causality between the two variables. The unit root test was first carried out on all the variables of interest in the model to ascertain if they are stationary or otherwise. This is because most economic variables used for policy analysis and forecasting are characterized by persistence and possibly non-stationary behavior (Akinyemi et al., 2014). The augmented Dickey-Fuller (ADF) unit root test is used to test for the presence of unit root in the series. Then, the long-run equilibrium relationship is assesses using the Johansen co-integration test. This methodology as modified by Johansen and Juselius (1990) gives asymptotic critical values which are used by the maximum eigenvalue and trace test statistics based on a pure unit root assumption (Akinyemi et al., 2014). The ECM is then carried out. It represents a model of time series that estimates the speed of adjustment of the dependent variable back to equilibrium state after a change in any of the independent variables. Lastly, the granger causality test is done to test for the possibility of a pairwise causality of the variables in the model. The results of the estimation are discussed in the next session

5. DISCUSSION OF RESULTS

This aspect focuses on the empirical investigation of the effect of fuel subsidy reforms on environmental quality in Nigeria. The section begins with examining the statistical properties of the time series data and then proceeds into examining the Johansen, and the Engle–Granger two step estimation techniques in an attempt to establish an econometric relationship.

H_0: There is unit root and time series is non-stationary

$$K = 0 \longrightarrow (1 - \Psi) = 0 \quad (3)$$

H_1: There is no unit root and time series is stationary

$$K < 0 \longrightarrow (1 - \Psi) < 0 \longrightarrow \Psi < 1 \quad (4)$$

As indicated in Table 3, all the variables were not stationary at level except the indicator of population density. This implies the existence of unit root at I (0) leading to failure to reject the null hypothesis. This is not unexpected as most economic variables exhibit a very high persistence and non-stationary behaviour. In order to obtain a stationary behavior, the series were subjected to differencing, obtaining stationarity for all the variables at first order of integration, i.e. I (1). Hence, the study rejects the null hypothesis and accepts the alternative of pure unit root processes. This process of differencing the series to obtain stationary series becomes imperative in order to avoid spurious regression and biased estimates that could mislead policy analysis and forecasting. The stationarity procedure adopts a unit root testing based on ADF and Philip-Perron, while the ADF is based on an autoregressive redistributive lags, the Philip-Perron test uses non-parametric statistical methods to take

Table 3: Stationary test

Variables	Unit root test			
	Level		First difference	
	ADF	PP	ADF	PP
EDG	−2.2107	−2.0925	−6.6597	−7.1832
SUB	2.0469	1.6498	−8.0461	−7.9026
PCI	0.2874	−0.2654	−5.3648	−5.5376
PDN	1.8486	21.4273	−0.9056	−0.9112
OPN	−1.5741	−1.5683	−6.6139	−6.6147
RRQ	−1.0238	−2.8608	−16.5922	−21.2110
Critical values (%)				
1	−3.6056	−3.6010	−3.6156	−3.6156
5	−2.9369	−2.9350	−2.9411	−2.2912
10	−2.6069	−2.6069	−2.6069	−2.6091

ADF: Augmented Dickey-Fuller test, using lag length of 1 and SIC maxlag of 9.
PP: Phillip Perron test, bandmoth of 3 (Newey-West automatic) using Bartlett kernel

Table 4: Co-integration test

Johansen and Juselius maximum likelihood co-integration rank test				
Eigen value	**Trace statistics**	**LL**	**CV @ 5% Max.**	**Hypothesized number of CE(s)**
	194.1737	164.572	156.00	None*
0.8229	126.6721	198.323	124.24	At most 1
0.6603	84.5610	219.378	94.15	At most 2
0.5176	56.1349	233.591	68.52	At most 3
0.3662	38.3529	242.483	47.21	At most 4
0.2967	24.6269	249.345	29.68	At most 5
0.2627	12.7416	255.288	15.41	At most 6
0.2198	3.0602	260.129	3.76	At most 7
0.0755		261.659		At most 8
Engle-Granger co-integration residual long-run test				
Variable	**Coefficient**	**Standard error**	**t-statistics**	**CV @ 5%**	***P****
ECM (−1)	−0.9702	0.1661	−6.2080	−2.9411	0.0000
C	−0.0024	0.0312	−0.0769		0.9391
Engle-Granger co-integration residual long-run test (effective subsidy)				
Variable	**Coefficient**	**Standard error**	**t-statistics**	**CV @ 1%**	***P****
ECM (−1)	−0.8456	0.1660	−6.2391	−2.9411	0.0000
C	−0.0025	0.0312	−0.079		0.9372
Engle–Granger co-integration residual long-run test (no subsidy)				
Variable	**Coefficient**	**Standard error**	**t-statistics**	**CV @ 5%**	***P****
ECM (−1)	−0.7241	0.1662	−6.2815	−2.9411	0.0000
C	−0.0021	0.0310	−0.0668		0.9471

Source: Computed using Stata 11.0, *5%

care of the serial correlation in the error terms without adding lagged difference terms.

As contained in Table 4, there exists a unique co-integrating vector at 5% level of significant for the trace statistics; it implies that we obtained a linear combine stationary for the model at unique vector. In accordance to the trace statistics, the Engle-granger technique reveals the existence of long run equilibrium relationship. The relationship holds sway even with our control for effective subsidy and no subsidy scenarios.

Table 5 reveals the result of the long run normalized coefficients. The result indicates the magnitude and pattern of long run equilibrium behaviour of our model. From the readily available results, at the initial stages of development; per capita GDP exerts a significant and positive influence on liquid fuel consumption in Nigeria. This implies that rising household income ultimately culminate into increasing consumption of emission emitting equipment, this is mostly common in the lower rungs of developmental efforts where increasing income is associated with increasing emissions.

Likewise, the study validates the literature strands espoused by Kuznets (1955) and popularized by Grossman and Krueger (1991) as it confirmed the existence of the EKC in Nigeria. This stand is reinforced by the negative and significant coefficient of the per capita income squared. The significant negative relationship between per capita GDP income squared and liquid fuel emissions indicates that, though, emissions is a rising function of income at the early development stages, on reaching a certain threshold, emissions begins to fall with rising income. Our results also reveal a positive relationship between liquid fuel emissions and population density, implying that as a community becomes densely populated, the hope for cleaner environment dwindles. The indicator of economic openness seems to contribute to emissions inversely which imply therefore that, the more economically open a country is, the less susceptible to emissions and likely to enjoy the technological results of the advanced world commitment to reducing emissions[1].

Consequently, subsidy payment does not contribute significantly to liquid fuel emissions in Nigeria. It implies that fuel subsidy - An official price payment to enhance consumption or an official remove of tax of fuel, has not significantly influence the consumption of liquid fuel in Nigeria. This would not be unconnected with the wide elastic capture of economic resources and the elimination of the middle class due to the dismal Nigeria's economic performance. The gradual elimination of the middle class group has led to a sharp distinct between the poor and the rich; while the poor largely depend on traditional biomass/solid fuel for consumption, liquid fuel are mostly consumed by the rich and business outfit[2] whose demand are fairly inelastic. Another likely evidence for the non-significant relation between subsidy and liquid fuel consumption could be premised on ineffective subsidy, as have been largely espoused by available literature. The consumption subsidies in developing Africa economies are highly sabotaged due to weak law enforcing institutions. This has also transcended into fuel subsidy arrangement in Nigeria, as these subsidized contents are secretly diverted into neighbouring countries where they are disposed at the ruling international market price. This diversion creates artificial scarceness in home countries, mostly in rural areas (those whom the subsidy arrangement is meant to benefit) causing pump prices to go as high as twice the official price.

Since Table 5 clearly shows presence of a non-significant inverse relationship between subsidy and emissions from liquid fuel consumption, we attempted to build a scenario for effective subsidy by developing an interaction of a state of sound institutions with subsidy payments through a simple multiplicative procedure. As shown in Table 6, our estimated result remained quite similar to that of Table 5 in terms of magnitude and sign of our parameters except that subsidy payments now significantly contributes (positively) to emissions from liquid fuel consumption. This implies that in a well constructed institutional arrangement, where contracts are legally enforced and rules are binding; subsidy influences the consumption of liquid fuel because the benefits gets to the lowest rung of the population. This arises from the fact that sound institutional arrangement and law enforcement deters the diversion of public goods for private enrichment and as well ensures the apparatus of the state such as

1 A position that has been highly emphasized by the Kyoto protocol and which a number of high technology producing economies have endorsed their commitment.

2 Any fuel increase occasioned by sudden subsidy removal or rise in international oil price are passed to final consumers as price burden in form of indirect taxes on goods and services. This further eliminates the middle class while business outfits suffer minimal impacts.

pipelines are well integrated and safe; in order to ensure transit of liquid fuel to rural areas.

In attempt to build a robust model and further validate the claims shown in Table 6, we also consider the effect of zero subsidy payment by examining the effect of international pump price on liquid fuel consumption. As similarly obtained in the subsidy payment scenario; we likewise found that international pump price does not significantly influence liquid fuel consumption while other relationships and sign subsist under the zero subsidy scenarios. This implies that without sound institutional framework, subsidy payments do not translate into any significant economic benefits for masses (Table 7).

The study estimated the equilibrium vector error correction in an attempt to adjust the disequilibrium in the co-integrating relationship. This is based on the logic that a long run relationship exists and that there are disturbances in the short-run which needs adjustment back to long run equilibrium (Akinyemi et al., 2014).

The coefficient of the error correction mechanism as seen in Table 8 conforms with the theoretical stand, as it is correctly signed (negative), statistically significant and its absolute magnitude being between 1 and 0. It shows that the model has a self-adjusting mechanism for correcting short-run dynamics in the series to their long run path. With the *ECM*(−1) satisfying the rule of thumb, it can be concluded that there exist a long run converging relationship between liquid fuel emissions and its determinants. The *ECM*(−1) reveals that about 21.1% of short run disturbances are adjusted back to equilibrium path in the long run. The speed of error correction tends to be quite low, signifying that short-term errors tend to long lived in the model. The statistical significance at about 10% significance level and magnitude of 21.1% indicates that that a deviation in the model from equilibrium is corrected by 21.1% in the successive period.

6. CONCLUSION AND RECOMMENDATIONS

This study investigates the effect of fuel subsidy as a fiscal policy on environmental quality in Nigeria using a time series data for the period 1970-2012. The study adopts the Johansen and Joselius co-integration technique and the Engle-Granger two step procedure, and found an evidence supporting a unique co-integration relationship and a sustainable long run equilibrium relationship, though immediate shocks tend to be long lived in the model. The study also adopted a three scenario case; first, we considered a case of subsidy payment and discovered that subsidy payment does not significantly influence environment. Secondly, the study considered an effective subsidy payment by developing an interaction of subsidy payment and sound institutional regulatory arrangement; the interacted variable (effective subsidy) exerts

Table 5: Normalized co-integration estimates

Co-integrating coefficient normalized on environmental damage							
DLEDG	**DLPCI**	**DLPCI2**	**DLPDN**	**DLOPN**	**DLRRQ**	**DLSUB**	**C**
1.000000	−96.9535	7.4702	−1.6762	0.2702	−1.9252	−0.0013	317.2098
*P**	0.0000	0.0000	0.0000	0.0000	0.0000	0.660	0.0107
t-statistics	−4.72	4.73	−5.09	6.60	−6.71	−0.44	1.84

Source: Computed by authors using Stata 11.0. Since the Johansen co-integration test assumes all variables as endogenous, the signs of the magnitudes are alternated

Table 6: Normalized co-integration estimates (effective subsidy)

Co-integrating coefficient normalized on environmental damage							
DLEDG	**DLPCI**	**DLPCI2**	**DLPDN**	**DLOPN**	**DLRRQ**	**DLSUB**	**C**
1.000000	−94.055	7.2691	−0.7588	0.2631	−1.0995	−0.0034	298.4693
*P**	0.0000	0.0000	0.029	0.0000	0.0000	0.017	0.0107
t-statistics	−4.87	4.90	−2.19	6.37	−4.88	−2.39	1.84

Source: Computed by authors using Stata 11.0. Since the Johansen co-integration test assumes all variables as endogenous, the signs of the magnitudes are alternated

Table 7: Normalized co-integration estimates (no subsidy)

Co-integrating coefficient normalized on energy production							
DLEDG	**DLPCI**	**DLPCI2**	**DLPDN**	**DLOPN**	**DLRRQ**	**NSB**	**C**
1.000000	−127.2848	9.7844	−1.9465	0.2819	−2.2211	0.0010	420.4536
*P**	0.0000	0.0000	0.000	0.0000	0.0000	0.752	0.0107
t-statistics	−4.86	4.84	−3.98	5.52	−6.06	0.32	1.84

Source: Computed by authors using Eviews 7.0. Since the Johansen co-integation test assumes all variables as endogenous, the signs of the magnitudes are alternated

Table 8: Equilibrium vector error correction

Vector error correction model for energy production							
Variable	**D (DLEDG)**	**D (DLPCI)**	**D (DLPCI2)**	**D (DLPDN)**	**D (DLOPN)**	**D (DLRRQ)**	**D (NSB)**
ECT_1	−0.211	0.1231	1.6016	0.0015	−0.6835	0.0891	1.4219
	(0.0760)	(0.5906)	(0.7710)	(0.0004)	(0.5141)	(0.1261)	(11.001)
	[−2.78]	[2.08]	[2.08]	[3.32]	[−1.33]	[0.71]	[0.13]

Source: Computed by authors using eviews 7.0

a significant influence on environmental damage which stands contrary with the case of subsidy payment. This implies that liquid fuel consumption does not response significantly to variations in subsidy payments unless in a strong and effective institutional framework which ensure that subsided contents are not diverted and its benefits actually trickled down to those intended. Lastly, we evaluated a scenario of zero subsidy by examining the effect of international pump price on environmental damage and found an evidence consistent with our first scenario signifying a non-significant responsive impact of subsidy on liquid fuel emissions in Nigeria.

In the same manner, our evidences confirmed the EKC theory. In the early stages of development, GDP per capita income was a rising function of income while the negative significant parameter of GDP per capita income squared implies an attainment of a threshold where emissions begins to dwindle with increasing income. Likewise, population density enhances the level of environmental degradation while increasing economic openness enables developing economies such as Nigeria to benefits from technological outcomes of the advanced countries commitment in reducing emissions.

Finally, the major thrust of the study centered on the need to develop a sound and effective institutional arrangement, without which subsided consumption expenditure could exert any impact on the welfare of the economy. Thus, it is recommended that government should seek towards the strengthening of institutions and in the absence of this, take away fuel subsidy.

REFERENCES

Abraham, T.W. (2013), Mitigating Climate Change in Nigeria: fuel Subsidy Removal as a Possible Policy Option. USAEE Working Paper No. 13-105. Available from: http://ssrn.com/abstract=2205514.

Adagunodo, M. (2013), Petroleum products pricing reform in Nigeria: welfare effects analysis from household budget survey. International Journal of Energy Economics and Policy, 3(4), 459-472.

Adenikinju, A. (2000), Analysis of Energy Policy in Nigeria: An Application of a CGE Model. Research for Development. Ibadan: NISER.

Adenikinju, A. (2009), Analysis of Energy Policy in Nigeria: An Application of a CGE Model. In: Adenikinju, A., Ajakaiye, O., Decaluwe, B. and Iwayemi, A., editors. Computable General Equilibrium Modelling in Nigeria. Ibadan: Ibadan University Press.

Adenikinju, A. (2009), Energy Pricing and Subsidy Reforms in Nigeria. OECD Conference Centre, Paris 9-10 June 2009. Available from: http://www.oecd.org/dataoecd/58/61/42987402.pdf. [Last accessed on 2014 Jan 25].

Adenikinju, A., Omenka, S. (2013), Fuel subsidy removal in Nigeria: An analysis of dynamic general equilibrium effects. Nigerian Journal of Economic and Social Studies, 55(2), 6-25.

Agbedo, C.U., Akaan, S.S. (2012), Fuel subsidy removal and mind control game in Nigeria: A critical discourse analysis perspective. IOSR Journal of Humanities and Social Science, 6(2), 6-16.

Akinwale, Y.O., Olaopa, O.R., Ogundari, I. and Siyanbola, W.O. (2013). Political economy of phasing out fuel subsidy in Nigeria. Energy and Power, 3(4), 37-43.

Akinyemi, O., Ogundipe, A.A., Alege, P.O. (2014), Energy supply and climate change in Nigeria. Journal of Environment and Earth Science, 4(14), 16-29.

Amegashie, J.A. (2006), The economics of subsidies. Crossroads, 6(2), 7-15.

Anand, R., Coady, D., Mohommad, A., Thakoor, V., Walsh, J.P. (2013), The Fiscal and Welfare Impacts of Reforming Fuel Subsidies in India. IMF Working Paper 128.

Anderson, K., McKibben, W.J. (1997), Reducing Coal Subsidies and Trade Barriers: Their Contribution to Greenhouse Ga Abatement. Seminar Paper 97-07. Centre for International Economic Studies, University of Adelaide: Adelaide, Australia.

Balouga, J. (2012), The political economy of oil subsidy in Nigeria. International Association for Energy Economics Second Quarter, 2012(2): 31-35.

Birol, F., Aleagha, A.V., Ferroukhi, R. (1995), The economic impact of subsidy phase-out in oil exporting developing countries: a case study of Algeria, Iran and Nigeria. Energy Policy, 23(3), 209-215.

Coady, D., El-Said, M., Gillingham, R., Kpodar, K., Medas, P., Newhouse, D. (2006), The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali and Sri Lanka. IMF Working Paper 247.

Davis, L. (2013), The Economic Cost of Global Fuel Subsidies. Hass Energy Institute Working Paper 247.

Efobi, U., Osabuohien, E., Beecroft, I. (2013), The macroeconomic consequences of the black sunday in Nigeria. In: Adibe, J., editor. The Politics and Economics of Removing Subsidies on Petroleum Products in Nigeria. London, Abuja: Adonis & Abbey Publishers.

Ekong, C.N., Akpan, U.F. (2014), On energy subsidy reform and sustainable development in Nigeria. International Journal of Management and Sustainability, 3(4), 186-202.

Ellis, J. (2010), The Effects of Fossil-Fuel Subsidy Reform: A Review of Modelling and Empirical Studies. In The Global Subsidies Initiative Paper Series Titled "Untold Billions: Fossil-fuel Subsidies, their Impacts and the path to Reform. International Institute for Sustainable Development.

European Environment Agency-EEA (2005). Market-based Instruments for Environmental Policy in Europe. EEA Technical Report No 8. Copenhagen.

Ezirim, A.C., Okeke, C.T., Ebiriga, O.T. (2010), Achieving vision 2020 in Nigeria: A review of the economic and market-oriented business reforms. Journal of Sustainable Development in Africa, 12(4), 78-101.

Fattouh, B. & El-Katiri, L. (2012), Energy Subsidies in the Arab World. Arab Human Development Report Research Paper Series.

Frankel, J.A., Rose, A.K. (2005), Is trade good for the environment? sorting out the causality. Review of Economics and Statistics, 87(1), 85-91.

Grossman, G.M., Krueger, A.B. (1991), Environmental Impacts of a North American Free Trade Agreement. NBER Working Paper Series. Working Paper no. 3914.

Guiyang, Z. (2007), Energy subsidy policies and their reform: providing economic incentives for climate change mitigation. Advances in Climate Change Research, 3 Suppl, 92-96.

Gupta, S., Clements, B., Fletcher, K., Inchauste, G. (2002), Issues in Domestic Petroleum Pricing in Oil-Producing Countries. IMF Working paper. Washington.

Holton, C.J. (2012), What are the effects of fossil-fuel subsidies on growth, the environment and inequality? Being a Student Dissertation Presented at the School of Economics, University of Nottingham.

Hong, L., Liang, D., Di, W. (2013), Economic and environmental gains of china's fossil energy subsidies reform: a rebound effect case study with EIMO model. Energy Policy, 54, 335-342.

Hossain, S. (2003), Taxation and Pricing of Petroleum Products in Developing Countries: A Framework for Analysis with Application

to Nigeria. IMF Working Paper WP/03/42.
International Energy Agency (2011), IEA Analysis of Fossil-fuel Subsidies. World Energy Outlook, Paris.
International Energy Agency (IEA), Organisation of the Petroleum Exporting Countries (OPEC), Organisation for Economic Co-operation and Development (OECD) and World Bank Joint Report (2010). Analysis of the Scope of Energy Subsidies and Suggestions for the G-20 Initiative. Prepared for Submission to the G-20 Summit meeting in Toronto, Canada, 26th- 27th June, 2010.
Isihak, S., Akpan, U. (2012), Restructuring petroleum products subsidies: What is the roadmap for Nigeria? Readings in Management Sciences. Vol. 3. Sokoto: Usmanu Danfodiyo University.
Iwayemi, A., Adenikinju, A. (1996), Macroeconomic implications of higher energy prices in Nigeria. Pacific and Asian Journal of Energy, 6(1), 13-24.
Johanse, S., Juselius, K. (1990), Maximum likelihood estimation and inference on co-integration with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210.
Jones, B. (2011), Driving a green economy through fiscal policy and public finance. Journal of International Economics, Commerce and Policy, 2(2), 325-349.
Koplow, D. (2009), Measuring Energy Subsidies using the Price-gap Approach: What does it leave out? Global Subsidies Initiatives of the International Institute for Sustainable Development, Geneva.
Koplow, D. (2010), G20 Fossil Fuel Subsidy Phase-out: A Review of Current Gaps and Needed Changes to Achieve Success. Washington, USA: Oil Change International.
Koplow, D., Dernbach, J. (2001), Federal fossil fuel subsidies and greenhouse gas emissions: a case study of increasing transparency for fiscal policy. Annual Review of Energy and the Environment, 26, 361-389.
Kuznets, S. (1955), Economic growth and income inequality. The American Economic Review, 45, 1-28.
Larsen, B. (1994), World Fossil Fuel Subsidies and Global Carbon Emissions in a Model with Inter-fuel Substitution. World Bank Policy Research Working Paper WPS 1256.
Larsen, B., Shah, A. (1992), World Fossil Fuel Subsidies and Global Carbon Emissions. Background paper for World Development Report, 1992. WPS 1002.
Lawal, Y.O. (2014), Subsidy removal or deregulation: Investment challenge in Nigeria's petroleum industry. American Journal of Social and Management Sciences, 5(1), 1-10.
Lin, B., Jiang, Z. (2011), Estimates of energy subsidies in china and impact of energy subsidy reform. Energy Economics 33, 273-283.
Morgan, T. (2007), Energy Subsidies: Their Magnitude, How they Affect Energy Investment, and Greenhouse gas Emission, and Prospect for Reform. Report by Menecon Consulting for UNFCCC Secretariat Financial and Technical Support Programme.
Moyo, N., Songwe, V. (2012), Removal of Fuel Subsidies in Nigeria: An Economic Necessity and a Political Dilemma. Being an online Brookings Newsletter. Available from: http://www.brookings.edu.research.
Nwachukwu, M.U., Chike, H. (2011), Fuel subsidies in Nigeria: facts of fallacy. Energy, 36, 2796-2801.
Nwafor, M., Ogujiuba, K., Asogwa, R. (2006), Does Subsidy Removal Hurt the Poor? Secretariat for Institutional Support for Economic Research in Africa (SISERA) Working Paper 2.
Nwanne, B. (2014), Government propaganda and the fuel subsidy protests in Nigeria: matters arising. European Journal of Business and Social Science, 2(10), 117-127.
Oil Change International. (2012), Fossil Fuel Subsidies, Climate and the United Nations Framework Convention on Climate Change. An excerpt from: Low Hanging Fruit: Fossil Fuel Subsidies, Climate Finance and Sustainable Development by Oil Change International for the Heinrich Boll Stiftung North America.
Oladipo, S.B. (2012), Subsidy removal and crime effect in Nigeria (a case study of Nyanyan in Abuja): An empirical analysis. International Journal of Humanities and Social Science Invention, 1(1), 2319-7722.
Onyeizugbe, C.U., Onwuka, E.M. (2012), Fuel subsidy reform as an imperative for enhancing business development in Nigeria. VSRD-International Journal of Business and Management Research, 2(9), 454-461.
Onyemaechi, J.O. (2012), Economic implications of petroleum policies in Nigeria: An overview. American International Journal of Contemporary Research, 2(5), 2-19.
Onyishi, A.O., Eme, O.I., Emeh, I.E. (2012), The domestic and international implications of fuel subsidy removal crisis in Nigeria. Kuwait Chapter of Arabian Journal of Business and Management Review, 1(6), 57-80.
Organisation for Economic Co-Operation and Development (OECD). (1998), Improving the Environment through Reducing Subsidies: Summary and Policy Conclusions Part 1.
Pearce, D. (2002), Environmentally Harmful Subsidies: Barriers to Sustainable Development. Being Keynote Address Delivered at the OECD Workshop on Environmentally Harmful Subsidies. Paris, France.
Pearse, D., Finckenstein, F.V.D. (1999), Advancing Subsidy Reform: Towards a Viable Policy Package. Paper Prepared for the Fifth Expert Group Meeting on Financial Issues of Agenda 21.
Pieters, J. (2002). When Removing Subsidies Benefit the Environment: Developing a Checklist based on the Conditionality of Subsidies. Proceedings from PECD Workshop on Environmentally Harmful Subsidies.
Porter, G. (2002), Subsidies and the Environment: An Overview of the State of Knowledge. OECD Workshop on Environmentally Harmful Subsidies.
Sanders, M., Schneider, K. (2000), Removing Energy Subsidies in Developing and Transition Economies. ABARE Conference Paper 14.
Shafie-Pour M.M., Farsiabi, M.M. (2007), An environmental and economic analysis for reducing energy subsidies. International Journal for Environmental Research, 1(2), 150-162.
Siddig, K., Aguiar, A., Grethe, H., Minor, P., Walmmsley, T. (2014), Impacts of removing refined oil import subsidies in Nigeria on poverty. Energy Policy (Article in Press).
Umar, H.M., Umar, M.S. (2013), An assessment of the direct welfare impact of fuel subsidy reform in Nigeria. American Journal of Economics, 3(1), 23-26.
UNEP (2008). Reforming Energy Subsidies: Opportunities to Contribute to the Climate Change Agenda.
UNEP. (2003), Energy Subsidies: Lessons learned in Assessing their Impact and Designing Policy Reforms. UNEP/ETB/2003/1. Geneva: UNEP.
Whitley, S. (2013), Fossil Fuel Subsidies and Climate Change. In: Time to Change the Game: Subsidies and Climate. London, U.K: Overseas Development Institute.
Widodo, T., Sahadewo, G.A., Setiastuti, S.U., Chaerriyah, M. (2012), Impact of fuel subsidy removal on government spending. In: Wu, Y., Shi, X. and Kimura, F., editors. Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies. ERIA Research Project Report 2011-7, Jakarta: ERIA. p173-206..