

Forensic Investigation Into Petroleum Products Consumption, Subsidisation and Fiscal Spending in Nigeria by C. E. Alozie (PhD)

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Research Article

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Abstract

This paper analytically investigated petroleum products procurement, volume of consumption, fiscal expenditure on consumption subsidies, the utilisation of domestic crude-oil allocations in local refining production in satisfying consumption, discipline in the approved subsidy expenditure budget. Ex-post 'facto' materials were employed. Numerical descriptive statistics on volume of locally produced-supplied to imported products volume ratios, budget deviation indexing for fiscal discipline; simulated 'produce or import simulation of prior fiscal expenditures. Results indicate that local refining output of petroleum products were partly the major root cause of insufficient source of supply of products procurements which in turn compelled Nigeria to be reliant on importation in satisfying consumption requirements. Domestic crude allocation utilisation for refining production indicates that only about 33 percent of average aggregate expected minimum refined petroleum products yields of average aggregate volume consumption requirements were recorded. Budget discipline is lacking. Gross undersupply of electricity induced constant rise in the consumption of petroleum products. The paper concludes that lack of proper routine maintenance of extant local refineries, production inefficiencies as well as grossly mismanagement of the daily domestic crude-oil allocations were primarily responsible for the huge fiscal subsidies expenditure. Nigeria's indulgence in fuels importation and negligence of local refineries is tantamount to creating employment in those other refined fuels producing countries and escalating unemployment in Nigeria. T Fiscal spending on subsidies would have funded proper routine TAM and build four new refineries which is financing option that ought to have guaranteed 'pareto optimality' in the economy.

Introduction

1.0 Background information to products procurement, consumption, and subsidies

Nigeria is one of the world's major producers of crude oil but the country's local production capacity has remained poor and unsustainable to domestic consumption for many years (AfDB, 2009). Nigeria lacked the capacity to produce up to 50 percent of the average minimum volume of the annual petroleum products consumption with the associated supply –demand gap; the frequency of increase in consumer prices of the petroleum products in the domestic market remained inevitable. The domestic consumption of petroleum products around 1989, that was at the time of initial adoption of petroleum products subsidy was about 15 billion litres and reached 20 billion annually in 2020 provides baseline volume of the products consumption in the economy (PWC,2017; Aaron, Gilles & Katsouri; 2015). There are significant gaps in the demand and local production and actual quantities or volume of refined products readily available to the domestic consumers', and this phenomenon apparently impact on importation, pricing of fuels and subsidies fiscal spending. The gaps were continuously through the importation of Premium Motor Spirit (PMS); Kerosene (DPK or HHK), Diesel (AGO), Aviation fuel (Ogbuigwe, 2018) and other related daily consumable products. Prior empirical studies show that the average annual shortfall

of these consumable products hover around six million litres per day from 2004 to 2013 (except the sharp drop in 2011). The import and consumption of household kerosene (HHK) imports averaged about two million litres. Therefore, the gap between domestic consumption and refining of petroleum products partly reflects capacity utilization deficits in local refineries. Aside from the sprout in 2005 and dip in 2007, capacity utilization of Nigeria's main refineries ranged from 20 per cent in 2011, and reached 26 per cent in 2009 (Aaron, Gilles & Katsouri; 2015). Apparently, Nigeria's refineries have been operating inefficiently for many years; having suffered prolonged neglect and frequent breakdowns. Sadly, occasional turnaround maintenance efforts have failed to engineer sustained improvement in refining capacity over the years (International Institute for Sustainable Development (IISD), 2011: Aaron, Gilles & Katsouri; 2015).

Nigeria has a relatively small industrial base and demand for fuel is driven mainly by domestic use and transportation, and with distinctive segregation between urban and rural demand patterns. In rural communities, biomass sources of energy, such as firewood and burnt charcoal are still the main sources of domestic cooking fuel (AfDb, 2009). Petrol, kerosene and diesel oil are still the main determinants in the Nigerian energy consumption mix with small amounts of refined products are exported sporadically from her domestic refineries. The demand and supply of Premium Motor Spirit (PMS) in Nigeria is an inelastic, which make it is extremely difficult for consumers to find alternatives to the use of products gasoline in daily usage (PWC, 2015; 2017; Aaron, Gilles & Katsouri; 2015). Nigeria is currently a net importer of about 65-75 percent of petroleum products and domestic consumption of petroleum products are linked to price regimes in the international markets (Aaron, Gilles & Katsouri; 2015). The domestically fuel supply of refined petroleum appears have been monopolized by the NNPC and its subsidiaries together with the major marketers and independent indigenous marketing firm. As a regulator, NNPC, licenses importers and distributors, fixes local pump prices, owns fuel stations and depots and administers payments of subsidies to distributors. Therefore, NNPC acts as a regulator, a distributor, producer and competitor in the retail markets. With this arrangement in place, the Nigerian petroleum product market can be classified a regulated monopoly with the added distinction that the regulator is also core competitor in the market.

As a result of the price volatility of crude and refined petroleum products; rise in foreign exchanges rates that are used in the procurement of crude oil for refining operations and import of refined products and scarce supply to demand pulled increase in consumer prices compelled government to provide subsidies to the pump prices of PMS and DPK for some years. Petroleum products subsidies have been retained for years but trimmed down from time to time, perhaps due to the impact of its total withdrawal on transportation spending. Petrol (PMS) has dominated domestic consumption of refined petroleum products in Nigeria which makes it the cynosure of public policy and political interest. The past successive Nigerian governments as well as the present administrations have consistently increased the pump price of the products, periodically from 1978 and presently. The subsidization on petroleum products with special reference to petrol and kerosene (DPK) represents the difference between the market price (called the 'derived' open market price (DOMP) and the government-approved retail price for PMS and DPK which is paid to marketers (CPPA, 2012).

1.2 Statement of the Problems

The main problem of availability of refined petroleum products hinge on the fact that Nigeria as an oil producing and exporting country has not been able to produce sufficient volume refined products to meet her consumptions. Flowing from this prevailing situation and Nigeria's indulgence on importation, the nation has spent substantial public funds in fiscal expenditure on fuels consumption subsidies over the years thereby creating employment in other economies and tacitly promotes unemployment at home. The phenomenon of sourcing petroleum products for consumption and possibly export is directly associated with inability of existing domestic refineries to produce the required volumes of refined petroleum for distribution in the markets.

The existing refineries in Nigeria lacked the capacity to produce up to 50 percent of the average minimum volume of the annual petroleum products consumption with the associated supply –demand gap; the frequency of increase in consumer prices of the petroleum products in the domestic market remained inevitable. Due to the fact that crude oil and refined petroleum products are procured with international currencies, therefore the movements in exchange rates determines the retailing prices of refined petroleum products. Apparently, the fiscal policy makers inadvertently failed to foresee the deep rooted macroeconomic disturbances that have plagued the population in form of continuous inflationary trends. The resources, already committed in funding fuels consumption subsidies ought to have been more prudently channelled to the provision of other critical social infrastructure projects and programmes, if the government had utilised such funds wisely and efficiently. Furthermore, the challenges insufficient availability of refined petroleum products and consumption subsidy regimes in Nigeria were not merely the retention or withdrawal of petrol and kerosene subsidies but prudence in fiscal policy formulation in maximising citizens' welfare (pareto optimum). However, available evidence indicate that the successive Nigerian governments have ignored to utilise the country's oil revenue windfall in vertical and horizontal investment in development of the oil and gas subsectors particularly in sustaining existing refineries/ petrochemical industries to ensure self-sustenance and export.

Research Questions:

- • To what extent did the local refineries to produce sufficient refined petroleum products to satisfy aggregate demand and consumption?
- • To what extent were domestic crude allocation effectively utilised in local refining production?

or to what extent was the domestic crude-oil allocation properly used for local refining production?

- • To what extent does government conduct direct fiscal expenditure on consumption subsidies in compliance with the established fiscal regulations and approved budgetary allocations?
- • To what extent would Nigeria utilised the aggregate fiscal expenditures in facilitating either establishment of additional refineries or proper maintenance of the existing one in sustaining normal supply of products?

- To what extent does the consumption of refined petroleum products have any direct substitutionality effect with electricity power supply and usage in the country?

These research questions may be replicated or restated within the reviewed empirical literature*

1.3 Objectives of the Study

The main objective of this study is to carry out forensic investigation on petroleum products consumption subsidies and fiscal spending in Nigeria. This is with the view to unravel the nature, dimension, causal factor(s), magnitude of this fiscal spends and other realistic usage of fuels subsidies expenditures in the economy as specific objectives. The specific objectives are to: To establish the gaps between aggregate proportions of locally produced petroleum products total consumption and relative ratio of imported proportion to corresponding total consumption volumes. Consider the extent to which the domestic crude allocation utilisation in local refining production of petroleum products in satisfying domestic demand and consumers; requirements. Determine fiscal budget deviation between actual annual subsidies expenditure and actual spends in gauge the degree of fiscal discipline. Examine the extent to which aggregate government annual expenditure on petroleum products subsidies could have been invested in refinery infrastructure to promote domestic production and social welfare. Assess the extent to which the consumption of refined petroleum products might have had direct substitutionality effect with electricity power supply and usage in the economy.

1.4 Research Hypotheses.

Hypotheses are formulated to guide data generation and analyses are:

Ho₁: There is no significant difference(s) between the aggregate average annual proportions of locally produced refined petroleum products in comparison to the average aggregate annual volume of the proportion of imported products.

Ho₂: There is no significant difference between domestic crude-oil allocation (DCA) utilisation alongside the expected refining production yield alongside actual quantity of DCA usage and refined product output.

Ho₃: There is no significant difference between the subsidies approved budgetary allocations for and actual direct fiscal subsidies expenditures.

Ho₄: There is no significant difference between public expenditure on aggregates cost estimate of investments in refinery infrastructure (turnaround maintenance and or in building refineries and actual direct fiscal subsidies expenditure on consumers' social welfare.

Ho₅: There is no significant difference between increases or decreases in average aggregate annual domestic consumption of petroleum product and average aggregate annual electricity supply as influencing factor size of economic operation;

This scope of the paper is restricted to conduct independent forensic investigation on petroleum products procurement, consumption subsidies and fiscal spending in Nigeria for the period of 32 years based on ex-post 'facto' data analysis from 1989 to 2020.

The remainder of the study after this introduction is arranged into four sections, as follows. Section two presents review of literature and methodology in section three. Analysis of data, results of the research, interpretation and discussion of research results are presented in section four. The Summary of findings; conclusions and recommendations are contained in section five

2. LITERATURE REVIEW

2.1 Conceptual Framework

Procurement of petroleum products refers to all arrangements followed in making fuels products readily available to consumers within the economy (Almakki, 1987; Adagunodo, 2013; Abudullahi, 2014). The consumption encompasses actual volume all categories of products utilised locally but includes export purchases during from 1989 to 2020 (Abudullahi, 2014). However, domestic consumption relates to the proportion of aggregate consumption by the population, but it inadvertently covers quantities exported to other countries either formally or informally. Local production of the products can be described as the aggregate volume of refined products produced by existing refineries that were lifted and distributed to marketing enterprises (Almakki, 1987; Adagunodo, 2013). Local productivity of the petroleum products alongside importation is critical in meeting aggregate demand of the consumers. It also influences the magnitude of government's fiscal subsidies spending, public revenue, and macro-economic stability and influence public policies on total removal or continue retention of subsidies regime (Abudullahi, 2014).

2.1.1 Petroleum products consumption, subsidies and Nigeria's public spending

Petroleum products consumption in Nigeria have ever been increasing in line with population growth, increase in size of economic activities and other factors (Abudullahi, 2014). This trend is inadvertently encouraged by the state policy in lower prices of products below the realistic market determined levels as expected in many oil producing and exporting nations with similar economic and social characteristics like Nigeria. The bulk of the fast moving consumer petroleum products are petrol (PMS), diesel (AGO), kerosene (DPK), aviation fuel (ATK) and liquefied petroleum gas (LPG) oil. These products put together account for more than 60 percent of the aggregate petroleum products consumption in Nigeria. The common characteristics of these consumer petroleum products are that: first, their consumption cut across various sectors of the economy. Therefore, they are widely utilized as energy fuels and the elasticity of substitution of the products varies across sectors; they highly used in transportation, in industry and residential centres. The low elasticity of substitutions in transportation makes the impact of pricing policies in the sector very extensive in reach and quite sensitive. PMS and AGO are the major fuels utilized in the road transportation sector. Similar user-effect applies to the small to medium sized electricity generation plants for power supply in homes and locations detached from PHCN, as well as

industries. Petrol is specifically used in vehicles, small generating plants, drives for compressors while AGO is used largely on heavier engines. Third, the political impact that pricing of petroleum products engender varies.

Petroleum products' subsidies is inevitable in the crude-oil producing and exporting countries due to its supervening effect on economy as well as its impact on cost of living in oil producing and non-oil producing countries. Organisation for Economic Co-operation and Development (OECD, 2005) defines a subsidy as a result of government action that confers an advantage on consumers or producers, in order to supplement their income or lower their costs. NEITI (2014) further defines refined products subsidies as financial assistance granted to independent petroleum products importers and local refineries by the government to enable them supply their products at a cheaper rate for the good of public users. Petroleum Products Price Regulatory Agency (PPPRA) (2012) defines subsidy as reimbursement to the marketers-based on landing cost of the products, less its approved ex-depot price. It is a mechanism that is designed to reconstitute real costs incurred by marketers in the process of products procurement while ensuring that end users pay a limited amount for the product. A subsidy is defined as a benefit granted by government to the citizenry, business operators and institutions to remove some portion of the burden on the use or consumption of certain goods or services in an economy (World Bank, 2010). Petroleum products subsidies normally come in two main forms: those designed to reduce cost of consuming the products; and those aimed at supporting domestic fossil-fuel production (Burniaux, Martin & Oliveira-Martins, 2009). These two types of subsidies exist in Nigeria because the four government-owned refineries are allocated crude-oil below the international market prices and also maintained with public money.

Nigeria operates a subsidy regime mainly on two or three core petroleum products; PMS, DPK and AGO, but AGO and DPK subsidies were gradually phased out over the years. PMS subsidy has dominated, which makes it cynosure of public policy and political interest. Fuels subsidies y represents the difference between market price (called the 'derived' open market price [DOMP]) and government-approved retail price that is paid to marketers (CPPA, 2012). Nigeria has been encumbered into the regime of consumer subsidies for many decades, and the economy is heavily dependent on local and imported technologies powered by fossil fuels. But very little is known about the magnitude of public spending on subsidies of refined petroleum products either on consumption or production during the past three or four decades till date.

Several reasons advanced as motivating factors compelling some countries to provide subsidisation on consumption petroleum products. There are three variants and sources of products subsidy under this arrangement, that is, producer's cost per barrel subsidy, exchange rate subsidy (in both the cost of crude oil and refined products import). As at 1992, the prices of petroleum products in neighbouring countries were at least 700% of those in Nigeria (Iwayemi & Adenikinju, 1996) calculated the implicit subsidy in 2002 to worth N94billion or 1.8% of GDP. The prices of refined petroleum products in Nigeria were much lower than in neighbouring countries and this is smuggling-induced consumption subsidy. Nwachukwu and Chike (2011) established that there is strong relationship between demand on petroleum products

and energy and the related subsidies in Nigeria. Such subsidies made domestic price of petroleum products lower than its international price and also made the price of other energy become uncompetitive compared to fossil fuel energy. Mourougane (2010) states that petroleum products subsidies influence demand for fossil fuel energy in two ways and explained that subsidies stimulate over-consumption of subsidized energy which leads to inefficient use of energy.

2.1.2 Domestic crude allocation utilisation, misuse and refining production efficiency

Refining operation efficiency relates to the volume of crude oil supplies as input in refining operations and its expected normal range of the output volume yield(s). This contextually links domestic crude-oil allocation(s) for local refining production with utilisation of such allocated quantities and actual production volumes over time and also their other alternative usage. By convention, the average standard barrel of crude-oil using Bonny light specie as example; a barrel of crude is expected to yield of around 137 to 142 litres of assorted petroleum products under an efficient refining production scheme. To buttress this fact, in 1989, the total of 108,000,000 crude allocations to the refineries were processed with actual yield of 14.2 billion litres of refined products, which is 95% of 15 billion litres expected normal output. This presupposes that the 445000 barrels per allocation and 160200000 bpd allocation in 2001 and 2002 ought to have produced 22 billion litres of refined assorted products but actually yielded 12.8 billion litres each.

The available data obtained from the Department of Petroleum Resources for the productivity of Nigeria's four existing refineries recently indicated that their total annual outputs hovered from five to 20 percent during the past two decades. Furthermore, various financial consultants that performed in Nigeria's Extractive Industry (NEITI) review and physical audit of the refining activities of Nigeria's refineries reported that production of these refineries were inefficient with high volume of wastage. This presupposes that the 445000 barrels per allocation and 160200000 BPD allocation in 2001 and 2002 ought to have produced 22 billion litres of refined assorted products but actually yielded 12.8 billion litres each. In real life, the available data obtained from the Department of Petroleum Resources for the productivity of Nigeria's four existing refineries recently indicated that their total annual outputs hovered from five to 20 percent during the past two decades. Furthermore, various financial consultants that performed the Nigeria's Extractive Industry review and physical audit of the refining activities of Nigeria's refineries reported that production of these refineries were inefficient with high volume of wastages

2.1.3 Products subsidies budgetary allocations, disposition and spending performance

Following Federal government's recognition of the necessity to subsidise the pump prices of certain the products particularly, petrol, kerosene and diesel consumed locally, government commenced direct reimbursement of consumption subsidies to the importers-marketers and distributors of these products. Nigerian government introduced budgetary allocation for subsidies fiscal expenditure in 2005 and tacitly

discontinued it around 2013 but reinstated it in the same year through 2015. Nigeria has operated unbudgeted, budgeted and extra-budgetary fiscal subsidies payments between 1989 and now.

The budget credibility and fiscal discipline can be described as the process of ensuring transparency compliance to fiscal rules and proper accountability of public resources. Fiscal discipline requires that government maintains its fiscal positions in the manner that are consistent with macroeconomic stability and sustained economic growth and it warrants avoiding excessive borrowing and debt accumulation. At the same time, policy needs to be judicious in pursuing resource allocation and distributional objectives, and in smoothing output fluctuations. It is also prudent to create budgetary cushions in order to allow for the possibility of a response to both adverse shocks and to deal with predictable fiscal pressures. Reflecting deficit and debt sustainability problems, weak fiscal discipline has often compromised stability and growth, and in the worst scenarios, lead to economic and financial crises. It is generally acknowledged that discretion in the disposition of the budgetary allocation can be and often misused, which results in deficit bias and pro-cyclical policies. These, in turn, lead to weak fiscal positions, rising debt levels, and over time, a loss in policy credibility. However, the maintenance of fiscal discipline is essential to maintaining macroeconomic stability, reducing vulnerabilities, and improving aggregate economic performance.

Thus, this study focuses on import driven explicit subsidies since they represent transfers from government budget to consumers (Koplow, 2009). Budget deviation index (BDI) technique is frequently employed in empirical literature in assessing the relationship between actual annual fiscal expenditure with approved budget estimates of fuels subsidies in this study. Contextually, Nigeria as an oil exporting and importing nation, has incurred subsidies on both the local refining productivity (the implicit type) and on importation-the explicit subsidies which is herein measured within the price-gap approach, and aptly representing budgetary/ unbudgeted spending arising from domestic sale of imported energy at subsidized prices (OECD, 2000)

2.1.4 Refinery infrastructure cost efficiency and refining operation efficiency

Fuels consumption subsidies and turnaround maintenance or producers' spending are two variants of government subsidy incurred for sustenance on products procurement for consumption. These two interrelated explicit expenditures are representatives' of "Make (refine) or Importation" adopted in this paper's framework in comparison of fiscal decision of either effective routine maintenance of Nigerian refineries for steady production or reliance on importation. Refineries and petrochemical facilities run on a continuous rather than a batch production cycle must, every few years, shut down operations to provide access to the production units (Lawrence, 2013). This is in order that essential maintenance, modification and inspection work can be carried-out that could not be done while such units are in operation. Turnarounds are events that are planned well in advance and typically take place on a four-to-six year cycle. A turnaround maintenance in the context of oil processing industries) is defined by the American Petroleum Institute cited in Lawrence,(2013) as "a planned, periodic shutdown (total or partial) of a unit

or process or plant to perform maintenance, overhaul and repair operations and to inspect, test and replace process materials and equipment. The length of a typical turnaround execution phase (ie, the period when the facility is shut down and hydrocarbon free) is usually around three-to-five weeks (link this with TAM cost effectiveness). TAM is performed at least once in every three years during the economic useful life of refineries (FGN, 2012) but Ogbuigwe (2018) reported that the last TAM in PHRFC was in 2000 and 2008 for all other Nigerian refineries, is against the best practice.

Cost efficiency and effectiveness of TAM in facilitates comparative decision-making of direct subsidies fiscal expenditure on imported products consumption or building additional new refineries as an expansion programmer in ensuring steady sufficient production, distribution and consumption. This is a variant of buy (importation) subsidise or make (produce) locally at lower costs with resource employment for domestic consumption and even export with reduced or zero subsidization (Lawrence, 2013). This effort enables the study to extrapolate the extent to which aggregate public subsidy expenditure that may alternatively be utilised for proper maintenance of existing refineries for sustained production in satisfying demand and consumption.

2.1.5 Electricity supply /usage and substitutionality on products consumption

The electricity power usage to the petroleum products consumption framework provides exploration of whether usage of electricity from the national grid has substitution effect in energy fuels consumption in the economy. Several factors such as population growth; increase in urbanisation, expansion in productivity or size of economy vis-à-vis electricity usage, supply and power generation are frequently mentioned as core factors that can induce substitutionality effect of the petroleum products consumption in prior studies. This model interrogates economic factors influencing the national demand and supply for refined petroleum products, and it focuses on electricity usage and supply as proxy for urbanization and productivity in comparison with increase or decrease in consumption of petroleum products.

2.2 Nigeria's petroleum subsidies experience and movement in products prices

The successive Nigerian governments have adjusted the pump prices of petroleum products on several occasions; that commenced from the Obasanjo's first Military reign in 1976 to 1979) and the present Buhari's Administration from 2015 to date. The emergence of petrol subsidy in Nigeria was experienced around April, 1988 when the pump price for fuel was first increased from 39.80 in 48 kobo and further to 60 kobo per liter in January, 1989 (Ogunlari, 2018). Thereafter, it has become a recurring event in the Nigeria's political economy. Furthermore, on October 2nd, 1994, the pump price of fuel increased from N3.25 to N15; and on October 4, 1995 the pump price dropped from N15 to N11. It was further increased in 1998, from N11 to N25 and reduced it to N20 on January 6th, 1999. By the time that administration left office in 2007, Obasanjo's civilian administration took the pump price of fuel from N20 in 1999 to N75 (Ogunlari, 2018). However, the government of President Yar'Adua, considered it wise to reduce the price of

fuel per liter to N65 in 2007. Then on assumption of office, President Jonathan increased the price to N143 and later N97 per liter of fuel after many days of protest, killings and destruction of properties (Ogunlari, 2018). In 2015, the present administration further raised the pump price from N97.00 to N143.00; and by the third quarter of (September) 2020, the government through NNPC increase it to N165.00 under the current deregulated pricing system.

The most recent change in Nigeria's subsidy policy began in January 2016, when PMS price was adjusted from ₦87 per litre to ₦86.5 per litre from independent outlets and ₦86.0 per litre from NNPC outlets (US\$0.2 and 0.7 US cent reduction from an initial level of USD 0.43) (Ogunlari, 2018). At that time the price of kerosene was adjusted from ₦50 to ₦83 (USD 0.25 to USD 0.41) per litre. The new levels were estimated to be around market prices for each fuel (Adugbo, 2016; Ohaeri & Adeyinka, 2016 cited in Ogundari, 2018). The downward adjustment in the PMS pump-price was possible due to the rapid fall in world oil prices since mid-2014; while the upward adjustment in the HHK price was necessary because it had always enjoyed a larger per litre subsidy than PMS, and as such still required an upward price adjustment, despite low world oil prices.

Government announced that it was now making use of a "price modulation" policy, where it would adjust prices on a regular basis, either upward or downward, so that on average no subsidies would be paid, though at some specific periods of time, this would involve over-charging and collecting revenue or under-charging and paying a subsidy (Ogundari, 2018). As of the middle of years 2016, one subsequent price adjustment has taken place for the price of PMS, increased to ₦145 (USD 0.72) per litre in May, reflecting a recovery in world oil prices (Gaffey, 2016). DPK prices were not adjusted at the same time, implying the return of an implicit subsidy on kerosene. In August, NNPC depots confirmed that the price of DPK had been increased to ₦150 (USD 0.46) per litre. Despite these changes, the government still approves retail prices set by the Presidency and there are no clear indices that determine when adjustments should be made and to what level, as previously reported by CPPA (2012). Price increases are usually resisted by citizens led by labour unions and civil society groups, including Standup Nigeria strike in 2012 and often leading to compromises and reduction in the level of price increases.

2.4 Theories Framework

2.4.1 Petroleum products procurement, local production and consumption theory

Petroleum products or energy demand has been recently used as basis for maintenance of energy dependent systems or to produce output in excess of sheer system maintenance. Energy supply and demand derive their basis from the traditional assumptions of the pure theory of consumer and producer behavior. According to the theory of consumer behavior, the important factors that affect energy demand are: price of the commodity under consideration; consumer level of income; population size; as well as the price of other commodities, substitute or complement; Other factors include the tastes and preferences of the population; and, Income distribution between individuals. The theory of energy

demand is founded upon the economic principle of diminishing marginal returns which underlies the conventional downward sloping demand curve. Consumers adjust their energy consumption to their income and the energy product price, assuming other things remain constant. Producers of energy products combine the available factors of production so as to produce a given level of output that maximizes their net profit. Petroleum products consumption is a reflection of the theory of consumer behaviour derived from the demand for various non-energy goods and services with which it is consumed. Therefore, if the supply and demand for non-energy goods and services change, the consumption of the energy product will change. This implies that there is a relationship between energy uses and other economic activities. This relationship may be affected by the relative price of energy as well as the substitution possibilities in the economy.

2.4.2 Domestic crude allocation utilization and refining production efficiency model

Refining operation efficiency theorem links domestic crude allocation with ideal the volume of crude oil supplies as input in refining operations to expected normal range of the output volume. By convention of the crude-oil refining operation, the average standard barrel of crude-oil and using Bonny light specie; a barrel of crude is expected to yield of around 137 to 142 litres of assorted petroleum products under an efficient refining production scheme. The forensic investigation on domestic crude utilization in this study leans on the established range of expected output from an average barrel of crude and aggregate input quantities in a given period in determining the degree of refining operation efficiency for this industry in Nigeria.

2.4.3 Theories of petroleum subsidies and fiscal expenditure

Fiscal subsidies are widely used in several countries on several commodities such as petroleum products, food or farm inputs like fertilizer and machinery. Though, a subsidy can be a very powerful policy tool that can be used by the state to address market failures or achieve social objectives, it may also be an artificial tool to skew markets and this can impose large economic costs with huge negative externalities such as corruption. Since government is the primary provider of subsidies, it is expedient that policymakers should be well equipped to decide whether, where and when to provide subsidies. It is equally important that any such subsidy injection should adequately recognize the costs to the economy of distorting competition when assessing subsidies and to identify where, if possible, such costs may be minimized.

Agency theory of the fiscal budgeting, funds utilisation and budget discipline

Agency model of the public finance management theory is involved this paper in explaining the phenomena of incompatible incentive of public functionaries and financial information asymmetry in public budgeting, implementation and government financial reporting (Alozie, 2017). It describes the phenomenon of incompatible incentive phenomenon is a situation where public managers / public office

holders to pursue their goals and pecuniary interest (Alozie 2017) Financial information asymmetry in our environment and contemporary era comes in the form in which public managers handling of oil resources, revenues indulge in unbudgeted / budgetary allocations for petroleum products subsidy in Nigeria. Dabla-Norris, et al (2010) as cited in Nwaorgu & Alozie (2017) argued that public finance management system is often bedeviled with the struggle for bigger budgetary allocations and competition among the various portfolio ministers and heads of agencies and the incompatible incentive of public office holders.

The asymmetric financial information is perpetrated in the periodic fiscal responsibility reporting and government's institutions published financial statements and other forms of non-audited financial reports and macroeconomic statistics deliberately by the public treasury managers primarily to consolidate their activities in order to impress the principals who are the constituents and larger proportion of the society (Dabla-Norris et al (2010) cited in Alozie (2017)). Therefore, an assessment of the periodic fiscal management account statements and gazetted financial statements which in this context particularly relates aggregate annual unbudgeted / budgetary allocations for direct fiscal expenditure on fuels consumption subsidies, facilitate checks and balances on the uses of such treasury disbursements.

2.4.4 Cost efficiency of refinery infrastructure, refining efficiency and welfare delivery

Cost efficiency of refinery infrastructure and efficiency in refining operations are essential ingredients for production and supplying sufficient petroleum products to satisfy consumers requirements at all times. The "business benchmark" cost estimation model of the oil refinery industry as provided by Solomon Associates (Lawrence, 2013) is the theoretical framework supporting the selection of fuels importation or local refining production' (produce) comparative subsidies spending decision for Nigeria in the first angle. This cost estimation model effectively regular TAM of refinery complexes links local refining production' make (produce) with fuels importation in analyzing judicious alternative subsidies spending in ensuring steady procurement and distribution of products in the economy. Benchmark TAM cost estimation model provides basis for comparison of the direct fiscal subsidies expenditure and estimation of more prudent concurrent spending of the same fiscal subsidies on routine maintenance in sustaining the refineries productivity to meet local consumptions without reliance on imports (Lawrence, 2013). The established principles of the oil refinery industry worldwide require that TAM is essentially carried out in refineries within every two to three years and maximum of five years (Ogbuigwe, 2018). The life cycle costing or terotechnology that inter alia defined as: 'the maintenance of physical asset cost records over the entire asset lines, is normally applied to the cost estimation of turnaround maintenance expenditure and profit margin performance of a plant over a refinery' productive life cycle, including the pre-production stage (terotechnology), and to both company and its life cycle' (Sizer, 1996).

Prospect theory and cumulative prospect theory (CPT) also known as risk-aversion theory developed and adopted by Kahneman and Tversky (1979) is theoretical framework of financial assessment strategy guiding investments in refinery infrastructure in comparison with fiscal spending on products

consumption subsidies. The financial appraisal of direct fiscal expenditure on products subsidies assesses the financial impact of government's petroleum subsidy expenditure on public resources. It also assesses its implication on social welfare delivery.

2.4.5 Petroleum products consumption and energy use substitutionality theory

The Structural Time Series Model (STSM) developed by Harvey (1989), and employed by Hunt and Ninomiya (2003) has been frequently employed to estimate the demand and supply function for the various petroleum products in Nigeria. The model allows for the estimation of a stochastic rather than deterministic trend which is important when estimating price elasticity of demand as discussed by Hunt and Ninomiya (2003a). This method takes into consideration the structural changes in energy demand estimation. The STSMs permits a more flexible approach of modelling the Underlying Energy Demand Trend (UEDT) which can reveal the true pattern of changes in economic structure over time. Structural Time Series Model (STSM) permits a more general and flexible approach of modelling the trend component of time varying economic variables such as energy demand. It therefore allows for the estimation of non-linear 'Underlying Energy Demand Trend (UEDT)' which can be negative, positive or zero as time changes. Flowing from these premises this paper models petroleum products demand and supply in Nigeria with adoption of the STSM approach, but departs from the prior studies by holding products prices as constants that anchor on the reasoning that consumption of petroleum products in developing countries ignores pricing effects.

The estimation of energy demand for developing countries is a significant trend variable has as emphasized by Bhattacharyya and Timilsina (2010). The underlying trend would be affected by economic and technological structural changes. As the economic structure changes, the role of informal economy and traditional energy declines, thus impacting on the choice of technology and fuel mix. In addition, changes in tastes, preferences and demographic factors are difficult to measure and therefore necessitating the inclusion of a stochastic trend in estimating long-run oil products demand (Ahmadian et al., 2007; Broadstock and Hunt, 2010). The assessment of the magnitude of petroleum products subsidies in Nigeria contextually focuses on explicit subsidies which correctly represent transfers from the sovereign government's treasury budgetary (fund) disbursement for the population consumption (Koplow, 2009) and commodity optimal taxation / subsidisation theory adopted in Stern (1984) and Ahmad and Stern (1983) cited in Stern (1984).

2.5 Review of Empirical Studies

Several studies have rarely been carried on the demand, procurement, distribution, consumption but more on consumption subsidies in different countries including Nigeria.

Ogundari (2018) examined effect of oil deregulation debate in Nigeria based on the price-demand elasticity analyses of petroleum products (petrol, diesel, and kerosene). Shows that reductions in fuel subsidies in the past, translates to increase in fuel prices and induce increase in the demand trend for

petrol and diesel and or decrease in the demand trend for kerosene. This decrease in kerosene demand trend have significant implications for the environment as rural dwellers and urban poor would have to meet up their energy needs through using firewood from forest sources, as fuel replacement for their domestic energy needs. The findings supports the argument for deregulation of petrol and diesel markets as price increases here do not foster demand collapse. However, the argument for the kerosene market would be to sustain and even increase subsidies for socio-economic and environmental reasons.

KPMG (2017) on its part examined the pattern of fuels subsidizing spending in Nigerian and found that in three years, NNPC paid itself roughly \$6.5 billion to fund the subsidy on 15.6 billion litres of products that “apparently were not available to the Nigerian market. The study observed that NNPC spent hundreds of millions of dollars from domestic crude allocation revenues on pipeline protection, but levels of theft from some crude oil pipelines have risen, in some cases by over 500 percent in a year. The report further stated that since year 2011, NNPC spent as much as \$7.52 per barrel to transport oil to the refineries by ship under an opaque, multi-vessel arrangement (as compared with \$0.03 per barrel in pipeline fees), yet refinery outputs during the period did not improve.

The plausible research question for ascertaining the extent to which Nigerian government owned four refineries effectively served as source of procurement of the product is: To what extent did local refineries produce sufficient refined products to satisfy demands?

Aaron, Gilles and Katsouri (2015) assessed NNPC’s discretionary spending from domestic crude returns and confirmed that it has reached runaway, unsustainable levels, averaging \$6 billion a year between 2010 and 2013. The paper reported that the DCA facilitates some of the NNPC’s worst habits, and no longer serves its intended purpose. NNPC’s discretionary spending from domestic crude returns has reached runaway, unsustainable levels, averaging \$6 billion a year between 2010 and 2013. Especially now that Nigeria faces major budgetary and savings shortfalls, unchecked off-budget spending on this scale threatens the nation’s economic health. In 2004, NNPC retained around \$1.6 billion, or 27 percent of the DCA’s full assessed value. the amount had jumped to \$7.9 billion or 42 percent of the value of the domestic oil for year 2012. The DCA revenues spent by NNPC deliver poor value for money and a large portion of withholdings is spent on subsidy payments that were vulnerable to misappropriation. The paper stated that Nigeria faces major budgetary and savings shortfalls as well as unchecked off-budget spending on this scale threatens the nation’s economic health.

Related research question: To what extent were domestic crude allocation effectively utilised in local refining production? or To what extent was the domestic crude-oil allocation properly used for local refining production?

Sulistiowati (2015) examined the relationship between fossil fuel subsidies and growth, employing employs panel data analysis. The result of the regression confirmed that fossil fuel subsidies, coal subsidies, electricity and natural gas subsidies have negative and significant impact toward growth. The research found that oil subsidies are negative but not significant toward growth. Result confirmed that fuel, coal, electricity and natural gas subsidies have negative and significant impact toward growth.

However, oil subsidies are negative but not significant toward growth. Fuel subsidies are used to maintain stability of domestic price. Subsidies fill the gaps between international and domestic price. The trend shows that the amount of fossil fuel subsidies increase as the international price and the consumption increases. Subsidies distort the market prices and hinder growth by affecting government budget while huge subsidies spends depress fiscal budgets.

PriceWaterhouseCoopers (2015) report observed that despite the much canvassed transparency in handling of petroleum resources and revenues by successive Nigerian governments, nothing has change all together. The trade by barter of the allocations of crude-oil for local refinery production and domestic crude sales accounting still remains a sort of magic fire; the more you look, the less you can see.

In order to assess the direction of optimum subsidies fiscal spending the paper demands that: To what extent could Nigeria have fiscal subsidy spends in optimizing consumers' welfare?

Asian Development Bank (ADB) (2015) measured the size of petroleum subsidies in Indonesia such as underpricing of petroleum products and electricity, tax exemptions, and subsidized credit. Results show that the short-term adverse impacts of subsidy reform turn positive in the long term as households and industry respond to changing market realities by adjusting energy demand, supply, and production capacity. Some pertinent policy options for sustainable energy use are provided to aid policy makers in their current subsidy reform process.

Hope et al; showed that energy subsidies are pervasive in many developing countries. The author revealed that oil exporting / developing countries heavily subsidises all domestic oil consumption; but several oil importer developing countries subsidize particular petroleum products. The study opined that subsidies for electricity, natural gas and coal are even more persuasive in virtually all of the countries studied which signifies that the prices of these fuels do not reflect their marginal cost. Whilst Birol, Aleagha, and Ferroukhi (1995) investigated the impacts of a subsidy phase-out in oil exporting developing countries of Algeria, Iran and Nigeria and reported that the effects of different deregulation policies in these three countries are substantial. The study revealed that a policy geared at more rational use of energy would permit these countries to save enough oil to meet future increases in demand while maintaining stable production.

Research question: To what extent does the consumption of refined petroleum products have any direct substitutionality effect with electricity power supply and usage in the country?

International Energy Agency (IEA) (2016) estimated that the total value of the petroleum products subsidy in 20 non-OECD countries was \$220 billion per annum in 2005. This increased to \$250 billion per year when subsidies from other non-OECD countries were added. In 2007, these subsidies stood at \$350 billion in the same 20 non- OECD nations. Iran was the highest subsidizer at \$56 billion per annum, followed by Russia with \$51 billion per annum. Other subsidizers were China, Saudi Arabia, India, Venezuela, Indonesia, Egypt and Ukraine with annual subsidies in excess of \$10 billion per annum and most of these subsidies were aimed at lowering the price of fuel for the final consumers

Methodology

This paper adopts ex-post 'facto' method in construction of petroleum products procurements through import and locally supplied sources, and supply gap measurement, discipline in public subsidy expenditure and comparison of 'make and buy' spending options. It also applies the financial forensic investigation the assessment of inherent citizens' / consumers' social welfare benefits or losses associated with either suboptimal local production of petroleum products or import and rampant price changes in the economy

3.1 Materials and Method of Collection

This is country specific study that investigated petroleum products' production, importation, local production and demand gap, associated consumption subsidies expenditure, domestic crude allocations and usage, degree of discipline in budgetary allocation; efficiency in alternative use of subsidies and substitution effect of electricity supply to fuels consumption. The materials sourced and used also covered electricity power generation and supply; fiscal subsidies approved budgets, actual disbursements for fuels consumption and budget variances. These pertinent data-sets obtained through secondary source, published by government's agencies responsible for regulation and management of activities of the petroleum sector. These include: Department of Petroleum Resources (DPR), Nigeria's National Petroleum Corporation (NNPC), Central Bank of Nigeria (CBN) and relevant empirical papers.

3.2 Theoretical Foundation of Empirical Models

The "Structural Time Series Model (STSM)" method as in Almakki, 1987; Adagunodo, 2013; Abudullahi, (2014); government transfers spending on fuels subsidies (Koplow, 2009) to consumers with budget deviation indexing method as previously adopted in Alozie (2017); and "TAM cost efficiency and effectiveness business model Lawrence (2013) alongside with direct fiscal expenditure are the empirical model frameworks supporting specification and development of model functions employed in this study. The demand and supply function(s) for major petroleum products consumptions in Nigeria notably petrol, diesel, kerosene, fuel oil, liquefied petroleum gas (LPG) (Almakki, 1987; Adagunodo, 2013; Abudullahi, 2014). Hence, Structural Time Series Models (STSMs) empirical model is followed in ascertaining and measuring the aggregate procurement, imports and utilization is estimated in the economy. The Structural Time Series Model (STSM) developed by Harvey as cited and employed in Hunt and Ninomiya (2003) is employed in estimation of demand and supply for various petroleum products fossil fuels.

Price-gap approach theory vividly links petroleum subsidies as prescribed in Koplow (2009) with fiscal expenditures is applied in the "refine (produce) and buy (products importation)" is analytical modeling in comparing actual fiscal expenditure on fuels subsidies with cost estimation of proper regular maintenance refineries in sustenance of production and supply of refined products locally (Okafor, 2018). TAM "Cost efficiency and effectiveness business model" with direct fiscal expenditure is empirical model that guides the comparison of Nigeria fiscal subsidies expenditure and TAM cost estimations during the

evaluated period (OECD, 2000; Lawrence, 2013). The strategy moderate alternating government's annual direct subsidies fiscal spending on consumption of imported products or the plausibility of local refining of products thereby enhance utilisation of available labour and other resources. .

3.3 Model Specification and Development

The models' specifications are configured and presented in five separate compartments.

(1) Local refineries production, consumption trends and demand-to-supply gap

Similar STSM approach adopted in the first model is replicated here to derive demand and supply analysis as well as linking actual local production of refined products with aggregate volume consumed annually. It is further applied in the determination of actual volumes or quantities of products supplied from domestic sources of products in comparison with importation in satisfying consumption and in ascertainment of realistic local supply deficit.

The model function equation(s) for determination of the aggregate annual petroleum products' local production component of procurement, consumption and the imported volume of the products in augmenting volumes of products from local refineries are expressed as follows:

$$1. (1.1) Q_{xij} = f[(pq_1 \cdot pt_1 + pq_2 \cdot pt_2 + \dots n - \text{annual_consm} p q_1 \cdot pt_1 + p q_2 \cdot pt_2 + \dots n)] - [(q_1 - \text{exp} + hpq_x)] = n. \dots$$

(3.3.2a)

$$2. (1.2) Q_{xvij} = f[(nvpqx_1 - \text{ann_export} nvpqx_1 + nvpqx_2 - \text{ann_export} nvpqx_2 + \dots n)] - [(q_1 - \text{exp} + hpq_x)] = n. \dots$$

(3.3.2b)

Where Q_7 is the annual volume of petrol's procurement including domestic production and exports to which the total volume of locally produced is deducted to establish the short-fall or supply gap and representative of the aggregate annual volume of PMS imported in meeting its local demand as they were over the years.

$$(1.3) \text{ The mean(s) of means equation function } (Z) = Xxi / Yyi \sqrt{Yyi} = n \dots \dots (3.3.2c)$$

(2) Domestic crude allocation utilisation, local refining efficiency or misuse of resource

Domestic crude allocation (DCA) has become the main nexus of waste and revenue loss from NNPC oil sales. Federal government allocates around 445,000 barrels per day to NNPC in so-called "domestic crude." NNPC sells this oil to the Pipelines and Product Marketing Company (PPMC), one of its subsidiaries. This translates to about 13.35 million barrels per month and 160 million barrels per annum. The refineries only process around 100,000 barrels per day. NNPC ultimately re-routes most DCA oil into export sales or oil-for-product swaps, and payments enter separate NNPC accounts, which NNPC officials then draw upon freely. PPMC is supposed to send the oil to Nigeria's four state-owned refineries, sell the

resulting petroleum products, and pay NNPC for crude it received, then, NNPC is supposed to pay the government.

(3) Petroleum products subsidies' spending budget performance evaluation model

This model focuses on explicit subsidies of the petroleum products subsidies since they represent transfers from government budget to consumers (Koplow, 2009) and developed primarily to capture and evaluate the relationship between actual annual fiscal expenditure with the approved annual budget estimates during the years. Furthermore, evaluation of the magnitude of petroleum products subsidies focuses on consumption representing government transfers / budgetary (fund) disbursement for the consumer's refers to commodity optimal taxation / subsidisation in Stern (1984) and Ahmad and Stern (1983) cited in Stern (1984); Decoster and Schokkaer (1989).

Government's direct fiscal spending on the consumers' subsidies as in Koplow (2009) in this context is the combination with the budget deviation indexing methodology by Dabbla et al (2010) that compares actual annual fiscal expenditure with the approved annual budget estimates supports the assessment of subsidies fiscal discipline in this paper. However, we are particularly interested in assessing fuels consumption subsidies as specify of the price-gap approach with concentration on the approved budget allocation for only fuels subsidies. These are known as producer subsidy equivalent and consumer subsidy equivalent until 1999 (OECD, 2000 Steenblik and Wigley, 1990; Cox and Schmidt, 2002) and more of consumers subsidies thereafter.

The set of system equation function(s) construct for fiscal subsidies expenditure budget deviation index (BDI), thus, FGN product Subsidies' expenditure budget Variance / BDI (V_2) equation is expressed as follows:

$$1. F_{GN-FSE-BDI} = (V_1) = f(F_{GN*FSE_ACP} - F_{GN*FSE_BXP}) = 1, 2 \text{ or } -1, -2, -n \dots\dots\dots (3.3.3a)$$

$$2. (ii) = (V_2) = (F_{GN*PS_AXP} - F_{GN*PS_BXP}) \dots\dots\dots (3.3.3b)$$

Where; actual annual products' subsidies expenditures is F_{GN*PS_ACP} and F_{GN*PS_BXP} ; and budget expenditure deviation indicators, is $= F_{GN*PS_ACP} - F_{GN*PS_BXP} = i$.

(4) Fiscal spending on consumption subsidies', TAM/Build-refine spending decisions

This model utilises subsidies fiscal expenditure in past 32 years with TAM cost efficiency business model in a comparative refine (produce) and import linked consumption subsidies spending decision in measuring which of the two options that offers better citizens' social welfare on one angle. Furthermore, its supplementary assessment employs the same values of subsidies fiscal expenditure in past 32 years to comparatively measure costs of building new refineries in another refine (produce) and import linked consumption subsidies spending decision in measuring which of the two options that offers better citizens' social welfare. The equation function(s) for the refineries repair and refine (local production) or

4.1 Data Presentation

The materials used in analyses were arranged in five distinct sub-themes, namely; petroleum products procurement and distribution; local refineries production/lifting and aggregate annual consumption. The DCA and local refineries output; aggregate and average annual subsidies fiscal expenditures with the related aggregate and average annual approved budgetary allocations; aggregate and average annual subsidies fiscal expenditures with the related aggregate and average annual estimates for TAM and new refineries acquisition. The aggregate volumes of consumed petroleum products and electricity energy supplied through the grid are presented in the last sub-theme.

4.1 Numerical Descriptive Statistics -

The aggregate annual local production of refined products and importation data employed in supply-gap trend analysis is presented in table 4.1. Domestic crude allocation utilization and refinery output is given in table 4.2. The subsidies budget spends with the relevant approved annual estimates is provided in table 4.3; Data for actual direct fiscal subsidies expenditure in comparison with cost estimates for regular annual routine turnaround maintenance of Nigeria's four extant refineries as optional produce (make) or import (buy) spending decision is provided in table 4.4. This facilitated comparative assessment of direct subsidies spending and TAM cost efficient recurrent spending estimates for refineries. Finally, energy fuels consumption and electricity power supply-usage are summarised in table 4.5 and these tables are provided in the appendices (as attachment)

4.2 Results of Analyses

Table 4.6 SUMMARY OF RESULTS OF HYPOTHESES TESTS

PAIRWISE VARIABLES		Mean /	Sig Level	Ho
<u>Model s</u>	<u>Prefix</u>	<u>Mean-R</u>	<u>Level</u>	<u>Decision</u>
Model (1)	LRP-PS	38/82%	5% *	Rejection
Model (2)	DCA-RP	67.00%	5 %*	Rejection
Model (3)	BDI-FD	149/180%	5%**	Rejection
Model (4) (a)	RFP-EE	456.0%	5% **	Rejection
Model (4) (b)	BRP-FE	142.0%	5 %**	Rejection
Model (5)	RRR&B	57.5.0%	5% **	Rejection
Sources:		Author's Computation 2021		

Notes: (1) * Significance Level at 5% ; ** above 5%

(1) Result for local refining output of petroleum products indicates that the major root cause of insufficient source of supply of products procurements was the refineries low productivity, which in turn compelled Nigeria to be reliant on importation in satisfying consumption requirements. The output from government owned refineries declined sharply the ratio of 1.01 in the first 16 years (1989 -2004) down to 37.5% around 2012 and down to an average of 18 percent in the last eight years with zero output in 2020. Based on this result, the alternative hypothesis is adopted. This implies that Nigeria's is over over-dependent on importation necessitates significant fiscal subsidies spends which is seen as the root cause of subsidies sand wastage of public resources.

(2) This result show that expected yields from domestic crude-oil annual allocations is a paltry 33 percent of the average annual consumption volume requirements; which leaves 67 percent inefficiency or imprudence in the utilisation of DCA for local production. The computation of domestic crude-oil allocation for production and distribution show that the expected normal outputs falls within the range of 19.53 (20 billion approx.) billion litres compared 14.61 billion litres annually. Based on this finding the alternative hypothesis is adopted. It signifies that Nigeria failed to utilise the DCA prudently for local refinery productivity and consumption. –

(3) Result of assessment of subsidies fiscal spending budget performance reveals excessive overspending / unbudgeted spends in the range of 1.49 percent (or 149%) adverse deviations for the total periods 15 years that products' subsidies budget were in place and about 1.88 percent (188%) for the entire 32 years' review period. The derived BDI were far greater than the statistically permissible limit of 5% fiscal budget variance for credible budget performance. The paper adopts alternative hypothesis. This confirms that Nigeria indulges in excessive extra-budgetary spending in petroleum products' subsidies scheme. and there is fiscal budget indiscipline.

(4a) The third model result indicates that 456 percent (556:1) and 142 percent (or 1.5: 2:1) of Nigeria's consumption subsidies spending as ratios to TAM spending within those 32 years based on the use of only 25 percent of dollar equivalence of the spends. The paper estimates that Nigeria's fiscal expenditure exceeds average annual TAM cost estimates of \$36 million annually by 456%. Thus, the paper adopts the alternative hypothesis. This result confirm that Nigeria would have provided the consumers' with the required volume of petroleum products at much cheaper prices and lower public expenditure with greater social welfare benefit and macroeconomic (price) stability than by importation.

(4b) Result of supplementary analysis on building of new refineries option with the same 25 percent of fiscal subsidies show that Nigeria would have acquired two to three new refineries with capacity for 100000 to 125000 daily at average cost of \$2.5-\$3 billion plus TAM spends during the same periods. –

(5) The evidence of -57.5 (ratio of 0.015: 0.026) percent undersupply of electricity supply emerges from this analysis result. In effect, there were 57.5% aggregate adverse variances between average aggregate normal ranges of expected electricity supply to consumers and only 27 percent of electricity supply was provided through the grid. There was prevalence of gross undersupply of electricity from the national grid. The substitution effect of electricity usage induced constant rise in petroleum products consumption.

Thus, the alternative hypothesis is adopted. Contrary to prior arguments that fuels prices and cross-elasticities influence petroleum products consumptions, this study established that substitutionality effect of shortage or electricity outages actually cause high fuels consumption in Nigeria.

4.3 Discussions

(1) There were sudden and consistent rise in demand, supply and consumption of petroleum products in last two decades. The aggregate volume of refined products procurement in Nigeria from 1989 to 2020 was 504,721.25 million litres. The annual average volume of the products procured during the years ranges between 14.610 billion litres to approximately 20 billion litres per annum. This is in tandem with KPMG (2017) which confirms about 15.6 billion litres of products were apparently not available to the Nigerian market. —

The trend pattern of ratio of the import to local production of refined petroleum products steadily sharp decline in local production ranging 2.42 to 1 and 5.56.1 or from 37.5 to 82 percent in the third and fourth quartile years (2005 to 2012 and 2013 to 2020) respectively. This provided vivid illustration of sharp decrease in the output of Nigeria's refineries and the magnitude of impact of lowered domestic productivity on consumption. The abysmally domestic refining capacity largely induced Nigeria's reliance on importation for about 80-90 of her local consumption (Aaron, et al, 2015; DPR 2015; 2018). This confirm Nigeria's overdependence on importation necessitates such fiscal subsidies spends is root cause of on subsidies spending and wastage of public resources and corroborated in BudgIT (2019). Ogbuigwe (2018) argued that which have total installed capacity of 445000 bpsd but due to the refineries poor operating performance in the last 20 to 24 years with less than 20 percent average capacity utilisation resorted to importation to meet consumers' demand.

A conservative estimate suggests that 55 million litres of petroleum products are consumed daily in Nigeria at the ratio of 35:12:8 for PMS, AGO and DPK respectively. Analysis also shows that at the current demand growth rate, we will need to process 750,000 barrels of crude per day to meet the nation's demand for petroleum product by 2020. There is currently a deficit of 2.6 million barrels per stream day between demand and supply of petroleum products in Africa.—

(2) There would have been zero incidences of products shortages (demand-to-supply gaps) or zero requirements for petroleum products subsidies in Nigeria, if the refineries were in normal working conditions. Even with five percent allowance out of the normal production yield based on 1989 refining output, and given the quantum of daily DCA were sufficient in producing sufficient volume of assorted refined products, Nigeria ought to have produced enough products for local consumption. The existing refineries proved to have operated sub-optimally over two decades. Similarly, had the revenue proceeds from the barter trading of 445000 bbl efficiently and judiciously ploughed into sourcing of imported products are reasonable bargain prices, Only about 100000 barrels of crude-oil or small quantity were most times processed by the existing refineries, leaving as much as about 335000 barrels per day for exchange or barter trading by the NNPC as stated in Aaron, Gilles and Katsouri (2015). If these allocations were judiciously utilised and properly managed, Nigeria would not have incurred significant

fiscal expenditure on subsidies. DCA has been grossly mismanaged which has resulted in substantial fiscal subsidy spends. It is inappropriate therefore for government to impose the consequences of the financial burden of fuels importation on the citizens thus no justification for government's agitation for subsidy removal without functioning refineries that produces sufficient products for domestic need.

(3) There was the preponderance of excessive over-spending, unbudgeted spends and high degree of fiscal indiscipline in handling products subsidy funds and manifests higher order of malpractices. Out the total sum of N14.73 trillion incurred as FGN direct fiscal expenditure on products subsidies from 1989 to 2020, only N5.98 trillion (N6 trillion approx.) were formally approved between 2006 and 2015. The remainder N11.28 trillion were disbursed without the statutory fiscal approval by the federal legislature; meaning that the bulk of petroleum products subsidy payments were disbursed by the fiat of either the Executive arm of government and the NNPC over the years. BudgIT (2019) stated that according to Petroleum Products Pricing and Regulatory Agency, PPPRA, and NNPC, reports revealed that at least N10 trillion has been spent on petrol import subsidy between 2006 when the Petroleum Support Fund, PSF, was set up and 2018, The subsidies are captured by administrators and middle-men and do not even reach consumer markets: for example, kerosene is supposed to be priced at ₦50 (US\$0.31) per litre, but is instead sold for between ₦100 and ₦250 (US\$0.62–1.55) in most parts of the country (IISD, 2012).

Additionally, subsidies have had serious impacts on investment in Nigeria's energy sector, with ramifications for the economy and the availability of energy for Nigerian citizens. At the moment the annual spending on fuel subsidy fiscal spending now accounts for roughly one-fourth of all federal budgetary spending. This is significantly greater than the executed federal capital budget, spending on education and public health combined. and greater than all federal relative to the size of the Nigerian economy is far greater than the nominal declines and far greater spending on education and public health combined (World Bank 2015). —————

The observed or observable policy inconsistency in Nigeria's subsidy fiscal expenditure which has increased significantly during the past six years even though government formally declared that the era of subsidies spends is done and dusted. The FGN, whilst speaking through the incumbent NNPC's Managing Director as reported in the Premium Times of March 25, 2021 stated that governments spends about N120 billion monthly on subsidising pump price of petrol. However, the same public functionary announced to the public sometime in 2017 or 2018 that fuel subsidies has gone forever! However, private demand for domestic refined oil increases while it decreases for imported refined oil. And decrease of private demand for imported refined oil drives the results of the composite, total, private demand and all scenarios lead to a reduction in imported refined oil (Khalid, Siddiq, Angel, Aguiar & Peter Minoorr et al).

(4) Nigeria would have provided consumers' the required volume of petroleum products at lower public expenditure with greater welfare benefit and economic (price) stability rather than resorting to importation. The acquisition and installation cost of mint refineries of 100000 to 150000 bpsd is within the range of \$2 billion for 100000 bbl capacity; \$2.5 billion for 125000 per day production capacity. Whilst the 300000 bbl daily production capacity installed in India 10 years ago (in 2010) cost a total sum

of \$4 billion. It would have been more economical for Nigeria to have borrowed funds from the international financial institution to finance the acquisition of four additional new refineries or modernization of the existing ones. The nation would also be better off than resorting to becoming net importer of refined petroleum products over the years which advertently left the economy bleeding. –

Nigeria's refineries were not effectively and efficiently operated for 15 years and about 23 years now (1997–2020). The maintenance of the local refineries were neglected for several years which resulted to their inability to be operating optimally. None of the Nigerian refineries produces aviation (ATK) fuels; meaning that the country predominantly relies on importation for the consumption of this product. Nnodim (2021) stated that Nigeria, through the NNPC reportedly spent about N103.4 billion within 13 months in 2020 / 2021 without (zero) refining productivity and it corroborates the degree of wastefulness in local refinery effort as extensions of subsidy spending. Even if Nigeria had opted to finance acquisition of two to four additional new refineries or modernization of the existing ones plus two-to-three new plants, through project loans from international agencies (using such project assets as part of collaterals), the nation would also be better off than resorting to becoming net importer of refined petroleum products over the years which advertently left the economy bleeding.

Daily Trust news (n.d) reported that the total sum of \$1.746 billion TAM investments had been spent by the Nigerian government from around 1998 through 2007 without increase in local production of refined products. Reuters (2021) states that Nigeria has approved \$1.5 billion TAM spending to Tecnimint of Italy for revamping the Port Harcourt Refinery Plant and that the project which has been split into three stages is expected to be completed with 44 months. In essence, the inability of Nigeria's policy makers and management of NNPC in managing the nation's refineries, domestic crude-oil allocations and lack of prudence in subsidy fund management have resulted in products' scarcity, indulgence fuels importations and wastages of public funds. Nigerian government's policies on fuels subsidies can be likened to the proverb of slave-debtor that was given the options of repayment of debts or cutting forest or drinking drums of pond water. They initially chose to cut and weed the forest only to opt-out to drum drums of pond water and later change to repayment of debts after 20 years of serving punishments.

(5) The factor triggering steady high volume consumption petroleum products is caused by lowering volume of electricity generation and supply. The Nigerian population relied more on consumption of petrol, kerosene and diesel as alternative sources of energy. Therefore, insufficient electricity power generation and supply is core factor inducing high fuels consumption of fuels.

Summary, Conclusion And Recommendation

This paper forensically investigated petroleum products procurement and distribution; local refining production, lifting alongside the ascertainment of demand-to-supply-gaps of local refining operation. It also examined domestic crude-oil allocation and utilization in satisfying consumption, assessment of the factors influencing demand and supply of refined products outside of prices and income; fiscal discipline

of the approved subsidy expenditure budget. The results and deliverable from the study are highly rewarding.

5.1 Conclusions

The decline in domestic production of refined products is the root cause of subsidies spending with all the associated wastages of funds and macroeconomic disturbances. Nigeria relied on importation for about 85-90% of fuels consumption; local refineries were inefficiently run, and DCA grossly mismanaged. There was significant fiscal expenditure on subsidization refined petroleum (petrol, kerosene and diesel) products and significant relationship between fuel demand and fuel subsidy factors. Domestic prices of petroleum products are highly subsidized; a phenomenon that has contributed to rapid growth in domestic demand. In effect decreases fiscal revenues and the rising cost of subsidy, becomes a serious fiscal policy concern. Sub-optimal power generation and supply contributed to high level fuels consumption due poor electric supply. There was lack of fiscal discipline was lacking in handling of allocated subsidies fund. Fiscal spending on subsidies would have funded proper routine TAM and build four new refineries which is financing option that ought to have guaranteed 'pareto optimality' in the economy. If the subsidy is withdrawn, expenditure will remain high as long as domestic consumption flows from imports.

5.2 Recommendations

Government should refrain from her overdependence importation of the products and fast-track resumption of normal local production. Government should increase domestic crude-oil allocation from 44500- to about 650000 bbl to ensure adequate production of domestic consumable fuels. Nigeria should ensure proper and regular routine TAM and build more refineries in order to produce sufficient volumes of refined products for both domestic consumption and exporting. Nigeria should drop the idea of subsidy but to sustain subsidisation on consumption of fuels (PMS, DPK and AGO) until such a time she also to produce and provide consumers enough products at lower prices, because subsidy withdrawal will reduce current excessive household consumption spending and macroeconomic disturbances. In order to moderate consistent rise in fuels demand and consumption, Nigeria should strive to enhance her electricity and alternative energy generation / supply of 40000 to 100000 kilowatt daily in order to moderate substitution effect of electricity usage on consumption of energy fuels.

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Declarations

The author declares no competing interests.

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