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Petroleum Subsidy Reduction and Poverty in Nigeria: A Choice between Maintaining the Subsidy or Providing Infrastructural Services Equivalent to the Deadweight Loss

Matthew Oladapo Gidigbi[1] and Kehinde Mary Bello[2]

[1]Modibbo Adama University of Technology, [2]Obafemi Awolowo University

Government interventions in energy pricing can either aggravate or alleviate overall poverty, complicating efforts to reduce the burden of subsidies on developing country budgets. This issue is particularly acute for Nigeria, where a large subsidy on Premium Motor Spirit (PMS) consumes a considerable portion of the country's resources and is subject to large scale corruption and misuse, yet where there continues to be a high rate of poverty incidence and a large indigent population sensitive to any increase in the price of fuel. This study assesses the choice between maintaining the PMS subsidy and redirecting those resources to the additional provision of infrastructure services, proxied by the deadweight loss. Annual data covering the period of 1981-2016 were sourced from the Nigerian National Petroleum Corporation (NNPC) Monthly Financial Operations, the NNPC Annual Statistical Bulletin, the Central Bank of Nigeria Statistical Bulletin and Annual Reports. Vector Autoregression was used to regress poverty incidence on the subsidy and the deadweight value from the subsidy. The study found barely any difference between the contributions of both variables to poverty reduction, with the according coefficients 0.02 and 0.01 percent respectively. Empirically, maintaining the subsidy is the slightly better choice in terms of poverty reduction. This supports the view that the PMS subsidy is important for the indigent due to the susceptibility of such households to income shock. However, greater health investment appears to be an effective intervention, and improving primary health could significantly reduce poverty incidence in the country.

Keywords: Poverty incidence, Petroleum subsidy, Energy reforms, Education, Health, Efficiency loss

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Corresponding Author
Matthew Oladapo Gidigbi
Modibbo Adama University of Technology
E-mail: gidigbimdres@gmail.com

INTRODUCTION

Energy subsidies are government interventions that affect prices or the cost of energy products, influencing energy market outcomes (International Energy Agency, 2010). While developed countries have mostly relied on regulatory instruments in influencing their energy markets, developing countries employ interventions such as subsidies to decrease the prices of energy for consumers. According to International Energy Agency (2009), modern access to energy services is a key objective for the 1.5 billion poor people in the world who lack access

to electricity. Energy subsidies have been implemented to alleviate poverty, enabling the less privileged to access affordable energy and enhance economic growth. The policy can be linked to the three pillars of the sustainable development goals: poverty reduction, affordable and modern energy, and economic growth. Also, subsidies can shield fragile economies from shocks experienced due to international markets (Onyishi, Eme & Emeh, 2012).

However, efforts to carry out fuel subsidy reform—policies that change the size and allocation of a subsidy (Inchauste & Victor, 2017)—are becoming more pronounced and tenable in policy circles in the face of their inefficiency and unsustainable financial burden. Not only are fuel subsidies increasingly perceived as an unsustainable burden on government finances, they often favor the rich, who are the major consumers of energy (Rentschler, 2015). Studies have shown that subsidies are inefficiently transferred to poor households, who are the main reason for granting a fuel subsidy in the first place (Atansah, Khandan, Moss, Mukherjee, & Richmond, 2017). Accordingly, fuel subsidy reform has been debated and endorsed as an important step to achieving sustainable development, with anticipated advantages of improved social distribution and reduced carbon emissions.

The experience of Nigeria is noteworthy in this debate. The Nigerian economy depends on gasoline or petrol, known as premium motor spirit (PMS), for the transportation of goods and provision of services (Ogubodede, Ilesanmi & Olurankinse, 2010). Although PMS is rarely used for the production of goods in Nigeria, its crucial role in distribution means that an increase in its price can initiate an increase in the consumer price index and subsequently the inflation rate.

PMS has been highly subsidized in Nigeria. The government expended US$10 billion on the fuel subsidy in a space of 18 months between January 2012 and July 2013, a figure which was between two to five times the education budget, and seven times the health budget (McCulloch & Okigbo-III, 2015). According to Adenikinju (2009), the fuel subsidy consumed US$9.7 billion (₦1,173.2 billion) between 2006 and 2008. Subsidies increased by 400 percent (from 188 billion Naira to 971 billion Naira) between 2007 and 2014, a rate considerably higher than the growth in consumption (SDN, 2015). In 2011, Nigeria spent a record US$8.4 billion on the gasoline subsidy, or 4.1 percent of GDP (Atansah, Khandan, Moss, Mukherjee, & Richmond, 2017).

In addition to this considerable burden on governmental finances, the fuel subsidy has been linked to other serious problems. Increase in demand for PMS as a result of the subsidy caused a reduction in prices of the products, thereby creating a scarcity of supply. It contributed to the collapse of local refineries due to a price effect, increased the reluctance of private investors to invest in refineries, and caused sporadic fuel shortages at fuel stations as the subsidy encouraged smuggling and adulteration of products among other problems.

It has also been the source of considerable corruption and waste. The politically well-connected and intermediary dealers hike the market price before the fuel reaches the market. For instance, in the case of kerosene, it was subsidized at the rate of US$0.25 (₦ [1]50) per liter to the privileged individuals but sold at the rate of US$0.61 (₦120) and US$1.27 (₦250) to the general public (Udo, 2015). In 2012, the National Assembly's committee on Administration of Subsidies chaired by Farouk Lawan revealed that over 232 Billion Naira (US$6.8bn) of subsidy paid to marketers for PMS in 2011 was not supplied, and that 31 million liters per day were supplied as opposed to marketers claims of 60 million liters (Channels Television, 2012; BBC, 2013). Unfortunately, the Committee Chairman was taped collecting a kick-back to free two marketers from the indicted companies[2] (BBC, 2013).

Finally, the major problem is that the subsidy discriminates against the poor, who are the supposed target of the subsidy and comprise about 61 percent of the population. The direct benefits are concentrated on the rich (Rentschler, 2015), with the poorest 20 percent of the population consuming only 2.1 percent of the subsidized fuel, while the richest 40 percent consumes 85 percent (McCulloch & Okigbo-III, 2015). This has further widened the inequality gap (The Centre for Public Policy Alternatives, 2011; Rentschler, 2015).

[1]Naira (₦) is the denomination for the Nigerian currency. 100 Kobos = ₦1. The US$ equivalent is calculated as per official exchange rate (US$1=₦197) as of 2015.

[2]A new report on the case is available for viewing here: https://www.youtube.com/watch?v=v7gzT5vd0vE&gl=NG.
https://www.premiumtimesng.com/news/5552-inside_details_of_the_sting_operation_that_caught_farouk_lawan.html.

The issues described above have led to general concern from both the government and the policy experts about sustainable development and fuel subsidy reforms in Nigeria (Ekong & Akpan, 2014). The magnitude of the fuel subsidy mess has made some stakeholders and policymakers advocate fixing the value of the subsidy rather than the fuel price, and even the abolishment of the PMS subsidy entirely (McCulloch & Okigbo-III, 2015).

In 2012, Nigeria experienced a partial removal of fuel subsidy which generated much discussion among scholars. There has been a mixed reaction to fuel subsidy reforms in Nigeria. According to Umar and Umar (2013), there are two main opposing views. The first, in consonance with Adenikinju (2009), is that removal of fuel subsidy will enhance efficiency and remove market distortions. The other side worries that the removal of the fuel subsidy would be harmful to the lower-income groups in the country. Despite its problems, the subsidy may serve as an important shock absorber for the poor households' consumption. Removal of the petroleum subsidy would hurt the indigent because its pricing effect cuts across almost all commodities in Nigeria, especially if this support is not compensated for in other ways.

As such, important trade-offs are involved in this debate. The government is facing fiscal constraint in the face of several developmental projects needed for inclusive and sustainable growth. At the same time, there is an alarming rate of poverty incidence. Therefore, there is a need to relate fuel subsidy reforms to welfare.

Against this backdrop, this paper focuses on the impact of the PMS subsidy on households and businesses, and considers its implications for poverty reduction. It tests whether the subsidy is superior in terms of alleviating poverty compared to the greater provision of infrastructural services, proxied by a calculation of the deadweight loss.

LITERATURE REVIEW

A fuel subsidy is a social obligation to reduce the fuel price, ostensibly to benefit the poor (Ogunbodede et al., 2010). Nevertheless, households with high-incomes benefit more from subsidies compared with those with low incomes, in that they use approximately 20 times more fuel compared with those with low incomes (Azel del Granado, Coady & Gillingham, 2012). According to the World Bank (2010), subsidy reforms have mixed effects on the rich and the poor. Its effect can be significant because around 90 percent of transportation of goods and services is carried out through the use of fuel (Aketola, 2014). This directly affects household incomes which could be detrimental to their standards of living. Yusuf and Resosudarmo (2008) delved into the severe distribution of reduced fuel subsidies, the study suggested that subsidies could be more beneficial if rural and urban cash transfers are separated.

Employing Computable General Equilibrium (CGE) modelling, Dartanto (2013) established that decreasing a fuel subsidy intensified poverty incidence in Indonesia. But if the decrease is channeled in the direction of government spending, it will reduce poverty incidence. On direct and indirect subsidies in Ecuador, Llerena et al. (2015) used microsimulations generated from a household survey. The survey concluded that indirect subsidies are regressive. On the contrary, Lustig (2018) found that indirect subsidies are progressive with a positive Kakwani index and help to reduce inequality in Ecuador. Chanatásig (2017) used a regression model to simulate scenarios for the poor and the rich alike. The study concluded that removing the subsidy on Liquefied Petroleum Gas (LPG) consumption would affect the richest three deciles of the population while the best scenario case is where the government subsidizes the wealthiest populace and reallocates the surplus to the poor.

Lustig (2018) and Bucheli et al. (2013) used simulation approaches in Latin America to analyze the effect of fuel subsidies consumed in the household. The results revealed that indirect subsidies were able to reduce inequality. Arze del Granado, Coady, and Gillingham (2012) examined the effect of the subsidy on household income in 20 developing countries, including India. The study showed that fuel subsidies are of more benefit to the rich and an indirect effect makes up approximately 60 percent of the total impact on subsidy removal. The top income quintile was offered six times more benefit than the bottom quintile. Also, LPG and diesel account for 70

percent and 65 percent subsidy benefit respectively while petroleum subsidy was the most regressive with over 80 percent of the benefit accrued to the top two quintiles. The benefits of kerosene subsidies accrued uniformly across income groups, but the most substantial benefit was linked to higher-income groups.

Employing data from Indian Human Development Survey, Lahoti, Suchitra and Goutam (2012) investigated which groups benefit more from LPG subsidies in India. The result revealed that the impact of reducing LPG prices affects the poor rather than the rich who can afford cooking fuel at a higher price. Jara et al. (2018) examined the various effect of eliminating fuel subsidies in Ecuador. The result showed that diesel and gasoline subsidies are regressive while domestic gas was progressive in the course of the study. Therefore, the study inferred that eliminating gasoline and diesel subsidies will have no effect on poverty but reduce government expenditure. On the other hand, eliminating all fuel subsidies would increase poverty due to its importance for low-income households. The result of a study from Ghana showed that the indirect effect of subsidy reforms affects firms indirectly by increasing the cost of raw materials and transportation thereby decreasing purchasing power (Jamal & Ayarkwa 2014).

The poverty rate in Nigeria continued increase after the introduction of the PMS subsidy. The rate of poverty increased from about 34 percent in 1987 to 67 percent in 2011, representing an alarming 33 percent increase (National Bureau of Statistics, 2012). As of 2014, the poverty rate was estimated to be 72 percent (Central Bank of Nigeria, 2014). The statistics show that the subsidy policy has not achieved its aim of poverty reduction in which the poor are most vulnerable. The poor who are majorly located in the rural areas of the country is the major consumer of fuel in the country. In Nigeria, uncompensated subsidy removal was estimated to cause a rise in the national poverty rate by 3-4 percent while identical cash compensation which appears to be effective at average mitigated price shocks in 16 out of the 36 states. In respect to this, Rentschler (2016) examined the regional variability of direct welfare effects on fuel subsidy removal. The result shows that regional disaggregated reimbursement can be neutral thereby reducing pre-reform poverty rates distributed in all states.

In 2012, the attempt to remove the fuel subsidy caused an adverse effect, which jeopardized the entire subsidy reform effort. The price of fuel to doubled, wherein violent protests and strikes erupted, prompting the government to immediately reintroduce subsidies to control the situation (Bazilian & Onyeji, 2012; Siddig et al., 2014). Adelowokan and Osoba (2015) investigated the effect of oil revenue proceeds and government spending on the poverty rate in Nigeria. The granger causality and Ordinary Least squares (OLS) methods were used to analyze data set from 1970 to 2013. The result showed that GDP growth and increased revenue from oil exhibited a negative impact on the poverty rate in Nigeria. The study concluded that the income from oil revenue is not channeled into government spending on capital projects which further worsens the poverty rate.

Okereke (2017) examined the impact of petroleum subsidy removal on government expenditure in Nigeria. The error correction technique (ECM) was used to analyze time-series data spanning from 1985 to 2015. The result revealed that subsidizing the price of PMS positively affected government expenditure in Nigeria. It was also found that the subsidized price of Dual Purpose Kerosene (DPK) exhibited a negative and positive influence on government expenditure in Nigeria. Okwanya, Ogbu and Job (2015) examined the relationship between the Consumer Price Index (CPI) and fuel subsidy removal in Nigeria. The paper employed ECM techniques and data for the pump price of PMS spanning between 1986 and 2014. The result showed that changes in fuel prices have a short-run impact of 12 percent on the CPI. This suggests that fuel subsidy reforms could have a permanent effect on the economy but will not increase poverty nor lower the real income of the household. Therefore, the slow removal of subsidy has little effect on the overall prices of retail goods. Gidigbi, Bello and Babarinde (2019) investigated the petroleum subsidy and its impact on tax revenue volatility. The study found that petroleum subsidy aids tax revenue volatility in Nigeria, though, they asserted that the impact is minimal but significant.

Extant studies have shown that the contribution of fuel subsidies to poverty incidence is mixed, favoring poverty reduction in some instances and the contrary in some other instances. At times, it is one or other component of the fuel subsidy that does the work. In a situation whereby unfavorable results were found, it was discov-

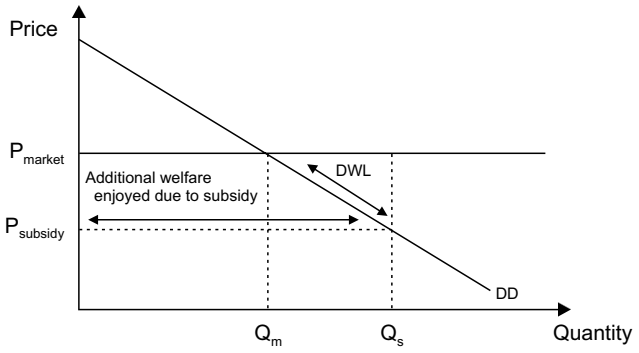

Fig. 1. The fuel subsidy and its implication.

ered that not only had the government failed to bring down the poverty rate, it also lost revenue in trying. It can be concluded from the reviewed studies above that the fuel subsidy has the potential to be favorable to the poor households with the right policy design and implementation.

MATERIALS AND METHODOLOGY

Research Design and Sources of Data

This paper examines the causal relationship between PMS subsidy, deadweight loss on PMS subsidy and poverty incidence, thereby, quantitative method of analysis is applied. We draw on Ekong and Akpan (2014), who followed up on Coady et al. (2010) to discuss the subsidy measurements in Nigeria with regards to fuel. The pricing template for PMS in line with the Petroleum Product Pricing Regulatory Agency (PPPRA) in Nigeria, includes landing and distribution costs as well as the subsidy. The subsidy, in this case, is the differential in the amount at which the expected open market price (EOMP) is greater than the government announced price. Unfortunately, these two costs categories for EOMP is tax-free, which means the government sacrificed both direct intervention through a cash payment and indirectly through sacrificing tax-revenue.

Consider Figure. 1, in the absence of fuel subsidy, the prevailing market price would be P_{market} and the market would clear at quantity Q_m. The P_{market} will equally be the supply curve assuming a perfectly competitive market where a region is a price taker. But with the introduction of the subsidy in the market, a consumer buys more because purchasing power would increase with additional welfare to enjoy. Therefore, the market would clear at quantity Q_s and at price $P_{subsidy}$ (implies market price minus subsidy). The increasing quantity consumed and the additional welfare have an opportunity cost, which is the efficiency loss or deadweight loss (DWL). In a real sense, someone pays for the subsidy because it has an opportunity cost. Ekong and Akpan (2014) asserted that the trade-off for a subsidy could be higher taxes, poorer infrastructure, and lower stock of human capital among others. The concern of this paper is an investigation on the extent to which PMS subsidy and its deadweight loss (DWL) could serve the indigent population through a reduction in poverty incidence. Furthermore, Deadweight Loss is measured thus:

$$DWL = \left(P_{market} - P_{subsidy}\right)Q_s - \frac{A}{(1+\varepsilon)}\left[P_{market}^{(1+\varepsilon)} - P_{subsidy}^{(1+\varepsilon)}\right]$$

Where P_{market} is the market price for the fuel (Premium Motor Spirit in this case). Also, it could as well be referred to as supply cost; $P_{subsidy}$ is the subsidized price, that is, the retail price at which the general populace is buying the fuel; Q_s is the quantity consumed, which is usually higher than the quantity at the market price; A is defined as a scalable parameter and measured thus: $A = \frac{Q}{P^{\varepsilon}}$; Epsilon (ε) which is minus slope, taken as the power/index of price, and use the outcome to divided quantity. The Epsilon itself stands for the price elasticity, which is mea-

sured to be between −0.6 and −0.8 according to estimates in the literature for the long-run elasticity of demand for transportation fuels (Sterner, 2007; Brons, Peter, Eric, & Piet, 2008 as cited in Davis, 2017). This implies that a 10 percent increase in the price of PMS will lead to 8 percent decreases in demand for PMS. This paper adapts −0.8 as its epsilon in calculating the DWL. The welfare consumer enjoys from a subsidy is less than the opportunity cost borne by the government on the same subsidy (Katz & Rosen, 1994).

Furthermore, the DWL was calculated using the stated DWL equation, with the calculated PMS subsidy data as the feeder for the DWL calculation. PMS subsidy was calculated by taking the difference between the market price (supply cost) and retail price. In tandem with the PMS pricing template of Petroleum Products Pricing Regulatory Agency[3] (PPPRA) in Nigeria, the market price for PMS includes the following cost elements: (a) landing cost[4]; and (b) total distribution margins. The summation of these two cost elements will give the Expected Open Market Price (EOMP), which is the same thing as the supply cost. PMS Subsidy is the difference in the EOMP and the Approved Retail Price (ARP). PMS Subsidy is calculated thus: (EOMP minus ARP) multiplied by Consumption, all the three variables at period t. Nigerian National Petroleum Corporation (NNPC) records, Annual Statistical Bulletins (ASBs) among other records[5], serve as the major source of identifying market quantity or consumption level. The variables used in the specified models are defined in Table 1 below.

Model Specification

Equation 1:

$$POVI_t = \beta_0 + \sum_{j=1}^{n=5} \beta_j POVI_{t-j} + \sum_{j=1}^{n=5} \beta_j PMS_{Sub\ t-j} + \sum_{j=1}^{n=5} \beta_j EINV_{t-j} + \sum_{j=1}^{n=5} \beta_j HINV_{t-j} + \upsilon_t^{POVI}$$

Equation 2:

$$POVI_t = \beta_0 + \sum_{j=1}^{n=5} \beta_j POVI_{t-j} + \sum_{j=1}^{n=5} \beta_j PMS_{DWL\ t-j} + \sum_{j=1}^{n=5} \beta_j EINV_{t-j} + \sum_{j=1}^{n=5} \beta_j HINV_{t-j} + \upsilon_t^{POVI}$$

Stationarity Test

This test is carried out before the estimation of the specified model. This paper used Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Testing the stationarity of the data becomes imperative in order not to estimate spurious regressions, which implies significant coefficients without a long-run relationship. The unit-root test was carried out, starting from the level without inducement, to the stage at which stationarity was attained. ADF is used in the first instance, but where an ideal result is not obtainable using it, a PP test was applied because it is more powerful than ADF due to its relaxation of the homoscedasticity assumption, and thus it works better in the presence of heteroskedasticity (Hamilton, 2006). Furthermore, using a PP test is still in order because a variable stationary at a particular order of integration in ADF will surely be stationary at the same order of integration in PP, but the reverse may not be true. Variables that were stationary at the first difference in ADF

[3]Details are available here: http://pppra.gov.ng/petroleum-products-pricing-template-for-6th-march-2020-pms/.

[4]Landing cost entails Cost + Freight offshore Nigeria, Lightering expenses (SVH), NPA, NIMASA charge, Jetty Thru'Put charge, Storage charge and Financing.

[5]Data used for the analysis were sourced from the Nigerian National Petroleum Corporation (NNPC) Annual Statistical Bulletin (ASB) for the year 1997, 2005, 2008 and 2016; Central Bank of Nigeria (CBN) Statistical Bulletin and Statement of Accounts and Annual Reports. The extracted data for this paper covers the period of 1981- 2016. The A time-series data were used and analyzed using are a time-series in nature.

Table 1. Variable definitions

Notation	Variable	Measurement	
POVI	Poverty incidence	The ratio of headcount poverty to population	Dependent variable
PMS_SUB	Premium motor spirit subsidy	Premium motor spirit subsidy in billions of Naira	IV
PMS_DWL	Premium motor spirit deadweight loss from subsidy	Efficiency loss on premium motor spirit subsidy (or opportunity cost of premium motor spirit subsidy) in billions of Naira	IV
EINV	Investment in education	Government expenditure in education, captured in billions of Naira	IV and CV
HINV	Investment in health	Government expenditure in health, captured in billions of Naira	IV and CV
INF	Inflation	The inflation rate measures the rate of increase of a price index (unit of measurement is in percentage).	IV and CV

Note: IV and CV imply independent variable and controlled variable, respectively.
Source: Authors' computation.

were equally stationary at the first difference in PP. However, it becomes reasonable to consider a test that is more considerate for heteroskedasticity because the following variables: PMS_SUB and PMS_DWL are not variables with a consistent pattern. International crude oil price dictates what the subsidy would be, and this often fluctuates. Thereby, the variables tend to exhibit heteroskedasticity and unit-root test that tolerate heteroskedasticity was found more appropriate.

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{j=2}^{\beta} \beta_j \Delta y_{t-j} + \varepsilon_t \qquad \varepsilon \sim IID(0, \sigma^2)$$

$$H_0{:}\gamma = 0 \ (nonstationary, i.e. presence\ of\ unit\ root$$

$$H_1{:}\gamma < 0 \ (stationary, i.e. no\ presence\ of\ unit\ root$$

Where: y in the equation represent each of the variables in the specified model; ε is an error term; γ is the stationarity coefficient; α_0 and β_j are parameters to be estimated.

Cointegration Test

A Johansen and Juselius Cointegration Test was used to assess the existence of a long-run relationship among the variables. If at all the variables involved are not stationary at the non-induced stationarity level, then the variables involved will be tested at difference so that their linear combination will cancel out the stochastic trends in them (Johansen, 1991).

RESULTS AND DISCUSSION

The results of the data analysis are arranged in the order at which they were carried out. Descriptive statistics first, then, unit-root tests followed by the cointegration test which verify the existence of a long-run relationship among the variables in the model. Moreover, these tests point out an appropriate method of analysis for the data. Vector Autoregression (VAR) estimates were estimated based on unit-root and cointegration tests outcomes.

Descriptive Statistics

Table 2 shows the descriptive statistics of the variables in the specified model, which are measured in billions of Naira except for poverty incidence (POVI) and inflation (INF), which are measured in percentage. Following

the Central Limit Theorem (CLT), it is assumed that each of the time series variables is normally distributed irrespective of its Jarque-Bera's probability value since the observation in each of the variables is above thirty (30). Less attention is given to the maximum and minimum values towards data cleaning since the data are from an emerging economy.

Unit-Root Tests

The unit root test results summarized in Table 3 shows that all the variables are not stationary at level but at induced level, first difference precisely. Both the Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) tests confirmed and affirmed the stationarity of the variables in the specified models at the first difference. Thereby, there is a need to test for the existence of a long-run relationship to override any possible chances of running a nonsensical regression.

Cointegration Estimation

The unit root tests show that all the variables of concern are not stationary until the first difference. Testing for cointegration becomes imperative to ascertain whether the variables in the model share a long-run relationship. The test results as shown in Tables 4 and 5 for the two specified models indicate no long-run relationship, which implies the impossibility of relating the variables in the long-run. In response to this, only the short-run relationship estimation is possible.

Table 2. Descriptive statistics

	POVI	PMS_SUB	PMS_DWL	EINV	HINV	INF
Mean	54.0688	11114.40	7663.630	101.1447	65.0451	20.4224
Median	54.2000	85.9244	56.2687	39.2548	16.8266	12.9210
Maximum	81.2000	87903.49	71652.78	390.4200	257.7200	76.7588
Minimum	21.3000	0.5178	–5.7526	0.3438	0.1108	0.2236
Std. Dev.	16.8417	24177.48	19288.15	127.5716	83.4486	18.7567
Skewness	–0.3161	2.1342	2.4931	1.1013	0.9720	1.5355
Kurtosis	1.7951	6.2520	7.9004	2.7718	2.4154	4.3563
Jarque-Bera	2.7771	43.1936	73.3145	7.3564	6.1817	16.9068
Probability	0.2494	0.0000	0.0000	0.0252	0.0454	0.0002
Observations	36	36	36	36	36	36

Source: Authors' computation using EViews 8.

Table 3. Unit root tests

Variable	ADF test t-statistic		PP test Adj. t-statistic		Decision
	At level	At 1st difference	At Level	At 1st difference	Order of integration
POVI	–1.6960	–10.8377***	–1.9092	–10.4635***	I (1)
PMS_SUB	16.5615	6.2390	0.0730	–2.5570***	I (1)
PMS_DWL	1.6788	–2.3353**	–2.0139	–2.3353**	I (1)
EINV	0.5103	–4.6845***	0.5906	–5.6554***	I (1)
HINV	–1.7538	0.6108	0.2510	–7.7224***	I (1)
INF	–1.5316	–6.2465***	–3.2010	11.4708***	I (1)

Note: ***, ** and * implies statistically significant at 1 percent, 5 percent and 10 percent significance level respectively.
Source: Authors' computation using EViews 8.

Table 4. Unrestricted cointegration rank test (Trace and maximum eigenvalue)

Hypothesized		Trace	Max-eigen	0.05
No. of CE (s)	Eigenvalue	Statistic	Statistic	Critical value
At most 1	0.3996	41.0409	47.8561	0.1874
At most 2	0.3835	23.6955	29.7970	0.2136
At most 3	0.1844	7.2458	15.4947	0.5492
At most 4	0.0091	0.3137	3.8414	0.5754

Note: Trace test indicates no cointegrating eqn (s) at the 0.05 level. Max-eigenvalue test indicates no cointegrating eqn (s) at the 0.05 level (sic), ** denotes rejection of the hypothesis at the 0.05 level.

Source: Authors' computation using EViews 8.

Table 5. Unrestricted cointegration rank test (Trace and maximum eigenvalue)

Hypothesized		Trace	Max-eigen	0.05
No. of CE (s)	Eigenvalue	Statistic	Statistic	Critical value
At most 1	0.4920	45.3288	47.8561	0.0848
At most 2	0.3529	22.2948	29.7970	0.2824
At most 3	0.1915	7.4925	15.4947	0.5211
At most 4	0.0077	0.2638	3.8414	0.6075

Source: Authors' computation using EViews 8.

Vector Autoregressive (VAR) Estimates

VAR was used to estimate the relationship between the Poverty incidence (POVI) and PMS subsidy (PMS_SUB), deadweight loss on PMS subsidy (PMS_DWL), and other control variables because the variables are of induced stationarity at the first difference and there is no long-run relationship among the variables in both specified models. VAR estimation in both Table 6 and 7 have poverty incidence as their dependent, meaning no particular variable is dependent on VAR estimation. The two estimations maintained five-period lags as the ideal lag based on the lag selection with the supported statistical criterion. The two tables only summarized the statistically relevant coefficients among the estimated output table from the statistical package deployed. PMS subsidy was only observed to be reducing poverty incidence at 3 lagged periods. This implies that the subsidy in the prior three year affects the present poverty incidence at the miniscule rate of 0.02 percent per increment of PMS subsidy. This finding is consistent with the finding of Lustig (2018), Bucheli et al. (2013), and Dartanto (2013), though the magnitude of the contribution of the (PMS) subsidy differs in each of the studies. Meanwhile, health investment reduces poverty more, at 1.26 and 2.02 percent when considering the health expenditure in the previous three and five years respectively. All these findings are statistically relevant, mostly at 1 percent significance levels.

Likewise, in the second model, deadweight loss from the PMS subsidy reduces poverty at the third-year mark at the low rate of 0.01 percent. In contrast, health investment reduces poverty incidence by up to 1.97 percent per point increment increase in health expenditure. The time taken for the impact to be felt is long. The findings align with the position of Katz and Rosen (1994), who observed that direct intervention is the most ideal means of assisting the poor rather than subsidies.

Empirically, this paper found that the impact of the PMS Subsidy (PMS_SUB) on Poverty Incidence (POVI) is higher compared to the impact of PMS Deadweight Loss (PMS_DWL), though the difference is very minimal. This finding agrees with the findings of Lustig (2018) and Chanatasig (2017) on Latin America, as well as Yusuf and Resosudarmo (2008). The findings contrast with the findings of Jara (2018) and Llerana et al. (2015)

Table 6. Vector autoregression (VAR) estimation

Variable	Coefficient	t-statistics	Prob.
D(LOG(POVI(-1)))	0.9588	4.9933	0.0041
D(LOG(PMS_SUB(-1)))	0.0019	4.0503	0.0098
D(LOG(PMS_SUB(-3)))	–0.0145	–4.5227	0.0063
D(LOG(EINV(-5)))	1.2930	3.7204	0.0137
D(LOG(HINV(-2)))	0.8384	3.7208	0.0137
D(LOG(HINV(-3)))	–1.2613	–2.8168	0.0372
D(LOG(HINV(-5)))	–2.0164	–7.1253	0.0008
D(LOG(INF(-4)))	0.0947	2.5112	0.0537
R-squared	0.9963		
Adj. R-squared	0.9781		
F-stat	54.6084		

Source: Authors' computation using EViews 8.

Table 7. Vector autoregression (VAR) estimation

Variable	Coefficient	t-statistics	Prob.
D(LOG(POVI(-1)))	0.9566	4.2849	0.0078
D(LOG(PMS_DWL(-3)))	–0.0119	–2.4919	0.0550
D(LOG(EINV(-5)))	0.9337	2.5681	0.0501
D(LOG(HINV(-5)))	–1.9743	–5.0257	0.0040
R-squared	0.9948		
Adj. R-squared	0.9689		
F-stat	38.3963		

Source: Authors' computation using EViews 8.

on Ecuador, Jamal and Aryarkwa (2014) on Ghana, and Dartanto (2013) on Indonesia. Though PMS Subsidy had been faulted with a huge and unsustainable level of corruption in Nigeria, still, this paper gives credence to its continued relevance in mitigating poverty. By implication, removal of the PMS Subsidy should be done cautiously to avoid harm to the poor.

CONCLUSION AND RECOMMENDATIONS

This paper investigated the impact of PMS Subsidy reduction on poverty reduction and considers a comparison between the PMS subsidy and deadweight loss proxys for infrastructure services. A Vector Autoregressive Model was used to investigate, which is the better choice. There is barely any difference between the contribution of PMS subsidy and deadweight loss on PMS subsidy to poverty reduction. The impact of PMS subsidy is very low and slow, manifesting in the third year (lag three). Likewise, the efficiency loss due to the subsidy is equally low, though lower than the effect of PMS subsidy; and slow—it manifests in the third year (lag three). This paper concludes that the better choice between the two choices is the PMS subsidy, though, its difference to the deadweight loss on PMS subsidy is minimal. Removal of PMS subsidy and its replacement with other interventions that improve household welfare may not contribute more to the reduction of poverty incidence in the country. Since there is no substantial difference between the impact of the subsidy and the deadweight loss due to the subsidy, both the PMS subsidy and its deadweight loss should be forgone for other productive, efficient and effective interventions for the poor. However, investment in health care services, especially, at the grassroots

where the majority of the indigent are living may be highly rewarding in fighting poverty. Improving primary health might be the first giant step to reduce poverty incidence in the country. Auditing of the subsidy scheme at regular intervals may improve its benefit to the poor that rely on it. The PMS subsidy is preferable to deadweight loss on PMS towards infrastructure services in mitigating poverty in Nigeria. As it is, PMS subsidy appears to still remains the better choice in Nigeria.

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