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Research Paper

Oil Shock, Household Income and Expenditure: Evidence from Nigeria

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ABSTRACT: *We pose three research questions: What is the effect of 2015 oil shock on household income? Does the effect vary depending on sector of employment and state of residence of households? What effect did income have on household food spending for the period under review? To this end, panel data covering 4616 households for the period of 2010, 2012 and 2015, and a two-stage method of estimation are used. The first stage estimates the effect of oil shock on household income. Interaction of oil shock with sector of employment, and oil shock with state of residence are used as instruments for income. This first stage reveals that 2015 oil shock significantly decreased household income by 8.3%. It also shows that the effect was felt more by households employed in oil sector and those residing in oil-producing states. More specifically, household employed in oil sector and those residing in oil-producing states earned 6.9% and 17% less respectively. The Second stage estimates how income affected households spending on food. The result shows that a 1% increase in income will lead to significant increase in food spending by 0.507%. The estimates are robust to the use of different instruments.*

KEY WORDS*: 2015 Oil shock; Household Income; Food Spending*

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I. INTRODUCTION

Oil shocks have continued to plague different economies of the world: developing and developed economies; oil and non-oil exporting countries. Different oil shocks have been recorded in history, starting with the oil crises of 1973 which pushed up the price of oil tremendously, from $3 to $12 per barrel by the end of March 1974. The most recent is the oil shock of 2015 which was caused by excess supply of oil.

Nigeria is one of such developing countries that is abundantly endowed with oil resources. Before oil was discovered in Nigeria in large quantity, agricultural sector was the mainstay of the economy and provided employment for over 70% of the population. Now the country is the highest oil producer in Africa and the top 6 oil exporter in the world and this comes with benefits. According to Budina&Wijnbergen (2008), a surplus of about $390 was made by Nigeria from oil between 1971 and 2005. Of course, this is a good thing, but it has made the economy to be almost totally dependent on the oil sector at the neglect of other sectors. This implies that oil shock always affects the revenue and spending of the government because over 80 percent or revenue comes from the sale of oil.

The effects oil shock include fall in revenue from oil exportation (Osuji, 2015),reduction in government expenditure, increase in the production cost (Ibrahim, 2015), unemployment, etc. However, the specific direction of the impact depends on if a country exports or imports oil, and also if the shock manifested in the form of sudden rise or fall in the price of oil.

Nigeria, an oil exporting country, has received its fair share of the effects of oil shock. 2015 oil shock for instance, reduced government spending as a result of shortfall in revenue, bringing about deficit problems. This is not surprising at all, since economy of Nigeria depends heavily on the oil sector.

Having realized the uncertainties which are created by oil price fluctuations, empirical studies have been carried out to figure out the effect on household income and spending (see Kahn & Ahmed; Liping et al., 2014), profit of industries (Eifayoumi. 2018), stock prices (Lescaroux& Mignon, 2008; Effiong, 2014) and somemacroeconomic variables such as unemployment (Karanassou& Sala, 2009; Iwayemi&Fowowe, 2011) and

inflation (Misati et al., 2013; Wong, 2015).

But first, with respect to Nigeria, there is lack of empirical studies on how changes in oil price affect households. Most studies only examined how inflation, economic growth, unemployment, government expenditure, stock prices and other macroeconomic variables are affected by oil shock. What about the income of households? Essama-Nssah et al. (2006), Odusami (2010), Naranpanawa&Bandara (2012), and Saari, Dietzenbacher& Los (2016) find that oil shock significantly explains changes in income of households.

Second, if it is accepted that oil shock affects the income of household, coupled with the fact that households reside in different states of Nigeria (oil-producing and non-oil producing), and that different households are employed in different sectors of the economy (oil and non-oil), it would make sense to think that the effect of oil shock on income would depend on their state of residence and sector of employment (see Essama-Nssah et al., 2006; Naranpanawa&Bandara, 2012; Saari, Dietzenbacher& Los, 2016).

Third, on the effect of changes in income on household spending, there have been several studies about. Certainly, the problem of endogeneity is expected because notonly does changes in household income explain spending, the spending of households can also explain their income. One way of understanding this is by recognizing that households with higher expenditure will be propelled to seek higher paying jobs. This issue of endogeneity has been addressed by many studies using many viable instruments, including average rain fall, firm shocks, unemployment rate, inflation rate, oil prices, and transfer payments (see Acemoglu et al., 2013; Baker, 2014; 2016).

It is upon the provided background that we seek to answer three research questions in this study:

- What is the effect of 2015 oil shock on household income?
- Does this effect vary depending on state of residence and sector of employment?
- What effect did income have on household spending on food for the period under review?

II. OIL SHOCKS AND NIGERIAN ECONOMY

There has been unquenching need to understand what caused oil shocks since 1970. Problems such as rising inflation, falling Gross Domestic product (GDP), and distortions in labour market and changing monetary policies of the government have all been traced to oil shock. Oil shock of 1970 which tremendously increased the price of oil fetched Nigeria huge revenue from oil. As a result, the country became overdependent on the oil sector and neglected agricultural and manufacturing sectors. In 2002 oil and gas sector accounted for about 98% of the earnings from export of goods and services and about 84% of the revenue of the federal government.

However, the fluctuation in world oil price constantly affected the economy of Nigeria in ways the government did not anticipate. Unsteady prices brought about unsteady business environment and made it difficult for the government to make budget and push the country forward. It increased government borrowing from international organizations to carry out the expenditure in the budget, thereby worsening the debt problem of the country.

The oil shock of 2008 which was believed to result from the conflict between Israel and Lebanon and the problem of nuclear power of Iran left the country devastated. It manifested in the form of a decline in the price of oil as seen in Figure 1.1 below. The government of Nigeria experienced a huge loss in oil revenue. It however put the idea of embracing other sectors of the economy into the mind of the people.As a result, policies were put forward to revitalize the

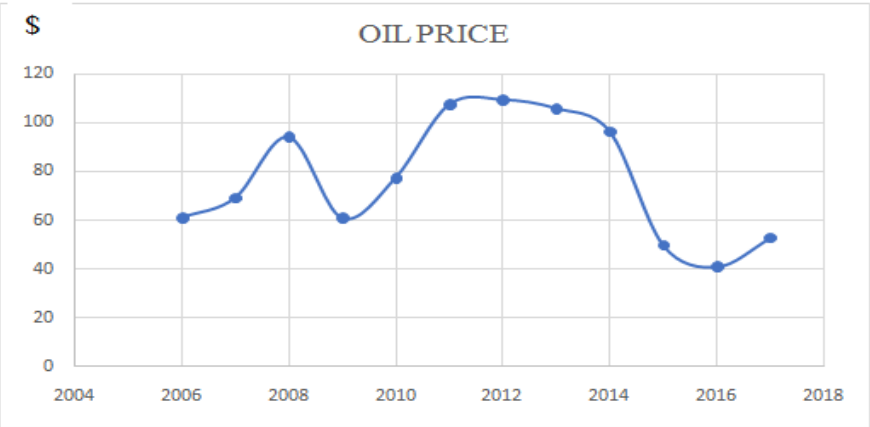

Figure 1.1: Trend in Oil Price

Source: OPEC website

agricultural sector which was almost dead. But this did not help the debt problem of the country because borrowing continued to increase.

Oil shock of 2015 which is the thrust of this study was caused by increased supply of crude oil and it reduced the world price of oil significantly to $49. This reduced the growth of the economy, leading to the contraction of the economy in 2016. The oil sector revenue from oil sector reduced by 30% leading to deficit budget due to inability of the government to fiancé the expenditure and more borrowing.

It is worthy of that the effect of oil shock always trickles down to other economic units[1] apart from the government. It affects firms that use oil product as input in the process of production, so that it affects the price of finished products of such firms. It can also affect the profit of firms because increase in the price of finished goods as a result of increase in the price of oil, will reduce sales and as a result profit. The effect on households could be either on their income or spending. A look at Figure 1.2 below confirms that household average income of householdswas declining

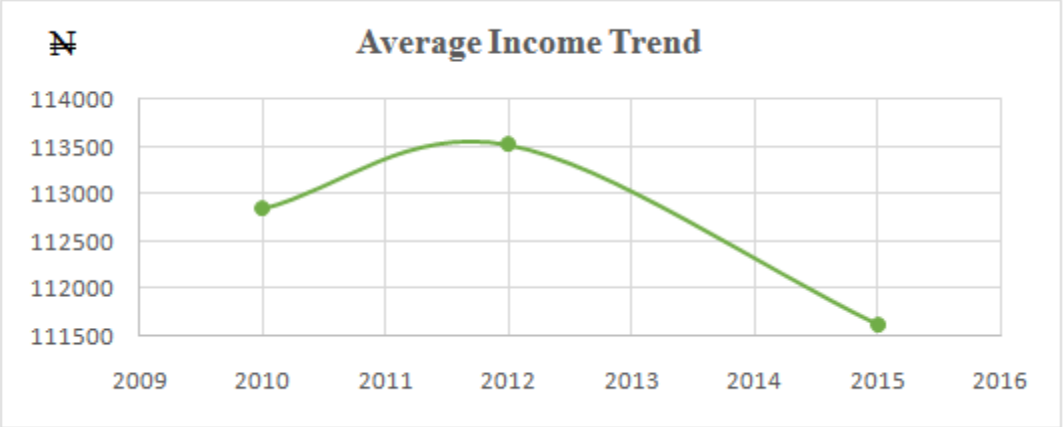

Figure 1.2: Trend in Average Income of Households

Source: based on the author's calculation

during the 2015 shock. Also, there is difference in average income of households employed in the oil sector and that those employed in other sectors as can be seen in Figure 1.3 below

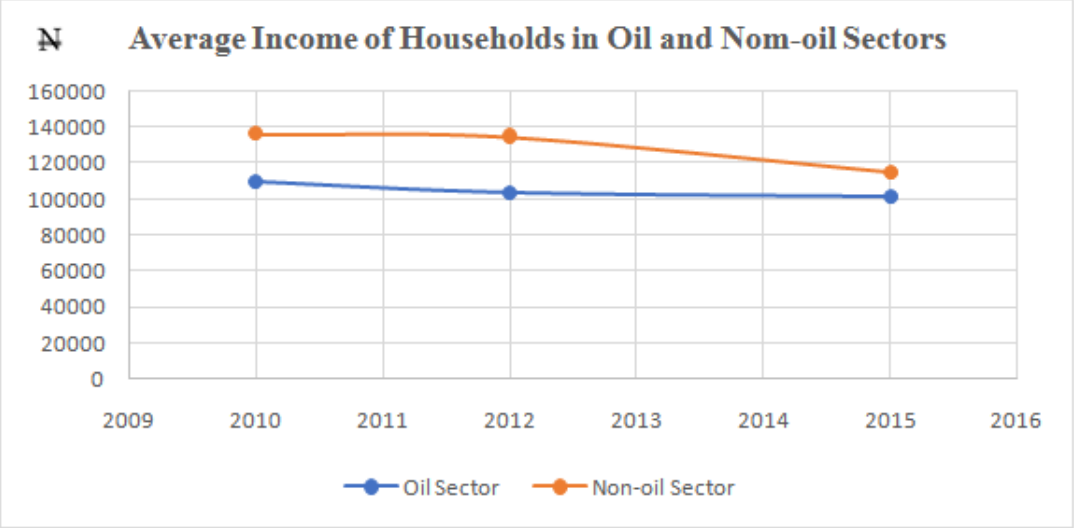

Figure 1.3: Trend in Average Income for Households in Oil and Non-Oil Sectors

Source: based on the author's calculation

[1] Other economic units here represent firms and households.

One possible link through which it impacts the income of households is through the effect on revenue from oil. This is because oil revenue already covers a great percentage of the resources used to run the economy. The effect on household spending is through the effect on overall price level measured by the consumer price index (CPI).

III. THEORETICAL FRAMEWORK

Income shocks as a key component of the oil shock may cause changes in consumption. There have been several theories exploring the impacts of income shocks on consumption. Varying by the model setup about temporary income shock or permanent income shock, single generation or multiple generation, multiple theories have derived different conclusions on the research question.

Absolute Income Hypothesis of Keynes (1936) was the first attempt ever made to explain consumption behaviour of households. He made two basic postulations which his consumption function below satisfies.

$$C = \beta_0 + \beta_1 Y$$

$$0 < \beta_1 < 1$$

Where C is consumption, β_0 is a constant also known as autonomous consumption, β_1 is marginal propensity to consume (MPC) and Y is current disposable income, that is, after-tax income. Keynes first posited that the main factor that explains consumption behaviour is present income and that effect of the rate of interest is not significant, which is why the only explanatory variable in hismodel is Y. This is true, plus a lot of studies have shown that income significantly explain consumption (see Hryshko. 2014; Baker &Yannelis, 2017).

Again, he conjectured that increase in consumption as result of rise in income is always less than the actual amount by which income increased. This is why β1 which is MPC is greater than zero but less than one as stated in his model. The implication is that all the addition to income are not spent on consumption because part of it will be saved.

Although Keynes' theory of consumption went a long way in explaining the behaviour of consumers, his idea that interest rate has no meaningful effect on consumption has been shown to be wrong. This is because higher interest rate encourages savings and reduces consumption.There are also Intertemporal Choice Theory of Fisher (1930), Relative Income Hypothesis of Duesenberry (1949), Life-Cycle Consumption Hypothesis of Modigliani (1954), and Permanent Income Hypothesis of Friedman (1957). However, they differ in various aspects of income that explain household consumption. For Instance, Fisher (1930), Modigliani (1954) and Friedman (1957) all posit that spending is determined by both present and future income. But while Fisher (1930) recognizes that current consumption can be lowered to secure higher future consumptionthrough the mechanism of interest rate, Modigliani (1954) claims the rate of interest is at zerolevel,so that higher future income is only as a result of higher current saving. Friedman (1957)recognizes the importance of fluctuations which can reduce or increase future income.Only Duesenberry (1949) asserts that consumption behaviour depends on individual's past income and his status in the society. He claimed that there is struggle by households to meet up with the consumption level of one another.

Given availability of data, and the need to keep the analysis of this study micro withoutintroducing aggregate economic variables such as interest rate, we follow Absolute IncomeHypothesis.

3.1. Determinants of Household expenditures

Household spending is an important measure of the standard of living of people within the household. It is an indicator of how well a household can carter for its basic needs such as food, clothing, housing, transportation, education, etc. According to Varlamova&Larionova (2015), spending of households explains the idea of well-being and also depicts the level of development that has been achieved by any economy.

There is abundance of studies which have explained the major factors that influence household spending. Initial notion is that spending is determined mainly by household wealth, income and interest rate (see Keynes, 1936; Modigliani &Brumberg, 1954). However, Verter& Osakwe(2014) point out that globalization has made it possible for spending not to be determined aloneby internal factors but also external factors. Thus, household spending in general, is affected by internal and external, social and environmental factors.

Varlamovaa&Larionovaa (2015) show that internal factors.that explain spending are inflation, government size, disposable income, and interest rate. Verter& Osakwe (2014) also show that growth rate of GDP is an internal factor that explains household spending.

External factors that determine household spending are remittance, import and oil prices. Forinstance, Thapa & Acharya (2017) show that international remittance significantly explains domestic spending in Nepal. Verter& Osakwe (2014) introduce a factor called globalization index, and they find this index to be a significant determinant of household spending in Czech Republic.

Coming to changes in oil price, Wang (2013) shows asymmetric and nonlinear association between oil prices and consumption expenditure. This is consistent with the findings of Mehra& Petersen (2005), that there

is presence of nonlinear and asymmetric relationship between oil prices and consumption expenditure. Similarly, Zhang &Broadstock (2014) adopt the working model of Mehra& Petersen (2005) to analyze the effect of oil shocks on consumption expenditure in East Asia. Their results show that oil prices have significant negative effect on consumption expenditure and there exist asymmetric effects. Though the results of Tuttle (2017) and Altai (2015) show a
significant negative relationship between oil prices and spending, they are not able to confirm the existence of any kind of asymmetric effect.

On the contrary, Algaeed (2017), uses time series data to estimate the model of study. His study is in line with that of Zhang &Broadstock (2014) and Mehra& Petersen (2005), but he introduces the link through which oil price can affect consumption. He finds that increase in oil price is associated with increase in oil revenue, and thus consumption1. This is different from the results of Mehra& Petersen (2005), but he traces the why to the fact that Saudi Arabia is an oil-exporting country.

Factors such as size of household, area of residence, gender of head of household and his education level, occupation of head of household, etc. have been identified as social factors that explain variation in spending of households. Jacobson et el. (2009) find in their study that size of household is an important determinant of householdexpenditure in Cyprus. Huang (2015) also confirms the result of Jacobson et al., (2009) in his findings that household size, housing areas, number of appliances, and house ownership explain a huge part of the variation in electricity consumption. Also, Ogundari&Abdulai (2014) show that households with females as the heads spend more on health and education of the members than those headed by males.

Of great importance is the impact of environmental factors on spending. Murray et al. (2010) estimate how weather affects the spending behaviour of consumers. They argue that hot weather makes people stay at home thereby not doing shopping to get the things they need (this reduces spending). As a result, they conjecture that as the negative effect of increased exposure to sunlight falls, consumers spend more. The results of their study provide evidence in support of that. Also, Rous & Hotchkiss (2003) show that sanitary conditions affect health spending through their effect on illness. Higher smoking is found to reduce per head spending on education by 17 yuan and 11 yuan for health annually (Xin et al., 2009).

IV. EMPIRICAL LITERATURE

How do changes in the price of oil affect income of households? This has become an interesting question over the years given that a number of oil crises have been observed in the history. Though empirical studies have been geared towards answering this question, the problem of pinpointing the direction of the effect still exists. This is because the effects of rising and falling oil prices are different and it also depends on whether or not the country in question is oil exporter. Given that per capita income which is a measure of income of individuals in a country is obtained by dividing output by population, it would not be bad to think that oil shocks which affect real output will
also affect income.

Take for instance the study of Bastianin et al. (2017) which investigate how oil shock from the supply sides affect the growth of real output for both oil exporting and importing countries. They find the effect to be different for oil importing and exporting countries. More specifically, they find the effect to be negative and significant for oil importing countries but it is not significant for oil exporting countries. The study ofBerument et al. (2010) provide results which totally contradict the results of Bastianin et al. (2017). They find that increase in oil price impact positively and significantly on the real output of oil exporters but does not affect that of oil importers.

Asatryan et al. (2017) examine how international remittance affect the tax revenue of the government (income). They instrument remittance with oil shock since it directly explains remittance without a direct effect on tax revenue. Also, heterogenous analysis is performed to see how remittance affects various forms of taxes. They find positive and significant effect for Value Added Tax (VAT) but no significant effect on revenue from income tax.

Eifayoumi (2018) examines the effect of oil shock on the balance sheet (profit) of industries. Industries involved covered sectors such as mining, trade and manufacturing. Their results suggest that one percent increase in the price of oil is associated with a decrease of 1.3 percent in the profit of firms in the manufacturing sector, which implies fall income. Though they also observe similar trend for mining and trade sectors, the effect on manufacturing sector is the highest.

Furthermore, Naranpanawa&Bandara (2012) investigate how oil shock affects poverty in Sri Lanka. They perform a heterogenous study by differentiating the effect of oil shock on both rich and poor households. They find evidence that oil shock significantly affects the income of households. Going further, they also find that high oil prices affect low income households more than it affect high income group. Saari,Dietzenbacher& Los (2016) find that oil shock significantly impacts employment, revenue from tax, GDP and income of labour.

With respect to expenditure-income link, there is abundance of empirical studies. From intuition and according to economic theory, expenditure is an increasing function of income. However, the obvious problem always encountered is addressing the endogeneity of income. Different instruments have been adopted by various studies to address it. One instrument which have been employed in the literature by a lot of researchers is oil price. The main reason is that since price of oil is externally determined, it is already considered an exogenous instrument. For instance, Acemoglu et al. (2013) use oil prices as instrument for income and estimate both partial and general equilibrium effect of income on health expenditure in the United States. Loken (2010) instruments income with oil shock of 1970 and showed that income of parents does not affect education level of children.

Kilic et al. (2009) investigate how income from nonfarm activities affect the expenditure of households. The percentage of employment in nonfarm activities and a dummy variable which represents whether or not a household member could speak Italian and Greek language as at 1990 are used as instruments for income. Their results suggest that income significantly and positively explain agricultural expenditure.

Similarly, the proportion of the business assets of a household owned by women, the ratio between eldest woman in a household and the head of that household, the total schooling years of husband and wife, and the monetary value of total assets of a household are used as instruments for income by Aromolaran (2010) to investigate how income impacts the intake of calorie. He also finds that a positive significant effect of income on caloric intake.

Mishra et al. (2015) use the predicted values of household total income from unconditional quantile regression (UQR) as instrument for income and estimate the effect of off farm income on food expenditure of households living in rural part of Bangladesh. They find a positive and significant effect of off farm income on food expenditure. They also find that household characteristics affect expenditure on food.

To understand how household agricultural income affects per capita expenditure, Akobeng(2017) carries out two-stage least square estimation and uses average rainfall in wet and dry season as instrument for income. Data for the study were pooled cross section involving thousands of households. He finds that a decrease in income significantly reduces per capita expenditure.

We make two basic contributions to the literature. As pointed out in previous section, studies on oil shock and Nigerian economy mostly focused on how different macroeconomic variables are affected by oil price changes. So, there is nothing definitive on how it affects wellbeing of households. Thus, the first contribution is that we employ three years panel data to analyze 2015 oil shock, the income and expenditure of households in Nigeria.

Second, the need to examine income-expenditure link always presents the problem of endogeneity. Solving it requires adopting a valid instrument which affects income but does not directly affect spending. Different studies have fixed this problem using different instruments for income. In this study, we propose new instruments for solving the same problem.

V. DATA AND MODELS

The necessary data come from the General Household Survey of 2010, 2012 and 2015 of National Statistics Bureau (NBS) of Nigeria and 4,616 households are used. Data on zone, state and sector of households' residence, household size, household expenditures, income, and gender, employment sector, and education attainment of household heads are used for this study.The model for estimating impact of 2015 oil shock on household income is
specified below.

$$\ln(INCMit) = \beta_2 OILJOB_{it} + \beta_3(Y2015_t \times OILJOB_{it}) + \beta_5(Y2015_t \times OILSTATE_i) + \beta X_{it} + \Theta_i + \delta_t + \mu_{it} \quad \ldots\ldots (1)$$

Where $INCM_{it}$ is total income of household i in year t, Y2015 is oil shock, and X_{it} is a vector of control variables which are household characteristics.

Household that live in oil producing states are expected to have better chance of securing highly paid employment to earn higher income. Also, the income of households working in the oil sector would be significantly different from that of those working in other sectors, and households that reside in urban cities which are cities with high standard of living are expected to be richer than those residing in rural areas. Thus, state of residence, sector of employment and sector of residence (urban or rural) are included as control variables.

The size of a households could explain their income level. This is because household with many people will need higher income to meet up with the necessary needs of that household. Given the observed gender discrimination in employment and salary where male workers are paid higher than female, it is expected that households headed by males will have higher income. If the head of a household has acquired a college degree,

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they have higher chances of earning more than those without college degrees. This is why size of household, gender of head of household and educational attainment of head of household are also added as control variables.

To be able to understand how the effect of oil shock on income depend on the residence and employment sector of households, the dummy variable for oil shock will be interacted with both state of residence and sector of employment. It is expected that households living in oil producing states and those whose heads are employed in oil sectors will be affected more because they are closer to the issue under investigation. As a result, we expect that they feel the impact of the shock more than others.

However, recognition is given to the fact that there are omitted variables which could bias the estimate of the impact of oil shock on income. These variables are in the form of unobserved heterogenous characteristics of households that either vary across household but constant across time and those that vary across time but fixed among households. It is the need to take them into consideration that leads to controlling for both household fixed effects (Θ_i) and time fixed effects (δ_t). This explains the absence of $Y2015_t$ and $OILSTATE_i$ which should have β_1 and β_4 respectively in model (1) above.

This is what panel fixed effect method has over Ordinary Least Squares (OLS) method of estimation which will generate biased estimates. So, panel fixed effect estimation is adopted to control for fixed effects. Also, the logarithm of income is taken so that the results of the regressions can be interpreted as percentages.
The model that will be used to the effect of income on the food expenditures of households is specified below.
$\ln(FOODEXP_{it}) = \beta_1 \ln(INCM_{it}) + \beta X_{it} + \Theta_i + \delta_t + \mu_{it}$……………………………………(2)

The need to understand the effect of income on food spending presents the problem of endogeneity since simultaneous causality exists between spending on food and income. This problem becomes clear when one understands that household that needs higher expenditure on food to survive are propelled to look for high paying jobs to earn higher income, so that income can also be explained by expenditure. Thus, there is need for instruments that satisfy the Instrumental Variable (IV) regression assumptions. Two instruments will be used here and they are the interaction of oil shock with sector of employment (Y2015t × OILJOBit) and state of residence (Y2015t × OILSTATEi).

Stock & Watson (2006) list three assumptions which an instrument must satisfy before it can be used to correct the problem of endogeneity:

- The instrument must be relevant, meaning that it must be correlated with the variable it will be used to instrument: Corr (Z1, X1) ≠ 0
- The instrument must be exogenous, so that it will not be correlated with the error term of the main relationship to be estimated: Corr (Z1, μi) = 0
- The instruments should not be direct factor that explains changes in Y which is the dependent variable.

The instruments are relevant. Households residing in oil states where things are expensive are expected to have higher income, maybe because they are mostly households that work in oil sectors.Also, oil shock which manifested in the form of fall in oil price reduced revenue from oil and as a result income of workers. The regression result in Table 1.1 shows that the two instruments are significant in explaining changes in household income.

The assumption of instruments being exogenous is satisfied. Oil shock is exogenous to the model since it is externally determined by what is happening in the world market and so are sector of employment and state of residence. This is because the only way they can affect the food expenditure of household is not directly but through their income.

Though the first model specified will be used to estimate how 2015 oil shock affected income of households, it will also serve the purpose of being the first stage least squares (FSLS) regression model with the two instruments. This IV method is preferred over OLS because it helps to fix the problem of endogeneity of income. The control variables in the first stage regression model are also added in this second stage model. The logarithm of food expenditure is taken, so that the coefficient of income can be interpreted as MPC. Also, both household and time fixed effects are taken into consideration.

As an extension, households will be divided into three different groups based on their average income for the three years – low-income, medium-income and high-income households.The ranking is performed as follows: household with average income level below the 25th percentile is classified as low-income households, those with average income from the 25th percentile but below 75th percentile are called medium-income households, and those with average income from 75th percentile and above are called high-income households. The point is to find out if the instruments will perform well for both the pooled sample and subsample.

VI. VARIABLES

For better understanding of different variables which are used in the empirical models which have been specified, a table describing each of the variable is presented below. LFOOD is the natural logarithm of expenditure of a household in a year while LINCM is the natural logarithm of annual income of a household.

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Y2015 is a time dummy variable. Since it takes 1 (one) for all households for 2015 and 0 (zero) for 2010 and 2012, its coefficient will capture the effect of 2015 oil shock on household income and expenditure. OILJOB captures the extra income and expenditure of households whose heads work in oil sectors.

OILSTATE will capture the extra expenditure and income of households that reside in oil producing state of the country. While COLLEGE represents additional expenditure and income of households whose head have college degree, URBAN shows the extra income and expenditure of households residing in urban part of the country. SIZE shows the effect on income and expenditure of change in household size by one person. MALE_HHHEAD captures extra income and expenditure of households that are headed by male.

VII.STATISTICS

Table 3.2 below presents the summary statistics of the variables used in this study. Data consist of 4616 households for three different years. The four different statistics are looked at and they are the minimum value, maximum value, mean and standard deviation. The first dependent variable in this study is income and it is measured in Nigerian currency which is Naira. It is the total annual income of everyone that make up a household. With a mean of 11.305 (which is about N81,227) and a standard deviation of 0.802, we can conclude that average annual income of households in Nigeria is very low. The second dependent variable is food expenditure and it is also measured in

Nigerian Naira. It has a mean of 12.646 (about N310,519) and a standard deviation of 0.696. It is the total amount of money spent by a household on food per year. Y2015 takes only 1's (for 2015) and 0's (for other years). The same thing obtains for OILJOB, OILSTATE, COLLEGE, URBAN, and MALE_HHHEAD.

Table 3.1: Summary Statistics of Variables

Variables	Households	Min	Mean	Max	SD
LFOODEXP	4616	7.590	12.646	17.139	0.696
LINCM	4616	8.146	11.305	20.327	0.802
Y2015	4616	0	0.333	1	0.471
OILJOB	4616	0	0.218	1	0.413
COLLEGE	4616	0	0.339	1	0.473
OILSTATE	4616	0	0.323	1	0.468
URBAN	4616	0	0.314	1	0.464
SIZE	4616	1	5.417	31	3.056
MALE_HHHEAD	4616	0	0.848	1	0.359

Note: LFOODEXP (log of food expenditure) and LINCM (log of income)

It can be seen that about 85% of households have males as their heads. This is consistent with what obtains in the real world, since females can become the head of household only when their husbands are dead or not around. Also, there is evidence that roughly22% of household heads are employed in oil sector and about 34% of them have college degree. In Nigeria, only a small percentage of people work in oil sector because securing job there is always by appointment. Also, until recently, most parents hardly make it to the university level, but they still do their best to train their children to the university level. About 32% of households lives in urban parts of the country and 31% live in oil producing states. This is not surprising because urban areas and oil states are expensive to live in. Household size is measured in terms of number of persons that make up a household and it ranges from 1 to 31. Also, average household size is 5 persons per household which could include husband, wife and three children.

Having a high correlation among the explanatory variables is not good because high standard errors will be generated, so that there is always the tendency not to reject a coefficient even when it should be rejected. To this end, a correlation matrix showing the correlation coefficients of the variables of our models can be seen found in appendix. It can be seen that no two explanatory variables have a correlation coefficient up to 0.5. This suggests there is absence of multicollinearity.

VIII. MAIN RESULTS

Applying model 1, column 1 of Table 1.2 shows the results of how oil shock affects household income and it controlled for household fixed effects. A significant reduction of income by 8.3% is observed. This effect disappears immediately we control for time fixed effects in column 2 and both household and time fixed effects in column 3. This is because oil shock is just a dummy variable which takes 1 for all households in 2015and 0 for all households in other years. In other words, it remains constant across individuals but varies across time. The OLS estimate is less negative and shows asignificant reduction of income by 6.3%.

On average, households whose heads work in oil sector earned 29% less than those employed in other sectors as seen in column 1. This effect is significant at 10% level. Negative significant estimates are also observed in other columns. Controlling for both household and time fixed effects produced a less negative coefficient, suggesting that OLS could have over-estimated the effect.

To understand how effect of oil shock differ for households employed in oil sectors and those that are not, and how it differs for households residing in oil and non-oil producing states, an interaction of oil shock with sector of employment and state of residence are added. From column 3, Theinteraction of oil shock with oil job shows that on average household employed in oil sectors earned 4.3% less than those employed in other sectors of the economy during the shock. This is understandable because since they are employed in oil sectors they felt the shock more than other households. Column 1, 2 and 4 still have negative and significant estimates but they are more negative than that of column 3.

From column 2 and 4 it is seen that households that live in oil producing states earned 30.9% more than those living in non-oil producing states and this is significant at 1% level. This makes sense because oil producing states have higher standard of living, so households living in such states are mostly rich households. Again, the interaction of oil shock with oil state shows that households living in oil states of the country earned 15.5% less than those living in non-oil states as can be seen from column 3. Since 2015 oil shock manifested in the form of a fall in oil price, oil-producing states felt the effect morebecause they immediately experienced a fall in revenue

Table 4.1: Impact of Oil Shock on Household Income

	Dependent Variable: LINCM			
	FE	FE	FE	OLS
Y2015	-0.083***			-0.063***
	(0.016)			(0.019)
OILJOB	-0.029*	-0.023*	-0.014*	-0.023**
	(0.017)	(0.015)	(0.008)	(0.009)
Y2015×OILJOB	-0.069**	-0.124***	-0.043**	-0.124***
	(0.037)	(0.037)	(0.020)	(0.034)
OILSTATE		0.309***		0.309***
		(0.017)		(0.018)
Y2015×OILSTATE	-0.170***	-0.154***	-0.155***	-0.157***
	(0.024)	(0.031)	(0.025)	(0.030)
URBAN	0.339***	0.286***	0.337***	0.285***
	(0.089)	(0.015)	(0.105)	(0.014)
SIZE	0.002	0.0001	0.010***	0.000103
	(0.003)	(0.003)	(0.003)	(0.002)
MALE HHHEAD	0.182***	0.149***	0.167***	0.150***
	(0.025)	(0.020)	(0.029)	(0.019)
COLLEGE	0.013	-0.015	-0.008	-0.015
	(0.015)	(0.014)	(0.019)	(0.014)
INTERCEPT				11.285***
				(0.034)
Adjusted R^2	0.143	0.067	0.144	0.067
Household FE	Yes	No	Yes	No
Year FE	No	Yes	Yes	No
Observations	13848	13848	13848	13848

Note: (1) controlled for only household fixed effects, (2) controlled for only time fixed effects, (3) controlled for household and time fixed effects, and (4) is the OLS estimates. *, **, and *** show significance at 10%, 5% and 1% respectively. Robust standard errors are in parenthesis.

from oil. So, it is possible that households in these oil states would experience reduction of income. This effect is always significant at 1% no matter the kind of fixed effects controlled.

Controlling for sector of residence of households shows that households that reside in urban areas on average earned 33.7% more than those living in rural areas. The line of argument used for oil state variable also applies here. Standard of living is higher in urban areas than rural areas. As a result, it is expected that households living in urbanareas would be richer.

Controlling for the size of household shows that households which constitute higher number of persons earned higher income than those with lower size. More specifically, an increase in household size by one person is associated with 1% increase in the income of households. This effect is significant at 1% only when both household and time fixed effects are controlled for. Intuition will already make us understand that households with higher size will earn more because they need more income to meet with higher expenditure needed.

Furthermore, controlling for the gender of the head of households shows that households which have male as their heads on average earned 16.7% more than households with female as their heads. This effect is significant in all the columns. This points to the idea of gender discrimination in employment so that male workers earned higher salaries than their female counterparts.

By controlling for educational achievement of the head of households, it is seen that households with heads who have college degree earned 1.3% more than those without college degree from column 1. This is what would be expected because with a college degree one stands the chance of getting better job and earn higher. But a different pattern gets revealed in column 2, 3 and 4. It can be seen that this effect becomes negative, so that having college education is associated with lesser income by 0.8%. One possible explanation for this is that in Nigeria, having a college degree does not guaranty higher income over those without such degree because of high unemployment rate.

Table 4.2 below shows the effect of income on household food spending for the period of our study. Positive and significant coefficients are observed both for OLS estimate and fixed effects estimate. Column 3 which controlled for both household and time fixed effects shows a coefficient estimate of 0.507 which is significant at 1% level. This means that during the coverage period, that a 1% increase income of household is associated with an increase of 0.507% in expenditure on food. This is in line with the Absolute Income Hypothesis of Keynes (1936) that MPC is less than zero but not more than one.

Oil shock increased household spending by 17.8% in fixed effect estimate of column 1 and by 11.9% in the OLS estimate in column 4. A simple process through which this could have happened is that fall in oil price leads to a fall in cost of input for firms using oil products for production of goods. This leads to a fall in the price of final products thereby making households to raise their spending on food. This estimate is not significant.

Going further, households whose heads are employed in oil sector of Nigeria on average spent 0.2% less than the ones who work in non-oil sectors. It is expected thatthose employed in oil sector will earn and spend more than others, but when one understands that only about 22% of households are employed in oil sectors, it becomes clear why they earned on average less than the non-oil job households who constitute the remaining 78%. However, this estimate is not significant in any of the columns.

Households residing in oil producing states spent more than those living in non-oil producing states and the effect is neither significant in fixed effect estimation nor in OLS estimation. Also, Households living in the urban part of the states spent 1.8% more than those living in rural parts, but the effect is not significant after controlling for both household and time fixed effects. This also expected because household residing in urban parts tend to be richer.

Higher household size requires higher expenditure to maintain. Thus, from column 3, increase inthe size of household by one person is associated with 8% significant increase in expenditure on food. Significant positive coefficients for size are also observed in other columns. Also, on average, households with male heads spent more on food than those with female heads. This is significant across all specifications. Households whose heads already have college degrees spent 4.1% more on food over households whose head do not have college degrees. The effect is also significant in

OLS and other IV specifications.

Table 4.2: Effect of Income on Household Food Expenditure

	Dependent Variable: LFOODEXP			
	IV	IV	IV	OLS
LINCM	0.694***	0.240**	0.507***	0.294***
	(0.134)	(0.114)	(0.132)	(0.006)
Y2015	0.178			0.119
	(0.223)			(0.111)
OILJOB	-0.002	-0.007	-0.002	-0.007
	(0.018)	(0.012)	(0.016)	(0.012)
OILSTATE		0.020		0.004
		(0.032)		(0.010)
URBAN	0.024	0.182***	0.018	0.166***
	(0.095)	(0.034)	(0.086)	(0.010)
SIZE	0.077***	0.100***	0.080***	0.099***
	(0.003)	(0.002)	(0.003)	(0.001)
MALE_HHHEAD	0.210***	0.247***	0.240***	0.244***
	(0.032)	(0.022)	(0.030)	(0.014)
COLLEGE	0.040***	0.064***	0.041***	0.066***
	(0.015)	(0.010)	(0.013)	(0.010)
INTERCEPT				8.316***
				(0.073)
Adjusted R^2	0.256	0.372	0.419	0.369
Household FE	Yes	No	Yes	No
Time FE	No	Yes	Yes	No
F-Weak Inst.	18.064	20.729	14.726	-
J-statistic (p-value)	0.1342	0.1194	0.1225	
N	13848	13848	13848	13848

Note: (1) controlled for only household fixed effects, (2) controlled for only time fixed effects, (3) controlled for household and time fixed effects, and (4) is the OLS estimates. *, **, and *** show significance at 10%, 5% and 1% respectively.

The instruments are not weak given the f-statistics for weak instrument test which are all greater than 10. Furthermore, the J-statistics for test of overidentification do not lead us to reject the null hypothesis of instruments being exogeneous. Also, the results are significantly robust. This is because the significance of the variable of interest is still maintained when we estimated the OLS, and also controlled for household and time fixed effects.

To further test the heterogeneity of income using the instruments, households are divided into low-income, medium-income and high-income households, and the model for the effect of income on food spending is estimated again.There is significant effect of income on food expenditure of households across the three income groups. The estimate for poor households is the highest, suggesting that they tend to change their expenditure greatly in response to changes in income compared to other two groups.

Table 4.3: Effect of Income on Household Food Expenditure

	Dependent Variable: LFOODEXP			
	IV	IV	IV	OLS
LINCM (Low Income)	0.379***	0.378**	0.386***	0.598***
	(0.050)	(0.025)	(0.050)	(0.020)
LINCM (Med. Income)	0.314***	0.279***	0.292***	0.444***
	(0.033)	(0.021)	(0.033)	(0.015)
LINCM (High Income)	0.297***	0.207***	0.320***	0.189***
	(0.047)	(0.022)	(0.046)	(0.022)
Adjusted R^2	0.417	0.407	0.421	0.604
	0.305	0.320	0.326	0.525
	0.386	0.366	0.418	0.350
Household FE	Yes	No	Yes	No
Time FE	No	Yes	Yes	No
F-Weak Inst.	12.274	11.690	12.831	-
	26.299	14.890	19.491	-
	18.120	20.005	19.310	-
J-statistic (p-value)	0.1340	0.4363	0.3386	
	0.2995	0.4502	0.4607	
	0.1925	0.1885	0.6868	
N	3462	3462	3462	3462
	6921	6921	6921	6921
	3465	3465	3465	3465

Note: (1) controlled for only household fixed effects, (2) controlled for only time fixed effects, (3) controlled for household and time fixed effects, and (4) is the OLS estimates. *, **, and *** show significance at 10%, 5% and 1% respectively. Estimates if LICNM, Adjusted R^2, F-Weak Inst., J-statistic (p-value) and N are arranged in the order: Low, Medium and High income households.

To verify that we did not just estimate some relationships that do not have any meaning, robustness is checked by re-estimating the regression models withdifferent instruments for income. Interaction of oil price with state of residence (PRICE × OILSTATE) and interaction of oil price with sector of employment (PRICE × OILJOB) are used as instruments for income. Table 4.4 and 4.5 in appendix present the result and it can be verified that the results of this study are robust. Oil shock reduced income significantly by 6.8%. During the shock, income of households living in oil
producing states and those employed in oil sector reduced more by 19.8% and 5.5% respectively. Also, 1% increase in income is associated with 0.654% increase in spending on food.

IX. CONCLUSION

As stated from the outset of this study, this study seeks to understand the effect of 2015 oil shock on household income, and if the effect varies depending on the sector of employment and state of resident of households. Also, we seek to find out how income influenced spending on food for our study period.

For the first objective of this study, it was found that oil shock reduced household income by 8.3%. This effect is significant at one percent level. As pointed out in the background of this study, Nigeria is an oil dependent economy. Over 80% of government revenue comes from the exportation of oil to other countries of the world. As a result, the oil shock which manifested in the form of fall in the world price of oil could have reduced government revenue from the sale of oil and thus income of households.

Coming to the second objective of this study, it was found that the effect of the shock was felt more by households employed in oil sectors and those residing in oil producing states. More specifically, household employed in oil sector and those residing in oil-producing states earned 6.9% and 17% less respectively. Households employed in oil sectors could have felt the impact more because revenue from the sale of oil reduced during the shock. Also, those living in oil states could have been mostly those working in oil sectors so they felt the effect more in the same way.

On the effect of income affected the food expenditure, 1% rise in income is associated with about 0.507% rise in food spending when we controlled for both household and time fixed effects. This effect is significant at one percent level. This is just as expected because consumption expenditure is expected to positively relate with income.

This study contributes to existing literature by throwing some light on how oil shock affects income and the variation depending on some observed household characteristics. Also, instruments which have not been used in the literature are used to estimate the effect of income of expenditure and these instruments performed very well because they are strong and exogenous. The results are robust to the use of differentinstruments. Also, dividing the households into different income groups provided estimates that are still significant.

Further extensions can be considered in this line of study in order to identified hidden patterns in the data. One of such further studies is breaking the households into different education group or into different regions to see how well the instruments will perform.

Given the findings of this study, some recommendations are made. There is need for immediate diversification of the economy of Nigeria. For now, a great deal of Nigerian economy is dependent on what is happening in the oil sector and over 80 percent of government revenue comes from the sale of oil extracted in the country. We have shown that oil shock significantly affects household income and one possible link through which it gets to them is government revenue. The implication is that any policy that aims at reducing the negative effect of oil shock should focus on diversifying the economy, so that it does not depend much on the oil sector. Also, the policy of subsidizing the price of oil products especially fuel (fuel subsidy) should be retained and it can be complemented with policies which seek to stabilize prices within the economy.

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Appendix

Table 3.2: Correlation Matrix

	1	2	3	4	5	6	7	8	9
1.LFOODEXP	1								
	(0.000)								
2. LINCM	0.339	1							
	(0.008)	(0.000)							
3. Y2015	0.076	0.011	1						
	(0.008)	(0.008)	(0.000)						
4. OILJOB	-0.159	-0.189	0.005	1					
	(0.008)	(0.008)	(0.008)	(0.000)					
5. COLLEGE	0.025	0.053	-0.001	0.005	1				
	(0.009)	(0.008)	(0.008)	(0.008)	(0.000)				
6. OILSTATE	-0.025	-0.033	0.037	0.155	0.005	1			
	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.000)			
7. URBAN	0.110	0.063	0.015	0.177	0.011	0.034	1		
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.000)		
8. SIZE	0.456	0.604	0.005	-0.035	0.078	-0.299	-0.076	1	
	(0.008)	(0.007)	(0.008)	(0.008)	(0.009)	(0.008)	(0.009)	(0.000)	
9 .MALE_HEAD	0.257	0.240	-0.023	0.031	-0.002	-0.149	0.063	0.005	1
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)	(0.009)	(0.000)

Note: figures are parenthesis are standard errors for testing if correlation coefficients are significantly different from zero

Table 4.4: Impact of Oil Shock on Household Income (FSLS Regression)

	Dependent Variable: LINCM			
	IV	IV	IV	OLS
Y2015	-0.068***			-0.055***
	(0.012)			(0.011)
OILJOB	-0.052**	-0.062*	-0.015*	-0.079**
	(0.027)	(0.024)	(0.008)	(0.056)
PRICE×OILJOB	-0.044*	-0.183***	-0.055*	-0.126***
	(0.026)	(0.021)	(0.033)	(0.035)
OILSTATE		0.064**		0.064***
		(0.030)		(0.030)
PRICE×OILSTATE	-0.208***	-0.200***	-0.198***	-0.248***
	(0.047)	(0.056)	(0.050)	(0.025)
URBAN	0.307**	0.286***	0.326***	0.283***
	(0.106)	(0.014)	(0.105)	(0.014)
SIZE	0.0005	0.0009	0.011***	0.004
	(0.003)	(0.002)	(0.003)	(0.002)
MALE_HHHEAD	0.193***	0.148***	0.167***	0.161***
	(0.029)	(0.019)	(0.029)	(0.020)
COLLEGE	0.010	-0.010	-0.004	-0.014
	(0.019)	(0.019)	(0.018)	(0.014)
INTERCEPT				11.127***
				(0.036)
Adjusted R^2	0.127	0.066	0.144	0.056
Household FE	Yes	No	Yes	No
Time FE	No	Yes	Yes	No
N	13848	13848	13848	13848

Note: (1) controlled for only household fixed effects, (2) controlled for only time fixed effects, (3) controlled for household and time fixed effects, and (4) is the OLS estimates. *, **, and *** show significance at 10%, 5% and 1% respectively.

Table 4.5: Effect of Income on Household Food Expenditure

	Dependent Variable: LFOODEXP			
	IV	IV	IV	OLS
LINCM	0.670***	0.732***	0.654***	0.287***
	(0.159)	(0.183)	(0.154)	(0.006)
PRICE	0.222			0.190
	(0.320)			(0.218)
OILJOB	-0.002	-0.002	-0.0001	-0.007
	(0.018)	(0.015)	(0.017)	(0.012)
OILSTATE		0.120		0.003
		(0.149)		(0.110)
URBAN	0.006	0.041	0.006	0.169***
	(0.097)	(0.054)	(0.096)	(0.010)
SIZE	0.088***	0.099***	0.079***	0.102***
	(0.003)	(0.002)	(0.001)	(0.002)
MALE_HHHEAD	0.190***	0.179***	0.214***	0.237***
	(0.038)	(0.031)	(0.034)	(0.014)
COLLEGE	0.045***	0.071***	0.040***	0.069***
	(0.015)	(0.012)	(0.015)	(0.010)
INTERCEPT				8.629***
				(0.071)
Adjusted R^2	0.262	0.128	0.293	0.364
Household FE	Yes	No	Yes	No
Time FE	No	Yes	Yes	No
F-Weak Inst.	14.110	19.512	14.744	-
J-statistic (p-value)	0.1827	0.1968	0.1745	
N	13848	13848	13848	13848

Note: (1) controlled for only household fixed effects, (2) controlled for only time fixed effects, (3) controlled for household and time fixed effects, and (4) is the OLS estimates. *, **, and *** show significance at 10%, 5% and 1% respectively.

Onwachukwu Chinedu Increase"Oil Shock, Household Income and Expenditure: Evidence from Nigeria" Quest Journals Journal of Research in Business and Management , vol. 06, no. 02, 2018, pp. 13-27.