

The Impact of Remittance on Food Expenditure, Food Insecurity Experience, and Coping Strategies During the High Food Price Shock in Nigeria.

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Abstract: International remittance is a significant source of foreign inflow to Nigeria after crude oil. Nigeria witness severe food price shock during the period of low crude oil prices between 2015 to 2016. Challenges of food insecurity in the country are aggravated by lack of money, environment issues, and internal conflicts. Using a representative data from the general household survey of 2015/2016, we investigated the impact of remittance on household food security during the time of high food price shock. We improve on earlier studies by examining both the direct and subjective food security indicators. The indicators; food expenditure per capita, household dietary diversity score, reduced coping strategy index, and food insecurity experience score, corrected perfectly in the right direction among themselves. We use instrument variable econometric approach to control for the endogeneity of remittance. We find that households that receive remittance are mostly headed by females who are older and widowed. Remittance plays a tremendous role in improving the household food security during food crises, especially in the southern region of the country. Remittance households spend as much as 200% on food than the households that do not receive remittance. Although this did not lead to a significant improvement in the dietary diversity, we find that during food crises, remittance households generally are more sufficient in the short-term food supply, and are likely to maintain long-term food stability. While pointing that remittance are being sent to compensate for the food insecurity problem in the country, we posit that policies that aim at tackling the root causes of migration in Africa should see the problem of food insecurity as an important area of consideration.

Keywords: Remittance, Food Security, Food Price, Coping Strategy, Nigeria

1.0 Introduction

The global remittance flows increased after two consecutive years of decline, reaching a value of \$613 billion in 2017 (World Bank, 2018). The world bank report also shows that the remittance flows rebounded in all regions with Sub-Saharan Africa (SSA) witnessing an 11.4% increment. Nigeria is the top remittance receiving country in SSA and the 5th in the world, reaching a value of \$22 billion in 2017. Although this value may be underestimated¹, formal remittance inflows are large in the country when considered as a share of GDP, contributing to

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about 5.6% of the GDP. The Central Bank of Nigeria (CBN) reported that home remittance has been the highest source of foreign inflows after oil, and have help offset the deficit caused by low oil price between 2015 and 2016 (CBN, 2017). The impact of remittance on the national economy has been studied extensively with majority views indicating that remittances contribute positively to the Nigerian economic growth (Afaha, 2012; Eigbiremolen & Nnetu, 2015; Nkoro & Furo, 2012; Olubiyi, 2014).

At the micro level, international remittance is primarily used for expenditure on food, education, health, and housing (Fonta *et al.*, 2015; Osili, 2004). Although these parameters are relevant for livelihood, only recently have researchers started examining the impact of remittance on household welfare in Nigeria. Two of the published studies in the international peer-reviewed journal include that of Ajaero, *et al.*, (2017) who examined the impact of remittance on household asset ownership, and Urama, *et al.*, (2017) who assessed the impact on labour supply. Nonetheless, there is still a huge dearth of a nationally representative survey on the impact of remittance on the most important dimension of household welfare – food security.

Food security represents a huge challenge in Nigeria since the 1980s when the country abandon agriculture for commercial oil exploration (Matemilola & Elegbede, 2017). In recent time, higher incidence of food insecurity has greatly manifested in rural farming households (Adepoju & Adejare, 2013; Jabo, *et al.*, 2017). In 2016, data shows that about 32.4% of the total population is undernourished (FAO, IFAD, UNICEF, WFP, & WHO, 2017). Internal conflicts (such as Boko-haram terrorism and farmers-herdsmen clashes), the oil price induced recession, and desertification have limited domestic food production, increase food prices, which resulted to a food shortage in many communities (Nwoko, *et al.*, 2016; Obi & Peart, 2016). The food price in Nigeria increased by 15.3% between mid-2015 and mid-2016 (National Bureau of Statistics, 2016). As such many households have adjusted their food consumption behaviours to meet their daily food requirement (Fonta *et al.*, 2015; Ike, *et al.*, 2017; Jabo *et al.*, 2017).

The New Economics of Labour Migration theory opined that migrants remittance may reduce financial constraints and improve household welfare (Stark & Bloom, 1985). A dominant view holds that migrants' remittance can impact positively on household food security (De Haas, 2008). Previous studies show that remittance receipt led to improvement in food expenditure and changes in the dietary habits of households (Isoto & Kraybill, 2017; Karamba, *et al.*, 2011),

impacted positively on the households calorie consumption and child growth (Damon & Kristiansen, 2014; Howard & Stanley, 2017; Karki Nepal, 2016), and lead to purchase of modern food preparation items (Macours & Vakis, 2010; Mergo, 2011). In Nigeria, Babatunde, (2017) finds that remittance does not significantly impact on the diet quality, the micronutrients supply, and the child nutritional status of remittance households, despite increasing household total disposable income and calorie consumption. However, the study of Babatunde, (2017) is not a nationally representative survey, neither was it conducted in high migrating areas nor during high food prices.

Generally, the commonality in these studies is that they measured food security using direct methods;- food expenditure, calories consumption, food diversities, and child anthropometric outcomes, which may not provide a reliable estimate in times of high food price shock (Maxwell & Caldwell, 2008). For an instant, food expenditure and dietary diversity may not reflect the actual household consumption since it is not guaranteed that all purchased food is consumed within the reference period (Moltedo, *et al.*, 2014). When household food stock alone is used for measuring food security, this may result in measurement error, as households may likely reduce the ration of food consumed. More so, the variabilities in food insecurity experiences that may likely exist during times of high food prices may not be captured with indicators that recall short reference period. Considering the occurrence of high food prices shock in Nigeria, we assume that these direct indicators alone may not estimate the accurate measure of food security in the country.

The use of a combined indicator that measures both direct and indirect (subjective) experiences have been recommended (Bickel, *et al.*, 2000; Carletto, *et al.*, 2013 Maxwell, *et al.*, 2013). Our study, therefore, examined the impact of remittance on food security in Nigeria using a set of complementary indicators that include; household food expenditure, dietary diversity, food insecurity experiences, and coping strategies. Table 1 describes these indicators and further details are found in the endnote. Our study is an improvement on the study of Abadi, *et al.*, (2018) who estimated the impact of remittance on food security in Tigray, Ethiopia using only subjective indicators. The novelty in our research is that we adopted both direct and indirect indicators, and disintegrated the analysis into short and long-term food security measures. Furthermore, we tried to stimulate the possible contribution of social remittance of ideas on the food security.

As a significant part of remittance is used for household food consumption in Nigeria (Fonta et al., 2015), we hypothesize, therefore, that remittance income and ideas are beneficiary to the household food expenditure and dietary pattern. Yet it is not certain if this benefit may translate to better security experience and coping behaviours during food shocks.

Table 1: Summary of Main Indicators Used in the Study

Item	Indicator	Description	Data	Measures
Input	Remittance	This indicates if the household receives cash and/or in-kind transfer from a person abroad.	Binary response variable. 1 if the household receives remittance, 0 if not	
Hypothesis	Remittance households have increased food expenditure and dietary diversity, which reduces short and long-term food insecurity experience.			
Channels	Total Food expenditure and expenditure on food classes	This is a summation of the amount spent on food in the last 7 days. It includes food eaten away from home, purchased, own production and food as a gift. This value is further disintegrated into different food classes.	The continuous variable measured in Naira Per capita per day	Quantity of food
Outcome	Household Dietary Diversity Score (HDDS)	This is the total number of food types eaten by household members in 7 days. We categorized the food classes into 7 groups including starch, pulses, fat and oil, fruits and vegetables, sugar, meat and fish, condiments.	Count variable from 1 – 7, indicating the total number of food class consumed	Quality and diversity
Short-term impact	Reduced Coping Strategy Index (rCSI) ⁱⁱ	Household Coping strategy during food shock This is a set of weighted 5 questions with 7 days recall period asked to ascertain the households that struggle (cope) to meet its daily food need.	Count variable between 0 – 56 with lower values signifying higher food security	Food sufficiency
Long-term impact	Household Hunger Score (HHS)	The HHS is an indicator that measures the state of severe hunger by asking if the household has been faced with situations where they do not have enough to eat in the last 12 months.	Binary response variable. 1 if the response is no (food secure), 0 if the response is yeas (food insecure)	The manifestation of severe hunger
	Food Insecurity Experience Scale (FIES) ⁱⁱⁱ	This is a 12 months recall period question that asked a set of 8 questions on the subjective well-being of household as regard to food consumption	Count variable between 0 – 8 with lower values signifying higher food security	Food sufficiency and psychological factors

Source: Ballard et al., (2013); Leroy et al., (2015); Maxwell & Caldwell, (2008) and Maxwell et al., (2013)

2.0 Methodology

Data

The data was collected from the Nigerian 2015/2016 GHS (Nigeria National Bureau of Statistics, 2015). The GHS is implemented as a panel survey in collaboration with the World Bank Living Standards Measurement Study (LSMS). The first wave conducted in 2010 is a nationally representative survey of 5,000 households from 500 Enumeration Areas (EAs) in the 6 geopolitical regions of the country. The 2015/2016 survey is the 3rd wave and it was collected on 2 visits for all households. The first visit was the post-planting session collected between August and October of 2015, and the second visit was the post-harvest session which was collected between February and April of 2016. As some households had moved and were not able to be located by the survey team, the 3rd wave recorded a reduced sample of 4581

households. We focus on information from the household roster, household expenditure, food security, remittance, and community questions.

To adequately capture the impact of remittance on the household food security, a strategic sample selection is required. This is because the number of households that receives remittance (treatment households) across the six geographical regions was only 5% of the total population (this gave a remittance to a non-remittance household ratio of 1:20). Hence, using the full sample in the analysis may not likely allow sufficient comparison between the treatment and control group. We, therefore, opted to consider a subset of the parent sample whereby we consider EAs where the rate of migration/remittance is large enough to yield a sample that will allow comparison. We are aware that such a subset of EAs will lead to an over-sampling of remittance-receiving households and that our results may not be representative of the total population in Nigeria. Yet, as we will explain below, we selected the state with the highest percentage of remittance households in each region and the EAs where at least one household received remittance. As such our results will provide relevant information on areas with sufficiently high remittances.

While oversampling the areas with remittance-receiving households, we are interested in retaining the representativeness of the sample at both the geopolitical region and national level. To achieve this, different factors were considered. First, there is a significant variation in the number of households that receive remittance in the six geopolitical regions of the country. Households in the southern regions receiving more remittance than households in the northern regions. This perhaps is because migration is generally more common in the southern regions compared to the northern regions (Afaha, 2012; Carling, 2006). Second, a significant variation was observed at the state level with some states having less than 3 remittance-receiving households ($n=16$). Therefore, we adopted a multistage stratified sampling procedure for the sample selection. We dropped all states that have less than 3 remittance households ($n= 16$), and selected the state with the highest percentage of remittance households in each region ($n= 6$). The states include Plateau, Bauchi, Kaduna, Anambra, Edo, and Lagos. The final sample includes the EAs in these states that have at least one remittance household. In total, 570 households of which 18.8% were remittance household were examined. We ran further test on the data confirming that the exclusion of households will not cause a significant change in the result^{iv}.

Household and Community Characteristics

Table 2 present the descriptive statistics of variables included in the analyses. The means of the variables are shown for both remittance household and non-remittance household. The remittance households are predominantly headed by older females who are likely to be single (mostly widowed or divorced). This result is very plausible because being old means that they may have children in their middle age who may have migrated. More so, by being widowed, these female household heads are more likely to receive gifts from relatives and friends living abroad. The pension service in Nigeria is not very efficient, retired citizens may rely on the pure altruistic gifts of their children and relatives. As expected, the extra income from remittance (136,326.43 naira per year, approximately US \$500) translated to higher household expenditure. While the remittance household spent in average 408,023 naira per adult equivalent per year (US \$1,400), the non-remittance household spent 303,408.83 naira (US \$1,000). The difference is significant at 5% level.

The result also shows that remittance households have more migrants than the non-remittance household. The two variables that describe the education level of the household head need to be interpreted carefully. Using the primary school variable, the head of non-remittance households appears to have higher education level than that of remittance household, however, when we examined the post-secondary school education, the remittance household head seems to do better, although not significant. If education level of the head is used to deduce the household well-being before a member migrated (or remitted), we can posit that remitting migrants may come from a poor household, and are sending money back home to improve the livelihood of the household. Result also shows that the difference in ownership of the household tangible asset (gas stove and fridge) is significant. The gas stove ownership is added to examine if there is an effect of social remittance (or placebo effect) on households' food security^v. We could not conclude that households benefited significantly from social remittance when a further econometric test was conducted. Furthermore, at the community level, we find no significant difference in any indicator used to describe the possible community-level variations that may influence household food security. Nevertheless, the increasing price of sachet water and sudden changes in food prices imply a general occurrence of food prices shock in the study areas.

Table 2: Descriptive statistics of variables

Remittance household (n = 107)		Non-Remittance Household (n =463)		
Mean	Std. Dev	Mean	Std. Dev	t-test

Key household characteristics					
Age (Head age in number of years)	57.17	16.16	52.71	13.98	2.64***
Sex: Female headed household (1: yes)	0.39	0.49	0.22	0.42	3.28***
Marry: head is presently married (1: yes)	0.61	0.49	0.71	0.45	-2.03**
Education: head attended primary (1: yes)	0.59	0.49	0.70	0.46	-2.16**
Education: attended post-secondary (1: yes)	0.15	0.36	0.13	0.33	0.61
Household size (number)	5.41	3.57	5.55	3.21	-0.39
Occupation: agriculture (1: yes)	0.51	0.50	0.59	0.49	-1.39
Household expenditure (Naira)	408,023.00	486,423.220	303,408.83	313,324.78	2.125**
Remittance Characteristics					
Remittance (Naira receive per year)	136,326.43	247,983.51	0	0	-
Migrant: Has international migrant (1: yes)	0.08	0.27	0.02	0.13	2.42**
Household assets					
Internet: head has access to internet (1: yes)	0.15	0.36	0.15	0.94	0.07
Insurance: head has insurance (1: yes)	0.07	0.25	0.03	0.18	1.30
Gas: household has gas cooker (1: yes)	0.14	0.36	0.05	0.22	2.35*
Fridge: household has fridge (1: yes)	0.44	0.55	0.28	0.54	2.69***
Community Variable					
Region: a household in the south (1: yes)	0.68	0.47	0.65	0.48	0.58
Location: a household in an urban location (1: yes)	0.58	0.50	0.49	0.50	1.63
Price of sachet water (per 50CL)	9.49	9.34	9.81	10.49	-0.29
Experience sharp change in food prices (1: yes)	0.51	0.50	0.54	0.50	-0.53
Instrumental Variable					
(Migration network + age) ²	3277.86	1876.27	3010.14	1558.70	2.91***

***, **, * are significant in 1%, 5% and 10% respectively. All monetary measures are calculated in Naira; 1 US dollar = 305 Naira in 2016

We used the HHS to examine the general level of food insecurity in the study area. The HHS is an indicator that measures the state of severe hunger. In the GHS data, the senior female member of the household or the most knowledgeable person about food consumption was asked if in the past 12 months, have the household been faced with a situation when they did not have enough food to feed? The response (Table 3) shows that about 45.3% answered affirmative, confirming the occurrence of severe food insecurity in almost half of the households. Chart 1 shows that households without remittance witness more severe hunger (47.3%) than households that receives remittance (36.4%). This difference is significant at 5% level. Furthermore, during the time of high food prices, the households in the south are more likely to report food shortages. This is possible as the economy of northern part of Nigeria is mostly agricultural based and the region have relatively lower cost of living than the south. The main factors causing food insecurity as per the answers of the households interviewed, are shown in Chart 2. Considering that lack of money (52%) is the major issue causing hunger during the reference period, the rest of the analysis will examine if the extra income from remittance impact positively on the food expenditure and food insecurity experiences of remittance households compared to non-remittance households.

Table 3: Have Household been faced situation of severe hunger in the past 12 months?

	Total Sample (n = 570)	Remittance Household (n = 107)	Non-Remittance Household** (n = 463)	Northern Region (n =195)	Southern Region* (n= 375)
	F (%)	F (%)	F (%)	F (%)	F (%)
No (food secure)	312 (54.7)	68 (63.6)	244 (52.7)	126(64.6)	186 (49.6)
Yes (food insecure)	258 (45.3)	39 (36.4)	219 (47.3)	69 (35.4)	189 (50.4)

*, and ** show significant different with the compare group. ***, **, * are significant in 1%,5% and 10% respectively.

Chart 1: Percentage of food insecurity in remittance and non-remittance household.

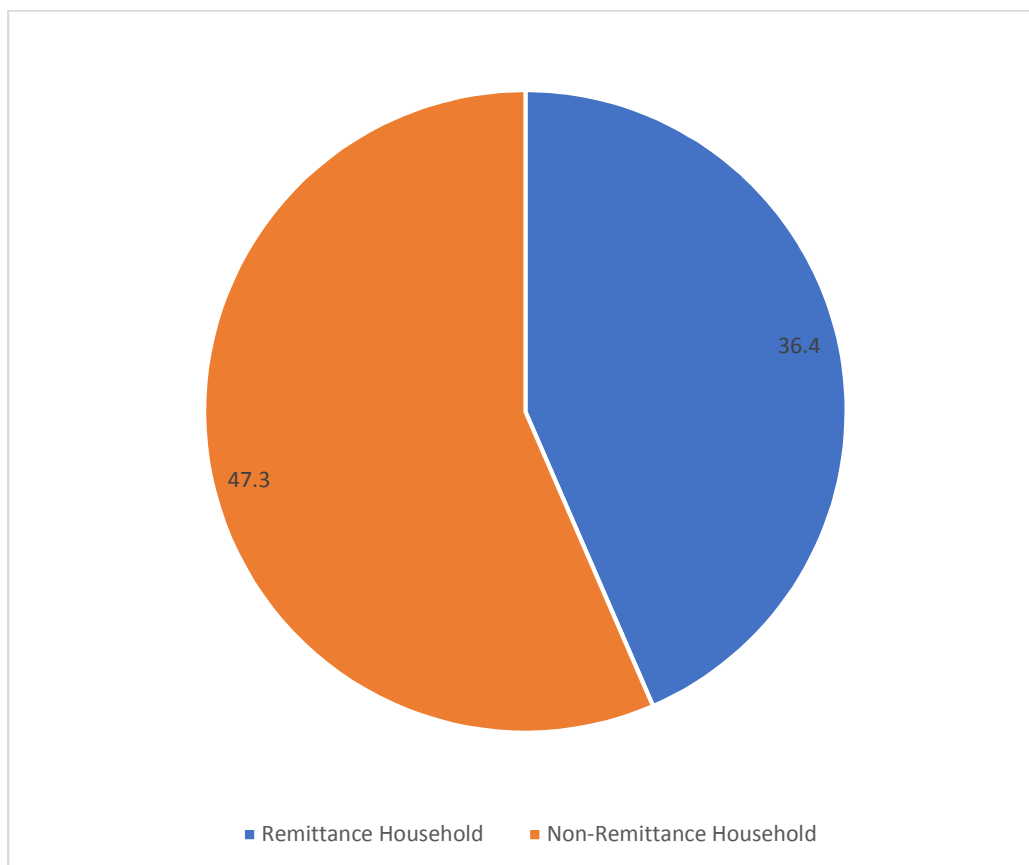
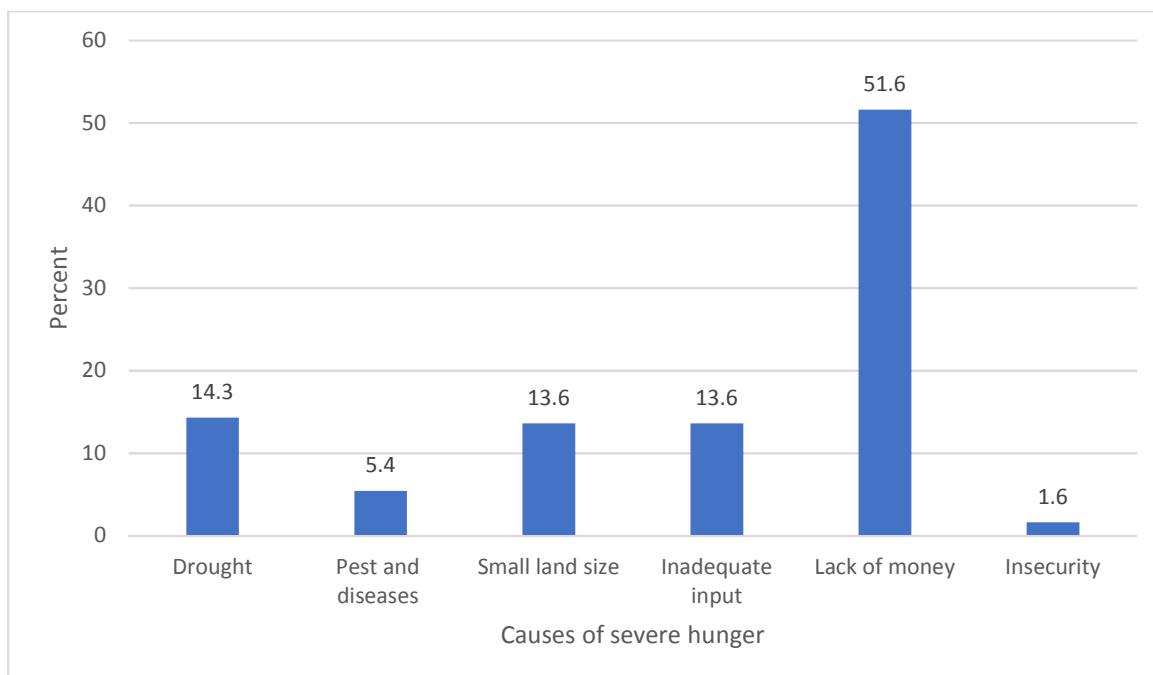


Chart 2: Main factors causing food insecurity during high food price shock



Remittance and food security

The household food security level is measured using the direct indicators (household food expenditure, and HDDS), and the indirect indicators (rCSI and FIES). To confirm the consistency of the measurements, we use the Spearman's rho correlations to examine if the different indicators correlate adequately. The result (Table 4) shows that the 4-food security indicators associated significantly in the expected direction among themselves and with the remittance variable. A similar result was found by Maxwell et al., (2013). The two indirect measures, FIES and rCSI, are well correlated, and as would be expected, are quite weakly correlated with food expenditure and HDDS. This variation confirms that they capture the different dimension of food security, and are quite complimentary.

Table 4: Spearman's rho correlations of food security measures

Spearman's Correlations	rho	Remittance	Food Exp	HDDS	rCSI	FIES
Remittance		1	0.09**	0.05	-0.09**	-0.14***
HHS		-0.09**	-0.12***	-0.04	0.61***	0.68***
Food exp		0.09**	1	0.07	-0.04	-0.04
HDDS		0.05	0.07	1	-0.05	-0.08*
rCSI		-0.09**	-0.04	-0.05	1	0.74***
FIES		-0.14***	-0.04	-0.08*	0.74***	1

***, **, * are significant in 1%,5% and 10% respectively

Table 5 provides the summary statistics of the four food security indicators. It also includes the disintegrated expenditure on food classes. The food classes are divided into food eaten at home; such as 1. Starch staple (Grains, flours, starchy roots), 2. Pulses, nut and seeds, 3. Fats and oils,

4. Fruits and vegetables, 5. Meat, fish egg, milk and other animal products, 6. Sugar, beverages, alcohol and juice, 7. Condiments, water and miscellaneous, and food eaten away from home. Generally, the result suggest that remittance households spend more on food than non-remittance household. Consistent with the result of Babatunde, (2017), the overall household food consumption is predominantly starch staple followed by fruits and vegetables, and meat and fish. The result on food class expenditure shows a significant different on expenditure on meat, fish eggs, and on sugar, beverages and alcohol between remittance and non-remittance household. The HDDS result equally show that remittance households tend to eat more diversified food than non-remittance household. On food insecurity experience and behaviour, the remittance households recorded lower score for both rCSI and FIES. While the different on rCSI is insignificant, the FIES is very significant. This indicates that remittance households are well likely to have long-term food sufficiency and stability than the non-remittance household. It is good to note that this interpretation does not imply causality as the t-test does not control for possible household and community characteristics that may influence the household food purchase, experience and coping behaviour. To explain causality, a more robust econometric strategy is required as discussed below.

Table 5: Comparing Food security level of Remittance and Non-remittance household food

	Remittance Household		Non-Remittance Household		T-test
	Mean	Std. Deviation	Mean	Std. Deviation	
Total food expenditure per capita per day	660.75	731.29	501.17	517.52	2.14**
Food expenditure away from home	79.08	193.78	59.33	114.12	1.02
Grains, flours, starchy roots	270.59	345.08	220.42	328.15	1.41
Pulses, nut and seeds	29.25	99.50	18.38	37.19	1.11
Fats and oils	7.30	15.83	6.53	16.88	0.43
Fruits and vegetables	88.76	170.93	73.53	150.13	0.92
Meat, fish eggs and milk	86.92	132.58	63.89	92.93	1.70*
Sugar, beverages, alcohol and juice	65.63	151.46	34.80	108.17	1.99**
Condiments, water	33.21	100.52	25.10	58.29	0.80
HDDS	6.40	0.76	6.22	1.02	2.07**
rCSI	4.67	7.14	5.63	6.61	-1.33
FIES	2.66	2.86	3.71	2.91	-3.36***

***, **, * are significant in 1%,5% and 10% respectively. Questions on food category expenditure are measured in per capita per day. 1dollar = 305 Naira in 2016

Econometric Modelling for testing causality

To examine the causal relationship between remittance and the household food security during the period of high food prices, we concentrated on the 4 food security indicators described above. The dependent variables; food expenditure parameters (total food expenditure and food classes expenditure) are natural log-transformed continuous variables, while the HDDS, rCSI, and FIES are count variables. The primary independent variable, remittance variable is a discrete dummy variable which is represented as 1 for remittance household, and 0 for non-

remittance household. Hence, it is appropriate to use two different modelling approaches which could capture the treatment effect of receiving remittance on food security. First, we use the two-stage least square equation, (ivregress) to estimate the impacts of remittance on the log of household food expenditure and the log of the expenditures on food classes. Second, the exponential mean model with endogenous regressors (ivpoisson) was used to examine the impact of remittance on HDDS, rCSI and FIES. As will be explained, these models are considerable improvement on the standard ordinary least square (OLS) and Poisson regression model (PRM).

Formally, the structural form of the OLS and PRM can be expressed below.

$$\text{OLS: } y_{1i} = \beta_1 y_{2i} + x'_{1i} \beta_2 + u_i \text{ ----- (1)}$$

$$\text{PRM: } E y_{1i} | y_{2i}, x_{1i}, u_{1i} = \exp(\beta_1 y_{2i} + x'_{1i} \beta_2 + u_{1i}) \text{ ----- (2)}$$

where y_{1i} is the dependent variable (OLS: log of food expenditure per capita per day, and log of food class expenditures per capita per day; and for PRM, dependent variables are HDDS, rCSI, and FIES), y_{2i} is remittance household, x'_{1i} represent the control variables, and u_i is the error term. The control variable includes several covariates factor collected from the household head such as Sex, Marry, Internet, Education, Insurance, Expenditure, Household Size, Agriculture occupation, and the variable that controls for social remittance, Gas Stove. Since there is a difference in welfare condition between the south and northern Nigeria, and possibly between remittance and non-remittance communities (Ajaero et al., 2017), some community-level variables that control for possible variation were added to the model. This includes Region either south or north, Location in urban or rural, Price of Sachet Water, and recent occurrence of Sharp Changes in Food Prices. All the included control variables have been found to impact on food security in Nigeria (Jabo et al., 2017; Owoo, 2018).

Remittance is the variable of interest in our analysis and our discussion will focus primarily on it. Receiving remittance nevertheless does not occur randomly across households resulting to potential endogeneity problem. Endogeneity problem caused by reverse-causality, selection bias and omitted variables have been extensively discoursed (Adams, 2011; Davis, *et al.*, 2010; McKenzie & Sasin, 2007). Households that receive remittances may be basically different from households that do not receive remittances (Selection Bias). For instance, as discoursed earlier, remittance households may likely be a previously poor household where a member was

opportune to migrate abroad. Reverse causality occurs when the problem of food insecurity influences the migrant to remit. This is plausible for the Nigerian context as more remittance may be sent to households to compensate for the increasing food prices. Furthermore, households that receive remittances may have several other unobservable characteristics that could influence both remittance receipt and the food security level (omitted variable). When remittance correlates with these unobservable characteristics, the standard OSL and PSM estimates may not give a consistent estimate. The result would either be overestimated or underestimated. If remittance is sent to wealthy households, who may not have a challenge of food security, then the result might be overestimated, but if remittance is sent to compensate for food insecurity shocks as likely in our case, the result may be underestimated.

Hence, following McKenzie, et al., (2010) we adopted instrumental variable (IV) regression approach to deal with the potential endogeneity problem in our models. The IV equation requires the introduction of an instrumental variable which could predict the variation in the remittance variable and at the same time uncorrelated with the unobserved variables. We used the community migration network which represents; 1 if a household in the community has an international migrant. The migration network is introduced with the assumption that households in migrants' communities are more likely to receive remittance than those in non-migrant communities. Studies using community migration network as the instrument has shown that although it may not directly affect household food security, migrant communities may generally have a higher standard of living than non-migrant communities, resulting to another endogeneity challenge (Karamba et al., 2011). To solve this possible spill-over problem, we introduced household level variation using the age of the household head. The adjusted migration network instrumental variable is computed as follows:

$$\text{Adjusted migration network} = (\text{migration network} + \text{age of household head})^2.$$

By adopting this instrument, the casual relation of remittance on the food security variables can be estimated in two stages with `ivregress` and `ivpoisson`. The first stage estimates the relationship between the endogenous variable and the instrument, while the second stage uses the predicted value of the first stage to analyse the impact of remittance of the different indicators of food security. The predicted variable included in the second stage provides the estimate of the treatment effect of remittance on the respective food security indicator variable. We use the `ivregress` and `ivpoisson` command in STATA 13 for the analysis. Specifically, we

use linear probability model in the first stage of the ivregress as recommended by Angrist & Krueger, (2001). Nevertheless, our result is robust to other alternative models.

We conducted series of test to justify the IV equations. The Robustified Durban-Wu-Hausman test of endogeneity model leads to a strong rejection of the null hypothesis that remittance variable is exogenous ($p = 0.003$), confirming the endogeneity of remittance. The Cragg-Donald Wald F statistic is approximately 10 (9.699) partially satisfying the widely used thumb of rule suggested by Staiger & Stock, (1997) for identifying weak instrument. To confirm that we do not have a problem with the instrument, we further conducted tests. The R-square is approximately 0.08, which according to Cameron & Trivedi, (2010) is not low enough to flag weak instrument problem in a just-identified model. We also conducted the test and conditional sets estimation (Mikusheva & Poi, 2006). The three coverage-corrected tests gave similar 95% confidence interval of [0.93, 5.76] which is very much wider than the conventional asymptotic interval of the endogenous variable [0.45, 3.59]. This result suggests that there is no strong need to correct for the weak instrument. Finally, we also followed the recommendation of Angrist & Krueger, (2001) that when the number of instruments is equal to the number of endogenous variables, the bias created by the weak instrument is approximately zero.

Given the difference in both remittance and food security level between the northern and southern region, and the fact that the data was collected on different occasions, we could not assume homoscedasticity. The pagan-Hall general test statistics confirm that the error term is heteroskedastic ($p=0.09$). Hence, to make allowance for the heteroskedasticity of the errors, we use the robust standard errors and clustered the errors at the regional level.

3. Results and Discussions

Table 6 shows the result of the analysis of the impact of remittance on household food expenditure per capita per day and food expenditure of different food classes. The table reports the result from the ivregress model and other alternative models to test the consistency of our result. We, however, truncated the table and restricted our report to the remittance coefficient only to avoid reporting variables that are less relevant. We find that without controlling for endogeneity, the result of the OLS analysis tends to suggest that remittance have no significant impact on household food expenditure per capita. Nevertheless, it shows that remittance has a negative impact on expenditure on food away from home and expenditure on fats and oil. If consuming food away from home leads to more quality food, then this might be an important challenge for remittance household in achieving higher dietary diversity.

However, when we controlled for endogeneity and possible heteroskedastic issues, we find that receiving remittance have a very tremendous impact on household total food expenditure per capita per day. Keeping other covariate factors included in the model and the error constants, households that receive remittance during the time of high food prices could spend as much as 200% more on food than those that do not receive remittance. While those that do not receive remittance resort to eating outside of the home. A possible explanation to give here is that during high food prices, stocking food at home becomes too expensive for the non-remittance household, hence they may rely on the daily purchase of meals from local sellers. This way, they may save the money on kerosene and firewood purchase. As expected, the result clearly shows that the OLS model produces an inconsistent result and underestimated the impact of remittance. This is another reason to confirm the existence of reverse causality, as it was plausible that remittances were sent to compensate for the increasing food price shock. The alternative models that use probit model in the first stage equally produce a similar and consistent result. However, these models tend to report lower coefficients. In general, the IV models indicate that remittance households spend more on starchy staple foods and on fruits and vegetables than the non-remittance household.

It is responsible to note that the results of the IV models capture more of the subsample which has more migrants. As such, we may infer that the positive signs of remittance on food security may be more pronounced in high migration region. To confirm this, we disintegrate our result into the northern and southern region, we find that remittance contributes significantly to food expenditure at the southern region than at the northern region, and at the urban location than at the rural location. For the urban-rural difference, it may that it is easier remit to household members in urban areas than those in rural areas which impacted on their food expenditure (Table 7). On the north-south disintegration, the result implies that the food expenditure of households in the northern part of Nigeria is generally not affected even when they receive remittance. In the southern region in the other hands, households that have remittance spend more than twice on food than households that do not have remittance. This goes on to reiterate the impact of remittance on household welfare in southern Nigeria, and an explanation of the greater number of international migrants from the region.

Table 6. Remittance and food expenditure

	OLS	2sls	Twostep treatment effect
Lnfood expenditure	0.04 (0.07)	2.02** (0.85)	1.84*** (0.97)
Lnfood away	-0.26	-4.37***	-4.38*

	(0.17)	(1.62)	(1.93)
Lnstarch	0.13	2.51***	2.39**
	(0.10)	(0.75)	(0.67)
Ln pulses	0.07	1.81**	1.39
	(0.14)	(0.71)	(0.90)
Ln fats	-0.12	0.89	1.00
	(0.12)	(1.30)	(1.89)
Ln fruits and veg	0.04	3.54**	3.39*
	(0.12)	(1.42)	(1.61)
Ln meat and fish	0.12	3.45**	3.07
	(0.09)	(1.59)	(2.44)
Ln sugar	0.24	1.39	0.69
	(0.21)	(1.44)	2.06
Ln condiments	-0.12	1.71**	1.13
	(0.11)	(0.86)	1.03

The sample is 570 households. The report provides remittance coefficient estimates from models that control for sex marry edu2 insurance expenditure household size agriculture occupation, internet, gas fridge region location sachet water price change. Standard errors are presented in parenthesis. All analysis is clustered at region level that includes all the 6 geopolitical regions. *, **, *** are significant at 10, 5 and 1 % level respectively.

Table 7. Impact of remittance on sub-samples

	Northern region	Southern region	Rural	Urban
Food expenditure	2.85	1.33*	3.88	0.86*
	(2.50)	(0.73)	(3.25)	(0.48)

*, and ** show significant differences with the comparison group. ***, **, * are significant in 1%,5% and 10% respectively. Standard error in parenthesis.

Remittance, dietary diversity household food insecurity experience and coping strategy

We now focus on the impact of remittance on household dietary diversity and the subjective food security measures in Table 8. Since the depended variables are count data, we used non-linear regression approach to investigate the incidence rate ratios of the change in dietary pattern due to remittance. Furthermore, we analysed the incident rate of experiencing food insecurity and resorting to social unacceptable coping strategies vis a vis receiving remittance. We use different specifications of Poisson regression and adopted the exponential mean model (ivpoission Generalized Methods of Moment, GMM). The other non-linear treatment effect models are added for a robust check, although it gave an inconsistent sign for rCSI. The result from the ivpoisson shows a positive but insignificant increase in dietary diversity for remittance household. This result is surprising but robust to other models and consistent with the study of Babatunde, (2017). It is surprising because we saw that remittance household were more likely to spend more on different food classes than the non-remittance household. A plausible explanation to the insignificant effect is that the bulk of expenditure was on stable food which is equally more accessible to the non-remittance household. The fact remittance does not lead to higher food diversity may partially reflect the lower education level of remittance households, and partially due to the low transfer of beneficial social remittance (food knowledge) from remitting migrants to households.

The result of the rCSI and FIES are significant and negative indicating that with fixed values for the other regressors, remittance households are less likely to resort to unsocial acceptable coping strategies and generally have lower food insecurity experience during high food price shock. The coefficient is in the raw form and needed to be interpreted with caution as the equations follow an exponential distribution. For this, we report the result from the incident rate ratio (IRR). The IRR of remittance on rCSI is 0.211 and on FIES is 0.29. This indicates that compared to the non-remittance household, the expected number of days that remittance household will resort to short-term coping strategy or report long-term food insecurity experience will be at least 0.2 times lesser. Aside from showing that remittance household is more sufficient in short-term food supply during high food price shock, the result also shows that they are more psychological prepared to maintain a stable food supply over the long term.

Table 8. Remittance, dietary diversity and food insecurity behaviours

	Poisson	IVpoisson-GMM- multi-robust	Treatment model	Effect
HDDS	0.02 (0.11)	0.20 0.16	0.02 (0.01)	
rCSI	-0.09* (0.05)	-1.55** (0.68)	0.18*** (0.06)	
FIES	-0.26** (0.13)	-1.25* (0.74)	-1.99*** (0.75)	

NB: The sample is 570 households. The report provides remittance coefficient estimates from models that include all the households and community level characteristics described in table 2. Standard errors are presented in parenthesis. *, **, *** are significant at 10, 5 and 1 % level respectively.

4. Conclusion

Nigeria is one of the highest remittance receiving country in the world. Remittance is predominantly received in migrating communities in the southern part of the country. Remittance play a considerable role both at the national level, by maintaining foreign inflow during the times of low oil production, and at the household level, by improving household assets and general welfare. Nevertheless, as the country witness food price inflation between 2015 and 2017, the role of remittance in improving food security has attracted major attention.

We studied if remittance enhances food expenditure and alleviates the food insecurity experience of the remittance receiving household during the period of high food prices. Improving on previous remittance-food security impact studies, we used a combination of direct and subjective indicators in our analysis. These indicators include household food expenditure per capita, food expenditure on different food classes, HHS, HDDS, rCSI, and

FIES. The food security indicators correlated significantly in the expected direction among themselves. Hence, we recommend the use of combine indicators for future analysis. The data for analysis is collected from the 2015/2016 GHS survey of Nigerian. We used a multistage sampling technique to select a representative sample of 570 households from the parent data. To control for possible endogeneity and heteroscedastic issues, we used instrumental variable approach and clustered standard error technique in our analysis.

Both remittance and non-remittance household report the occurrence of severe food security challenge during periods of high food price shock. The lack of money topped the list of factors aggravating the food insecurity in the country. Households in the southern region are more likely to report food insecurity than those in the northern region. We implied that this is because they generally produce less food, and suggested that food insecurity may be a reason why most out-migration occur in the south. We inferred that as remittance household are mostly previously poor and are likely to have a widowed female head, remittances are being sent to compensate for the food insecurity of their household members.

Generally, the econometric result shows that after controlling for endogeneity, remittance contributes massively to household food security. During the time of high food prices, the household that receives remittance spends almost 200% more on food than households that do not receive remittance. The result shows that this increase did not lead to dietary diversification as the extra income from remittance is often spent on the available stable food. Nevertheless, the result from the rCSI and FIES shows that remittance household is more sufficient in the short-term food supply, less likely to resort to unsocial coping strategy, and are more psychological prepared to maintain long-term food stability. We conclude that receiving remittance is a veritable strategy for meeting the dietary requirement in high migrating communities in southern Nigeria.

What does this mean for policy? First, the tremendous impact of remittance on household food consumption expenditure and at the same time leading to no significant increase in household food diversity is a major concern. Aside from the predominant consumption of the readily available starchy staples, social remittance seems not to be improving the knowledge on food choices for remittance household. The policy that enhances dietary choice education in high migrant communities is necessary for improving the nutritional level of the remittance households. Second, urban households are well-off in terms of receiving remittance and in the level of food security. Hence, there is need to improve the remittance channels to rural areas to

contribute to better food security experience in the area. Finally, considering the positive results found in the high migrating southern region, it is imperative to assert that pre-migration policies that hinder regular migration may have a countervailing effect on food security in the region. In extreme food insecurity situation, young people may seek all possible ways to migrate in order to help their households. It is based on this that we reiterate the need for policies that aim to solve the root causes of migration in Africa to see reducing food insecurity as an important goal.

Notes

ⁱ In Nigeria, due to the exchange rate fluctuations, undocumented resident status of some migrants, and challenges of remitting directly to rural areas, there is often more incentives to use informal channels to remit money back home than the formal channels (Hernandez-Coss & Bun, 2007; World Bank, 2018). This unrecorded informal transfer had been reported to constitute about 50% of total transfers from the UK to Nigeria (Hernandez-Coss & Bun, 2007).

ⁱⁱ The question for the rCSI is: in the past 7 days, how many days have you or someone in your household had to: (if no days, write '0'): 1, Rely on less preferred foods? (weight x1); 2, Borrow food or rely on help? (weight x2), 3, Limit portion size at meal times? (weight x1); 3, Restrict adult consumption for children? (weight x2); and 4, Reduce the number of meals? (weight x1). The sum of the weighted score was used in the calculation of the household rCSI.

ⁱⁱⁱ The FIES question is: During the last 12 months, was there a time when you were... (yes = 1, No = 0). 1, Worried you would not have enough food to eat because of lack of money? 2, Unable to eat healthy and nutritious food because of lack of money? 3, Ate only a few kinds of food because of lack of money? 4, Had to skip a meal because there was not enough money? 5, Ate less than you thought you should because of lack of money? 6, Your household ran out of food because of lack of money or other resources? 7, Were hungry but did not eat because there was not enough money? 8, Went without eating for a whole day because of lack of money? The sum of the raw score of the questions was used in the calculation of the household FIES

^{iv} To ensure that our sample do not lose its representativeness and external validity, we tested if there are significant differences in the household characteristics of the control groups and the households not selected in the study. We found that, the household size, sex of household head, household total expenditure, marital status of head, and ownership of insurance were not significantly different at a 5% significant level. Nevertheless, the t-test also return that households included in the sample are more likely to practice agriculture than those not included. Our results clearly showed that the exclusion of the households would not cause a significant change in the result. Furthermore, it compares favourably with earlier research conducted in Nigeria and neighbouring West African countries.

^v Social remittance exchanges occur through social networks, return migrants, visiting non-migrants, and exchanges of letters and other digitalized information. The transfer of foreign fertility norms (Beine, *et al.*, 2013), transition from firewood to kerosene stove (Manning & Taylor, 2014) and investment on modern food preparation items (Macours & Vakis, 2010; Mergo, 2011) are examples of social remittance recorded in literature, but social remittances are not been captured directly in national GHS. We tested if being a remittance household have a

significant impact on the probability of using a gas stove. The probit result shows that there is no significant impact of remittance on the gas stove ownership.

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