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Distributional Impacts of Policy Induced Prices on Household Welfare In Nigeria

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Abstract: In the face of continuous rise in price of essential commodities arising from the 2015-2016 currency crises which led to the introduction of different policies to tame the ugly tide, this paper analyzes the distributional impacts of the resulting prices on household welfare using two rounds of household data and commodity prices generated from National Bureau of Statistics Using pre-crisis post crises information and adopting Deaton and Muellbauer (1980) and Friedman & Levinson (2002) framework, the study found that although every household suffered money illusion, poor households in the urban areas were worst hit by the financial crises because the poor rural households had alternative to produce food which assisted them to reduce the effects of the price increase.

Keywords: Household consumption**,** food price increase**,** inflation, household welfare
JEL Classification: C14, D10, E31, E61, H30

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I. INTRODUCTION

The 2015-2016 gyration in foreign exchange in Nigeria, especially the dollar resulted in precipitated decline in the value of the Naira as well as rampant increase in the price of commodities. In an 18 month span, food prices tripled and prices of other essential goods also increased substantially, with inflation rising by 18.5 percent in December 2016 (NBS, 2017). The degree to which Nigeria households were vulnerable to these changes depended on variety of factors, including the types of commodities consumed and the household size. With increase in prices without a corresponding increase in income, it is apt to determine how household welfare adopted from the brunt of the price shocks. This study focuses on the household consumption choices and changes in the price of goods to explore how the price changes affected their welfare.

A definitive investigation of the impacts of the Nigeria commodity price crisis and potential differential impacts across levels of living requires detailed income and expenditure information for a large sample of households, both before and after the crisis. Although studies such as Frankenberg, Thomas & Beegle (1999), Friedman & Levinson (2002) used Indonesian data to investigate the impacts of financial crisis on consumption, employment, and education, this study present an in-depth of information on households. Our approach is distinct from these studies in that we use two set of household data collected before and after the crisis. In the face of continuous rise in price of essential commodities and its consequences on the growth process, the outcome of this study will be of immense value to policymakers towards improving household welfare.

II. DATA AND METHODOLOGY

The data set for this study is generated from National Bureau of Statistics (NBS). Household data on consumption are matched with data on food and selected commodity price changes. Since it has been argued that adopting household expenditure as a measure of welfare is problematic because it does not often reflect the true position of household welfare, this study uses household per capita expenditure as the measure of welfare. Although all households in the rural areas may face the same prices for high-quality and low-quality rice, the unit values recorded for a household that bought mostly high-quality rice, in line with Deaton (1997). The data from National Bureau of Statistics contain monthly price observations from January 2015 to December 2016. This period, which begins before the advent of the crisis, spans the steep devaluation of the naira and subsequent (and temporary) stabilization at the new higher rate. We employ a single price change measure, the percentage change in price from January 2015 to February 2016. By adopting such a long time period from before the onset of rapid inflation until hope to capture a robust measure of the price changes associated with the crisis. The price data provide information on both aggregate goods, such as food and housing, and individual goods, such as cassava and petrol. There are about 100 goods with observed prices in the data. However, the types of goods

observed vary by from town to town, perhaps reflecting taste and consumption heterogeneity throughout the country.

To determine the impacts of the price increases on household welfare, we consider changes in consumer surplus brought about by the change in prices. Following Deaton and Muellbauer (1980) and Friedman & Levinson (2002), an expenditure function which links prices with the cost required to attain utility level can be stated as:

$$C(U, P) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where P = price and U = utility

A first-order Taylor expansion of the minimum expenditure function with respect to price will yield an approximation of the income needed to compensate the household after a price change and to restore that household to the percentage utility level. Thus this expression will approximate the compensating variation. The partial derivative of the minimum expenditure function with respect to price yields quantities consumed gives:

$$\Delta C = \chi \Delta p \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where χ is a 1 x n vector of consumption goods quantities, Δp a 1 x n vector of price changes, and n the number of consumption goods in the total demand system. Note that this first approximation of compensating variation requires information only on pre-crisis consumption quintiles and on price changes. From equation (2) proportionate price changes in terms of budget shares, β can be reformulated as:

$$\Delta \mathrm{In} C^b \approx \sum_{i=1}^{n} \beta_i^b \, \Delta Q \mathrm{np}_\mathrm{i}^{\eta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

where Q = individual goods in the commodity system and η refers to the household. The budget share β is the household cost of good Q divided by pre-crisis total household expenditures. Equation (3) have shown that any differential distributional impact of the price changes must derive both from the presence of large relative price changes and large differences in the budget shares across households.

In general, the costs of attaining pre-crisis utility levels will increase less rapidly than expression (3) may suggest because households can substitute away from goods whose prices have risen disproportionately. Thus expression (3) provides a maximum bound on the impact of the crisis because it does not take into account the substitution toward relatively less costly products that will take place. Given the large relative price changes following the crisis, the substitution surly occurred to some extent. Returning to the minimum expenditure function, a second-order Taylor expansion of the minimum expenditure function allow for substitution behavior:

$$\Delta C = \chi \Delta p + \frac{1}{2} \Delta p^T \varphi \Delta p. \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Here, φ is the n x n matrix of compensated derivatives of demand. Equation (4) can be reformulated in terms of budget shares and proportional price changes as:

$$\Delta \mathrm{In} C^b \sum_{i=1}^{n} \beta_i^b \Delta \mathrm{In} + \frac{1}{2} \sum_{i=1}^{n} \sum_{i=1}^{n} c_{ij} \, \Delta \mathrm{In} p_i^{\eta} \cdot \Delta \mathrm{In} \mathrm{p}_\mathrm{i}^{\eta} \Delta \mathrm{In} \mathrm{p}_\mathrm{i}^{\eta} \quad \ldots\ldots\ldots\ldots \quad (5)$$

where c_{ij} contains the Slutsky derivatives φ_{ij}, defined by the expression

$$c_{ij} = \mathrm{p_i} \varphi_{\mathrm{ij}} \mathrm{p_i} / C_{b.}$$

With some simple algebraic manipulation it can be shown that the c_{ij} term to be equivalent to: $\beta_i \in_{ij}$,

$$c_{ij} = \frac{p_i \varphi_{ij} p_i}{C_b}$$

where $\in_{ij}$ is defined as the compensated price elasticity of good i with respect to price change j. Thus equation (5) can be re-specified as:

$$\Delta In C^b \approx \sum_{i=1}^{n} \beta_i^b \, \Delta In p_i^b + \frac{1}{2} \sum_{i=1}^{n} \sum_{i=1}^{n} w_i^b \in_{ij} \Delta In p_i^b \Delta In p_i^b \quad (6)$$

The two formulations of compensating variation given in equations (3) and (6) would be employed to explore the possible differential impacts of the crisis. Thus an approximation to the compensating variation that also account for potential household substitution behavior requires estimates of a complete set of price elasticities in addition to the pre-crisis consumption quantities and postcrisis price changes. Crucial to this approach is the recognition that prices for goods can vary greatly across time in a developing countries. Given this insight as well as certain assumptions on how households choose the quality of goods they purchase, the clustered nature of these data can be exploited to purge the unit value data of quality components. The cross-spatial variation in these purged unit values can then be used to identify own-price or cross-price elasticities.

As suggested by Friedman & Levinson (2002), in the estimation of compensating variation, it is imperative to adopt the following specifications for the log quantity and unit value of the product:

$InQ_{bc} = \alpha^{\circ} + \phi^{\circ} Inx_{bc} + \gamma^{\circ} z_{bc} + \in_p In\pi_c + f_c + u^{\circ}_{bc}$
$InQ_{bc} = \alpha + \phi\, Inx_{bc} + \gamma\, z_{bc} + \varphi In\pi_c + f_c + u_{bc}$

where ln = log of quantity, ln = log of price, b and c index household and cluster, x represents total household expenditures, z household demographic characteristics, and π the (unobserved) price of the good. The quantity equation also contains a cluster fixed effect, f_c, and the coefficient of interest is $\in_p$, the rice elasticity. The simplified process to be described here concerns only the estimation of own-price elasticities; cross-price terms can be added through a relatively straightforward extension. The final estimate of $\in_p$ derives from two main steps. In the first step, the within-cluster variation of household income and other characteristics is used to estimate β and γ (because prices are constant within clusters, these parameters can be consistently estimated). The estimated coefficients are then employed to generate two variables:

$\hat{y}^{\circ}_{bc} = Inq_{bc} - \beta^{\circ} Inx_{bc} - \hat{y}^{\circ} z_{bc}$
$\hat{y}^{1}_{bc} = In^{v}_{bc} - \beta^{1} In^{x}_{bc} - \hat{y}^{1} z_{bc}$

Another issue concerns the services provided by owner-occupied housing and self-produced agriculture. Many households, especially in rural areas, own their own home. Although the price of housing has increased, these households are not any better or worse off in an absolute sense (they are still living in the same house). However, these households are better off relative to those who do not own their own homes. We choose to account for these services provided by owner-occupied housing by treating the imputed rental value for these homes as a negative expenditure.

Many households, especially those in the rural areas also produce some of their own food which makes them potential net exporters of agricultural products. As the price of food increases, the value of their production also increased. Clearly, if the household were a net exporter of food, the household would benefit from the price increase. To the extent that a household produced some of its own food, such production would mute the impact of price increase relative to a household that purchased food in the market. We account for self-produced agricultural products by treating the imputed value of self-produced food as a negative expenditure.

Once the budget share and price change data is marched and the price elasticities estimated, it is possible calculate measures of compensating variation for each household so as to determine how equations (3) and (6) vary across levels of living (Friedman & Levinson, 2002). In this study, we use a measure to assess a household's level of living, which is per capita household expenditure. As suggested, the most standard approach to measuring the level-of-living in a developing economy setting is to use some estimate of household expenditures. In view of this, the level of household consumption constitutes the larger share of total household utility, and total consumption. Expenditure is generally viewed as a better measure of welfare than income because the ability to smooth consumption in the presence of income shocks suggests that expenditures can be used to closely track actual welfare (Jianqing1992). On the basis of this and for analysis, we calculate the budget shares of each of the selected products and product aggregates based on the reported expenditures for each item. For durable goods and other nonfood items, we use the monthly average of annual expenditure.

III. RESULTS AND DISCUSSION

A major observation from the data generated is that there was heterogeneity in the consumption pattern. For this reason, we determined the mean and standard deviation for the entire sample as well as for the top and bottom strata of households expenditure and the result presented in Table 1.

Table 1: Budget shares and price changes for selected goods price changes

Product	Mean	Standard deviation	All households	Top strata	Bottom strata
Rice	195.2	29.2	0.164	0.048	0.269
Other cereals and rubbers	137.5	101.8	0.010	0.003	0.030
Fish	89.1	67.4	0.040	0.032	0.033
Meat	97.0	49.3	0.025	0.040	0.008
Dairy and eggs	117.1	31.9	0.027	0.031	0.015
Vegetables	200.3	1229.5	0.032	0.020	0.034
Fruit	103.7	61.3	0.021	0.027	0.016
Vegetable Oils	122.0	-4.8	0.030	0.015	0.040
Sugar, coffee, and tea	142.9	28.3	0.034	0.019	0.041
Prepared food and beverages	81.4	51.7	0.047	0.058	0.025
Alcohol and tobacco	93.9	43.8	0.049	0.031	0.039
Housing, fuel, lighting and water	23.8	10.9	0.162	0.223	0.146
Clothing	84.4	25.2	0.045	0.041	0.044

Durable goods	114.3	34.3	0.034	0.075	0.013

Source: Authors' calculations.

In Table 1, it can be clearly seen that for majority of the household, rice is the single most important commodity and households in the bottom expenditure strata devote more than a quarter of all expenditure to rice, whereas for the mean household about 16 percent of total expenditures is on rice. Housing and utilities are the next most important aggregate consumption category especially for the top expenditure strata where 22 percent of expenditure is for such purposes.

Table 2: Compensating Variation by Expenditure Decile and Poor/Nonpoor Status

Expenditure decile	All households	Urban	Rural
1	0.73	1.03	0.67
2	0.79	1.03	0.73
3	0.82	1.00	0.74
4	0.83	0.96	0.77
5	0.84	0.93	0.77
6	0.85	0.92	0.78
7	0.85	0.89	0.78
8	0.85	0.84	0.79
9	0.84	0.81	0.79
1	0.77	0.70	0.81
Poor	0.77	1.09	0.70
Non-poor	0.82	0.90	0.78
All households	0.82	0.91	0.76

Source: Authors' calculations

Table 2 reports summary mean values of household expenditure as well as poor and non-poor status of all households. It can be observed that the lowest strata have average compensating variation of 73 percent of initial household expenditures, rising to 85 percent of household expenditures for those in the sixth, seventh, and eighth strata and falling back to 77 percent for households in the top strata. This implies that households in the middle of the distribution were mostly affected by the price changes. Table 2 also suggests that it is the urban poor who were the most adversely affected by the crisis requiring, on average, 109 percent of their pre-crisis income to attain pre-crisis utility levels while the rural poor required 70 percent of their pre-crisis income. In general, urban households fared worst under the price changes. However, it was observed that in rural areas, lower-income households needed the least relative compensation to increase their expenditures marginally.

From the above, the impacts of the crisis were large. For instance, the prices of rice increased on the average by almost 150 percent while the prices of many foodstuffs increased by more than 100 percent. Nonfood prices did not rise rapidly, with the housing price increasing only 24 percent on average. As a result of the constructed nature of the reported price changes, variations in price change also arose due to both regional variation and household variation in consumption. For rice, a relatively homogenous good, all of the variation in the price increases is regional, and a standard deviation of 40 percent shows how varied the price increases actually were. Given the wide dispersion of price changes both within and across produce aggregates, what a household consumes and where a household lives will go a long way toward in determining the particular impacts of the crisis. The impacts of the crisis were not uniform because household consumption choices, sources of income, and location were significant in determining the specific impact. The diversity of impacts was due both to wide geographical variation in price changes and wide variation in household structure and consumption.

Table 3 presents these estimated price elasticities for the composite good demand system. The three products: preserved meat and prepared beverages found to have positive own-price elasticities are goods that have substantially fewer positive consumption values in comparism with the other goods. Their cross-price elasticities are generally smaller in magnitude than the own-price elasticities and, of course, vary in sign depending on whether the data suggest a particular pair of goods to be either substitutes or complements.

Table 3: Estimate of price elasticities for aggregate food and residual consumption

Product	Rice	Other cereals	Tubers	Fresh fish	Preserved fish	Fresh meat	Preserved meat	Eggs	Dairy	Green vegetable
Rice	-	0.082	-0.032	-	-0.038	0.098	-0.016	0.00	-	-0.018

	0.479			0.029				8	0.009	
Other cereals	2.762	-5.046	-0.413	-0.074	0.387	-0.200	-0.134	0.300	-0.014	0.048
Tubers	2.521	-0.127	-0.590	0.233	0.205	-0.672	0.087	0.531	-0.167	-0.919
Fresh fish	-0.383	0.027	0.217	-0.996	-0.686	0.169	0.219	-0.087	-0.012	0.026
Preserved fish	-0.533	-0.295	-0.059	0.373	0.118	0.013	-0.015	-0.022	0.138	-0.013
Fresh Meat	0.042	0.073	-0.046	0.056	0.254	-0.616	-0.004	-0.134	0.109	-0.135
Preserved meat	-0.224	0.318	0.127	0.256	-0.080	-0.418	0.955	-0.281	-0.260	-0.215
Eggs	-0.458	0.128	0.013	-0.006	-0.083	0.084	-0.080	-0.985	-0.028	0.113
Dairy	-0.194	0.121	0.097	-0.072	-0.041	-0.216	0.548	0.040	-0.133	0.077
Green vegetables	-0.384	0.097	0.189	-0.202	-0.064	-0.067	0.136	0.014	0.023	-0.789
Pulses	-0.406	0.367	-0.001	-0.153	-0.033	0.266	-0.271	-0.248	-0.474	-0.014
Fruit	-0.181	-0.144	-0.141	0.098	-0.003	-0.253	0.044	-0.147	-0.110	-0.021
Oils	-0.238	-0.012	0.027	-0.143	0.013	-0.136	-0.019	-0.004	0.007	-0.009
Beverage additives	-0.173	0.059	0.044	-0.167	-0.007	0.001	-0.111	-0.047	-0.106	0.064
Spices	-0.210	-0.018	0.104	-0.072	0.004	0.000	-0.034	-0.057	-0.107	0.032
Other food	0.140	-0.056	0.069	-0.027	-0.006	-0.238	0.098	0.112	0.013	0.029
Prepared food	0.020	0.243	0.055	0.092	-0.006	-0.037	-0.037	0.060	-0.093	0.042
Prepared beverages	-0.429	0.026	-0.083	0.246	0.005	0.034	0.259	-0.191	-0203	0.146
Other consumption	0.010	0.017	0.008	-0.010	-0.003	0.019	-0.003	0.013	-0.008	-0.002

Source: Authors' calculations

It can be visualized from Table 3 that across urban areas the compensating variation reduces as household expenditures increase, an indication that poor urban households are affected mostly by the price changes. In the same vein, poor rural households appear to fare the better with marginal difference between rich urban and rural households. Analysis was further conducted with ordinary least squares (OLS) regressions using measure on household size and demographic characteristics, including per capita household expenditures and the result presented in Table 4.

Table 4: Regressions result with household demographic variables

In (Household PCE)	0.0919 (0.0144)	0.0948 (0.0147)	-0.1709 (0.0075)	-0.1720 (0.0076)
In(Household size)	0.1034 (0.0105)	0.0722 (0.0127)	0.0239 (0.0067)	0.0013 (0.0068)
Proportion of household:				
Male (0-4) years old	_	0.1362 (0.0401)	_	0.0817 (0.0211)
Female (0-4) years old	_	0.1224 (0.0404)	_	0.0758 (0.0235)
Male (5-14) years old	_	0.0511 (0.0300)	_	0.0289 (0.0158)
Female (5-14) years old	_	0.0186 (0.0307)	_	-0.0106 (0.0165)
Male (15-59) years old	_	_	_	_
Female (15-59) years old	_	-0.0516 (0.0276)	_	-0.0293 (0.0139)
Male (60) years old	_	-0.0226 (0.0352)	_	-0.0791 (0.0303)
Female (60) years old	_	-0.1441 (0.1362)	_	-0.1857 (0.0276)
R^2	0.8213	0.5902	0.5032	0.4531

Source: Authors' calculations, Note: figures in parentheses are t-statistics

The positive coefficient for rural households suggests that the impact of the crisis increases with income levels in rural areas but the reverse is the case for urban households. Also, household size, larger households are associated with higher compensating variations. This implies that larger rural households tend to consume more of goods whose prices have risen. The result also suggests that consumption patterns differ by age and, to a lesser extent, by the gender composition of the household members because as can be seen in the result, urban rural households with a large proportion of young children face a significantly higher compensating variation measure. Also, households with young children tend to spend more on food, especially rice. For this reason, a proportionate increase in the price of this product leads to corresponding decrease in household welfare.

IV. CONCLUSION

From the study, it is observed that the distributional impacts of the financial crisis on household welfare were not uniform because household consumption choices, sources of income, and location were significant in determining the specific impact, although the urban poor fare the worst because the ability of poor rural households to produce food mitigated the impact of the high inflation. The diversity of impacts was due both to wide geographical variation in price changes and wide variation in household structure and consumption. As a result of the constructed nature of the reported price changes, variations in price change also arose due to both regional variation and household variation in consumption. For rice, a relatively homogenous good, all of the variation in the price increases is regional, and a standard deviation of 40 percent shows how varied the price increases actually were. Given the wide dispersion of price changes both within and across produce aggregates, what a household consumes and where a household lives will go a long way toward in determining the particular impacts of the crisis.

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