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FOOD PRICE DYNAMICS AND ECONOMIC PROSPERITY IN SUB-SAHARAN AFRICA: A COMPREHENSIVE ANALYSIS

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Abstract The escalating prices of essential food commodities globally, including cereals, oilseeds, dairy products, and meat, have garnered significant attention in recent years. From 2002 to 2013, the Food Price Index (FPI) experienced a notable surge, reaching its highest levels since the establishment of the United Nations Food and Agriculture Organization (FAO) in 1990. This upward trend in food prices raises concerns about its potential adverse impacts on people's income and overall welfare. Consumers, particularly in the face of limited substitutes, exhibit heightened sensitivity to fluctuations in food prices, which can profoundly influence their consumption choices and economic well-being.

Keywords: Food Price Index, Global food prices, Consumer behavior, Economic welfare, Substitutability

1. Introduction

The prices of most of the world's key cereals, oil seeds, dairy products and meat have increased significantly over the years. The food price index (FPI) rose sharply from 89.6 in 2002 to 201.4 in 2008 and eventually to 209.8 in 2013. This rate of increase has been the highest since the inception of the United Nation's Food and Agriculture Organization (FAO) Food price index in 1990 (FAO, 2014). By implication, if the upward movement in the prices of food items remains unabated, it is likely to have deleterious effect on the income and the entire welfare of the people. While the consumers are more responsive and sensitive to changes in prices of goods with variety of close substitutes, they tend to be restrictive in their choice when there are no close substitutes, like in the case of food (Schnepf, 2013). So, when food prices increase and consumer's budgets or income tend to remain fixed (or decline), allocation decisions among expenditure for meeting food and non-food demands become difficult, with these trade-offs becoming particularly acute for the low income earners. They face acute challenge in terms of the required quality and quantity of food (Hadley *et al*., 2012).

The investigation of the effects of rising food prices on economic well-being for Sub-Saharan Africa (SSA) is quite apt and vital for a number of reasons. First, many countries in the SSA region are net-food importing. These

countries have high degree of susceptibility to spikes in food prices. In a comprehensive survey, Compton *et al*. (2010) classified 35 SSA countries according to their degrees of vulnerability to hikes in food prices (based on a Global Vulnerability Index and High Price Risk Index compiled from 30 sub- indicators). Angola, Namibia and Somalia were found to be *somewhat* vulnerable, while Congo Democratic Republic, Cote d Ivoire, Eritrea, Gambia, Guinea Bissau, Liberia, Mauritania, Senegal and Swaziland were found to be most vulnerable. On the other hand, Benin, Burkina Faso, Burundi, Cameroun, Central African Republic, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Sierra Leone, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe were classified among the *highly* vulnerable countries in the world in terms of vulnerability to surge in prices of food. Second, physical, social and economic access to safe, sufficient and nutritious food still remain poor in the SSA region and could be exacerbated by the soaring global food prices. Third, the desire of countries in the region to meet the Goal 1 of ending poverty in all its forms everywhere; Goal 2 of ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture; and Goal 3 of ensuring healthy lives and promoting well-being for all at all ages as stipulated under the Sustainable Development Goals (SDGs) is likely to be a myth, with the attendant impact of rising food prices. The little achievement recorded in relation to these goals over the years may be swiftly reversed.

Moreover, there is growing consensus that the current food price surge is not a temporary hump but rather a structural change and a sustained move to a new and higher plateau for food prices. This structural change is attributable to increasing demand for food items due to rising global population and income, unprecedented increase in the use of food grains for animal feed and biofuel production, rapid urbanization and dwindling investment in agriculture in many developing and less developed countries in Latin America, South Asia and Sub-Saharan Africa (Odusanya, 2015; Karugia *et al*., 2009).

Despite the perceived pervasiveness and extremity of the impact of high food prices, many of the existing studies on SSA were conducted at the household level; with a large number of them conducted at the country level while very few were conducted at the sub-regional level. Some of these studies only focused on the impact of changes in price of a single food item on poverty with extremely few of them making use of quantitative approach (Campenhout *et al*., 2013; Osei-Asare and Eghan, 2013; Ivanic *et al.* 2011; Shimeles and Delegn, 2013; Matovu and Twimukye, 2009; Benson, 2008; Joseph and Wodon, 2008; Nouve and Wodon, 2008; Bussolo *et al.,* 2006; Barret and Dorosh, 1996). Some of them relied on conceptual representation to explain how high food prices affect income and poverty, thereby speculating possible impact and policy implications of rising food prices in SSA countries. Findings from these studies have also been mixed.

Owing to the foregoing, this paper examines the effects of the soaring prices of food items on economic well-being in SSA countries, using a more robust panel data analysis. The remaining part of the paper is structured into four sections. Section 2 is on related literature review while section 3 focuses on data and methodology used in the study. Section 4 is on results and the discussion of findings, while section 5 concludes the paper.

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2. Review of Relevant Literature

2.1 Theoretical Issues

The demand for food is perceived to be price inelastic relative to other goods since people require food irrespective of its price, implying that the demand for food is likely to be constant in the face of changing prices. Accordingly, households' absolute disposable income directly affects their abilities to respond to such changes in price (Schnepf, 2013; Hadley, 2012). In the same vein, the basic objective of the theory of consumer behavior is to explain how a rational consumer makes decision on - what to consume, when confronted with various prices and a limited budget (Mittal, 2010). Thus, households with small incomes are likely to be more responsive to price changes across all categories of food than the higher-income households as the size of disposable income determines their purchasing power. For households with low disposable income levels (where food expenditures are a large share of budget), rising food prices brings about a greater responsiveness compared to households with high disposable income. Consumers with higher incomes and strong purchasing power do opt for high quality variety of food while those earning lower incomes and with weak purchasing power tend to demand for less nutritious and fewer quantities of food (Schnepf, 2013).

In a closely related theoretical analysis, Mellor (1978) stated that changes in food price pose both *income* and *substitution* effects. The substitution effect is noticed through an increase in food price which leads to reduction in consumption by the rich and mainly by the poor through substitution of higher quality and more expensive food, with high nutritive value for less nutritive food items and vice-versa. On the other hand, an absolute reduction in consumption of food items (particularly those that are labor intensive) reduces employment. The reduction in employment results into reduction in incomes, depicting an indirect income effect of change in relative food prices. Mellor (1978) however noted that the substitution effect of relative price changes cannot be determined on a priori basis and cannot be empirically separated from several other influences.

While analyzing the effects of changes in food prices on poverty and income inequality through consumption and income channels, De Hoyos and Medvedev (2009) submitted that as food prices increase, the monetary cost of achieving a fixed consumption basket increases, thereby reducing consumer's welfare. This is generally peculiar to the consumers. However, for the segment of population whose income depends (directly or indirectly) on markets for agricultural products (wage workers in the agricultural sector, self-employed farmers and rural land owners), a rise in food prices result into an increase in their monetary income. For each household, the net welfare of an increase in food prices will be based on combination of a loss in purchasing power (*consumption effect*) and a gain in monetary income (*income effect*). It will also be consequent upon whether the households' incomes are closely related to the activities in the agricultural markets or not.

2.2 Empirical Issues

Basically, findings on the effects of food prices on welfare or economic well-being can be divided into three folds- those that found the effects to be positive; those that found the effects to be mixed given specific conditions; and those that found the effects to be negative. Thus, the effects of food price inflation on income (or welfare) remain unresolved in the literature. A number of studies have shown that rising food prices may be quite beneficial or may be associated with positive impacts. For instance, a non-parametric analysis of the effect

of higher rice prices across different regions of Thailand revealed that higher food prices can benefit many groups in society (Deaton, 1989). In this study, Deaton (1989) found that higher prices for rice were beneficial to rural households at all levels of living. It was also revealed that the major beneficiaries were households in the middle income group, with poor and rich households benefitting less. This is associated with the fact that the rice farmers who were better off and were able to produce more were usually richer and sold more than their smaller and poorer counterparts when there was an increase in the price of rice. In the same vein, Walsh and Yu (2012) examined the effects of food inflation and non-food inflation on income inequality in China and India. Income inequality was measured by the GINI coefficient for India and the analysis was differentiated into rural and urban areas while the Theil coefficient was the proxy for income inequality for China without differentiating the analysis into rural and urban areas. The analysis was done for four different specifications-pooled OLS, fixed effects, random effects and Arellano-Bond. The findings were that food price inflation was associated with declining income inequality for China, suggesting that food price inflation may not be bad for all lower income earners. It could also imply that at least the effect on the income taken by some groups may be balanced or even be offset by increased income accruing to other groups, such as low-income food producers. In the case of India, higher food inflation was also found to be associated with lower inequality in both the rural and urban areas. It was even found to be significant for the rural areas in India. Jacoby (2013) while examining the relationship among food prices, wages and welfare in rural India also found that the impact of rising food prices on income was positive. It was inferred that nominal wages for manual labor, both within and outside agriculture respond elastically to increases in producer prices. That is, wage rose faster in rural districts growing more crops with large run-ups in price over the period 2004 to 2009. Considering these wage gains, the analysis found that rural households across the income spectrum benefited from higher agricultural commodity prices.

While the studies reviewed above found the impact of rising food prices to be positive, others revealed that the impact could either be positive or negative (mixed) or even ambiguous. These findings are predicated on certain specific conditions. For instance, Mellor and Dar (1968) found that increasing food grain price directly depress savings and investment rates in the industrial sector by forcing up money wages with eventual depletion of profits. It was revealed that it could also increase urban political unrest, directly and indirectly force government expenditures for increased money wages, and thereby reduce allocation of funds for promotion of industrial growth. Mellor and Dar (1968) however inferred that it could cause increased profitability of farm investment and probably create pool of income from which agricultural savings could be drawn.

While examining economic reform, food price and poverty in India, Ravallion (1998) found a negative relationship between the relative price of food and wage rate, with a coefficient of -0.59 which was highly significant. He also reported a very strong positive correlation between relative price of food and poverty rate in India over a 35-year period (1958-1993). Meanwhile, Ravallion (1998) also corroborated the positive impact of a change in price of food items by reporting that higher relative price of agriculture goods would benefit the rural sector, where poverty tends to be concentrated in most developing countries. Matovu and Twimukye (2009) used Compatible General Equilibrium (CGE) model to investigate the impact of increasing food prices on households in Uganda. They also found that the benefits of increasing food price is predicated on whether the

household or the country is a net producer or consumer of a given commodity. Rural households that are major producer of maize benefited from increase in price of maize while non-farming rural and urban households were negatively affected and might likely be further impoverished as a result of increase in food prices. They inferred that increase in world food prices (especially for exported cereals) would generally benefit Uganda and reduce rural poverty. Wodon *et al.* (2008) with the aid of simple statistics and non-parametric methods reported that the effect of an increase in the price of rice was negative in Ghana since the large share of rice is imported. However, the increase in the price of maize (which is mainly produced locally) was found to be poverty reducing as the higher price paid by consumers translates into higher profit received by producers. They further deduced that a 25 percent increase in the price of various cereals caused less than one percentage point increase in poverty in Ghana.

Similarly, Joseph and Wodon (2008) found that there was a 2.5 percentage points increase in poverty associated with increase in the prices of cereals from the consumers' point of view in Mali. This percentage point increase translates to additional 290,000 people falling into poverty. From the producers' point of view, the increased prices of cereals were favorable as the national poverty headcount index reduced slightly by less than one point. However, the poverty headcount index increased by 1.7 point to 49.2 percent (with a 25 percent increase in prices) when taking into account both producer and consumer impacts while a 50 percent increase in price resulted into 3.5 points increase in the poverty headcount index. Studies by Campenhout *et al.* (2013), Shimeles and Delelegn (2013), Karugia (2011), Ivanic and Martin (2008), Loening and Oseni (2007), found similar results of negative effects on consumers, positive effects on producers and overall negative effects of rising food prices on welfare.

On the contrary, a given number of studies have found the impact of increasing food prices to be purely negative on income or welfare. Sen (1996) examined the effect of relative prices of cereals on the proportion of the rural population living below the poverty line in India. It was found that any reform that increases food prices would have adverse effect on the poor. He deduced that the impact could be more severe on poverty when such reform is associated with increases in food prices relative to prices of other commodities in the economy. The severity and duration of the impact of rising food prices are exacerbated by lack of safety net. In a study on prices, wages and poverty in rural India from 1958-1994, Ravallion (2000) found that higher relative food prices exerted negatively on the real wage rate of agricultural workers.

In a similar vein, Wodon and Zaman (2008) found that 50 percent increase in price of rice was associated with 8 percentage points increase in share of the population living in poverty in Sub-Saharan Africa. This translated to additional 30 million people falling into poverty when increase in the headcount index of 3.5 percentage point is used as a midpoint. The impacts were also considered to be terrible for the urban poor and the major food importing developing countries as higher percentage of their limited income is spent on food.

Using data on 73 developing countries, with series of simulation, De Hoyos and Medvedev (2009) provided a formal assessment of the direct and indirect impact of rising food prices on global poverty. Computing the direct impact of the changes based on domestic food consumer price data between January 2005 and December 2007, they found that a rise in food price by an average of 5.6 percent resulted into 1.7 percentage point increase in

global poverty. For the purpose of computing the indirect (or second order effects), household survey was linked to a general equilibrium.

Osei-Asare and Eghan (2013) also estimated compensated price elasticity and used them to compute the compensating variation for measuring the welfare impact of changes in food price in Ghana between 2005 and 2011. The compensating variation measures the amount required to compensate households for price changes between these periods. The compensating variation of Ghanaian households was put at 47.18 percent, implying that food price increase between 2005 and 2011 has eroded real household food purchasing power by 47.18 percent.

Kym *et al.* (2013) in a study involving thirty (30) developing countries (comprising eight countries in SSA) found that rapid increases in food prices for four major food items (rice, wheat, maize and edible oils) between 2006 and 2008 pushed 80 million people into poverty. Using CGE model to simulate the increase in wages associated with increases in food prices (of seven key staples for nine low-income countries) for unskilled agricultural workers, they also found that 10 percent increase in price culminated into an increase in poverty headcount ratio by 0.4 percentage point. Urban households were found to be worse hit than the net food buyers in the rural areas. Hanif (2012), Ivanic *et al.* (2011), Brinkman *et al.* (2010), Compton *et al.* (2010), Karugia *et al.* (2009), among other studies also found that escalating food prices impacted negatively on welfare. It is apt to note that investment in health (measured by health care expenditure) and prevailing political environment are crucial in determining the effects of food price inflation on welfare. Lee *et al*. (2013) in a study on the effects of rising food prices in 63 developing countries, comprising of selected Sub-Sahara African countries, deduced that health care expenditure and political score (a measure of the degree of autocracy or democracy in governing institutions) were highly significant in assessing the influence of food price inflation on welfare for the developing and the less developed nations.

3. Data and Methodology

The annual data used in this study covered the period 2001 to 2012 for 31 Sub-Sahara African countries[1]. The variables in this study include per capita income (*source, World Bank, WDI*),

1

These countries are Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad,

Congo, Cote d'Ivoire, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Lesotho, Madagascar, Malawi, Mali, general government expenditure on health per capita in constant (2005) dollars (*source, WHO Global Health Observatory Data Repository*), political score defined as index of political regime measured as concomitant qualities of democratic and autocratic authority in governing institutions, on a 21-point scale ranging from – 10 (hereditary monarchy) to +10 (consolidated democracy) (*source, POLITY IV database of the Centre for Systemic Peace*) and food price inflation rate (*source, FAOSTAT database*). The food price inflation rate is calculated as the annual growth rate of the consumer Food Price Index (FPI[2]) based on observation made in December of every year which is extracted from the Food and Agriculture Organization statistical database (FAOSTAT). The

consumer Food Price Index measures the changes over time in the prices of food items that households acquire for consumption.

In order to empirically examine the effect of food price inflation on economic well-being, the study used this model: $\ln PCI_{i\,t,} \square \square \square_0 \quad _1 \ln FPIR_{i\,t,} \square\square_2 \ln HCE_{i\,t,} \square\square_3 PLT_{i\,t,} \square\square_{it}$ _____(1)

where PCI is the per capita income, FPIR is the food price inflation, HCE is the per capita government health expenditure, PLT is the political score, and *i,t* represent panel of countries observed over period *t*. The model is adapted from earlier studies by Walsh and Yu (2012) on the effects of food price inflation in India and China and by Lee *et al.* (2013) on the effects of food prices in 63 developing countries. Per capita government health expenditure (HCE) and political score (PLT) are control variables in the model.

The dynamic form of the model is specified as: $\ln PCIi\ t, \square \square\square 0 \square \ln PCIi\ t, \square 1 \square\square 1 \ln FPIRi\ t, \square\square \ln FPIRi\ t, \square 1 \square\square 2 \ln HCEi\ t, \square\square 3 PLTi\ t, \square \square\square i \square it$ ____(2) Where i=1,……., 31; t = 2001,……, 2012 = 1,……12; $PCI_{i,t-1}$ denotes per capita income for country *i* in period $_{t-1}$ while $FPIR_{i,t-1}$ is the food price inflation for country *i* in period $_{t-1}$. The country specific effect is denoted by μ_i and U_{it} is the remainder disturbance term.

The increase in food prices is expected to have a negative association with per capita income (a measure of economic well-being) as it erodes the purchasing power of the food consumers (Karugia, 2011; Brinkman *et al.*, 2010; Karugia *et al.*, 2009; Wodon and Zaman, 2008; Ravallion, 1990).

Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Sierra Leone, South Africa, Togo, Uganda, United Republic of Tanzania and Zambia.

2

The FAO Food Price Index comprises of five commodity group price indices: Cereal Price Index, Vegetable Oil Price Index, Meat Price Index, Sugar Price Index and the Dairy Price Index.

The inclusion of the per capita health care expenditure (HCE) in the model as a control variable is premised on the role of healthy living in productivity and level of income earnings as evidently found in many studies. Several studies have articulated that health is a capital good and investment in health is a prominent source of income growth (Tang, 2010; Hansen and King, 1996; Newhouse, 1977). Investment in health is considered very crucial for income earnings as health capital affects the production of other human capital, such as education or health itself, through self-productivity (Kuehle, 2014). Kuehle (2014) also related that health generated at time *t* improves health at time *t+1* while health produced at time *t* fosters the production of other skills at period *t+1*. Thus, a positive relationship is theoretically expected between per capita government health expenditure and income.

The political score (PLT) which is a measure of qualities of democratic and autocratic authority in governing institutions is a control variable included to capture the effects of prevailing political environment on income. A positive relationship has been reported between income and democracy (Che *et al.*, 2013; Heid *et al*., 2012). By implication, in countries where democracy is not strong (like in the case of many African countries), and the control of governing institutions is autocratic in nature, this is expected to have negative influence on income generation in the economy.

Original Article

For the purpose of analyzing the dynamic relationship among the variables as specified in (2) above, and for robustness check, the generalized methods of moments (GMM) estimators were used. Specifically, the difference-GMM developed by Arellano and Bond (1991) was used for two-step. The Hansen statistic developed by Hansen (1982) which is the minimized value of the two-step GMM function, is robust and used in this study to test for identifying restrictions and the validity of the instruments. For this purpose, it is expected that the p-value of the Hansen test should range between 0.1 and 0.25. Additionally, Roodman (2009) recommends that the number of instruments should not outnumber the cross-sections (i.e. countries). Another very necessary condition for the difference GMM is that the error term does not have second-order autocorrelation; otherwise, the standard error of the instrument estimates grow without bound (Doytch and Uctum, 2011). Therefore, the presence of second-order serial correlation is confirmed based on the value of AR (2) which is generated by default using the xtabond2 command in STATA. If the p-value of AR (2) is significant, then there is problem of second order serial correlation.

4. Results and Discussions

4.1. Descriptive Statistics

The core statistics on the variables in the study are presented in Table 1. There are 372 observations on each of the variables, which implies a balanced panel data set. The food price inflation rate (FPIR), per capita health care expenditure (HCE), per capita income (PCI) and the political index (PLT) have average values of 7.96, 76.64, 1356.33 and 2.54 respectively. **Table 1: Descriptive Statistics of Variables**

Variables	Mean	Median	Minimum	Maximum	Standard Deviation	Observation
Food Price Inflation Rate	7.95	6.55	-69.93	118.74	14.53	372
Health Care Expenditure	76.63	32.50	5.20	790.20	115.72	372
Per capita Income	1356.32	497.62	143.78	6709.07	1826.66	372
Political Score	2.54	4.00	6.00	10.00	4.65	372

The mean and the median values of the annual series fall within their maximum and minimum values, thereby implying their high level of consistency.

Original Article

4.2 Regression Results

The results of the panel regressions used in examining the effects of food prices on economic well-being are presented in Table 2. The estimated results from the two-step Arellano-Bond difference GMM revealed that the contemporaneous food prices are negatively associated with economic well-being at 10 percent level of significance. In the same vein, prevailing food prices in the preceding year (i.e. $FPIR_{t-1}$) have negative association with per capita income. Furthermore, 2-year lagged food prices have significant negative effects on economic wellbeing. This implies that not only the contemporaneous but also the initially prevailing food prices have deleterious effects on economic well-being in the Sub-Sahara African region. The anticipated positive association between health care expenditure and per capita income is also strongly established with the aid of the GMM estimators while the coefficient for political index is not significant. It could be inferred that improved health care expenditure could enhance income earnings.

Table 2: Regression Results

Dependent Variable: Per Capita Income	
	Arellano-Bond (Two-step)
Per Capita Income$_{t-1}$	0.68943***
	(0.07003)
Food Price Inflation	-0.00026*
	(0.00014)
Food Price Inflation$_{t-1}$	-0.00036
	(0.00027)
Food Price Inflation$_{t-2}$	-0.00035*
	(0.00020)
Log Health Care Expenditure	0.06460***
	(0.01996)
Political Score	0.00453
	(0.00471)
Instruments	24
Hansen Test	0.144
AR(1)	0.001
AR (2)	0.403
Observations	372
Countries	31

Notes: Standard error in parentheses; $^{***}p< 0.01$; $^{**}p< 0.05$ and $^{*}p< 0.1$. The values for Hansen test, Arellano-Bond test for first order serial correlation AR (1) and Arellano-Bond test for second order serial correlation AR (2) are probability values.

Based on the probability value of the Arellano-Bond test (for the second order autocorrelation) which is generated by default using STATA 10.1, there is no problem of second order serial correlation. This indicates

that the models are well-specified. Also, the number of the instruments used for the difference GMM are less than the number of the cross-sections while the probability values of the Hansen test ranges between 0.1 and 0.25 (Roodman, 2009). This confirms the validity of the instruments.

6. Conclusion

The study applied panel regression to examine the effects of rising food prices on economic well-being in Sub-Sahara Africa. It is deduced that both the contemporaneous and the initially prevailing food prices are negatively associated with welfare. The results show that health care expenditure, aside from food prices, also has a strong influence on economic well-being.

Based on these findings, it is imperative for the government and the concerned stakeholders to put in place policies that will enhance income earnings of the people and improve their economic access to sufficient food. The impact could be minimized through direct food distribution (to the worst-hit consumers), provision of social safety nets and special cash transfers. Targeted food subsidies (with the use of food vouchers) could also be adopted in order to stem the severe impact of the soaring food prices.

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