African Journal of Economic Review, Volume IV, Issue 1, January 2016
ISSN 1821-8148, e-ISSN 2453-5966

Effects of Food Prices on Under-five and Infant Mortality Rates in Sub-Saharan Africa

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Abstract
Over the years, the rising food prices coupled with the prevailing food insecurity in the entire Sub-Saharan Africa region are perceived to be having debilitating effects on nutrition and health outcomes. This paper therefore examines the impact of rising food prices on under-five and infant mortality rates in 31 selected sub-Saharan African countries for the period 2001-2012 using the fixed effects, random effects, difference GMM and the system GMM. The results show that rising food prices exert significant adverse effects on both infant and under-five mortality rates in Sub-Saharan Africa. The paper suggests the need for increased government's efforts toward increased food supply and urgent nutritional support involving nutrient-rich-food items to the target groups.

Keywords: food price, under-five mortality, infant mortality, panel data, Sub-Saharan Africa.

JEL Classification: 110 118, F365

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1 Introduction

What is the effect of rising food prices on under-five and infant mortality rates in Sub-Saharan Africa? This question merits investigation for at least four reasons. First, in the wake of the global food price crisis in 2007-2008 in Sub-Saharan Africa, food prices soared by about 70 per cent. The high and increasing food prices have sort of exacerbated hunger and malnutrition in as clearly revealed in the high rates of poverty in most countries of the sub-region. In view of the fact that poorer households spend over half of their incomes on food (Deaton 1989, Skoufias, Twari and Zaman, 2012), it is not unlikely that households in the SSA might have been induced to substitute away from foods that are high in required nutrients with possible adverse effects on human health outcomes.

Second, children are particularly vulnerable to food insecurity that results from high and rising food prices. Inadequate food intake and unfavourable changes in dietary patterns may impair the physical and mental development of children in the sub-region. In particular, the effects are likely to increase the incidence of child stunting, wasting and other micronutrient deficiency disorders and chronic diseases. Ultimately, these might result in increased child mortality and morbidity.

Third, two of the goals of the Millennium Development Goals (MDGs) are namely reduction of under-five mortality by two-thirds (Goal 4) and halving of the proportion of underweight children (Goal 1) between 1990-2015. Unfortunately, Sub-Saharan Africa is still far behind in achieving these two goals. Worse still, with high and rising food prices, the sub-region stands the risk of undoing much of the little progress made in achieving these two MGD goals. This becomes critical considering the fact most countries in the sub-region are net food importers depending on imports for a large share of her food consumption.

Fourth, the impact of high food prices on health outcomes merits further investigation as most existing works tend to rely on conceptual representation to explain the impacts. Empirical estimates of the impact of high food prices on under-five and infant mortality are still scarce. Despite the perceived ubiquity and severity of the impact of high food prices and couple with the prevailing food insecurity, not many studies have provided empirical estimates of its effects on health outcomes in the sub-region. An accurate empirical estimate of the effect of the food crisis on nutrition, health, and poverty is therefore critical for development of public policies and social programmes to assist the vulnerable groups.

Therefore, the objective of this paper is to examine the effects of rising food prices on under-five and infant mortality rates using a panel dataset of 31 sub-Saharan African countries during the period 2001-2012. The rest of the paper is organized as follows: section 2 presents the theoretical and empirical issues. Section 3 is on data and methodology. Section 4 presents the results while section 5 discusses the findings. The last section concludes the paper.

2 Theoretical and Empirical issues

2.1 Theoretical Issues

A number of studies have articulated theoretically and empirically the ways in which high food prices affect health outcomes. Theoretically, some identified channels include increased poverty and livelihood through loss of purchasing power, increased household indebtedness, sales of household assets to buy food and reduced spending on children's feeding, particularly when it is pronounced and unabated. It is argued that the health implication is felt through reduced spending on health care, increased micronutrient deficiencies, malnutrition and concomitant increases in infectious disease (morbidity) and mortality.

Rapid increases in food prices impact on individuals (especially the poor) through increasing nutritional deficits. These nutritional deficits culminate into higher degree of susceptibility to health deficiencies as poor diets have been found to be the main culpable factor for communicable diseases like measles, chicken pox, cholera and tuberculosis, and even non-communicable diseases like obesity, cancer, diabetes, heart diseases (Lin *et al.*, 2014). The costs to human development outcomes particularly for the poor children may be irreversible. This is because as households face shocks to their real income, they eat less and switch from more expensive sources of protein such as meat, fish and eggs to cheaper cereals. This culminates into deficiencies in iron, iodine, vitamin A, B and other vital vitamins. Evidence from economic crises in the past revealed that the most vulnerable are pregnant and lactating women, children under 2 years of age and those already suffering from malnutrition. The food price crisis could heighten the risk child mortality. This is because decreases in dietary quantity and quality, as well as micronutrient content can result into increased morbidity and eventually raise mortality rate. Also, declines in nutritional status as a result of upsurge in food prices may cause poor birth outcomes, like foetal growth restriction and pre-term birth, which are also linked with infant and child mortality (Wodon and Zaman, 2008; Brinkman *et al*, 2010; Christian, 2010).

Christian (2010) explored and illustrated nutritional pathways through which rising food prices may culminate into increased child mortality. He identified the various pathways by which nutritional deficiency directly or through their interactions with infectious diseases could increase the risk of child mortality. The deficiencies are suffered in terms of micronutrients like vitamin A, zinc. This is associated with childhood under nutrition which causes wasting (low weight for height) and stunning (low height for age) while maternal under nutrition (for pregnant and lactating women), which could lead to series of health complications like increased risk of low birth weight. The emanating complications associated with under nutrition increase susceptibility to diseases (morbidity) and risks of mortality.

However, the extent of the adverse effect of high food prices on the under-five and infant mortality depends on the economic and social condition of the country involved. For countries with abundant resources to procure food and other necessities, the impact of high food might be mitigated through government policies and social programs to help the vulnerable groups.

Moreover, the effects depend on whether the country involved is a net food importer or exporter. The effects of rising food prices will be much more serious in poor net –food importing countries compared the situation in net food exporting countries. Unfortunately, most countries in Sub-Saharan African region are low-income, poor net food-importing countries that depend on imports for a large share of their consumption. This simply means that high food prices will likely have significant adverse effect on health outcomes in SSA.

2.2 Empirical Review

Few empirical works have been provided on the effects of high food prices on health outcomes. These include Brinkmam *et al*. (2010), Cornia and Deotti (2008), Bibl *et al.* (2009) Lee *et al.* (2013), Chibuye (2014), Thomas and Strauss (1992) among others. The study by Brinkmam *et al.* (2010) assessed the potential effects of high food prices on food consumption. They found that a food consumption score (a measure of diet frequency and diversity) was negatively correlated with food prices in Haiti, Nepal and Niger. They contended that a large number of vulnerable households in developing countries reduced the quality and quantity of their consumption with high risk of malnutrition.

Cornia and Deotti (2008) while examining the impact of millet prices on child malnutrition found that moderate fall in output and net import of millet caused a substantial rise in the price of millet which resulted into higher rates of child malnutrition and child mortality in Niger republic. Also, Bibl *et al* (2009) reported that the crisis associated with the upsurge in food prices increased the caloric insufficiency rate among children between the ages of 0-14 from 32.1% (prior to the crisis) to 40.6% (after the crisis) in Mali. The children in the rural areas were more ravaged as 11.1% of them fell into a situation of insufficient caloric intake while only 2% of children were affected in the urban areas after the food crisis. This culminated into chronic health problems.

The study by Lee *et al.* (2013) found that rising food prices had significant adverse effect on health indicators including infant mortality and child mortality. However, the results showed that the impact of high food prices was severer in the least developing countries. Chibuye (2014) used micro-econometrics to assess the impact of a price increase in the various food commodities on the height-for-age z-scores of under-five children in Zambia. The results showed that rise in prices of some food commodities adversely affected children's health outcomes. Similar result was obtained by Thomas and Strauss (1992) for Brazil particularly the rise in prices of dairy products and sugar.

The study by Christiaensen and Alderman (2004) in Ethiopia found that higher price of Ethiopia's staple food (teff) adversely affected children height while higher maize, Sorghum, beef and milk prices were associated with taller children. In general, the paper concluded that the effects of rising prices on nutrition outcomes of children are dependent on commodity and other factors such as the areas of residence and age. The consensus from these studies is that high food prices led to increased malnutrition and increased infant and under-five mortality.

4 Data and Methodology

4.1 Data

The annual data used in this study cover the period 2001 to 2012 for 31 Sub-Saharan countries[17]. The variables in this study include infant mortality defined as the number of infant who die before reaching the age of one, per 1000 live births in a given year (*source, World Bank, WDI*), under-five mortality defined as the number of deaths per 1,000 of total population (sourced from WDI) and general government expenditure on health per capita in constant (2005) dollars (*source, WHO Global Health Observatory Data Repository*). Other variables are access to sanitation defined as proportion of population using improved sanitation facility (*source, UN MDGs Indicators database)*, 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 measured as food price inflation rate (*source, FAOSTAT database*).

4.2 Model specification

Taking cue from previous studies (Lee *et al*. 2013, Freire and Kajiura 2011 among others), the relation between health outcomes and food price inflation is captured as:

$$C_{it} = \beta + \alpha_1 + FPI_{it} + \alpha_2 CV_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

where C_{it} is the log of infant mortality rate or infant mortality rate in country i and year t. FPI is the annual food price inflation and CV is a vector of control variables, ε is the error term and η is country specific effect. The control variables- per capita health care expenditure,(HCE), political score (PLT)-a measure of qualities of autocratic and democratic authority in governing institutions), and the proportion of population using improved sanitation (SAN). The model is explicitly specified as:

$$C_{it} = \beta + \alpha_1 + FPI_{it} + \alpha_2 HCE_{it} + \alpha_3 SAN_{it} + \alpha_4 PLT_{it} + \eta_i + \varepsilon_{it} \quad (2)$$

A positive relationship is anticipated between food price increases and the measures of health outcomes- infant mortality and under-five mortality rate. A negative relationship is expected between access to improved sanitation and mortality. In the same vein, a negative relationship is anticipated between per capita government health expenditure and the health outcomes. Studies have shown that both access to improved sanitation and per capita government health expenditure complement dietary intakes in improving health outcomes (Lee *et al*, 2013). The political score, when tilted towards autocratic control of governing institutions (i.e. negative) is expected to be positively related with poor health outcomes. This implies that the more

[17] These countries are Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Togo, Burundi, Madagascar, Malawi, Mauritius, Mozambique, Uganda, United Republic of Tanzania and Zambia, Angola, Cameroon, Central African Republic, Chad, Congo and Gabon, Botswana, Lesotho, Namibia and South Africa.

autocratic the prevailing political environment, the higher would the mortality rates. On the other hand, the more democratic the political situation, the lower will be the mortality rates.

The linear panel data model is estimated using the pooled ordinary least square (OLS) techniques while the fixed effects and random effects are also used as the data set is assumed to be a priori heterogeneous, given the variations in social, political and economic structure across the countries in the data set. The appropriateness of the fixed effect or random effect model is confirmed based on the Hausman test[18]. For the purpose of robustness check, the generalized methods of moments (GMM) estimators are also used. Specifically, the difference-GMM developed by Arellano and Bond (1991) and the system-GMM developed by Blundell and Bond (1998) are employed. Additionally, it is recommended that the number of instruments should not outnumber the cross-sections (Roodman, 2009).

5 Results

The results of the pooled OLS, fixed effects and GMM estimation for infant mortality are as shown in table 1. Columns 1 and 2 of the table 1 gives the estimated coefficients from the pooled OLS and fixed effects while columns 3, 4, 5 and 6 show the estimated coefficients from the one-step difference GMM, two-step difference GMM, one-step system GMM and two-step system GMM respectively.

[18] The Hausman test clearly shows that the fixed effect model is better than random effect model. Hence, only the results of the fixed effects are reported here.

Table 1: Effects of Food Price Inflation on Infant Mortality Rate

Dependent Variable: Infant Mortality Rate

	Pooled OLS	Fixed Effects	Diff-1 GMM	Diff-2 GMM	Sys-1 GMM	Sys-2 GMM
	(1)	(2)	(3)	(4)	(5)	(6)
FPI_t	0.0100***	0.0057***	0.0003	0.00038	0.0006***	0.0005**
	(0.0019)	(0.0015)	(0.0004)	(0.0006)	(0.0002)	(0.0002)
HCE_t	-0.0469***	-0.0497***	-0.0023**	-0.0028***	-0.0013	-0.0010
	(0.0128)	(0.0111)	(0.0011)	(0.0008)	(0.0013)	(0.0014)
SAN_t	0.0214	-3.4506***	-0.1823**	-0.1737**	-0.0028	-0.0093
	(0.0700)	(0.2817)	(0.0822)	(0.0833)	(0.0084)	(0.0095)
PLT_t	0.2064	0.1206	-0.0162	-0.0128	-0.0573	-0.0508
	(0.2510)	(0.2495)	(0.0213)	(0.0205)	(0.0404)	(0.0429)
IMR_{t-1}			0.9389	0.9374***	0.9416***	0.9557***
			(0.0153)	(0.0160)	(0.0130)	(0.0142)
Instruments			8	8	15	15
Hansen Test			0.19	0.19	0.11	0.11
AR(1)			0.443	0.459	0.58	0.48
AR (2)			0.55	0.560	0.69	0.62

Notes: Standard errors 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.

The coefficient of food price inflation is found to be positive and highly significant. A 1% increase in contemporaneous price inflation rate leads to 0.1%, 0.006% and 0.006% increase in infant mortality using pooled OLS, fixed effect and system GMM estimations respectively. The result is consistent with a priori expectation. For all specifications, the log of health care expenditure is negative and significant except in system GMM where the coefficient is insignificant. It implies that as health care expenditure per capita increases, the infant mortality rate declines. This simply means that government's strong commitment to public health plays an

important role in reducing infant mortality. The coefficient of the proportion of the population with access to sanitation is found to be negative for all specifications and highly significant in the fixed effects and the difference-GMM estimations. This shows that as the proportion of the population with access to sanitation improves infant mortality rate declines. However, the results show that the prevailing political environment or system of government is not crucial and significant in determining infant mortality rate in Sub-Saharan Africa. Finally, infant mortality is highly persistent as the coefficient of the lagged value is close to one and significant. Table 2 presents the results of the impact of food price inflation on under-five mortality.

Table 2: Effects of Food Price Inflation on Under-five Mortality Rate
Dependent Variable: Under-five Mortality Rate

	Pooled OLS	Fixed Effects	Diff-1 GMM	Diff-2 GMM	Sys-1 GMM	Sys-2 GMM
	(1)	(2)	(3)	(4)	(5)	(6)
FPI_t	0.0211***	0.0107***	0.0009***	0.0006*	0.0013***	0.0012***
	(0.0033)	(0.0029)	(0.0004)	(0.0003)	(0.0003)	(0.0003)
HCE_t	-0.1329***	-0.0243	-0.0069***	-0.0063***	-0.0065**	-0.0063
	(0.0217)	(0.0223)	(0.0012)	(0.0017)	(0.0029)	(0.0043)
SAN_t	-0.6286***	-7.1309***	-0.4908***	-0.3472***	-0.0119	-0.0204
	(0.1189)	(0.5677)	(0.1286)	(0.1257)	(0.0230)	(0.0288)
PLT_t	0.2528	-0.5329	0.0069	0.0129	-0.0696	-0.0773
	(0.4261)	(0.5028)	(0.0158)	(0.0182)	(0.0806)	(0.0741)
UMR_{t-1}			0.9508***	0.9689***	0.9247***	0.9266***
			(0.0158)	(0.0149)	(0.0111)	(0.0152)
Instruments			8	8	17	17
Hansen Test			0.24	0.24	0.04	0.04
AR(1)			0.07	0.05	0.01	0.02
AR (2)			0.37	0.43	0.97	0.90

Standard errors 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.

The results obtained are quite similar to those reported for infant mortality in both sign and magnitude. In all specifications, high food prices have positive and significant effect on under-five mortality rate SSA.

The coefficients of health care expenditure and access to improved sanitation are negative and significant. This means that access to sanitation and improved health care expenditure are very vital in reducing under-five mortality rates in Sub-Saharan African countries. However, the coefficient of political index is not significant in any of the specifications. Consequent upon all the p-values of AR (2), there is no problem of second-order serial correlation and the models are thus well-specified. Also, the number of instruments used for the difference and system GMM are less than the cross-sections. This confirms the validity of the instruments.

5.1 Discussion of Findings

Increase in prices of food leads directly to a decline in real purchasing power and makes households worse-off. In response to higher food prices, households adjust or reshuffle their food budgets, by substituting more expensive nutritious food items for cheaper and less nourishing foods, usually staples (Jensen and Miller, 2008; Schnepf, 2013). They therefore subsist on monotonous staple-based diet (like rice, millet, sorghum and maize), and have fettered access to nutritious foods like fruits, vegetables and animal source foods of high nutrient (like beef, egg and fish). Consequently, the risk of morbidity and mortality is heightened. This submission was empirically confirmed as a very significant positive association was found between contemporaneous food prices and infant mortality for the Sub-Saharan African countries. This suggests that surging food price increases the risk of morbidity and mortality, particularly among children (who are worst affected by malnutrition). This implies that Sub-Saharan African countries are highly vulnerable to health implications of increasing food prices. These findings are in conformity with those of Lee et al (2013) on the impact of food prices on population health for 63 developing countries.

The hike in food prices if uncontrolled may aggravate child malnutrition, increase morbidity, reduce the cognitive abilities of children and could pose a long-term threat to the economic development potentials of most African countries (Bibl et al, 2009). This development could also undermine the little success made so far towards the achievement of the MDGs- eradication of extreme poverty and hunger (Goal 1), reduction of child mortality (Goal 4), and the Goal 6 of fighting HIV/AIDS, malaria and other diseases.

It is quite apt and vital to state that per capita government health care expenditure and access to improved sanitation were also found be to have serious implications on infant mortality rate and prevalence of undernourishment in the Sub-Saharan Africa. Empirical findings revealed that contemporaneous per capita government health expenditure has a strong negative relationship with infant mortality rates and prevalence of undernourishment. By implication, increased government spending or investment in public health are sine qua non for stemming mortality rates and curbing the negative impact of malnutrition. These findings corroborate the outcome of the study by Lee et al (2013) on 63 developing countries drawn from different regions (including Sub-Saharan African countries). In the same vein, access to improved sanitation was also found to be essential and possibly complementing government spending on health in reversing the rate

of child mortality which is the Goal 4 under the MDGs. This is premised on the fact that access to improved sanitation has a significant negative association with infant mortality rate.

Owing to the foregoing, there should be massive investments in agriculture in the Sub-Saharan African region through expanded public spending that will cover rural infrastructural development, extension services, research and development while short-term supply to farmers in terms of basic inputs should be greatly improved. These should be complemented with reforms that will ensure easy access to cultivable land. The investment drive should also take into cognizance measures that could possibly curtail the menace of climatic change. These combinations of factors could attract more investors into agriculture, reduce rural-urban drift, and improve farm yield and profitability over time. They will also address the challenges posed by food insecurity in the Sub-Saharan Africa. The set of consumers that are glaringly more vulnerable to the impact of the rising food prices should be urgently provided safety nets. This category of individuals is usually found in war and epidemic-ravaged countries, among internally displaced persons and in extremely poor countries in Africa.

6 Conclusions

We employ panel regressions to examine the effects of high food prices on infant and under-five mortality in Sub-Saharan Africa. We find that rising food price has a significant adverse effect on infant and under-five mortality. Moreover, our results show that health care expenditure and access to sanitation help to reduce infant and under-five mortality in SSA. The results show that it remains essential for governments in SSA to initiate policy that will mitigate the effects of food price inflation. Moreover, increased government investment in public health will assist in reducing infant and under-five mortality in SSA.

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