FOOD INFLATION AND CHILD HEALTH IN AFRICA: EVIDENCE FROM COUNTRIES WITH HIGH MISERY INDEX

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ABSTRACT

This paper investigates the effect of food price inflation on the public health improvement as measured in terms of life expectancy, infant mortality rate, under five mortality rate and neonatal mortality rate in six selected African countries with high misery index for the period from 2000 to 2020. The Augmented Mean Group and Common Correlated Estimation Mean Group were used to determine the effect, as well as Westerlund Cointegration tests. Our findings revealed that rising food prices have a significant detrimental effect on nourishment and consequently lead to higher levels of infant under five and neonatal mortality while reducing the expected life expectancy in the African countries. High food price inflation also has a long run effect on public health. The implication of the result shows that with high rate of food prices coupled with poor child health, the Sustainable Development Goals target of ending preventable deaths of newborns and children under age of 5, and the aim of having a neonatal mortality rate of 12 or fewer deaths per 1,000 live births, and an under-five mortality rate of 25 or fewer deaths per 1,000 live births, by 2030 may not be realistic. Therefore, African Governments should gear up efforts towards reducing food price inflation, improving health expenditure, per capita income and enabling environment for safe sanitation, especially for pregnant women and little children. Also, Governments should create enabling environment for sanitation and access to safe drinking water.

1. INTRODUCTION

Since the dawn of humanity, ensuring healthy lives, promoting well-being at all ages and reduction of child mortality have been at the center of health debate in literature. Governments both in the developed, emerging and developing economy, health care professionals, and policymakers all over the world have expressed a strong desire to reduce the global occurrence of childhood mortality and improve public health of its citizens. This attention has not only spread to the international level but has also resulted in the development of effective interventions to reduce child mortality among children under the age of five, before the first 28 days and infant between 1990 and 2015, as well as between 2015 and 2030, as outlined in the United Nations' Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), respectively (Bao, Tao, Afzal & Dördüncü, 2022; Fadnes, Økland, Haaland & Johansson, 2022). Understanding the importance of child health therefore led the United Nation in 2015 to include it as one of its important targets, Goal 3.2 of the Sustainable Development Goals, calls for an end to preventable deaths of newborns and children under age 5, with all countries aiming to have a neonatal mortality rate of 12 or fewer deaths per 1,000 live births, and an under-five mortality rate of 25 or fewer deaths per 1,000 live births, by 2030.

However, after a historic low level in the early 2000s, global food prices surged upwards to bring about the global food crisis of 2008 (Woldemichael, Kidane & Shimeles, 2017). As a result, Usman, Mekonnen, Kornher, and Braun (2021) opined that high and increasing food prices can generate an immediate threat to the security of a household's food supply, thereby undermining population health. In Africa, for example, interstate policies are dragging some countries into further food price increase and economic discomfort. For example, in the recent time, the World Bank has advised the Nigerian economy to increase tax and remove fuel subsidy at the expense of the mass poor who do not have enough resources to feed their households.

Inflation is rising around the world. In sub-Saharan Africa, one item is driving the trend more than others: food prices. Food accounts for roughly 40 percent of the region's consumption to correct measure of goods and services used to measure consumer price index (CPI) inflation. Food inflation increased throughout 2019, on average, across 20 countries in the region where monthly food price data are available. On a global scale, the recent increase in food inflation is attributed to rising oil prices (which raise fertilizer prices and transportation costs), droughts and export restrictions imposed by some major food exporters and stockpiling in some countries. In addition, pandemic containment measures disrupted production and imports of seeds and fertilizers and caused labor shortages during planting seasons (Eng. et al, 2022; Cassidy-Vu, Way & Spangler, 2022).

The continuous increase in inflation coupled with high rate of unemployment has placed some African countries among miserable countries in the world. The misery index is intended to evaluate the level of economic pain experienced by ordinary people because of the threat of (or actual) joblessness paired with rising living costs. However, since unemployment and inflation are both considered detrimental to one's economic well-being, their combined value is useful as an indicator of overall economic health. In Africa, the Hapkins misery index, an economic indicator that helps determine how the average citizen is doing economically, ranked Nigeria first with high rate of unemployment leading to their misery, followed by South Africa and then Egypt as the third. Rising inflation and unemployment have a detrimental effect on children's outcomes (Kessler & Hevenstone, 2022).

It is a pity that despite efforts put in place by government of most African countries to ensure healthy life, Africa still recorded the poorest in terms of life expectancy at birth with average life expectancy of 63 years for male, and 66 years for female as compared to the world expected life expectancy of 71 years and 75 years. However, for Asia, Europe, North America, South America, Oceania, and Antarctica, the life expectancy is 72 years for men and 76 for women, 75 years for men and 81 for women, 75 years for men and 81 for women, 73 years for men and 79 for women, 76 years for men and 80 for women, and 73 years for men and 79 for women, respectively. The average life expectancy for each of these continents is bigger than the global average. Also, African continent has the highest mortality rate in terms of infant, under-five and neonatal with declining infant, under-five and neonatal mortality rates and increased the life expectancy (WDI, 2022).

High and increasing food prices can generate an immediate threat to the security of a household's food supply, thereby undermining population health, slowing down human development, and lowering labor productivity for the economy in the long term. Understanding the effect of a food crisis on nutrition and health is therefore critical for the development of public policies and social programs to help vulnerable groups of individuals, households, and countries alike. Therefore, this paper investigates the effects of food price inflation on public health improvement in Africa using top six African countries with high misery index. The paper contributes to the literature in the following areas. First, the application of second-generation econometrics techniques (Augmented Mean Group (AMG), Common Correlated Mean Group (CCEMG) and the Westerlund cointegration test to estimate the relationship between food price inflation and public health improvement in Africa. Second, among African nations with high misery indices, this study adds to existing literature on food inflation and child health.

Aside from the introduction, the rest of the paper is structured as follows: The data and methodology employed is presented in section 2, Empirical results are discussed in section 3, while conclusion and policy implication are addressed in section 4.

2. MATERIALS AND METHODS

2.1. Data

The study sample is made up of the top six African countries with high misery index, namely, Nigeria, South Africa, Egypt, Angola, Mauritius, and Mali. The study period is from 2000 to 2020. The variables of interest include food price inflation, under-five mortality, infant mortality, neonatal mortality, access to safe sanitation, life expectancy, GDP per capita and government health expenditure. The World Bank's cross-country data-base of inflation was used to obtain information on food consumer price inflation. The World Bank's database of global development indicators was used to obtain information on under-five mortality, infant mortality, neonatal mortality, access to safe sanitation, life expectancy, GDP per capita, and government health spending.

2.2. Methodology

The model by Lee, Lee, Lim & Park (2016) is adopted for this study with a slight modification. Therefore, to examine the effect of food price inflation on public health improvement in Africa we specify the following functional form model:

$$CH = f\left(FCPI, PKY, ASA,, GHE\right) \quad (1)$$

Where: CH represents child health measured by under-five mortality, infant mortality, neonatal mortality, and life expectancy, FCPI, represents food consumer price inflation, PKY stands for GDP per capita, ASA means access to sanitation, while GHE represents government health expenditure. Although, the paper seeks to investigate the effect of food price inflation on child health, per capita income, access to sanitation and government health expenditure are added as control variables as supported by Lee et al, (2016). Equation (1) is transformed into an econometric log form as specified bellow:

$$CH_t = \alpha_0 + \alpha_1 FCPI_{it} + \alpha_2 PKY_{it} + \alpha_3 ASA_{it} + \alpha_4 GHE_{it} + \varepsilon_{it} \quad (2)$$

In logarithm form, equation 2 is re-specified as:

$$logCH_t = \alpha_0 + \alpha_1 logFCPI_{it} + \alpha_2 logPKY_{it} + \alpha_3 logASA_{it} + \alpha_4 logGHE_{it} + \varepsilon_{it} \quad (3)$$

A priori, we expect food price to have positive effect on infant mortality rate, under five mortality and neonatal mortality while the relationship should be negative with life expectancy at birth. All variables are logged to reduce the standard error.

2.3. Estimation Techniques

2.3.1. Preliminary Estimation and Cross-Sectional Dependence

The theoretical literature on panel data time series econometrics began with the first generation econometric methods consisting of unit root tests, cointegration tests, and empirical estimations, which assume that panel members are cross sectionally independent (Im, Pesaran & Shin, 2003; Maddala & Wu, 1998; Pedroni, 1999, 2004) However, Panel-data models tend to have substantial cross-sectional dependence in the errors, which can also arise owing to the presence of common shocks and non-observable components that eventually become component of the error term, spatial dependence, and idiosyncratic pairwise dependence in the interruptions with no particular pattern of common components or spatial dependence, according to the growing panel-data literature. (De Hoyos & Sarafidis, 2006). Hence, we employed the Breusch and Pagan (1980) LM test, Pesaran (2004) scaled LM test, Pesaran (2004) CD test, and Baltagi, Feng and Kao (2012) bias-corrected scaled LM test for testing the presence or absence of cross-section in this paper. The four tests were used to compare the null hypothesis of no cross-sectional dependence to the alternative hypothesis, presented in equations 4 and 5.

$$H_0 : \hat{\gamma}_{ij} = \text{cor}\left(\forall_{it}, \forall_{jt}\right) = 0 \text{ for } i \neq j \quad (4)$$

$$H_1 : \hat{\gamma}_{ij} = \text{cor}\left(\forall_{it}, \forall_{jt}\right) \neq 0 \text{ for } i \neq j \quad (5)$$

2.3.2. Slope Homogeneity Test

The presence of slope homogeneity among the variables employed is another essential consideration. Failure to test for the presence or absence of something could lead to a false result. We use the Pesaran and Yamagata (2008) slope heterogeneity test to avoid the unwarranted conclusion that large economic shocks identified in one country's variable do not immediately imply the existence of heterogeneity of slopes in the variables of another country based on the standardized version of the Swamy (1970) homogeneity test. The modification test is calculated as follows:

$$\hat{S}_{ht} = \sum_{i=1}^{N} \left(\hat{\rho}_i - \hat{\rho}_{sw}\right)' Z_I' \frac{G_T Z_i}{\rho_i^2} \left(\hat{\rho}_i - \hat{\rho}_{sw}\right) \quad (6)$$

Where. is the pooled estimated ordinary least square estimate, represents pooled estimator for weighted fixed effect and is the estimator symbol in the equation.

Calculating the regular variance and bias statistics of the adjusted version of the specified equation in 6 is calculated using equations 7 and 8.

$$\hat{\Delta} = N^{\frac{1}{2}} = \left(\frac{N^{-1}\hat{S}_{ht} - \kappa}{2\kappa} \right) \quad (7)$$

$$\hat{\Delta}_{adj} = N^{\frac{1}{2}} \left(\frac{N^{-1}\hat{S}_{ht} - E\left(\tilde{X}_{it}\right)}{\operatorname{var}^{\frac{1}{2}}\left(\tilde{X}_{it}\right)} \right) \quad (8)$$

Panel Unit Root Test

In order to avoid spurious regression arising from regressing a non-stationary series on another non-stationary series, we employ the cross-sectionally augmented Dickey-Fuller (CADF) panel unit root test of Pesaran (2007) and the cross-sectionally augmented of Im, Pesaran and Shin (2003) (CIPS) panel unit root test in determining the stationarity property of the variables employed in this study. The test statistics for CADF based on Pesaran (2007) is derived from an error correction model as:

$$\Delta h_{it} = \beta_i + a_i h_{i,t-1} + b_i \bar{h}_{t-1} + c_i \Delta \bar{h}_t + e_{it} \quad (9)$$

Where is the cross-sectional average of lagged levels is the first difference at period T for the entire panel. Following Pesaran (2007), the CADF is computed as:

$$CADF_i = t_i(N,T) = \frac{\Delta h_i' \bar{G}_w h_{i,-1}}{\hat{\pi}_i \left(h_{i,-1}' \bar{G}_w h_{i,-1}\right)^{\frac{1}{2}}} \quad (10)$$

The CIPS statistics is calculated from equation 14 and specified as:

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} CADF_i \quad (11)$$

Westerlund Cointegration Test

We further test for the existence of a long-run relationship among the variables. To achieve this, we employ Westerlund (2007) panel cointegration test that is robust to challenges associated with cross-sectionally dependent panel data collections. The test is conducted under the null hypothesis of no long run relationship between food price inflation and public health improvement. This study carried out a total of two panel tests (p-tau and p-alpha) and two group-mean tests (g-tau, g-alpha respectively. The test is computed from error correction model as:

$$\Delta Z_{it} = \varphi_i' m_t + n_i\left(Z_{i,t-1} - \alpha_i' y_{i,t-1}\right) + \sum_{j=1}^{pi} n_{ij}\Delta Z_{i,t-j} + \sum_{qi}^{pi} \gamma_{ij}\Delta y_{i,t-j} + \varepsilon_{it} \quad (12)$$

Where, represents the deterministic component of the equation, whereas pi and qi are the lag lengths and lead orders in the equation which vary among the different cross-sections in the panel. The panel statistics and mean group test statistics are calculated using equation 13 and 14 respectively as follows:

$$g_{-\tau} = \frac{1}{N}\sum_{i=1}^{N} \frac{\hat{e}_i}{SE(\hat{e}_i)} \quad (13)$$

$$g_{-\alpha} = \frac{1}{N}\sum_{i=1}^{N} \frac{T\hat{e}_i}{\hat{\hat{e}}_i(1)} \quad (14)$$

Where we assume as the error correction estimates, and means the standard error associated with .

The panel statistics are obtained through equation 15 and 16:

$$p_{-\tau} = \frac{\hat{e}}{SE(\hat{e})} \quad (15)$$

$$p_{-\alpha} = T\hat{e} \quad (16)$$

3. RESULTS

3.1. Descriptive Analysis

Table 1 presents the summary statistics of all the variables used. The average life expectancy in Nigeria, South Africa, Egypt, Algeria, Mauritius, and Mali is 50.71 years, 58.46 years, 70.37 years, 74.48 years, 73.23 years, 54.66 years, and 63.66 years, respectively. Algeria has the longest average life expectancy of 77.07 years, followed by Mauritius 74 years and 9 months and South Africa 72.68 years. Nigeria has the shortest average life expectancy of 55.06 years. This was expected given that the nation is one of the poorest nations with adequate access to healthcare and is ranked low in terms of health outcomes.

The under-five mortality rate (the likelihood that a child born in a certain year or period would pass away before turning five) has a mean value for Nigeria, South Africa, Egypt, Algeria, Mauritius, and Mali of 87.69, 39.75, 25.01, 25.24, 15.53, 77.93, and 44.69, as shown in Table 1 below. Nigeria has the highest average rate of under-five mortality (87.69 per 1000 live births). Then comes Mali (77.93). Nigeria also has the greatest maximum value, 110.00, with Mali coming in second with 101.50. Mauritius, out of the chosen nations, has the lowest rate of under-five mortality (18.80 per 1000 live births).

Surprisingly, Mali and Nigeria continue to lead the list of nations with a high infant mortality rate, with a respective infant death rate of 187.20 for Mali and 183.10 for Nigeria. The highest average infant mortality rate, however, of 141.86, was found in Nigeria. With 16.60, Mauritius has the lowest number, nevertheless. In terms of neonatal mortality, which is defined as passing away during the first 28 days of life, Mali has the highest mean of infant deaths occurring before the age of 28, with 39.42, followed by Nigeria with 39.20. The highest number of neonatal deaths was likewise noted in Mali (50.70), followed by Nigeria (46.30). With 12.40 and 14.90 respectively, Mauritius and South Africa have the lowest scores.

In most African countries, government health spending continues to have a significant impact on health outcomes and the economy. As seen, Nigeria, South Africa, Egypt, Algeria, Mauritius, and Mali have the average health expenditures of \$3.56 billion, \$8.37 billion, \$4.91 billion, \$5.07 billion, \$4.45 billion, and \$4.54 billion, respectively. The greatest mean value is \$8.37 billion, recorded in South Africa. The country with the highest government health spending is South Africa, with \$9.12 billion, followed by Algeria (\$7.10 billion) and Mauritius (\$6.25 billion). Nigeria recorded the lowest amount (\$5.05 billion) for public health spending. This represents one of the factors contributing to the nation's poor performance in terms of health outcomes.

During the study period, Mali had the highest mean value for access to safe sanitation (40.83), followed by Nigeria (22.16). Egypt and Mauritius had the lowest mean values for access to safe sanitation (3.62 and 4.98, respectively). The highest value was again found in Mali at 49.18, followed by Nigeria at 24.12, while the lowest value was recorded in Egypt and Mauritius at 6.00 and 7.18, respectively. South Africa ($6112.63), Mauritius ($7681.81 billion), and Mali ($654.08 billion) have the highest mean GDP per capita values, respectively. Mauritius had the highest GDP per capita at ($11208.34 billion), followed by South Africa ($8810.25) and Algeria ($5592.22). Among the nations with high misery indices that were chosen, Mali had the lowest maximum GDP per capita ($894.80).

Table 1: Descriptive analysis of variables

Country	Mean	Std. Dev	Min	Max
Life Expectancy				
Nigeria	50.71	2.83	46.27	55.06
South Africa	58.46	4.15	53.44	64.48
Egypt	70.37	1.12	68.60	72.16
Algeria	74.48	1.99	70.64	77.07
Mauritius	73.23	1.05	71.66	74.88
Mali	54.66	3.59	48.07	59.74
Panel	63.66	9.80	46.27	77.07
Under-five mortality rates				
Nigeria	87.69	11.13	72.63	110.00
South Africa	39.75	8.82	27.30	48.30
Egypt	25.01	6.18	16.70	37.20
Algeria	25.24	4.68	18.53	33.90
Mauritius	15.53	1.10	14.50	18.80
Mali	77.93	13.29	58.53	101.50
Panel	44.69	29.13	14.30	110.00
Infant Mortality Rate				
Nigeria	141.86	20.48	114.40	183.10
South Africa	55.30	18.57	33.90	79.40
Egypt	30.19	8.16	19.60	48.60
Algeria	29.44	5.49	22.80	39.70
Mauritius	13.53	1.04	12.50	16.60
Mali	133.47	30.00	90.40	187.20
Panel	67.29	54.16	12.50	187.20

Country	Mean	Std. Dev	Min	Max
Neonatal Mortality				
Nigeria	39.20	3.13	35.60	46.30
South Africa	11.94	1.30	10.15	14.90
Egypt	15.98	3.69	10.02	22.30
Algeria	17.85	2.20	14.43	21.00
Mauritius	9.86	0.81	8.89	12.40
Mali	39.42	5.05	30.07	50.70
Panel	22.38	12.71	8.89	50.70
Food Consumer Price Inflation				
Nigeria	12.89	6.24	2.13	28.58
South Africa	6.96	4.04	1.37	17.39
Egypt	11.62	8.76	-0.20	38.66
Algeria	4.05	3.27	-2.10	12.95
Mauritius	5.18	4.09	0.72	15.84
Mali	2.13	5.52	-7.00	13.01
Panel	7.14	6.77	-7.00	38.66
Government Health Expenditure				
Nigeria	3.56	0.63	2.49	5.05
South Africa	8.37	0.54	7.46	9.11
Egypt	4.91	0.40	4.13	5.63
Algeria	5.07	1.36	3.23	7.10
Mauritius	4.45	1.13	2.89	6.25
Mali	4.54	0.65	3.67	5.47
Panel	5.15	1.74	2.49	9.12
Access to Safe Sanitation				
Nigeria	22.16	1.43	19.54	24.12
South Africa	10.44	2.34	6.54	14.27
Egypt	3.62	1.36	1.62	6.00
Algeria	8.45	0.90	7.78	10.51
Mauritius	4.98	1.43	2.71	7.14
Mali	40.83	5.23	32.35	49.18
Panel	15.11	13.25	1.62	49.18
GDP Per Capita				
Nigeria	1877.21	775.31	567.93	3098.99
South Africa	6112.63	1633.72	2797.09	8810.93
Egypt	2322.55	918.81	1062.16	3569.21
Algeria	3787.82	1253.83	1740.61	5592.22
Mauritius	7691.81	2461.46	3856.63	11208.54
Mali	654.08	206.69	270.54	894.80
Panel	3741.02	2824.21	270.54	11208.34

Source: Authors' calculation

3.2. Test For Cross Sectional Dependence and Slope Homogeneity

Before estimating panel data, two important conditions must be verified. First, the existence of cross-sectional dependence among the variables. This is to ensure whether shock in one country's data is not affected by another country's data. Second is the presence of slope homogeneity. This is important because the failure to do so can lead to incorrect assessment techniques. These tests were conducted and reported in Table 2 and Table 3, respectively. Based on the test statistics for the four different tests for the presence of cross-sectional dependence among the series, the outcome shows that all test statistics were significant at 1% and 5%, respectively. Consequently, the null hypothesis of no cross-sectional dependence among the series was rejected. Also, in Table 3, the delta tests for all the variables were significant indicating the rejection of the null hypothesis of no presence of slope homogeneity among the variables. The presence of cross-sectional dependence and slope homogeneity among the variables support the use of a second-generation econometric techniques that can capture the presence of cross-sectional dependence and slope homogeneity.

Table 2: Test for Cross-sectional dependence results

	Test Statistics and Probability							
	LE	U5M	IFM	NNM	FCPI	PKY	GHE	ASA
Breusch - Pagan LM	290.72***	235.21***	212.58***	257.91***	22.24**	220.07***	112.22***	281.13***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Pesaran Scaled LM	49.24***	39.12***	34.97***	43.25***	0.22	36.35***	16.65***	47.49***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.81)	(0.00)	(0.00)	(0.00)
Bias-Corrected Scaled LM	49.09***	38.96***	34.83***	43.10***	0.08	36.19***	16.90***	47.34***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.93)	(0.00)	(0.00)	(0.00)
Pesaran CD	17.04***	15.03***	13.88***	16.01***	3.37***	14.74***	-0.94	6.72***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.35)	(0.00)

*Note: (i) ***and**denote rejection of the null hypothesis at the 1% and 5% levels, respectively. (2) The Schwarz Information Criterion (SIC) is the optimal lags used. (3) The probability values are reported in parentheses.*

Source: Authors' calculation

Table 3: Test for Slope homogeneity

Delta Tests	Test Statistics and Probability							
	LE	U5M	IFM	NNM	FCPI	PKY	GHE	ASA
Delta tilde	2.36***	3.02***	2.68***	3.04***	2.27***	6.43***	5.90***	2.18***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Delta tilde adj	2.26***	1.67**	3.24***	2.82***	1.93**	4.39***	4.11***	2.32**
	(0.00)	(0.04)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.02)

*Note: (i) ***and** mean rejection of the null hypothesis at 1% and 5%, respectively of no presence slope homogeneity.*
Source: Authors' calculation

3.3. Unit Root Test

After verifying the existence of cross-sectional dependency and slope homogeneity across all the variables used, we move on to determining the stationarity features of each one. However, several panel unit root tests are used to identify the stationarity characteristics of variables where there is cross-sectional dependency. In our analysis we have used the second generation of unit root tests, CIPS cross-section Im, Pesaran, and Shin (2003), and cross-sectionally augmented Dickey Fuller (CADF) unit root test, proposed by Pesaran (2007). We present results of unit root tests in Table 4, and Table 5.

Table 4: Panel unit root test - CIPS cross-section Im, Pesaran, and Shin (H0: homogenous non-stationary; bi=0 for all i)

Variable	Exogenous variables	Test statistics	Critical values at		
			1%	5%	10%
LE	Constant and trend	-1.56	-3.15	-2.86	-2.71
Δ LE	Constant and trend	-3.59	-3.15	-2.86	-2.71
U5M	Constant and trend	-1.67	-3.15	-2.86	-2.71
Δ U5M	Constant and trend	-3.44	-3.15	-2.86	-2.71
IFM	Constant and trend	-1.54	-3.15	-2.86	-2.71
Δ IFM	Constant and trend	-3.2	-3.15	-2.86	-2.71
NNM	Constant and trend	-2.3	-3.15	-2.86	-2.71
Δ NNM	Constant and trend	-3.74	-3.15	-2.86	-2.71
FCPI	Constant and trend	-2.23	-3.15	-2.86	-2.71
Δ FCPI	Constant and trend	-3.85	-3.15	-2.86	-2.71
PKY	Constant and trend	-1.85	-3.15	-2.86	-2.71
Δ PKY	Constant and trend	-3.25	-3.15	-2.86	-2.71
GHE	Constant and trend	-2.38	-3.15	-2.86	-2.71
Δ GHE	Constant and trend	-3.77	-3.15	-2.86	-2.71
ASA	Constant and trend	-2.51	-3.15	-2.86	-2.71
Δ ASA	Constant and trend	-3.61	-3.15	-2.86	-2.71

Source: Authors' calculation

Table 5: Panel unit root test – CADF (H0: All panels contain unit roots; Ha: Some panels are stationary)

Variable	Exogenous variables	P value	Stationarity
LE	Constant and trend	0.998	I(1)
Δ LE	Constant and trend	0.000	I(0)
U5M	Constant and trend	0.785	I(1)
Δ U5M	Constant and trend	0.002	I(0)
IFM	Constant and trend	0.889	I(1)
Δ IFM	Constant and trend	0.001	I(0)
NNM	Constant and trend	0.784	I(1)
Δ NNM	Constant and trend	0.000	I(0)
FCPI	Constant and trend	0.551	I(1)
Δ FCPI	Constant and trend	0.000	I(0)
PKY	Constant and trend	0.473	I(1)
Δ PKY	Constant and trend	0.002	I(0)
GHE	Constant and trend	0.341	I(1)
Δ GHE	Constant and trend	0.000	I(0)
ASA	Constant and trend	0.481	I(1)
Δ ASA	Constant and trend	0.001	I(0)

Source: Authors' calculation

Our analysis confirms that all variables are I(1) and all variables are non-stationary at the level. In the next iteration we will apply the cointegration test.

3.4. Cointegration Test

We analyze the existence of a long period in the variables under discussion after confirming that the series are stationary. Although there are other tests for cointegration, we used the Westerlund (2007) Cointegration test in this paper since it can accept cross-section dependence and slope homogeneity. Table 6 shows the results of the cointegration test, which showed that the statistics values for all four tests were significant. These findings suggest that there is a long-term association between food price inflation and public health improvement in Africa. We therefore reject the null hypothesis that there is no long-term relationship between food price inflation and public health improvement in the countries studied.

Table 6: Test for cointegration (Westerlund, 2007)

Test Stat	Coefficient	asym.ρ-value	bootstrap ρ-value
g-tau	-3.857***	0.03	0.041
g-alpha	-4.462**	0.00	0.00
p-tau	-5.239**	0.02	0.04
p-alpha	-4.345***	0.00	0.01

*Note: ***, and ** mean rejection of the null hypothesis of no cointegration at 1%, and 5%..*

Source: Authors' calculation

4. DISCUSSIONS

Within the panel unit root-testing framework, there are two generations of tests. The first generation of tests assumes that cross-section units are cross-sectionally independent and the second generation of panel unit root tests that relaxes this assumption and allows for cross-sectional dependence (Jain et al, 2021). The second-generation econometric technique was used. The results of the Augmented Mean Group (AMG) by Eberhardt and Teal (2010) and the Common Correlated Mean Group (CCEMG) by Pesaran (2007) are presented together in the table.

Table 7: Regression Results

	AMG Techniques				CCEMG Techniques			
	logLE	logIFM	logU5M	logNNM	logLE	logIFM	logU5M	logNNM
logFCPI	-0.005**	0.031*	0.101**	0.023**	-0.008**	0.002**	0.012**	0.014**
	(0.04)	(0.08)	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
logPKY	0.074***	-0.201***	-0.195***	-0.214***	0.057**	-0.095**	-0.243***	-0.203***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)	(0.00)	(0.00)
logGHE	0.237**	-0.196*	-0.076**	-0.048***	0.212***	-0.271***	-0.042***	-0.139***
	(0.02)	(0.05)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
logASA	0.087**	-0.047***	-0.083***	-0.059***	0.162***	-0.085***	-0.091***	-0.038***
	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

*Note: ***,** and * denote significance at 1%, 5% and 10%, respectively.*

Source: Authors' calculation

The effect of food price inflation on life expectancy was negative and significant. Specifically, as reported, a percentage increase in food price inflation reduces life expectancy between (0.005% - 0.008%), respectively. The result was significant for both methods employed at 5%. This implies that food price inflation stands as a major determinant of longevity of both males and females life expectancy in Africa. The findings are supported by Worldernichael, Kidane and Shimeles (2017), and Bao et al. (2022) who found that increase in food prices positively affects infant mortality rate and negatively affects life expectancy in developed and developing countries.

Inflationary food prices raise infant, under-five, and neonatal mortality rates. Table 7 reveals that 1% increase in food prices increases newborn mortality, under-five mortality, and neonatal death rates by (0.002 percent - 0.031 percent), (0.012% - 0.101%), and (0,014% - 0.023%) accordingly. The results were statistically significant at 1% and 5%, respectively. In the literature, the findings corroborated the theoretical foundation that an increase in food prices promotes malnutrition, particularly among the poor, and so impairs child nutrition, leading to early death. The effect shows that constant food price increase stands as a detriment to health outcome in Africa. Studies by Arndt, Hussain, Salvucci, & Østerdal (2016), and Lee et al. (2016), concluded that continuous food price increase is detrimental to child health and therefore causes a high rate of poor child health improvement in Africa.

Per capita income enhances average life expectancy at birth and reduces infant, under-five, and neonatal mortality in Africa, according to both assessment approaches. According to reports, an increase in per capita income boosts an individual's predicted life expectancy in Africa by 0.057 percent to 0.074 percent. The work by Guzel, Arslan & Acaravci (2021), Fadnes et al. (2022), and Miladinov (2020), confirmed that per capital income improves wellbeing and ensures longevity in the average life span of individual. Our findings demonstrated that per capita income lessens the burden of continuous death in Africa for infant, under-five, and neonatal mortality. In particular, 1% increase in per capita income lowers mortality rates between (0.095% to 0.201 %). Newborn mortality rates range from 0.195%t to 0.243%, and neonatal mortality rates range from 0.203% to 0.214%. Our findings support the outcomes by Cardona et al. (2022), and Shapira de Walque & Friedman (2021). The result was also significant at 1% and 5%, respectively. These show that income per capita is an important factor that determines child health in Africa.

With theoretical expectations, government health spending produces an acceptable result. The results suggest that government health spending helps to reduce infant, under-five, and neonatal mortality while also increases average life expectancy at birth in Africa. As reported, a percentage increase in government health expenditure raises the life expectancy of individuals in Africa between 0.237% and 0.212%, respectively. The work by Rahman, Khanam &

Rahman (2018), and Rancic & Jakovljevic (2016), supported that government health expenditure raises the average life expectancy at birth in Africa. For infant mortality, under-five and neonatal mortality, our findings revealed that a negative and significant relationship exists between government health expenditure and mortality rate. Specifically, a percentage increase in government health expenditure reduces mortality rate (0.196% - 0.271%. 0.042% - 0.076% and 0.139% - 0.048%), respectively for infant, under-five and neonatal in the selected African region. The findings support the outcomes by Owusu, Sarkodie & Pedersen (2021). The result was also significant at 1% and 5%, respectively. These show that in Africa, government health expenditure plays a major role in terms of child health especially among countries with high misery index.

A priori expectation concerning access to safe sanitation and public health improvement was confirmed. As reported from the empirical analysis carried out, access to safe sanitation impacted positively on life expectancy and helped in reducing the rate of infant, under-five and neonatal mortality in Africa. Specifically, the provision of safe sanitation by 1% increases average life expectancy by approximately from 0.087% to 0.162%. This result was not surprising as the SDGs 6 calls for clean water and sanitation, seeing the importance of a good environment. The effect was also significant indicating that safe sanitation plays an important role in the average life expectancy in Africa. Our findings are in line with studies by Rahman, Rana & Khanam (2022), and Prüss-Ustün et al. (2019). As regards child health, the result revealed that access to safe sanitation reduces infant, under-five and neonatal mortality by approximately (0.047% - 0.085%, 0.083% - 0.091%, and 0.038% - 0.059%, respectively. The result was significant for all the variables indicating that access to safe sanitation plays an important role in child health. Our findings supported the outcome by Prüss-Ustün et al. (2019), and Revilla & Ram (2021).

5. CONCLUSIONS

The issue of growing food prices has posed a substantial danger to global health development in recent years. While SDG 3.2 calls for increased life expectancy and lower rates of newborn, under-five, and neonatal mortality, the cost of calories and food continues to rise, creating a barrier to individual well-being in Africa. This study evaluates the influence of continuous food price increase on public health improvement from 2000 to 2020 in six African countries with high misery indexes. Second-generation econometrics approaches were used to analyze the data. According to our results, increase in food prices reduces life expectancy and increases infant, under-five, and neonatal mortality. Government health spending, income per capita and access to adequate sanitation promote public health by reducing the rate of infant, under-five and neonatal mortality, and extends the life expectancy of the African's citizen. In addition, there is a long-term cointegration between food price inflation and public health improvement in Africa. Continuous food price inflation therefore stands as a detriment towards achieving good health in Africa. As a result, African governments should develop a policy to stabilize or reduce food prices to the bare minimum, ensuring that households have access to and can afford food. This will contribute to a reduction in malnutrition rates and provide parents with hope for their children. Safe sanitation should be provided as part of effective environmental sanitation activities. Because health is regarded as a source of prosperity, the government should invest more in the health industry. Households should be provided with wages that are adequate for their jobs, allowing them to meet the demands of their families with their take-home pay. If African countries are to meet the SDGs' aim of decreasing mortality rates to the bare minimum and improving the life expectancy by 2030, these recommendations must be implemented. Otherwise, higher food inflation would aggravate the situation in countries already experiencing food insecurity and shortages, disproportionately affecting poor households and hence reduce life expectancy and increase mortality rate of children.

Implications

The outlook is highly uncertain. Food inflation and CPI inflation could ease if commodity prices ease, and pandemic-induced global supply chain disruptions resolve. However, high food inflation could persist if inflation expectations become de-anchored or supply chain disruptions continue. Average inflation across the region is expected to edge up in 2021 before easing next year depending on commodity prices and the resolution of supply-demand mismatches. Higher food inflation would worsen the situation for the countries already facing food insecurity and shortages with a disproportional impact on poor households. The number of undernourished persons in the region is projected to increase by 20 percent in 2020, to 264 million people.

Conflict of interests

The authors declare there is no conflict of interest.

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ИНФЛАЦИЈА ХРАНЕ И ЗДРАВЉЕ ДЈЕЦЕ У АФРИЦИ: ДОКАЗИ ИЗ ЗЕМАЉА СА ВИСОКИМ ИНДЕКСОМ БИЈЕДЕ

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САЖЕТАК

Овај рад истражује утицај инфлације цијена хране на побољшање јавног здравља мјерено у погледу очекиваног животног вијека, стопе морталитета новорођенчади, стопе морталитета дјеце млађе од пет година и стопе неонаталне смртности у шест одабраних афричких земаља са високим индексом биједе за период од 2000. до 2020. године. Да би се одредио утицај, коришћена је група повећане средње вриједности и средња група заједничке корелиране процјене, као и Вестерлунд тестови коинтеграције. Наши резултати су открили да све веће цијене хране имају веома штетан утицај на исхрану и посљедично доводе до виших нивоа смртности дјеце млађе од пет година и новорођенчади, док истовремено смањују очекивани животни вијек у афричким земљама. Висока инфлација цијена хране такође има дугорочни ефекат на јавно здравље. Импликација резултата показује

да уз високу стопу цијена хране у комбинацији са лошим здрављем дјеце, циљеви одрживог развоја који треба да зауставе смртност новорођенчади која може да се спријечи и дјеце млађе од 5 година, као и постизање стопе неонаталне смртности 12 или мање умрлих на 1.000 живорођених и стопе смртности дјеце млађе од пет година 25 или мање смртних случајева на 1.000 живорођених до 2030. године, можда нису реални. Стога, афричке владе треба да усмјере напоре ка смањењу инфлације цијена хране, побољшању здравствене потрошње, прихода по глави становника и стварању окружења за добре санитарне услове, посебно за труднице и малу децу. Такође, владе треба да створе повољно окружење за санитарне услове и приступ чистој води за пиће.

Кључне ријечи: *Инфлација цијена хране, очекивани животни вијек, морталитет новорођенчади, смртност млађих од пет година, неонатална смртност.*