Received 30 August 2023
Revised 13 November 2023
Accepted 8 January 2024

Inflation-poverty causal nexus in sub-Saharan African countries: an asymmetric panel causality approach

Clement Olalekan Olaniyi
Department of Economics, College of Economic and Management Sciences, University of South Africa, Pretoria, South Africa, and
Nicholas M. Odhiambo
Department of Economics, University of South Africa, Pretoria, South Africa

Abstract

Purpose – This study examines the roles of cross-sectional dependence, asymmetric structure and country-to-country policy variations in the inflation-poverty reduction causal nexus in selected sub-Saharan African (SSA) countries from 1981 to 2019.

Design/methodology/approach – To account for cross-sectional dependence, heterogeneity and policy variations across countries in the inflation-poverty reduction causal nexus, this study uses robust Hatemi-J data decomposition procedures and a battery of second-generation techniques. These techniques include cross-sectional dependency tests, panel unit root tests, slope homogeneity tests and the Dumitrescu-Hurlin panel Granger non-causality approach.

Findings – Unlike existing studies, the panel and country-specific findings exhibit several dimensions of asymmetric causality in the inflation-poverty nexus. Positive inflationary shocks Granger-causes poverty reduction through investment and employment opportunities that benefit the impoverished in SSA. These findings align with country-specific analyses of Botswana, Cameroon, Gabon, Mauritania, South Africa and Togo. Also, a decline in poverty causes inflation to increase in the Congo Republic, Madagascar, Nigeria, Senegal and Togo. All panel and country-specific analyses reveal at least one dimension of asymmetric causality or another.

Practical implications – All stakeholders and policymakers must pay adequate attention to issues of asymmetric structures, nonlinearities and country-to-country policy variations to address country-specific issues and the socioeconomic problems in the probable causal nexus between the high incidence of extreme poverty and double-digit inflation rates in most SSA countries.

Originality/value – Studies on the inflation-poverty nexus are not uncommon in economic literature. Most existing studies focus on inflation's effect on poverty. Existing studies that examine the inflation-poverty causal relationship covertly assume no asymmetric structure and nonlinearity. Also, the issues of cross-sectional dependence and heterogeneity are unexplored in the causal link in existing studies. All panel studies covertly impose homogeneous policies on countries in the causality. This study relaxes this supposition by

JEL Classification — E31; I32

The authors appreciate the editorial team's professionalism as well as the anonymous referees' impartial suggestions and comments, which have increased the paper's quality. There is a normal disclaimer in place.

Authors' contribution: The work was equally contributed by all authors.

Availability of data and materials: On reasonable request, data are readily available.

Competing interests: There are no competing interests declared by the authors.

Consent for publication: The permission is expressly given.

International Trade, Politics and Development
Vol. 8 No. 1, 2024
pp. 34-64
Emerald Publishing Limited
e-ISSN: 2632-122X
p-ISSN: 2586-3932
DOI 10.1108/ITPD-08-2023-0024

allowing policies to vary across countries in the panel framework. Thus, this study makes three-dimensional contributions to increasing understanding of the inflation-poverty nexus.

Keywords Inflation, Poverty, Cross-sectional dependence, Asymmetric causality
Paper type Research paper

1. Introduction

Most developing countries grapple with extreme poverty and double-digit inflation rates. High inflation, particularly in developing countries, makes life very difficult for the poor. Inflation hits the poor worse than the rich (Artuc *et al.*, 2022; Sani and Yahaya, 2021; Easterly and Fischer, 2001). It hurts people living in extreme poverty since it reduces their purchasing power (Sulaeman, 2021; Sehrawat and Giri, 2018). Inflation is treated as a tax since it lowers the poor's real wages. In this condition, the poor's nominal pay, which is often fixed, does not rise as quickly as prices in the face of growing inflation rates (Cardoso, 1992). In the economic literature, there are numerous studies on inflation's impact on poverty. Predominantly, these studies show that inflation affects the poor and the rich differently. Inflation is a significant burden and a harsh tax on those in extreme poverty. Because of this, inflation has been dubbed the "cruelest tax" on the poor (Easterly and Fischer, 2001). As a result, inflation is a primary determinant of poverty (Junaidin and Muniarty, 2020). One of the most explored and saturated issues in economics is the inflation-poverty nexus. As a result, despite all the efforts of international institutions and governments around the world, the two macroeconomic problems continue to pose threats. Poverty and inflation are two phenomena that have varied implications in different parts of the world.

African continent, specifically sub-Saharan Africa (SSA), has remained the most plagued by extreme poverty and hunger (Olaoye *et al.*, 2023; Olaniyi and Ologundudu, 2022; Olaniyi *et al.*, 2023b; Solarin *et al.*, 2021; Folarin and Adeniyi, 2020; Keho, 2017). In SSA, 45–50% of the population is impoverished (Solarin *et al.*, 2021; Osinubi, 2005). More people live in abject poverty on the continent than on any other continent on the planet (Hussen, 2023; Solarin *et al.*, 2021; Ndlovu and Toerien, 2020). Over the last few decades, SSA has remained the only region on the planet to see an increase in extreme poverty (Olaoye and Zerihun, 2023; Olaniyi *et al.*, 2023b; Alpay, 2007). It is also well documented that SSA is the only region in the world that has failed to reach the Millennium Development Goals' (MDGs') poverty reduction targets (Mahembe and Odhiambo, 2021). Unlike in other parts of the world, the poor are becoming worse, and more people are falling into abject poverty (Simmons, 2015). In addition, African countries lead the top ten countries with the biggest number of people living in extreme poverty (Yomi, 2018). The total number of people living in extreme poverty in SSA climbed from 278 million in 1990 to 413 million in 2015, according to World Bank Group (2018) statistics. Also, in 2021, 490 million people are said to have been trapped in the web of abject poverty in Africa (Olaoye, 2023; Human, 2021). It was also reported that 27 of the world's 28 poorest countries, as well as 27 of the world's 34 lowest-income countries, are found in SSA (Salecker *et al.*, 2020). It has also been predicted that Africa will be home to 70% of the world's poorest people (Kharas *et al.*, 2018a, b; Coulibaly, 2020; Koomson *et al.*, 2020; Olaniyi *et al.*, 2023b). These statistics suggest that the region has a higher proportion of extremely poor people than the rest of the world combined (Olaniyi *et al.*, 2023b; Asongu *et al.*, 2021; Nwani and Osuji, 2020). In SSA, the prevalence of extreme poverty appears to be higher. According to research, SSA is home to over 50.7% of the world's poorest (World Bank, 2016; Omar and Inaba, 2020). This complicates and depresses the situation of poverty in SSA countries. It is worrisome that SSA now has the most people living in extreme poverty worldwide, surpassing the Asian region, based on a poverty line of $1.90 per person daily (Asongu *et al.*, 2023; Nwani and Osuji, 2020).

Similarly, countries in SSA have double-digit inflation rates on average. Inflation in SSA is unstable, resulting in unanticipated negative and positive shocks. According to some existing studies (Danlami *et al.*, 2020), high inflation rates could have further harmed and deteriorated the poor's economic situation in the region. Inflation has been linked to a rise in poverty levels (Cuong, 2011). In most SSA countries, the average inflation rate is in the double digits. According to WDI data, the average values for Nigeria and Kenya between 1981 and 2019 were 19.14% and 11.78%, respectively. In 2021, Nigeria's inflation rate rose to 21.34%, the highest in 17 years (The Central Bank of Nigeria, 2022; Olaoye *et al.*, 2023). Meanwhile, the country witnessed a phenomenal incidence of 72.84% in 1995 (Olaniyi, 2020). According to a recent study, inflation promotes poverty in South Africa (South African Reserve Bank, 2020). In SSA countries, double-digit inflation rates threaten poor well-being. It could cause an increase in the number of people in extreme poverty, complicating the continent's macroeconomic challenges. According to Cardoso (1992), inflation exacerbates extreme poverty by reducing the purchasing power of the impoverished. The causal responses of poverty to changes in inflation in SSA remain a subject of empirical investigation. Some studies have looked at the impact of inflation on poverty reduction in SSA, but the results have been inconclusive and mixed.

Few studies have looked at the nonlinear and asymmetric impacts of inflation on poverty (Meo *et al.*, 2018), allowing for testing of poverty responses to negative and positive shock components in inflation. Poverty (inflation) should react in different ways to inflation (poverty) changes, both positive and negative. However, no empirical research has looked into the asymmetric causality between inflation and poverty. All the previously published works on the inflation-poverty causal nexus covertly assumed no asymmetric structure and nonlinearity. This supposition is restrictive, and it is incongruent with socioeconomic realities. Recent advances in empirical and econometric analysis have revealed impracticality of symmetric and linear approach of causality. The asymmetric causality is more flexible, useful and informative. It provides more information than only the asymmetric and differential effects of negative and positive inflation shocks on poverty levels. Existing research has only looked at the asymmetric effect of inflation on poverty, which has little predictive power. Furthermore, it may be more fundamentally and factually true to investigate the sources (causes) before the consequences (Bettinsoli *et al.*, 2020; Trifunov *et al.*, 2019). The consequence is always preceded by the cause. Examining consequences without first addressing the underlying causes may not yield more accurate results. This study explores numerous ways in which negative and positive inflation shocks can produce negative and positive changes in inflation and poverty levels, based on previous research (Olaniyi, 2020, 2022; Olaniyi and Olayeni, 2020; Osabohien *et al.*, 2020). Another reason to investigate the asymmetric causal link between inflation and poverty is that the data for both variables have asymmetric and nonlinear distributions. As a result, reliance on a symmetric and linear approaches may result in inferior outcomes. It has also been stated that allowing for asymmetric structure in the empirical analysis is in line with reality (Olaniyi *et al.*, 2023b; Hatemi-J and El-Khatib, 2020; Olaniyi and Olayeni, 2020; Olaniyi, 2020, 2022; Olayeni *et al.*, 2021; Hatemi-J and Mustafa, 2016). By using a bootstrap simulation approach with leverage changes, this work adds to the previous understanding. The method is essential because it generates more accurate and dependable critical values and compensates for cross-sectional dependence correctly (Olaniyi, 2022, 2023; Olaniyi *et al.*, 2023c; Lopez and Weber, 2017; Hatemi-j, 2012). This technique also accommodates non-normally distributed and volatile variables, which are common in financial data.

Existing research on the poverty-inflation nexus has ignored the possibility of cross-sectional dependence in their time series and panel analyses, according to a broad review of the literature. Globalization has made the world's economies intertwined across borders (Olaniyi, 2022, 2023; Hatemi-J, 2020 a, b; De Hoyos and Sarafidis, 2006). As a result of

globalization and financial contagion, cross-sectional interdependence between nations is becoming the norm rather than the rare case (Meo *et al.*, 2020; Olaniyi, 2022; Olaniyi *et al.*, 2023a). Shocks in one country can readily spread to other countries (Olaniyi and Odhiambo, 2023b; Olaniyi, 2022; Olaniyi *et al.*, 2022; Olaniyi *et al.*, 2023c; Olaoye and Aderajo, 2020). Causality findings may be inefficient and biased if cross-sectional dependency is unaccounted for (Olaniyi and Odhiambo, 2023a; Uzar *et al.*, 2023). This calls into question the validity of cross-sectional independence among nations, which is implicitly assumed in studies on the poverty-inflation causal nexus. Similarly, prior time-series data analysis studies have overlooked potential cross-sectional spillover effects that could affect the results. This study covers the gap by accounting for cross-sectional dependence in the panel and time series asymmetric causality between inflation and poverty, which differs from previous research. It follows Hatemi-j's (2014) approach of decomposing data on inflation and poverty into negative and positive components. Following these processes, this study adopts the Dumitrescu and Hurlin's (2012) causality approach. This method considers panel causality and generates findings for each cross-sectional unit. Unlike previous studies' methods, this approach is flexible, and it gives more information on causal inferences by allowing policy to vary across cross-sections (countries) in a panel framework (Olaniyi, 2023; Olaniyi *et al.*, 2023c). Instead of imposing average restrictive policy on all the cross-sectional units, it accommodates heterogeneous features to account for each country's idiosyncrasies and peculiarities in the causality between inflation and poverty. To account for cross-sectional dependence, Lopez and Weber (2017) used Stata software to develop a practical Morte Carlo bootstrap simulation of Dumitrescu and Hurlin (2012). As a result, Lopez and Weber (2017) executed the Dumitrescu-Hurlin panel Granger causality test using the Stata code from Lopez and Weber (2017).

In essence, this research advances knowledge by giving the first empirical insight into the asymmetric causal relationship between inflation and poverty using a Morte-Carlo bootstrap simulation that accounts for cross-sectional dependency and heterogeneity. The method allows researchers to investigate how inflationary shocks (poverty), both positive and negative, cause negative and positive changes in poverty levels (inflation) in SSA countries. There is little research that has looked at the causality between inflation and poverty (Danlami *et al.*, 2020; Siyan *et al.*, 2016; Gillani *et al.*, 2009). These few studies used symmetric techniques, which provide limited information and can lead to erroneous conclusions and policy suggestions. This differs as it incorporates asymmetric structure into the causality between inflation and poverty within the framework of the Monte Carlo bootstrap simulation. This is unlike earlier panel and cross-sectional studies, which implicitly assume that impose a restrictive average policy to all countries within a panel analysis. This study adds new insights into the extant studies by relaxing this assumption to allow for the potential policy variations across countries in the panel framework to address country-specific issues in the inflation-poverty causal nexus.

Compared to earlier studies, this study has brought new insights and novelties into the poverty-inflation causal relationship. The contributions of this present research effort are as follows: **One**, all the relevant theories that explain the causal nexus between inflation and poverty are particularly silent on the roles of asymmetric and nonlinear features as well as cross-sectional dependence. Empirical outcomes establish that nonlinearities and asymmetries are more consistent with real-world realities. Both the inflation rate and poverty reduction indicator adopted in the study reveal significant nonlinearity features. Thus, this study has successfully introduced the significance of nonlinearity and asymmetry into the causal nexus between inflation and poverty, which all the previous studies (theoretical and empirical) implicitly assumed nonexistent. **Two**, regardless of trade across borders, globalization and financial integration and contagion among countries, extant studies are based on the supposition that countries are independent of one another. This

assumption has been proved wrong in this study. Robust evidence of interdependence and intertwining is found in this study, and this reveals that shocks from one are transmitted to other countries. This causes actions and reactions among countries in the panel analysis. **Three**, extant panel studies on the inflation-poverty causal nexus assume homogenous evidence and policies across all the countries. Meanwhile, the research outputs in this study vary across countries, and it has justified the need to account for heterogeneous policies to address country-specific peculiarities. The average policy recommendations from a panel analysis might not work for all countries. The findings vary across countries, and this adds value to the existing body of knowledge. **Four**, this study innovatively incorporates asymmetries and nonlinearities into the heterogeneous panel Granger non-causality approach proposed by Dumitrescu and Hurlin (2012).

Apart from this introductory aspect in Section 1, the rest of the text is organized as follows. Section 2 examines data description and methodology. Section 3 focuses on the presentation and discussion of empirical findings. Section 4 provides a concise and precise conclusion to the study.

2. Literature review

2.1 Theoretical perspective

This study is rooted in the philosophical foundation of the theories of inflation. From a general perspective, inflation has to do with the persistent increase in the prices of goods and services. Thus, inflation has great implications for the value of money, and it thereby affects the purchasing power of people. High inflation tends to reduce the value of money and its purchasing power, while a decrease in inflation is accompanied by a rise in the value of money and its purchasing power. The poor, on average, has income that is relatively fixed and stagnated. It does not increase as fast as the inflation rate rises. Poverty is associated with the inability to meet the basic needs of life. High inflation deteriorates the purchasing power and worsens the economic condition of the poor. This implies that there is a close link between poverty and inflation. High inflation negatively hits the income and savings of the poor (Easterly and Fischer, 2001), while moderate inflation enables and enriches the poor to afford the basic needs of life (Gyeke-Dako *et al.*, 2022). This explains why a rise in inflation is often tagged as the cruelest tax on the poor and deepens the extremity of poverty (Olaniyi *et al.*, 2023b). It impoverishes and equally widens the real income gap between the poor and the rich. The implication is that inflation influences the poverty level through the mechanism of the price which impacts the real wage of the people in abject poverty. Changes in the inflation rate generate shocks that could trigger changes in poverty indicators. An inflationary spiral (positive shock) is anticipated to reduce the real wage of the poor, which worsens and causes an increase in poverty. On the other hand, declines in inflation (negative shocks) are meant to empower the poor by increasing their real wage and purchasing power.

Aside from the theoretical explanations of causality from inflation to poverty, poverty can also drive inflation (Nwadike *et al.*, 2020; Siyan *et al.*, 2016; Danlami *et al.*, 2020). An increase in the economic power (income) of the impoverished in an economy through exogenous factors without a corresponding increase in productivity and aggregate supply could put extra pressure on aggregate demand for goods and services. The situation could lead to persistent price increases and inflationary pressures. On the contrary, a surge in poverty, given the aggregate supply, could equally dwindle aggregate demand as demand for goods and services falls. The occurrence might cause a persistent decline in price levels. Thus, a shrinkage in poverty could spur a fall in aggregate demand, causing inflation to fall. Inflation and poverty are causally related based on these theoretical propositions from the two strands. It implies that examining the effect of inflation on poverty without considering the likelihood of a feedback effect might bias the inferences and policy options. This study, however,

supplements existing theoretical and empirical research by bridging a missing link. This phenomenon could bias the practical relevance of the inflation-poverty nexus. All the theoretical and empirical research assumes the oversimplifying idea that the two-way relationship between inflation and poverty is linear and symmetric. We posit in this study that the assumption might be an oversimplification of realities regarding the fundamental intricacies of the inflation-poverty nexus. There could be several dimensions of hidden information, flexibilities, asymmetric structures, nonlinearities and heterogeneous policy across countries that are not obvious on the surface. Asymmetries and nonlinearities in the inflation-poverty nexus are more appropriate for addressing practical issues and designing more flexible policy options. The two macroeconomic variables generate shocks (positive and negative). These shocks might determine the causal relationship and give more information. Thus, the inflation-poverty nexus without capturing these shocks may result in inaccurate results and wrong policy implications for addressing inflationary spirals and extreme poverty.

2.2 Empirical evidence

Humanity continues to face a major challenge due to poverty, which is the lack of capacity and resources to meet the necessities of life. Poverty has multidimensional causes. One of the most prominent factors is inflation. Debates continue to trail the inflation-poverty nexus. Some scholars see inflation as the cruelest tax that drains the poor's economic power (purchasing power) and deepens poverty extremity in an economy (Loewald and Makrelov, 2020; Cardoso, 1992). Some others follow the notion that rising inflation is a stimulant that spurs investment prospects, resulting in more job opportunities and income for the poor (Olaniyi *et al.*, 2023b; Easterly and Fischer, 2001; Romer and Romer, 1998). Due to the macroeconomic implications of inflation on poverty, a plethora of studies have focused on the impact of inflation on poverty, with scanty or no attention paid to the likelihood of a reactionary effect from poverty to inflation (Danlami *et al.*, 2020). Meanwhile, the research outcomes of the existing research are mixed and inconclusive (Olaniyi *et al.*, 2023b; Vinayagathasan and Ramesh, 2022; Inegbedion and Obadiaru, 2022; Rizki and Solihati, 2022; Gyeke-Dako *et al.*, 2022; Sari and Rofiuddin, 2022; Sani and Yahaya, 2021; Sehrawat and Giri, 2018; Yolanda, 2017; Hassan *et al.*, 2016; Shrestha and Chaudhary, 2012). These studies are restricted to the effect of inflation on poverty. The research outcomes of these studies vary. Most of these studies establish that inflation weakens the real purchasing power of the poor's real wage and makes the poor worse off. Few others find the poverty-reducing effect of inflation The other group of studies establishes the insignificant role of inflation in driving poverty.

Aside from the inconclusiveness of the existing research, empirical studies on the causality between inflation and poverty are very scanty and still growing. The few studies on the two-way relationship produce divergent findings. In analysing Nigerian data covering 1980–2014, Siyan *et al.* (2016) used a vector autoregressive (VAR) estimator and found bidirectional causality between inflation and poverty. Danlami *et al.* (2020) also obtained similar findings on Nigeria from 1980 to 2016, using the Toda-Yamamoto causality approach. These two studies affirm the two-way perspective of modeling the inflation-poverty nexus. On the one hand, it implies that inflation drives poverty, as argued earlier. It suggests that high inflation could reduce the poor's purchasing power and drain their welfare. Low inflation, on the other hand, raises real wages and improves the poor welfare. Moreover, poverty reduction could cause inflation through its effects on aggregate demand and the price mechanism. Poverty reduction enables the needy to meet their fundamental needs, which may increase aggregate demand while aggregate supply remains unchanged. This situation might increase the economy's price level.

The findings, however, are inconsistent with the study by Gillani *et al.* (2009). This study establishes a unidirectional causality from inflation to poverty in Pakistan from 1975 to 2007 via the Toda-Yamamoto causality method. It also aligns with Cardoso's (1992) findings, which reveal that inflation causes poverty. The study posits that inflation passes through the real wage to cause poverty. The study's highlights suggest that prices rise faster than wages. Economic implication is that a higher inflation rate tends to spur a surge in poverty (Yusoff *et al.*, 2023; Keynes *et al.*, 2023). This situation weakens impoverished people's purchasing power to meet their basic needs. Meanwhile, a related study by Nwadike *et al.* (2020) on Nigeria, covering 2000–2018, utilized pairwise Granger causality to find a unidirectional causal flow from poverty to inflation. Different from studies that establish a bidirectional or unidirectional causality between inflation and poverty, there are few other research efforts that find no causal relationship. Vinayagathasan and Ramesh (2022) report evidence of no causality between inflation and poverty in a panel analysis of eight South Asian countries, covering the 1996–2019 period. Similar results are obtained in a study by Sehrawat and Giri (2018) in India over the period of 1970–2015. All the studies reviewed give exciting dimensions of causality between inflation and poverty.

Existing research has the following key characteristics. One, all the existing studies assume a linear relationship between inflation and poverty. Recent advances in empirical analysis and econometrics have invalidated the linearity assumption as impractical and unfit to unravel the realities and dynamics of modern socioeconomic and macroeconomic complexities in the real world. Two, previous research assumed no asymmetric structures in inflation and poverty dynamics. Thus, all the studies utilize symmetric causal approaches, which neglect asymmetric structure and nonlinear trends in the data analysis of the inflation rate and poverty reduction indicators. Three, despite the rich evidence of interdependence and intertwining among countries due to international trade and alliances, economic integration and financial contagion, existing research on the inflation-poverty causal nexus neglects the necessity of accounting for cross-sectional dependence. There is a possibility that neglect may result in biased causal inferences that lead to faulty policy implications. Four, all panel studies on the inflation-poverty causal nexus ignore the importance of accommodating heterogeneous policy perspectives across countries in the panel analysis. The underlying assumptions produce restrictive policy dimensions that offer no opportunity to address country-specific matters on inflation-poverty causal relationships. Thus, this study uses a causality methodology that accounts for both the average panel dimension and the country-specific dimension of causality in order for the inferred policy to differ across countries. This present study differs from all previous research by bridging the identified gaps and correcting the observed deficiencies. It adds new insights to existing research on the inflation-poverty causal link, enhancing policy options and relevance to explain real-world practicalities.

3. Methodology and data source

3.1 Data source

Annual data on the twelve selected sub-Saharan countries (Botswana, Burkina Faso, Cameroon, Congo Republic, Gabon, Kenya, Madagascar, Mauritania, Nigeria, Senegal, South Africa and Togo) are utilized for the period 1981–2019. The population of the study is the entire SSA countries, but the data availability restricts us to the selection of twelve countries. This study would have embraced an unbalanced panel dataset but the estimation technique of Dumitrescu and Hurlin Granger non-causality approach requires a balanced panel. The countries with missing data are dropped from the analysis. Following the position of extant studies, the sample size in this study (country-year observations, 468) is adequate to give reliable and unbiased estimates in panel analysis (Olaniyi, 2022; Ahmad *et al.*, 2021; Olaniyi

and Oladeji, 2021; Nathaniel *et al.*, 2021; Meo *et al.*, 2020). The data on poverty measured by per capita consumption expenditure and the consumer price index, a measure of inflation, are sourced from World Development Indicator (WDI). To maintain fair representation, all the sub-regions of SSA are well represented.

3.2 Definitions of variables

3.2.1 Poverty. Consistent with the definition of poverty by the World Bank which describes poverty as "the inability to attain a minimal standard of living," this study makes use of per capita consumption as a proxy for poverty. Poverty is defined in terms of basic consumer needs in this definition. Consumption expenditure data among the poor are generally more recorded and available, and it is also steadier than income metrics such as per capita income, according to existing studies (Olaniyi *et al.*, 2023b; Olaniyi and Ologundudu, 2022; Odhiambo, 2009; Woolard and Leibbrandt, 1999; Ravallion, 1992). Consumption-based metrics of poverty, according to academics, represent welfare and material well-being better than income-based measures (Koomson *et al.*, 2020; Norris and Pendakur, 2013; World Bank, 2001). Because it reveals people's ability to satisfy and meet basic and minimum consumption needs, both food and non-food components, consumption expenditure has been widely used as a reliable indicator of welfare and a preferred measure of household living standards (Chen *et al.*, 2021; Norris and Pendakur, 2013; Beegle *et al.*, 2012). Also, the consumption distribution, rather than the income distribution, maybe a better indicator of utility distribution or lifetime wealth (Norris and Pendakur, 2013). Furthermore, there are a plethora of previous studies which have adopted this measure of poverty, and examples include Olaniyi *et al.* (2023), Olaniyi and Ologundudu (2022), Akinlo and Dada (2021), Solarin *et al.* (2021), Musakwa and Odhiambo (2021), Das *et al.* (2021), Appiah *et al.* (2020), Adeleye *et al.* (2020), Danlami *et al.* (2020), Garza-Rodriguez (2018), Ho and Iyke (2018), Sehrawat and Giri (2016a, b), Dhrifi (2015), Uddin *et al.* (2014), Odhiambo (2010, 2009) and Quartey (2005). In addition, despite being the world's second-most populous continent, household consumption expenditures in Africa have been estimated to be among the lowest (Solarin *et al.*, 2021).

3.2.2 Inflation. Inflation, according to existing research, is a protracted rise in the price level. The common measure of inflation in the extant studies is the consumer price index (Amin *et al.*, 2020; Meo *et al.*, 2018). This proxy is more reliable because it captures and measures consumer purchasing power and welfare, as well as the economy's overall price level. It is also "an index that measures the rate at which the prices of consumption goods and services are changing from month to month (or from quarter to quarter)" (ILO, 2004). It is commonly defined as the average change in price over time that consumers pay for a basket of goods and services. Thus, it measures changes in the prices of goods and services that households consume (ILO, 2004). The inflation rates are expressed in percentages.

3.3 Estimation procedural steps

Before proceeding with the modeling for the causal nexus between inflationary shocks and poverty, the models for all the preliminary tests are concisely discussed in this section. These tests are necessary to reveal the true characteristics of the data, which will inform the appropriate estimation techniques.

3.3.1 Cross-sectional dependence tests. In modern econometrics, evaluating for cross-sectional dependence (CD) in panel analysis has become the rule rather than the rare case (Olaniyi, 2022; Olaniyi *et al.*, 2022; Olaniyi *et al.*, 2023c; Olaniyi *et al.*, 2023a; De Hoyos and Sarafidis, 2006; Meo *et al.*, 2020). Also, the increasing level of globalization and financial liberalization have spurred the intertwining and integration of countries across the globe. Countries rely on one another to transact and trade. Thus, shocks to a country are easily transmitted to other countries through the contagion effect within an economic bloc. In many

regards, African countries are highly integrated in policies and macroeconomic decisions, and shocks to one could transmit to other countries (Aluko *et al.*, 2021). Given this assertion, this study follows the CD modeling of Pesaran (2004) under the null hypothesis that there is no CD in panel data as thus:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=0}^{N-1}\sum_{j=i+1}^{N-1}\rho ij\right) N(0,1) \tag{1}$$

where ρij is the cross-section's correlation of errors between i and j. Other variants of CD tests such as Pesaran *et al.* (2008), Breusch and Pagan (1980) and Baltagi *et al.* (2012) are equally considered in this study, but their respective models are not specified. It should be stressed that Pesaran's (2004) study is the lifeline CD model for this study.

3.3.2 Slope homogeneity test. Following the work of Pesaran and Yamagata (2008), this study examines whether there exists slope homogeneity across the cross-sectional units in the panel analysis or not. Pesaran and Yamagata's (2008) test is adopted, as other prevalent slope homogeneity tests do not account for CD. The model specifications for the delta tilde and adjusted delta tilde are expressed as follows:

$$\widetilde{\Delta} = (N)^{\frac{1}{2}}(2K)^{-\frac{1}{2}}\left(\frac{1}{N}\widetilde{S} - k\right) \tag{2}$$

$$\widetilde{\Delta}_{adj} = (N)^{\frac{1}{2}}\left(\frac{2k(T-k-1)}{T+1}\right)^{-\frac{1}{2}}\left(\frac{1}{N}\widetilde{S} - k\right) \tag{3}$$

where $\widetilde{\Delta}$ is the delta tilde and $\widetilde{\Delta}_{adj}$ is the adjusted delta tilde. Equation (2) explains the delta tilde, while Equation (3) captures the adjusted delta tilde. The two equations are based on the well-tested null hypotheses of slope homogeneity across cross-sections.

3.3.3 Panel unit root tests. Adoption of the DH panel causality approach requires the stationarity of the variables. Due to the prevalence of cross-sectional dependence in panel analysis, second-generation panel unit root tests are chosen in this study. Following this assertion, cross-sectionally augmented Dicky-Fuller (CADF) and cross-sectionally augmented IPS (CIPS) tests developed by Pesaran (2007) are utilized. The panel data set's cross-sectional dependence and heterogeneity are not a problem for these unit root tests. Although it has been proven that CIPS performs better when CD and heterogeneity occur, the two outcomes are provided to guarantee robustness. The model for CIPS is specified thus:

$$X_{i,t} = \alpha_i + \alpha_i Y_{i,t-1} + \alpha_i \overline{Y}_{t-1} + \sum_{l=0}^{p} \alpha_{il}\Delta\overline{X}_{t-1} + \sum_{l=0}^{p} \alpha_{il}\Delta X_{i,t-1} + \mu_{it} \tag{4}$$

where $\overline{X}$ is the average cross-section of each of the variables in the study

The statistical test of CIPS is specified as follows:

$$\widehat{CIPS} = N^{-1}\sum_{i=0}^{n} CADF_i \tag{5}$$

CADF denotes cross-sectionally augmented Dicky-Fuller test.

3.4 Data decomposition and model specification

Modeling the causality process starts with the decomposition of data into negative and positive shock components. Consistent with the pioneer thoughts of Granger and

Yoon (2002), data on inflation (consumer price index) and poverty (per capita consumption) are transformed into negative and positive shock components. This study pioneers incorporating asymmetric structures into the causal relationship between poverty and inflation. Since negative and positive shocks are expected to have different causal effects, asymmetric causation is thereby inferred (Olaniyi, 2020; Olaniyi and Olayeni, 2020; Hatemi-J, 2020a). This important aspect has been neglected in extant studies. The baseline assumption of Hatemi-J (2012) is followed that the variables [poverty (pov_{it}) and inflation (inf_{it})] follow the order of first integrations. The integrated variables, pov_{it} and inf_{it}, follow the random walk process as thus:

$$pov_{i,t} = pov_{i,t-1} + \varepsilon_{1i,t} = pov_{i,0} + \sum_{j=1}^{t} \varepsilon_{1i,j} \tag{6}$$

and

$$inf_{i,t} = inf_{i,t-1} + \varepsilon_{2i,t} = inf_{i,0} + \sum_{j=1}^{t} \varepsilon_{2i,j} \tag{7}$$

where $i = 1, \ldots, N$ denotes the cross-sectional units, while $t = 1, 2, \ldots.., T$ denotes the time covered in the study. The initial values are represented by constant terms $pov_{i,0}$ and $inf_{i,0}$, whereas the error terms are represented by $\varepsilon_{1i,j}$ and $\varepsilon_{2i,j}$. $\varepsilon^{+}_{1i,t} = \max(\varepsilon_{1i,t}, 0)$, $\varepsilon^{+}_{1i,t} = \max(\varepsilon_{2i,t}, 0)$ are the positive shocks, while $\varepsilon^{-}_{1i,t} = \min(\varepsilon^{-}_{1i,t}, 0)$, $\varepsilon^{-}_{1i,t} = \min(\varepsilon^{-}_{1i,t}, 0)$ are the negative shocks. Hence, it could be stated that $\varepsilon_{1i,t} = \varepsilon^{+}_{1i,t} + \varepsilon^{-}_{1i,t}$ and $\varepsilon_{2i,t} = \varepsilon^{+}_{2i,t} + \varepsilon^{-}_{2i,t}$. Following these definitions, the partial cumulative sums of the shocks (negative and positive) are constructed and stated as follows:

$$pov_{i,t} = pov_{i,t-1} + \varepsilon_{1i,t} = pov_{ii,0} + \sum_{j=1}^{t} \varepsilon^{+}_{1i,jt} + \sum_{j=1}^{t} \varepsilon^{-}_{1i,jt} \tag{8}$$

and also:

$$inf_{i,t} = inf_{i,t-1} + \varepsilon_{1i,t} = inf_{ii,0} + \sum_{j=1}^{t} \varepsilon^{+}_{2i,jt} + \sum_{j=1}^{t} \varepsilon^{-}_{1i,jt} \tag{9}$$

Following the processes stated earlier, the positive and negative shocks in both poverty (pov) and inflation (inf) are defined in a partial cumulative form as follows:

$$pov^{+}_{i,t} = \sum_{j=1}^{t} \varepsilon^{+}_{i1,j};\ pov^{-}_{i,t} = \sum_{j=1}^{t} \varepsilon^{-}_{i1,j};\ inf^{+}_{i,t} = \sum_{j=1}^{t} \varepsilon^{+}_{i2,j};\ and\ inf^{-}_{i,t} = \sum_{j=1}^{t} \varepsilon^{-}_{i2,j}$$

where j, i *and* t are lag length, cross-sectional unit and time covered in the study, respectively.

The constructed negative and positive shocks components of poverty and inflation are described as follows: pov^{+}_{i} denotes an unanticipated increase in per capita consumption which signifies poverty reduction, while pov^{-}_{i} represents an unanticipated decline in per capita consumption which implies an increase in poverty. Similarly, inf^{+}_{i} is an unexpected increase in the inflation rate which tends to produce a positive inflationary shock, while inf^{-}_{i} denotes unanticipated declines in the inflation rate which signals negative inflationary shock.

It should be noted that the generated variables such as negative components and positive ones are expected to have causal effects on the underlying variable. After that, we examine the causality between constructed variables. In an attempt to unravel asymmetric causality between poverty and inflation, the pairs between positive cumulative shocks ($inf^{+}_{i,t}\, pov^{+}_{i,t}$) are presented in Equations (10) and (11). However, all other pairs such as ($inf^{-}_{i,t}\, pov^{-}_{i,t}$), ($inf^{+}_{i,t}\, pov^{-}_{i,t}$), ($inf^{-}, pov^{+}$) are also considered. This study explores the two-way asymmetric causality between all the possible component pairs of negative and positive shocks detected in inflation and poverty indicators. The panel causality approach proposed by Dumitrescu and Hurlin (2012, DH henceforth) is used to uncover the causal link. This panel causality method compensates for individual-country peculiarities and policy heterogeneities across cross-sectional units (countries), and it addresses the problem of cross-sectional dependence that is common in panel data analysis. The DH panel causality test uses a block bootstrapping method to compensate for cross-sectional dependence, generating resilient critical values that are robust to cross-sectional dependence. The following is the model's specification:

$$pov^{+}_{i,t} = \propto_{1i} + \sum_{k=1}^{K} \propto_{1i}^{(k)} pov^{+}_{i,t-k} + \sum_{k=1}^{K} \beta_{1i}^{(k)} inf^{+}_{i,t-k} + \mu^{+}_{1i,t} \tag{10}$$

$$inf^{+}_{i,t} = \propto_{2i} + \sum_{k=1}^{K} \propto_{2i}^{(k)} inf^{+}_{i,t-k} + \sum_{k=1}^{K} \beta_{2i}^{(k)} pov^{+}_{i,t-k} + \mu^{+}_{2i,t} \tag{11}$$

The fact that pov^{+} and inf^{+} are stationary and $\propto_{1i} and \propto_{2i}$ represent the fixed effect, underpins individual-specific effects. The cross-sectional units' lag order K is considered to be the same. Following the explanation in the Stata code provided by Lopez and Weber (2017), optimal lag length is endogenously determined using Bayesian information criteria (BIC). The provision is made to indicate the lag length criteria (BIC), while the precise optimal lag is endogenously determined. Also, the autoregressive parameters are $\propto_{1i}^{(k)} and \propto_{2i}^{(k)}$, and the regression coefficient slopes are $\beta_{1i}^{(k)} and \beta_{2i}^{(k)}$, which determine the causality decisions. The regression coefficients are allowed to vary across cross-sectional units (countries). In the DH panel causality test, the Wald statistic is used to assess the homogeneous non-causality (HNC) hypothesis of the absence of causality across all cross-sections. The null hypothesis is defined as:

$$H_0 : \beta_i = 0, i = 1, 2, 3, \ldots, N \tag{12}$$

The alternative hypothesis-heterogeneous non-causality (HENC) hypothesis of the presence of causality for at least one cross-section is expressed thus:

$$H_1 : \beta_i = 0\, i = 1, 2, 3, \ldots, N_1$$
$$\beta_i \neq 0\, i\, N_1 + 1, N_1 + 2, \ldots, N \tag{13}$$

Under the null hypothesis of homogeneous non-causality (HNC), the test statistic is said to be tending sequentially to a typical normal distribution with k degrees of freedom. Individual Wald statistics from Granger non-causality tests are averaged to get the Wald test statistic (Aluko *et al.*, 2021; Lopez and Weber, 2017; Dumitrescu and Hurlin, 2012). The individual Wald statistic is presented as follows:

$$W^{HNC}_{N,T} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T} \tag{14}$$

$W_{i,T}$ denotes the individual Wald statistic for the *ith* cross-section, which is assumed to be identically independent ($i.i.d$) with finite second-order moments.

This study applies a bivariate approach to analyze causality between inflation and poverty reduction. This method does not undermine the importance of other variables in causality. The unique nature of asymmetric causality reveals hidden information through pairing the positive and negative shock components in the variables. This process necessitates bivariate causality in the following ways. **One**, this study uses the panel causality technique of Dumitrescu and Hurlin (2012). This method accounts for cross-sectional dependence and policy variations across countries in the panel framework. The approach is distinctive, and it is developed within bivariate causal analysis (Dumitrescu and Hurlin, 2012; Lopez and Weber, 2017; Saba and Ngepah, 2019; Aluko *et al.*, 2021; Uzar *et al.*, 2023; Olaniyi *et al.*, 2023c; Yıldırım *et al.*, 2023; Olaniyi, 2023). **Two**, asymmetric causality, as developed by Hatemi-j (2012) within bivariate causality, reveals hidden causal inferences among all possible pairs of positive and negative shocks. Asymmetric causality is innovatively developed within the context of pairwise Granger causality to pair negative and positive shock components in variables in turn. Various extant studies have followed this approach (Ikhsan *et al.*, 2022; Hatemi-J and El-Khatib, 2020; Hatemi-J, 2020a; Olaniyi, 2020; Olaniyi and Olayeni, 2020; Hatemi-J *et al.*, 2017, 2019; Hatemi-J and El-Khatib, 2016), but none have verified it in the case of the inflation-poverty causal nexus, which is examined in this study. **Three**, Hacker and Hatemi-J (2012) developed the bootstrap causality test within bivariate causality. Other studies adopted this approach (Hatemi-J and Shamsuddin, 2016; Hatemi-J and Uddin, 2012; Gunduz and Hatemi-J, 2005; Hatemi-J, 2002).

Four, the Dumitrescu and Hurlin (2012) causality technique used in this work was designed to pair variables to determine underlying causality (see Lopez and Weber, 2017; Olaniyi, 2023; Uzar *et al.*, 2023; Olaniyi *et al.*, 2023c; Olaniyi and Odhiambo, 2023a). This approach's causal inference is valid since it compensates for potential simultaneity bias, omitted variable bias and endogeneity concerns. **Five**, aside from the Dumitrescu-Hurlin approach, there are other variants of bootstrap causality that account for policy variations across cross-sectional units in panel causality that are also designed within bivariate analysis (Yıldırım *et al.*, 2023; Hatemi-J, 2022; Gorus *et al.*, 2023; Usman and Bashir, 2022; Aytun and Akin, 2022; Gezer, 2022; Abar, 2022; Juodis *et al.*, 2021; Dumitrescu and Hurlin, 2012; Kar *et al.*, 2011; Emirmahmutoglu and Kose, 2011; Kónya, 2006). **Six**, Hatemi-j (2012) introduced the novel idea of asymmetric causality based on bivariate causality principles. All other known studies on asymmetric causality follow Hatemi-j's (2012) guidelines within bivariate causality by pairing all probable positive and negative shock components in turn (Yilanci *et al.*, 2021; Wang *et al.*, 2021; Olaniyi, 2020; Olaniyi and Olayeni, 2020; Olaniyi and Ologundudu, 2022; Hatemi-J, 2014; Hatemi-J *et al.*, 2016, 2017, 2018, 2019; Hatemi-J and El-Khatib, 2016, 2020; Hatemi-J and Uddin, 2012; Destek, 2016).

4. Discussion of empirical findings

4.1 Preliminary analysis

4.1.1 Descriptive statistics. The synopses of descriptive statistics of the variables in the study are presented in Table 1. The coefficients of variation, computed by dividing the standard deviation by the mean, suggest the two variables exhibit relatively large variations from their respective mean values across cross countries in the panel data set. It is, however, more revealing that the log of per capita consumption as a proxy for poverty (pov) is more stable than the consumer price index, a measure of inflation (inf). The inflation rate appears to be highly volatile. The non-volatility of the poverty indicator might be attributed to logarithmic data transformation which has reduced the variability of the data spread across countries.

	Poverty (pov)	Inflation (inf)
Mean	6.838	7.856
Median	6.732	5.715
Maximum	8.431	72.836
Minimum	5.545	0.016
Standard deviation	0.734	9.002
Coefficient of variation (%)	10.731	114.591
Skewness	0.577	3.193
Kurtosis	2.386	16.813
Jarque-Bera	33.347	4515.959
Probability	0.000	0.000
Observations	468	468

Table 1.
Descriptive statistics

Source(s): Authors' computations

The statistical estimates of skewness reveal that the variables do not follow the symmetric distribution. They do not follow a normal distribution and bell shape. The two variables are positively skewed. Thus, the data distributions are asymmetric. This is equally supported by the coefficient of kurtosis, as the inflation (*inf*) is leptokurtic, while the poverty indicator (*pov*) is platykurtic. None of the variables is mesokurtic. Thus, *inf* and *pov* do not follow a normal distribution, and they are not symmetric but rather portray evidence of asymmetries in their data distributions. Similarly, the Jarque-Bera statistics reveal that the two variables follow the non-normal distribution. All the necessary descriptive statistics suggest asymmetries in the data distributions of all the variables. This suggests the inappropriateness of prevalent symmetric approaches in extant studies which explore the relationship between inflation and poverty. The features of these variables validate the need for an asymmetric approach for determining causality (Olaniyi and Olayeni, 2020; Shahbaz *et al.*, 2017). It implies that the asymmetric approach is more appropriate and valid in examining the causal nexus between poverty and inflation in SSA.

4.1.2 Cross-sectional dependence and slope homogeneity tests. To confirm whether cross-sectional dependence (henceforth CD) exists or not in the series, four cross-sectional dependence tests, namely Pesaran (2021), Pesaran *et al.* (2008), Breusch and Pagan (1980) and Baltagi *et al.* (2012), are employed. The four different tests are examined to ensure the robustness of the findings (Olaniyi *et al.*, 2022; Olaniyi, 2023). The results of the tests are presented in Table 2. The null hypothesis of the independence of countries is strongly rejected. All the CD tests adopted confirm clear evidence of CD among the countries. This reaffirms the argument in the literature that countries are not independent but highly interlinked via globalization and other means (Meo *et al.*, 2020; Hatemi-J and El-Khatib (2020); De Hoyos and Sarafidis, 2006). Thus, the assumption of extant studies touching on the independence of cross-sectional units appears to be unrealistic. This backs up the decision to use an estimator that takes care of cross-sectional interdependence in the evaluation of the

Variables	CD-tests	*p*-value
Inflation (inf)	21.840***	0.000
Poverty (pov)	22.480***	0.000

Table 2.
Cross sectional dependence result test

Note(s): The symbol *** refers to the rejection of null hypothesis of CD at 1% level of significance
Source(s): Authors' computations

asymmetric causal link between inflation and poverty. It implies that the data series experience CD over the study period.

The results indicate clear evidence of common shocks, spatial dependence and degree of integration among countries in SSA due to financial integration and contagion which emanate from shocks that are transmitted from one country to others (Aluko *et al.*, 2021). This result has faulted the first-generation panel unit root tests and supports the adoption of second-generation unit root tests which produce robust and appropriate inferences in the presence of CD. Furthermore, as a sequel to the presence of CD, we follow the study of Pesaran and Yamagata (2008) to examine the slope homogeneity test across cross-sectional units. The test is a standardized form of Swamy's (1970) test. The slope homogeneity test assumes that error terms are independently distributed, but it accommodates heterogeneous variance (Bersvendsen and Ditzen, 2021). The results, as presented in Table 3, show that heterogeneity of slopes exists across the countries in the panel model. Thus, the null hypothesis of homogenous slopes is rejected. The slopes tend to vary across countries in the panel analysis. The result of CD and slope homogeneity tests have validated and justified the adoption of DH panel causality, which is robust to take care of CD and heterogeneity in the panel model.

4.1.3 Panel unit root tests. The second-generation panel unit root tests that account for CD are carefully used in this work to follow the condition of the DH panel Granger non-causality approach that the variables must be stationary. The presence of CD in the series makes it a matter of necessity to adopt second-generation panel unit root tests that produce valid inferences when the presence of CD is confirmed (Zoaka *et al.*, 2022). Unlike the prevalent first-generation panel unit root approaches which fail in the occurrence of CD, following the work of Pesaran (2007), this study adopts more robust cross-sectionally augmented IPS (CIPS) and cross-sectionally augmented DF (CADF) to explore the stationarity properties of per capita consumption expenditure and inflation rate. This is done to prevent misleading inferences about the affirmation of CD in the series. The results of CIPS and CADF are presented in Table 4. The results reveal that both variables are integrated of order zero. It implies that the variables attain stationarity at a level without passing through the process of difference. This

	$\tilde{\Delta}$	$\tilde{\Delta}$_adj
Poverty = f(inflation)	1.980** (0.048)	2.100** (0.036)

Note(s): The symbol ** represents rejection of null hypothesis at 1% level of significance
Probability values are in brackets ( )
Source(s): Authors' computations

Table 3.
Pesaran and Yamagata's (2008) slope homogeneity test

Variables	Level Constant and trend	
	CIPS	CADF
Inflation (inf)	−3.949*** (0.000)	−3.079*** (0.002)
Poverty (pov)	−3.476*** (0.000)	−3.257*** (0.000)
	constant	
Inflation (inf)	−4.083*** (0.000)	−2.804*** (0.000)
Poverty (pov)	−2.819*** (0.000)	−2.803*** (0.000)

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% levels of significance, respectively
Probability values are in bracket ( )
Source(s): Authors' computations

Table 4.
Second-generation panel unit root tests

further justifies the adoption of the DH causality procedure, which necessitates the stationarity of variables. Meanwhile, the result of the cointegration test is not reported because the DH panel causality test does not require it.

4.2 Presentation and discussion of empirical findings

This aspect addresses the main discourse of the paper, which is to examine asymmetric structures in the causal nexus between poverty and inflation in selected SSA countries. To ensure the robustness of the results, we begin the empirical analyses with symmetric and linear causality between inflation and poverty. Subsequently, asymmetric causality is rigorously explored through econometric analysis. The implications of the findings are well expatiated. Consistent with the explanation of Lopez and Weber (2017), optimal lag length is determined endogenously in each case of both symmetric and asymmetric causality using Bayesian information criteria (BIC). Also, to align with the explanations of Lopez and Weber (2017), 1,000 bootstrapped iterations are conducted to properly account for cross-sectional dependence in the dataset.

4.2.1 Linear and non-homogenous causality. The synopses of the result of bootstrapped symmetric DH panel causality are presented in Table 5. The research outputs of panel analysis indicate that there is a symmetric bidirectional causality between inflation (inf) to poverty level (pov). The economic implication suggests that the inflation rate in SSA can Granger-cause either an increase or a decline in poverty reduction. This implies that inflation in SSA is a casual and determining factor that could trigger a change in the level of poverty in SSA. This result of symmetric causality may have supported the argument in the previous studies that inflation is the "cruelest tax" on the poor (Easterly and Fischer, 2001; Cardoso, 1992). Stakeholders and policymakers must keep closely monitoring the inflationary trends to curb their adverse causal effect on the level of poverty in SSA countries. The causality from poverty reduction to inflation suggests that a reduction in poverty could trigger an increase in inflation in Africa. The implication of the findings indicates that poverty reduction can spur a rise in aggregate demand that does not go along with a corresponding increase in aggregate supply and productivity. The gap between aggregate demand and supply created

Cross sections	Null hypothesis Inflation (inf) does not cause poverty (pov)				Null hypothesis Poverty (pov) does not cause inflation (inf)			
	Wald stat	*p*-value	lag	Decision	Wald stat	*p*-value	lag	Decision
Panel	*31.992***	*0.048*	*11*	*Reject*	3.463***	*0.004*	*1*	*Reject*
Botswana	20.561	0.254	11	Accept	4.893**	0.034	1	Reject
Burkina Faso	26.856	0.167	11	Accept	*3.137**	0.085	1	Reject
Cameroon	6.095	0.808	11	Accept	0.705	0.407	1	Accept
Congo, Rep	67.274**	0.029	11	Reject	2.452	0.126	1	Accept
Gabon	29.133	0.146	11	Accept	2.216	0.146	1	Accept
Kenya	34.260	0.110	11	Accept	0.231	0.634	1	Accept
Madagascar	93.951**	0.014	11	Reject	1.365	0.250	1	Accept
Mauritania	18.138	0.303	11	Accept	8.026***	0.008	1	Reject
Nigeria	31.83	0.125	11	Accept	1.288	0.264	1	Accept
Senegal	8.471	0.668	11	Accept	1.606	0.213	1	Accept
South Africa	20.142	0.262	11	Accept	0.047	0.830	1	Accept
Togo	27.194	0.164	11	Accept	15.585***	0.000	1	Reject

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% level of significance, respectively. Also, computation of *p*-values is based on 1,000 bootstrap replications. The lag length criteria is endogenously determined based on Bayesian information criteria (BIC)
Source(s): Authors' computations

Table 5.
Panel symmetric and heterogeneous causality between inflation and poverty *(Infl and pov)*

by poverty reduction has potency of causing inflationary spiral which triggers continuous rise in prices. These research outcomes indicate the need for African countries to design poverty-mitigating approaches, policies and initiatives that have the potency to spur an increase in productivity and aggregate supply in African countries. These findings are consistent with the research outcomes of earlier works such as Danlami *et al.* (2020) and Siyan *et al.* (2016) which established a bidirectional causality between inflation and poverty. Interestingly, there is no evidence of bidirectional symmetric causality between inflation and poverty in the cases of country-specific analysis. This validates the earlier argument that the imposition of average panel causality findings on all the countries in the panel analysis might be too restrictive and less informative, as it cannot address the country-specific idiosyncrasies and peculiarities in the inflation-poverty nexus. Thus, the inferred policy dimensions and implications from the panel causality findings might be inappropriate for specific countries in the panel data set.

Similarly, the results of country-specific symmetric causal flow from inflation to poverty show that it is only established in the cases of the Congo Republic and Madagascar. This finding aligns with that of Gillani *et al.* (2009) and Cardoso (1992), which establish that inflation is causal driver of poverty. This study finds a one-way causality from poverty to inflation in the country-specific cases of Botswana, Burkina Faso, Congo Republic, Mauritania and Togo. This result implies that changes (increases or decreases) in the poverty level in these countries could spur an upward or downward trend in the inflation rate through aggregate demand and price level channels if aggregate supply and productivity levels do not respond appropriately. This research outcome is consistent with the study of Nwadike *et al.* (2020). The third dimension of country-specific causal analysis between inflation and poverty reveals no symmetric causal explanation in the case of Cameroon, Gabon, Kenya, Nigeria, Senegal and South Africa. The findings indicate that these six countries should strategically plan, design and execute policies to maintain macroeconomic stability and reduce poverty without causally linking inflation and poverty to each other. The findings on symmetric causality between inflation and poverty vary across the countries in the panel analysis. This position reinforces the preceding assertion that a restrictive and homogeneous policy may be unsuitable for explaining a country's specific characteristics and issues in the inflation-poverty causal nexus.

Meanwhile, all these extant studies assumed symmetric causal nexus between inflation and poverty, which did not consider how shocks in each variable cause shocks in the other. This symmetric causal inference in the inflation-poverty nexus does not give a decisive nature of causality either negative or positive. Thus, this study maintains a step ahead of previous studies by incorporating asymmetric and nonlinear into the causality between poverty and inflation.

4.2.2 Asymmetric and nonlinear causality tests. The results of all the possible pairs of the asymmetric causality tests are presented in Tables 6–9. Table 6 provides the concise results of asymmetric causal links between the pair of positive shock components in the poverty indicator and inflation in selected SSA countries. The findings reveal several dimensions of the inflation-poverty causal nexus to be robustly asymmetric. The heterogeneous panel causality affirms evidence of a unidirectional asymmetric causality from positive shock in inflation (inf^{+}), an increase in the inflation rate, to positive shocks in poverty (pov^{+}), an increase in per capita consumption, in the panel asymmetric causality analysis. The result implies that a rise in inflation causes a rise in poverty reduction in the panel analysis of the selected SSA countries. These findings are also reported in the country-specific causal analysis of Burkina Faso, Congo Republic, Gabon, Madagascar, Nigeria, Senegal and Togo, which reveal that the asymmetric causality flows from positive shock in inflation to positive shock in poverty. This is consistent with the findings of Cutler *et al.* (1991) who find that an

Cross sections	Null hypothesis							
	Inf^{+} does not cause pov^{+}				Pov^{+} does not cause inf^{+}			
	Wald stat	*p*-value	lag	Decision	Wald stat	*p*-value	lag	Decision
Panel	*55.695****	*0.006*	*11*	*Reject*	*3.512*	*0.220*	*1*	*Accept*
Botswana	28.506	0.152	11	Accept	3.446*	0.072	1	Reject
Burkina Faso	82.095**	0.019	11	Reject	2.423	0.129	1	Accept
Cameroon	9.905	0.591	11	Accept	6.320**	0.017	1	Reject
Congo, Rep	104.645**	0.011	11	Reject	0.823	0.370	1	Accept
Gabon	40.183*	0.082	11	Reject	2.954*	0.094	1	Reject
Kenya	21.315	0.241	11	Accept	1.563	0.220	1	Accept
Madagascar	148.935***	0.005	11	Reject	1.736	0.196	1	Accept
Mauritania	19.285	0.278	11	Accept	4.931**	0.033	1	Reject
Nigeria	94.206**	0.014	11	Reject	0.006	0.938	1	Accept
Senegal	43.404*	0.071	11	Reject	0.833	0.368	1	Accept
South Africa	22.435	0.223	11	Accept	12.755***	0.001	1	Reject
Togo	53.429**	0.047	11	Reject	4.354**	0.044	1	Reject

Table 6.
Panel asymmetric causality *(Inf^{+} and pov^{+})*

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% level of significance, respectively. Also, computation of *p*-values are based on 1,000 bootstrap replications. The lag length criteria is endogenously determined based on Bayesian information criteria (BIC)
Source(s): Authors' computations

Cross sections	Null hypothesis							
	Inf^{-} does not cause pov^{-}				Pov^{-} does not cause inf^{-}			
	Wald stat	*p*-value	lag	Decision	Wald stat	*p*-value	lag	Decision
Panel	*63.161****	*0.008*	*11*	*Reject*	*11.669***	*0.018*	*2*	*Reject*
Botswana	16.081	0.355	11	Accept	6.191*	0.059	2	Reject
Burkina Faso	14.832	0.392	11	Accept	25.526***	0.000	2	Reject
Cameroon	117.357***	0.009	11	Reject	7.211**	0.039	2	Reject
Congo, Rep	375.937***	0.000	11	Reject	3.299	0.208	2	Accept
Gabon	54.711**	0.045	11	Reject	4.791	0.107	2	Accept
Kenya	3.575	0.944	11	Accept	10.356***	0.011	2	Reject
Madagascar	64.885**	0.031	11	Reject	2.861	0.254	2	Accept
Mauritania	18.145	0.303	11	Accept	6.385**	0.054	2	Reject
Nigeria	8.988	0.639	11	Accept	2.548	0.294	2	Accept
Senegal	15.811	0.362	11	Accept	45.688***	0.000	2	Reject
South Africa	54.350**	0.045	11	Reject	3.972	0.154	2	Accept
Togo	13.263	0.445	11	Accept	21.204***	0.000	2	Reject

Table 7.
Panel asymmetric causality *(Inf^{-} and pov^{-})*

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% level of significance, respectively. Also, computation of *p*-values are based on 1,000 bootstrap replications. The lag length criteria is endogenously determined based on Bayesian information criteria (BIC)
Source(s): Authors' computations

increase in inflation reduces the poverty rate. This finding corroborates the notion that inflation is not the cruelest tax as suggested by Easterly and Fischer (2001). It also supports Romer and Romer's (1998) argument that higher inflation will produce more investment possibilities and job chances, which will lead to lower unemployment, and increase income, which will assist the poor to meet their basic needs. It indicates that inflation does not pose a significant threat to poverty reduction (Olaniyi *et al.*, 2023b), but rather stimulates it. This study contradicts the findings of Loewald and Makrelov (2020), who find that rising inflation aggravates the poor's economic situation in South Africa.

In contrast, an increase in inflation rate does not spur a poverty reduction in the case of Botswana, Cameroon, Kenya, Mauritania and South Africa. This indicates that average

Cross sections	Null hypothesis							
	Inf^{-} does not cause pov^{+}				Pov^{+} does not cause inf^{-}			
	Wald stat	*p*-value	lag	Decision	Wald stat	*p*-value	lag	Decision
Panel	*40.251***	*0.046*	*11*	*Reject*	*2.194*	*0.683*	*1*	*Accept*
Botswana	8.088	0.689	11	Accept	5.554**	0.024	1	Reject
Burkina faso	16.022	0.356	11	Accept	0.881	0.354	1	Accept
Cameroon	15.945	0.359	11	Accept	5.626**	0.023	1	Reject
Congo, Rep.	114.648***	0.009	11	Reject	2.407	0.130	1	Accept
Gabon	16.131	0.353	11	Accept	0.952	0.336	1	Accept
Kenya	23.898	0.202	11	Accept	0.007	0.932	1	Accept
Madagascar	62.120**	0.034	11	Reject	0.036	0.850	1	Accept
Mauritania	29.088	0.147	11	Accept	9.755***	0.004	1	Reject
Nigeria	36.150*	0.099	11	Reject	0.003	0.956	1	Accept
Senegal	61.639**	0.035	11	Reject	0.163	0.689	1	Accept
South Africa	32.833	0.119	11	Accept	0.001	0.975	1	Accept
Togo	66.455**	0.030	11	Reject	0.948	0.337	1	Accept

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% level of significance, respectively. Also, computation of *p*-values are based on 1,000 bootstrap replications. The lag length criteria is endogenously determined based on Bayesian information criteria (BIC)
Source(s): Authors' computations

Table 8.
Panel asymmetric causality *(Inf^{-} and pov^{+})*

Cross sections	Null hypothesis							
	Inf^{+} does not cause pov^{-}				Pov^{-} does not cause inf^{+}			
	Wald stat	*p*-value	lag	Decision	Wald stat	*p*-value	lag	Decision
Panel	*1.501*	*0.789*	*1*	*Accept*	*5.387***	*0.030*	*1*	*Reject*
Botswana	5.290**	0.028	1	Reject	2.951*	0.095	1	Reject
Burkina Faso	0.727	0.400	1	Accept	1.459	0.235	1	Accept
Cameroon	2.773	0.105	1	Accept	7.272**	0.011	1	Reject
Congo, Rep.	3.136*	0.085	1	Reject	2.974*	0.093	1	Reject
Gabon	1.254	0.270	1	Accept	4.021**	0.053	1	Reject
Kenya	0.653	0.425	1	Accept	1.672	0.204	1	Accept
Madagascar	0.428	0.517	1	Accept	4.894**	0.034	1	Reject
Mauritania	0.095	0.760	1	Accept	7.761***	0.009	1	Reject
Nigeria	0.409	0.527	1	Accept	0.466	0.499	1	Accept
Senegal	0.065	0.800	1	Accept	2.222	0.145	1	Accept
South Africa	2.735	0.107	1	Accept	0.761	0.389	1	Accept
Togo	0.444	0.510	1	Accept	28.185***	0.000	1	Reject

Note(s): The symbols ***, ** and * represent 1%, 5 and 10% level of significance, respectively. Also, computation of *p*-values are based on 1,000 bootstrap replications. The lag length criteria is endogenously determined based on Bayesian information criteria (BIC)
Source(s): Authors' computations

Table 9.
Panel asymmetric causality *(Inf^{+} and pov^{-})*

policy descriptions and recommendations from the panel analysis could not apply to all countries as some countries reported appreciable levels of exceptions. Thus, an inflationary spiral does have not the potency to spur poverty reduction in the same manner in these five countries. This appears to have invalidated the outcomes of the extant studies which implicitly ignore the importance of cross-sectional dependence in the inflation-poverty nexus. The reserve causality from positive shock in poverty indicator (pov^{+}), rises in consumption per capita, to positive shock in inflation (inf^{+}),

Increases in inflation is nonexistent in the heterogeneous panel causality. The results are equally valid for countries such as Burkina Faso, the Congo Republic, Kenya, Madagascar,

Nigeria and Senegal. This means that a poverty reduction does not cause an increase in aggregate demand that could spur an inflationary spiral. Meanwhile, the results appear different in the country-specific cases of Botswana, Cameroon, Gabon, Mauritania, South Africa and Togo, as an increase in consumption per capita causes a rise in inflation. The implication is that poverty reduction empowers the poor to demand more goods and services, which culminates in a persistent rise in price levels. This might have been attributed to a situation where poverty reduction does not translate to an increase in productivity and aggregate supply. This puts extra pressure on aggregate demand in the economy. It should be noted that bidirectional causality between positive shock components of inflation and poverty reduction is reported in Gabon and Togo. Thus, macroeconomic policy dimensions that explain and address the two-way relationship between an increase in inflation and a rise in consumption per capita – poverty reduction – should be prioritized in the two countries. A rising inflation rate could catalyze a reduction in poverty by stimulating investment prospects, generating employment opportunities and providing more income for poor people. On the other hand, poverty reduction could also fuel inflation by increasing aggregate demand. This is if it does not spur productivity and aggregate supply. Hence, the two-way relationship is sensitive.

Similarly, following the result in Table 7, the panel causality and that of Cameroon's country-specific case reveal evidence of bidirectional causality between a fall in the inflation rate (inf^-) and an increase in the poverty level (pov^-). These results further support the asymmetric structure in the causality. On one side of the coin, it implies that a fall in the inflation rate (inf^-) causes an increase in the poverty level (pov^-). These research outcomes reveal that a fall in inflation causes a rise in the poverty level in SSA. The implication is that a drop in inflation might have caused a corresponding dip in the investment climate which subsequently contracts economic activities and reduces employment opportunities for the poor. It suggests that a fall in inflation is not always beneficial to the poor in SSA, as its multiplier effect reveals that it triggers a rise in poverty. This research outcome is also reported in the country-specific cases of Congo Republic, Gabon, Madagascar and South Africa, while a fall in inflation is not a spurring causal input to catalyze a poverty reduction in Botswana, Burkina Faso, Kenya, Mauritania, Nigeria, Senegal and Togo. From the policy dimensions, it should be stressed that caution must be exercised as a fall in the inflation rate could hurt the well-being of the poor in some countries, while it has no causal effect on the poverty level in some other countries in SSA. Country-specific peculiarities should be given adequate attention, as the generalization assumption could be misleading and send some countries on the wrong path in terms of appropriate macroeconomic policies to address the problem of severe and extreme poverty in SSA.

On the other side, there is a causality from an increase in poverty (pov^-) to a fall in inflation (inf^-). The findings reveal that a surge in poverty, a fall in consumption per capita, tends to cause aggregate demand to fall because the number of impoverished people is on the increase. This low demand tends to cause excess supply which could bring the price levels down in the economy. Similarly, these explanations fit in to capture the unidirectional causal inference detected from an increase in poverty to a fall in inflation in the country-specific cases of Botswana, Burkina Faso, Kenya, Mauritania, Senegal and Togo. It should be stressed that there exists no evidence of causality between falls in inflation (inf^-), and increase in poverty (pov^-) is detected in the case of Nigeria.

Furthermore, as reported in Table 8, the research outputs indicate a unidirectional asymmetric causality from the negative shock of inflation (inf^-) to the positive shock of poverty (pov^+) in the panel and country-specific analysis of the Congo Republic, Madagascar, Senegal and Togo. This result suggests that a fall in the inflation rate tends to cause an increase in per capita consumption, which signals a poverty reduction. It is, however, observed that evidence of weak asymmetric causality is confirmed in Nigeria, while no causal

flow from negative shock in inflation to positive shock in poverty is established in the cases of Botswana, Burkina Faso, Cameroon, Gabon, Kenya, Mauritania and South Africa. In the plain language of economics, it signals that a fall in the inflation rate causes a reduction in the poverty level in Botswana, Burkina Faso, Cameroon, Gabon, Kenya, Mauritania and South Africa. This implies that keeping inflation at a moderate level could be a useful tool in reducing the severity of poverty in these seven countries.

Thus, stakeholders and policymakers in these countries are advised to introduce macroeconomic policies that will keep inflation at a moderate level to dwindle poverty. A continuous decline in the general price level has a favorable effect on the poor. Meanwhile, no causal flow is reported from the negative shocks' component of inflation to the positive shocks' component of poverty in panel analysis of selected SSA countries and country-specific cases of Botswana, Burkina Faso, Cameroon, Gabon, Kenya, Mauritania and South Africa. The causality from poverty reduction, an increase in per capita consumption, to a fall in inflation equally produces some interesting findings. The panel causality estimates and country-specific cases of Burkina Faso, the Congo Republic, Gabon, Kenya, Madagascar, Nigeria, Senegal, South Africa and Togo show no causality from a reduction in poverty to a decline in inflation. These findings imply that poverty reduction that culminates in the poor's economic empowerment does not spur inflation decline. Meanwhile, this causal inference is established in the country-specific cases of Botswana, Cameroon and Mauritania. A reduction in poverty triggers a fall in inflation. The economic implication is that the poor's economic empowerment that ensues from poverty reduction is not a burden on aggregate demand. This indicates that a rise in the poor's purchasing power, which is a by-product of poverty reduction, might have been accompanied by an increase in productivity and aggregate supply in the economy.

The results in Table 9 reveal that asymmetric causal inference is not detected from the positive component of inflation (inf^{+}) to a negative component of poverty (pov^{-}) in the panel analysis. Meanwhile, there is evidence of asymmetric causality from a rise in inflation to a decline in consumption per capita in the case of Botswana and the Congo Republic. The evidence of the Congo Republic is somewhat weak. The result signals that a rise in the inflation rate in Botswana and the Congo Republic causes a deterioration in the welfare of the poor by depriving them of the opportunities to meet their basic needs. It also suggests that a rise in inflation reduces the purchasing power of the poor in Botswana and the Congo Republic. Hence, inflation impoverishes and makes the poor worse off. The stakeholders and policymakers in Botswana and Congo Republic must utilize all the necessary macroeconomic policies (for instance monetary and fiscal policies) to keep the inflation rate at a moderate level to help the poor in the countries. This backs up the notion that posits inflation is the cruelest tax that impoverishes the poor (Cardoso, 1992). However, an increase in the inflation rate appears not to have an obvious causal impact to deepen and escalate the severity of poverty in the country-specific cases of Burkina Faso, Cameroon, Gabon, Kenya, Madagascar, Mauritania, Nigeria, Senegal, South Africa and Togo. It should be well emphasized from the symmetric and asymmetric perspectives that inflation has no causal impact on poverty reduction in both Kenya and Mauritania. It means that inflation is not a factor that drives and causes either an increase or decrease in poverty in the two countries. The high incidence of poverty in the two countries could not be attributed to inflationary shocks (positive or negative).

As reported in Table 9, the increase in poverty (cumulative falls in poverty) causes an increase in the inflation rate (cumulative upward trends in inflation) in the panel and specific cases of Botswana, Cameroon, The Congo Republic, Gabon, Madagascar, Mauritania and Togo. These findings suggest there are exogenous forces that seem to help the poor increase aggregate demand without contributing meaningfully to increasing aggregate supply and

productivity. It might also reveal some complexities in the inflation-poverty nexus. It could indicate that there were financial provisions and packages designed to improve the welfare of the poor but did not get to them due to corruption, opportunism and rent-seeking, which are prevalent in African countries. Since these financial resources were released into the economy without ameliorating poverty's severity, there is a high likelihood that these situations will culminate in higher inflation. Welfare packages and provisions for the poor need to be properly monitored and scrutinized to prune them of exploitative tendencies and sharp practices. The inability to do this will divert the resources and thwart the poverty reduction process in SSA. Meanwhile, causality does not exist in the cases of Burkina Faso, Kenya, Nigeria, Senegal and South Africa. Consistent with the explanations provided earlier, this confirms the case of bidirectional causality between cumulative increases in poverty and inflation rates in Botswana and the Congo Republic.

5. Conclusion

The inflation-poverty nexus remains one of the most saturated areas in the economics literature. However, the discourse on it is ever relevant as inflation has continued to be described as the cruelest tax on the poor because it weakens and erodes the purchasing power of the poor. The debates on the nexus have intensely continued to emerge as poverty remains a socioeconomic problem while double-digit inflation rates in developing countries have worsened. Although there have been several studies on the inflation-poverty nexus, most of them have implicitly assumed that there is no asymmetric structure in the inflation-poverty causal nexus. This does not accord well with realities, and it has been faulted in the recent development in econometrics as the symmetric approaches provide limited information on the causal links between various pairs of shocks generated by inflation and poverty indicator. Premised on this obvious gap in the extant literature, this study pioneer testing asymmetric causality between inflation and poverty within the framework of a panel causality test developed by Dumitrescu and Hurlin (2012) which accounts for cross-sectional dependence and heterogeneity following the path of Monte Carlo bootstrap simulation that generates robust critical values. Data on selected SSA countries from 1981 to 2019 are chosen as the case study because the region remains the most impoverished in the world, and most of the countries in SSA have continued to cope with the severe problem of double-digit inflation rates.

Unlike existing research, we confirm strong evidence in support of cross-sectional dependence (CD) and heterogeneity in SSA. This finding validates the adoption of a causality approach that takes care of CD and policy variations across countries in the panel dataset. A bidirectional symmetric causal nexus is detected between inflation and poverty in the panel analysis. Interestingly, there is no evidence of symmetric bidirectional causality in the country-specific analysis. A unidirectional symmetric causality from inflation to poverty is seen in the Congo Republic and Madagascar. It means that a rise in inflation could trigger an increase in investment and employment opportunities. This will benefit the poor and subsequently lead to poverty reduction. Still on the symmetric causality front, the findings reveal a reverse one-way linear causal inference from poverty to inflation in the country-specific analysis of Botswana, Burkina Faso, Mauritania and Togo. It suggests that poverty reduction increases aggregate demand, while aggregate supply and productivity remain unchanged. Hence, there is an increase in inflation. On asymmetric causality, the research outputs reveal different levels of asymmetries in the causality between inflation and poverty in the selected SSA countries. The findings detect asymmetric causality from a positive inflationary shock to a positive shock in the poverty indicator in Burkina Faso, the Congo Republic, Gabon, Madagascar, Nigeria, Senegal and Togo. This suggests that a rise in inflation could reduce poverty through an increase in investment and employment

opportunities. This would improve life for the poor in these seven countries. Evidence of reverse asymmetric causality is equally found from poverty reduction to an increase in inflation in the cases of Botswana, Cameroon, Gabon, Mauritania, South Africa and Togo. Several dimensions of asymmetric causality are evident in all probable pairings of negative and positive components of inflation and poverty. Diverse asymmetric causal structures are robust and persistent in all results. Asymmetric causality findings also vary across countries in the panel framework. These research outcomes demonstrate that existing studies that assumed no asymmetric structures in the causality between inflation and poverty might have overestimated their models with limited or restricted information and policy implications.

This study contributes to the existing debates on the poverty-inflation causal nexus literature by introducing asymmetric structure, cross-sectional dependence, bootstrap simulation and heterogeneous policy across countries, which have been neglected in previous studies. Based on the outcomes of this study, general and specific recommendations are made. SSA countries should take advantage of investment and employment opportunities that follow any rise in inflation as it tends to benefit the poor in terms of poverty reduction. Also, it should be noted that countries in SSA tend to enjoy a reduction in poverty levels if the rates of inflation are reduced to moderate levels. Stakeholders, policymakers and entrepreneurs are encouraged to consider asymmetric structure in the trends of inflation rate before embarking on policy formulations and implementations to reduce the severity of poverty in SSA countries. This is advised as the failure to consider asymmetric structure might undermine the effectiveness of the policies. It is obvious from the findings that there are policy variations in the inflation-poverty nexus across the selected SSA countries. As it is evident from the findings, country-specific peculiarities and matters should be cautiously considered in the choice of policy and initiatives on the inflation-poverty nexus. The prevalent homogeneous policies across countries suggested in the existing literature to address issues surrounding inflation-poverty nexus are inadequate. Welfare packages and financial provisions designed to empower the poor in Africa should be properly monitored and scrutinized. This will ensure that they are expended on things and schemes that will enable the poor to contribute to the nations' productivity and aggregate supply without putting extra burden on aggregate demand that could create demand deficit and fuel inflationary spiral.

6. Research limitations and future research recommendations

There are, however, obvious areas to improve on in the subsequent research efforts by other scholars. Efforts should be made to consider as many countries as possible in SSA in the subsequent studies. Although all the sub-regions of SSA are well represented in this study, the policy relevance is restricted to SSA countries. Thus, other scholars are enjoined to conduct similar studies for other continents to enrich and further validate the content of the empirical findings. Other scholars should endeavor to enrich these findings by undertaking similar works for other regions. Future research endeavors should consider other measures of poverty. Meanwhile, in this analysis, we are limited to using consumption per capita due to insufficient data availability and a lack of apparent asymmetric structures in the data of some variables. The identified limitations do not diminish the importance of the originality, novelty, study's scientific findings and policy implications. We raise them to enrich and supplement study research contents and innovative ideas.

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Corresponding author
Clement Olalekan Olaniyi can be contacted at: olanico@unisa.ac.za