Inflation Sensitive Analysis: using Sub-Sahara Africa data in poverty projection

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I. Introduction

The Ukraine war impacts the global economy through declining supplies of food, oil, and precious metals from Ukraine and Russia. Prices of wheat, corns, fertilizers, oil, and some precious metals have been rising rapidly since the outbreak of the war. Such price increases and declining supplies of key food and non-food products have already impacted many countries in the sub-Saharan region. According to the new Macro Poverty Outlooks (MPOs), the impact is expected to rise in the next few years. This note describes a methodology to project the impact of inflationary pressures due to the Ukraine war on poverty in the near future, between 2022 and 2024, using data available in MPOs by modifying an existing poverty projection method in MPO.

The approach of this note has two main features. First, it uses projections of GDP growth rates and overall inflation rates provided for MPOs of the Spring Meeting 2022. The World Bank prepares the projections of some key statistics in the national accounts, including GDP growth projections for 185 countries, using the World Bank's growth projection model, called MFMOD. For the MPOs of the Spring meeting 2022, the MFMOD incorporated the impact of the Ukraine war and the resulting high inflationary pressures. The MPOs also include projections of inflation rates from 2022 to 2024 based on information in and outside a country. The methodology proposed in this note uses these growth and inflation projections.

Second, it modifies a distribution-neutral approach, one of the MPO poverty projection methods.[1] The distribution-neutral approach assumes that all households face the same inflation rate. This is a strong assumption. Microdata provided by the World Bank's poverty economists suggests that inflation rates can differ significantly between the rich and the poor. In some countries, food inflation grows significantly faster than non-food inflation. If so, the poor usually face a higher inflation rate than the rich or non-poor because the budget share of food consumption among the poor tends to be bigger than the rich. The methodology described in this note estimates an inflation rate for each quintile of the household expenditure distribution separately. It then estimates poverty rates by deflating the real household expenditures with these quintile-specific inflation rates.

II. Description of the inflation-sensitive poverty projection

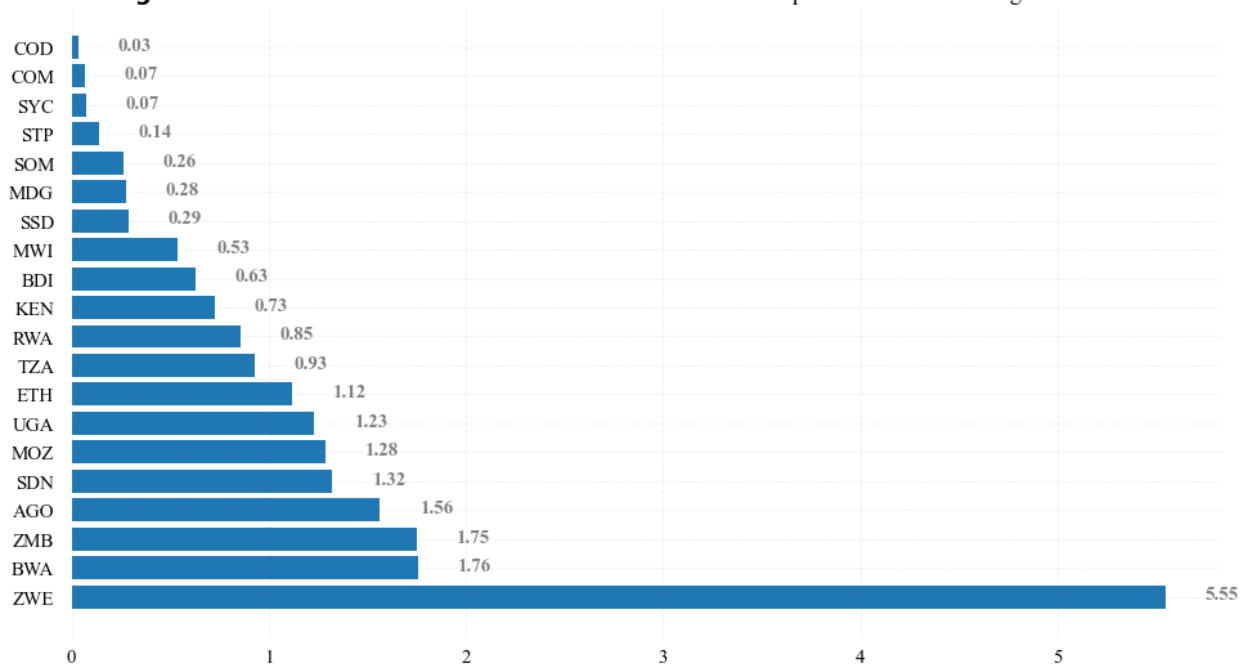
To describe the inflation-sensitive method, we begin with the distribution-neutral poverty projection approach. This approach uses household expenditures per capita in the latest household survey. It inflates the household expenditure data using the growth rate from the latest survey year to a year of interest, say 2022. The growth rate is calculated by compounding each year's real GDP per capita growth rate from the latest survey year to 2022. The growth rate is usually discounted to obtain the household expenditure growth rate because real GDP per capita tends to grow faster than household expenditure per capita. The discount rate is called a "pass-through rate," which is usually less than 1. MPO's distribution neutral approach allows three options of pass-through rate: 0.7, 0.85, and 1. The country poverty economists choose the most appropriate pass-through rate considering the past data and the latest economic environment of the country. The resulting growth rate is used to inflate household expenditure per capita of the latest household survey. The inflated household expenditures per capita are compared with an international poverty line, like $1.9 per day per capita, to estimate the proportion of people below the poverty line.

A modification of the distribution neutral poverty projection method

[1] MPO has three groups of poverty projection methods – (i) the distribution neutral approach; (ii) growth-elasticity approach; and (iii) a micro-simulation or computational general equilibrium approach. The approach described in this note is developed on the distribution neutral approach.

However, the impact of inflation can differ significantly between the poor and the rich because their consumption patterns differ. Figure 1 shows the percentage point differences in the inflation rate between the poorest 20 percent and the richest 20 percent if food inflation grows twice faster than non-food inflation.

Figure1. Possible difference in inflation rate between btm 20% and top 20% if food inflation grows twice faster



Source: Authors' calculations using the database of MPOs for the 2022 Spring Meeting

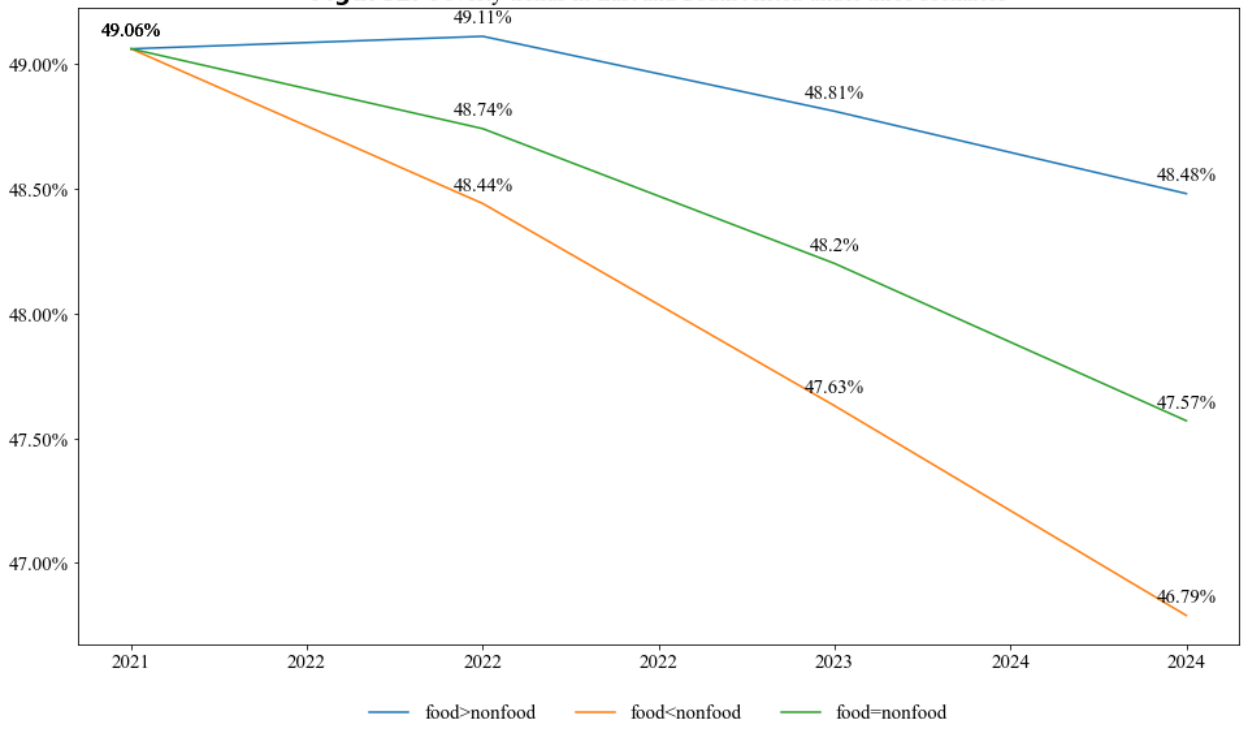
To capture different inflationary pressures by income group, we construct quintile-specific inflation rates for a country by calculating an average of food and non-food inflation rates weighted by the food budget share for each quintile. The exact formula for estimating poverty rates is available in Annex (equation (7)).

To estimate the quintile-specific inflation rates, we need food and non-food inflation rates, but MPOs provide only overall inflation projections. Instead of preparing food and non-food inflation rates, we prepare the following three scenarios: (i) food inflation grows twice faster than non-food inflation, (ii) non-food inflation grows twice faster than non-food inflation, and (iii) food and non-food inflations grow at the same rate.

There are a few notes. First, MPO's distribution-neutral approach produces poverty projections under scenario (iii) since if food and non-food inflation rates are the same, all households face the same inflation rate. Second, we selected scenarios (i) and (ii) because most countries' food and non-food inflation rates in 2020 and 2021 belong to this range. Third, when we estimate the food and non-food inflation rates for scenarios (i) and (ii), we ensure that the weighted average of these rates equals the MPOs' overall inflation rates.

Figure 2 shows the results of these three scenarios if the inflation-sensitive analysis is applied to the East and Southern Africa region. The poverty trend under scenario (iii) is identical to the poverty projections reported in MPOs of the 2022 Spring Meeting. In scenario (i) – if food inflation grows twice faster than non-food inflation – the regional poverty rate in 2024 will be 1.1 percentage points higher than the MPO poverty projections. In scenario (ii) – if non-food inflation grows twice faster than food inflation – the regional poverty rate in 2024 will be 0.9 percentage points lower than the MPO poverty projections.

Figure2. Poverty trends in East and South Africa under three scenarios



Source: Authors' calculations using the database of MPOs for the 2022 Spring Meeting

III. Fine-tuning of poverty projections under scenario (iii)

The main objective of this analysis is to show the impact of the inflationary pressures due to the Ukraine war by comparing the standard MPO poverty projections, which ignore differences in inflation by income groups, with those projected by quintile-specific inflation rates. But to do this analysis, we face two major challenges. The inflation-sensitive poverty projections can be made if the MPO poverty projections are made with the distribution-neutral approach. But, if the MPO poverty projections are made with other approaches, there is no direct way to introduce the quintile-specific inflation rates. Also, even if the MPO poverty projections use the distribution-neutral approach, if we use a different pass-through rate, our poverty projections will be different from those reported in MPOs.

To overcome these issues, we adopt the following adjustments.

If MPO's poverty projections of a country use the distribution neutral approach, we use the same pass-through rate as the MPO projections. In this way, we can replicate the country's MPO projection. Then, we modify the distribution-neutral approach by introducing the quintile-specific inflation rates when projecting poverty rates under scenarios (i) and (ii).

Suppose MPO's poverty projection of a country use other poverty projection approaches than the distribution neutral approach. In that case, we search for pass-through rates with which the distribution-neutral approach can project the same poverty rates as MPO's poverty projections of the country. Using the pass-through rates and the distribution neutral approach, we prepare poverty projections under scenario (iii), which will be identical to poverty projections reported by MPOs, by construction. We then modify the distribution-neutral approach by introducing the quintile-specific inflation rates when projecting poverty rates under scenarios (i) and (ii).

After this adjustment, poverty projections under scenario (iii) are identical to those reported by MPOs of the 2022 Spring Meeting. Differences in poverty rates between scenario (iii) and scenarios (i) or (ii) can be seen as the impact of incorporating quintile-specific inflation rates.

IV. Limitations of this approach

Admittedly, this approach has many limitations. First, it assumes all sectors grow at the same rate. MPOs include sector-specific growth projections, but we need to identify sectors where household members work to include the sector-specific growth projections into poverty projections. Such identification is not difficult if it is done for one country with rich household survey data. But it is not easy to apply it to all countries included in the regional database since data availability is severely limited in some countries. Therefore, we did not incorporate the sector-specific growth rates into our poverty projections.

Second, it does not incorporate the net seller effects. If farmers sell a crop whose price is increasing rapidly or consume what they produce, they might even benefit from the price increase. In this sense, the analysis might overestimate the impact of food price inflation. However, the Ukraine war has increased the price of fertilizer. As a result, even if farmers are net sellers of certain crops, they might suffer from the inflation (of fertilizer and other inputs). Also, to incorporate the net-seller effect, we need to have input-output data on agricultural productions, which are not available in many countries.

Third, the analysis can be done with more disaggregated inflation rates. Our experimentation with a few countries suggests that estimating inflation rates by quintile or decile does not make much difference. But disaggregating inflation rates across areas can likely have a non-negligible impact poverty projections. This is something we would like to do as part of future research.

Lastly, this methodology uses only food and non-food inflation projections, but we can use more disaggregated inflation projections like food, energy, and non-food except for energy. Since many expect the Ukraine war likely will have a large impact on food and energy prices, it is worth separating items in energy and other non-food items. However, this requires energy-specific budget shares and projections for inflation rates in energy and other non-food items. This can be done in a country with rich data availability. Still, it is difficult to implement for a regional or global study since some countries have very limited data availability. Furthermore, price increases in a good like oil can affect a wide variety of non-food items, including non-energy goods. Unless a good input-output table is available, estimating the full impact of oil price increases is difficult.

V. The existing poverty measurement and this methodology

This methodology estimates inflation rates for each quintile separately. This helps us differentiate the impact of inflation on household welfare between the rich and the poor. However, many countries' existing poverty measurement methodology does not have this feature. It tends to apply the same inflation adjustment to all households in the data even though, because of differences in consumption patterns, the poor might suffer much more than the rich if food inflation grows faster than non-food inflation. Given that inflationary pressures are rising globally, it is worth considering refinements of poverty measurement methodology to capture the impact of inflation on poverty properly.

VI. Conclusion

This note describes a methodology that modifies the existing MPO poverty projection methodology to capture the impact of inflationary pressures on poverty. Like the existing methodology, it uses MPO's growth and inflation projections. However, the existing methodology assumes all households face the same inflation rate, but this is not the case because consumption patterns differ largely between the poor and the

rich. Instead, the new methodology estimates the inflation rate for each quintile of the household expenditure distribution separately. This new methodology shows that the poverty rate of 2024 can differ depending on which grows faster, food or non-food inflation. If food inflation grows twice faster than non-food inflation between 2022 and 2024, the poverty rate of the Eastern and Southern Africa region in 2024 will be two percentage points higher than if non-food inflation grows twice faster than food inflation. Although this new methodology can show the impact of inflationary pressures on poverty, it is far from perfect. It does not include the net seller effect or the industry-specific impact of inflation. We can see that this is the first step to capturing the inflationary pressures on poverty projections.

Annex: Inflation sensitive MPO projections

We will estimate household welfare from the latest available household survey to project poverty rates. Assuming individual welfare from the latest survey is c_{T1}, welfare at $T2$ (c_{T2}) could be expressed as:

$$c_{T2} = c_{T1}(1 + \delta g_{y,T1}^{T2}) \tag{1}$$

where $g_{y,T1}^{T2}$ refers to the **real** GDP per capita growth rate between T1 and T2, and δ refers to the pass-through rate.[2]

Eq. (1) can be further written as:

$$c_{T2} = c_{T1}(1 + \delta g_{y,T1}^{T2}) = c_{T1}\left(1 + \delta\left(\frac{1 + g_{Y,T1}^{T2}}{1 + d_{T1}^{T2}} - 1\right)\right) \tag{2}$$

where $g_{Y,T1}^{T2}$ refers to the **nominal** GDP per capita growth rate between T1 and T2 and d_{T1}^{T2} refers to the growth rate of the GDP deflator between T1 and T2[3].

Next, since projections of GDP deflator are not available, we estimate them using projections of inflation (π_{T1}^{T2}) because GDP deflators and CPI-based inflation rates are highly correlated. Therefore, we estimate the growth rate of the GDP deflator as a function of the CPI-based inflation rate.

$$d_{T1}^{T2} = \beta_{T1}\pi_{T1}^{T2} \tag{3}$$

Therefore, equation (2) can be written as:

$$c_{T2} = c_{T1}\left(1 + \delta\left(\frac{1 + g_{Y,T1}^{T2}}{1 + \beta_{T1}\pi_{T1}^{T2}} - 1\right)\right) \tag{4}$$

On the other hand, the key assumption of inflation-sensitive analysis is the heterogeneous inflation rate for different quintiles of the household expenditure distribution. To do this, we discount the nominal GDP pc growth rate ($1 + g_{Y,T1}^{T2}$) with the quintile specific inflation rate ($1 + \beta\pi_{T1}^{q,T2}$) rather than a national average inflation rate ($1 + \beta\pi_{T1}^{T2}$). Using the quintile specific inflation rate, equation (4) is revised to be:

$$c_{T2} = c_{T1}\left(1 + \delta\left(\frac{1 + g_{Y,T1}^{T2}}{1 + \beta_{T1}\pi_{T1}^{q,T2}} - 1\right)\right) \tag{4'}$$

We now show how to estimate the quintile-specific inflation rate using food and non-food inflation rates and quintile-specific average food budget shares. We begin with the decomposition of CPI with food and non-food CPIs.

[2] Following the distribution neutral approach, we assume the welfare for all the household grow at the same rate, which is real GDP per capita growth rate.

[3] If private consumption is selected, we will use the growth rate of the private consumption deflator between T1 and T2.

$$CPI_t = \omega_f CPI_t^f + \omega_{nf} CPI_t^{nf} \quad (5)$$

where ω_f refers to the weight for food CPI and ω_{nf} refers to the weight for non-food CPI.

The quintile specific inflation rate ($\pi_{T1}^{q,T2}$) can be written as follows:

$$\pi_{T1}^{q,T2} = \frac{\omega_f^q CPI_{T2}^f + \omega_{nf}^q CPI_{T2}^{nf}}{\omega_f^q CPI_{T1}^f + \omega_{nf}^q CPI_{T1}^{nf}} - 1$$

where ω_f^q refers to the average food budget share of quintile q and ω_{nf}^q refers to the average non-food budget share of quintile q.

Since we know that$CPI_{T2}^f = CPI_{T1}^f\left(1 + \pi_{T1}^{f,T2}\right)$ and $CPI_{T2}^{nf} = CPI_{T1}^{nf}\left(1 + \pi_{T1}^{nf,T2}\right)$, we can rewrite the above question as:

$$\begin{aligned}
\pi_{T1}^{q,T2} &= \frac{\omega_f^q CPI_{T1}^f\left(1 + \pi_{T1}^{f,T2}\right) + \omega_{nf}^q CPI_{T1}^{nf}\left(1 + \pi_{T1}^{nf,T2}\right)}{\omega_f^q CPI_{T1}^f + \omega_{nf}^q CPI_{T1}^{nf}} - 1 \\
&= \frac{\omega_f^q CPI_{T1}^f \pi_{T1}^{f,T2} + \omega_{nf}^q CPI_{T1}^{nf} \pi_{T1}^{nf,T2}}{\omega_f^q CPI_{T1}^f + \omega_{nf}^q CPI_{T1}^{nf}} \\
&\cong \omega_f^q \pi_{T1}^{f,T2} + \omega_{nf}^q \pi_{T1}^{nf,T2} \quad (6)
\end{aligned}$$

The approximation in (6) holds if $CPI_{T1}^f \cong CPI_{T1}^{nf}$. By substituting (6) into (4'), welfare in T2 can be approximated in the following formula:

$$c_{T2}^q \cong c_{T1}\left(1 + \delta\left(\frac{\left(1 + g_{Y,T1}^{T2}\right)}{1 + \beta_{T1}\left(\omega_f^q \pi_{T1}^{f,T2} + \omega_{nf}^q \pi_{T1}^{nf,T2}\right)} - 1\right)\right) \quad (7)$$

Using equation (7), we estimate the impact of inflationary pressures on poverty.