How worse off are consumers in Ghana due to the recent price inflation?

Abstract

The paper estimates the welfare effect of the increases in consumer price indices between January and September 2023 across 9 commodity aggregates in Ghana using the 2018 living standard survey data. An EASI demand system was estimated using the expenditure and Stone-Lewbel prices generated following Castellón et al. (2015). Simulations were based on the growth in the consumer price indices for selected specific commodity aggregates as well as all commodities. The results revealed that Transportation, Communication, Recreation, entertainment and cultural services, and Education are luxury commodities. Increases in transportation cost had the least impact on consumer welfare whilst the general rise in prices for all commodities between January and September 2023 had astronomical effect on consumers, especially the demand for medical care and health. Rural households were least affected by the rise in transport cost when compared with urban dwellers. The price increase led to about 10 per cent reduction in the demand for education and 25 per cent reduction in food and non-alcoholic beverages demand. The welfare estimate suggest that consumer would require about twice the expenditure in January to consume the same amount of goods in September. Despite the significant impact of the recent price increases, there are no price or income support systems in Ghana to help consumer to maintain their wellbeing. Social and economic policies aimed at easing the effects of the price inflation should be considered by government.

Keywords: Demand analysis; EASI demand system; Inflation; Welfare analysis, CPI

1. Background

Recently there has been a significant increase in the prices of goods and services due to global phenomena such as Covid-19, Russia-Ukraine invasion. According to Arndt et al. (2023) the war in Ukraine has significant impact on food, fuel, and fertilizer prices. As the price level increases, each unit of currency buys fewer goods and services. Price inflation can be measured using various methods, including the Consumer Price Index (CPI), Producer Price Index (PPI), and the Retail Price Index (RPI) (Blanchard, 2021; Mankiw, 2020; Mishkin, 2007). The CPI and RPI measure the change in the prices of a basket of goods and services of fixed composition, quantity and quality (Gooding, 2011), while the PPI measures the change in prices of goods and services at the producer level.

Price inflation is a major concern in many countries due to its adverse effects on economic growth, social stability, and overall well-being (Blanchard, 2021; International Monetary Fund, 2021; Mankiw, 2020). The world has experienced varying levels of inflation, with some countries experiencing higher inflation rates than others (Dornbusch et al., 2019; Mankiw, 2020). In 2021, the IMF predicted an average inflation rate of 2.4% for advanced economies, while emerging markets and developing economies were expected to experience an average inflation rate of 6.0%. This divergence in inflation rates underscores the significant variation among nations (International Monetary Fund, 2021). Based on the International Monetary Fund's (IMF) report in 2021, the global trajectory of price inflation has experienced a modest uptick since 2018. This increase can be attributed to various factors, including disruptions in supply chains caused by the COVID-19 pandemic, Russia-Ukraine invasion, elevated commodity prices, and the implementation of accommodative monetary and fiscal policies (International Monetary Fund, 2021)

Developing countries have experienced higher inflation rates than developed countries in recent years (World Bank, 2021). The trend in inflation rates in developing countries reflects supply-side constraints, rising food, and energy prices, and exchange rate depreciations. Inflation rates in Latin America, Asian economies, and China have been driven by supply-side constraints such as food and energy price shocks, and accommodative monetary policies (International Monetary Fund, 2021). A typical example is Venezuela where inflation has been skyrocketing for several years, with the IMF estimating an inflation rate of over 10,000% in 2019 (Cohen, 2018). In Argentina,

inflation has been consistently high, with the annual inflation rate reaching 124% in August 2023 since 1991 (Bianco & Otaola, 2023).

In Sub-Saharan Africa, inflation rates have been high due to supply disruptions and short-sighted monetary policies (Andriantomanga et al., 2022; Nguyen et al., 2017). International Monetary Fund (IMF) predicted that elevated inflation rates in developing countries in 2021 would be driven by higher food and energy prices, currency depreciation, and supply chain disruptions (International Monetary Fund (IMF), 2022). Many countries in sub-Saharan Africa including Ghana were expected to face high inflation rates due to uncontrollable domestic factors such as rising food and energy prices, and high levels of public debt (Bolhuis & Kovacs, 2022).

Aljazeera citing the World Bank's report for Ghana showed that the surge in inflation has pushed 850,000 Ghanaians into poverty, raising the figure above 6 million (Dwamena, 2023). The African Development Bank estimated consumer price inflation to increase from 10% in 2021 to 31.5% in 2022, driven by food prices, energy prices, and depreciation of the local currency (African Economic Outlook (AEO), 2023). Similarly, the Bank of Ghana reported increase in inflation rate from 5.6% in May 2019 to 10.6% in May 2020 (Bank of Ghana, 2020). In March 2023, the Ghana Statistical Service (GSS) estimated the inflation rate to be 45.0% higher compared to the same month the previous year (Ghana Statistical Service, 2023).

The rise in inflation and/or CPI is largely driven by supply chain disruptions resulting from the COVID-19 pandemic, global oil prices increase, and the depreciation of the Ghana cedi against major foreign currencies (Bank of Ghana, 2021). For instance, the International Monetary Fund (IMF) confirmed that the COVID-19 pandemic adversely affected Ghana's economy, leading to lower growth rates and increased fiscal deficits (IMF Communications Department, 2020).

Figure 1 shows the trends in consumer price indices from January 2003 to September 2023. All commodity aggregate had a steady rise from January 2003 until 2015 when there were sharp rises. However, growth in CPI became relatively stable again from 2017 to 2022 after which it skyrocketed. Furnishing household equipment had the highest CPI in September 2023, followed by housing and utility cost, and food and non-alcoholic beverages. Education had the lowest CPI estimate in September 2023. Growth in CPI between January and September 2023 for Food and non-alcoholic beverages, Clothing and footwear, Housing, water, electricity, gas and other, Furnishings household equipment etc, Medical care and health, Transportation, Communications,

Recreation and culture, and Education are 22.44%, 15.54%, 12.38%, 22.10%, 17.35%, 4.17%, 9.35%, 17.11%, and 9.04%, respectively. Details in the growth of the CPI for food and non-alcoholic beverages is shown in Figure 2.

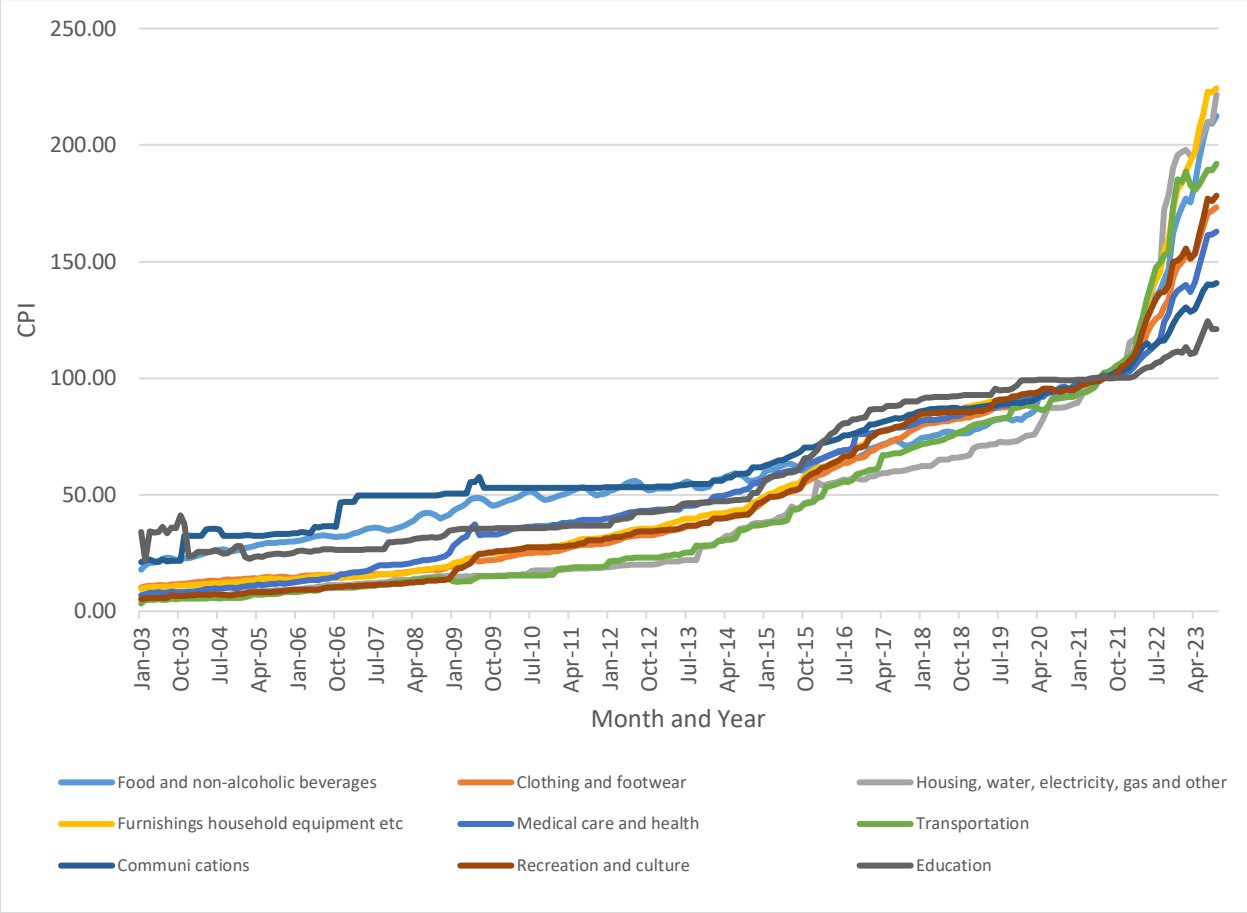

Figure 1 Trend in consumer price indices for commodities in Ghana
Source: Ghana Statistical Service (2023)

In March 2023, the year-on-year food and non-alcoholic beverage price inflation was 50.8 per cent compared the same month the previous year (GSS, 2023). Figure 2 shows the trend in consumer price inflation for food and non-alcoholic beverages since January 2003. Growth in the consumer price index has been steady until the third quarter of 2021 when it skyrocketed from 102% to 122 per cent in October 2023. This astronomical increase has implications for food and nutrition security in Ghana.

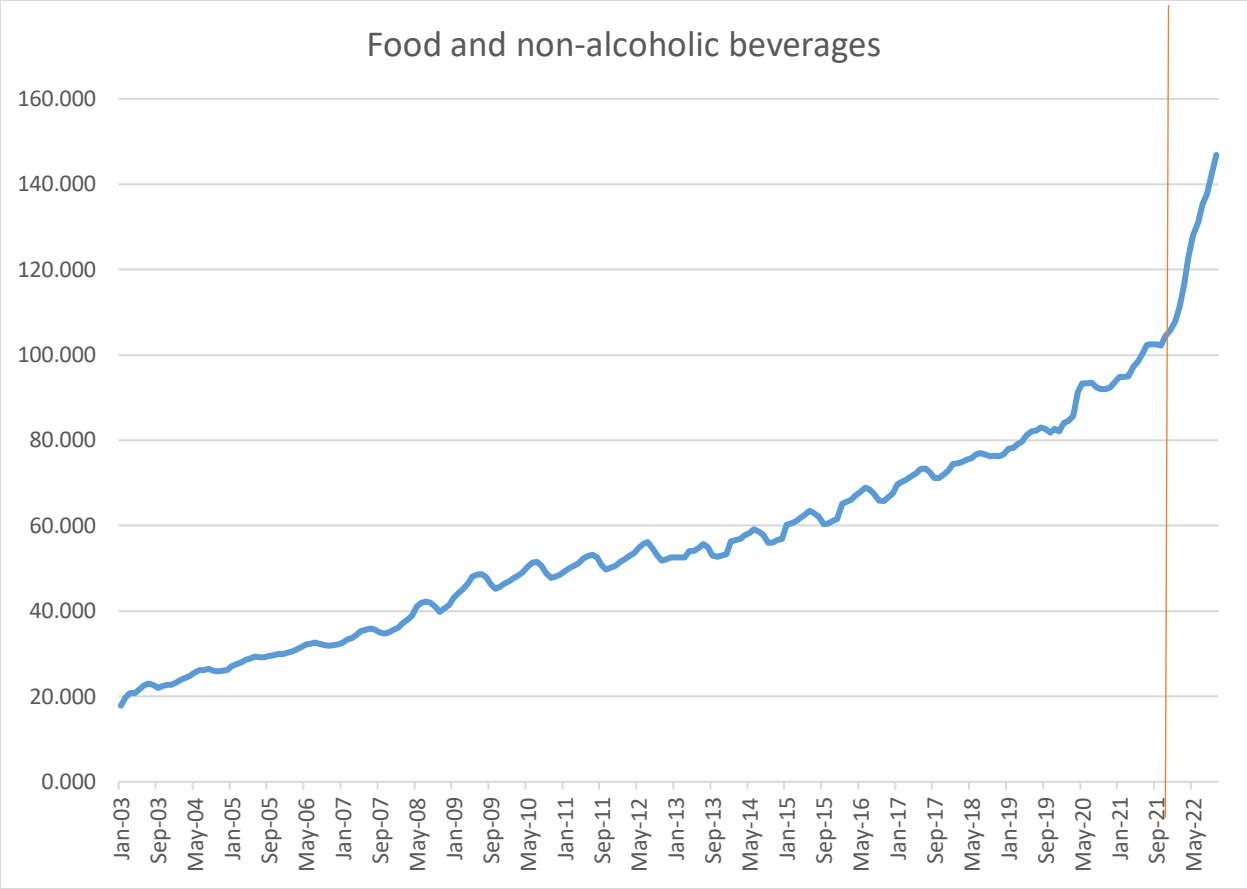

Figure 2 Trend in consumer price indices for food and non-alcoholic beverages from 2003 to 2023. Source: Ghana Statistical Service (2023)

Osei-Asare & Eghan (2013) noted that the 2005 and 2011 food prices inflation eroded consumers purchasing power. According to Unsal et al., (2020) food price inflation could restrict access to sufficient and nutritious food for many households, particularly for women and children. Low-income households have been particularly affected by the rising prices of food, as they spend a larger share of their income on food and other essential items, and these have seen the highest price increases (Charalampakis et al., 2022). Consequently, households tend to reduce their food consumption and shift towards even less balanced diets to cope with the rising cost of food (Von Braun, 2008). During the Covid-19 pandemic, the share of households that suffered food insecurity was about 69.04% (Bukari et al., 2022).

Price inflation does not only affect food price, education, healthcare, housing and utilities;transport fares are also adversely affected. These account for more than half of the total household budget

(Bureau of Labour Statistics (BLS), 2023). Transition to home ownership has become difficult due to rising house price inflation (Pratoomchat, 2019). Dolbeare (1988) found that housing inflation has a greater positive effect on homelessness among low-income households than in the UK. In addition, low income households are more dependent on public transport (Bourn, 2012). They are the most affected by bus fare increases as they spend up to 17% of their income on transportation (Blumenberg, 2003). In the UK, rising bus fares has been found to be a barrier to employment. Poor households are unable to afford bus fares to job interviews or decline their ideal job because of distance and cost of commutation (Urban Transport Group, 2010). Franklin (2018) found that providing transport subsidies to unemployed youth in Ethiopia increased their job search intensity and probability of finding permanent employment. During periods of hyperinflation government spend more on national healthcare. Studies in the USA have found that GDP growth decelerated in 2001 due to healthcare employment, medical inflation, and premium growth escalation (Levit et al., 2002).

Despite the numerous discussions on the implications of inflation to consumers and economic growth, studies quantifying the recent consumer price inflation on household demand and welfare using novel approaches are lacking in Ghana. To the best of the authors' knowledge, this is the first empirical study estimating a complete demand system for Ghana. Second, the study is based on the most recent nationwide living standard survey data that include households in all regions in Ghana, from diverse demographic and socio-economic groups. Third, the empirical approach adopted is the first of its kind. The paper estimate S-L prices using regional consumer price indices and EASI demand systems which are superior to all other existing demand models. Another advantage is that the model allows the incorporation of unobserved household heterogeneity in the welfare calculation and does not impose any restrictions on the shape of the Engel curve. Finally, the simulation approach adopted is based on actual price changes that occurred between January and September 2023 and reveals actual impact of price inflation on consumers in Ghana as of September 2023.

The remainder of the paper are as follows: the next section presents the data, and empirical strategy used to derive the results. The next section presents detailed results and discussion, and the final section presents the conclusion and limitations of the study.

2. Methods

Data

The data used in this research were obtained from a nation-wide representative household survey conducted by the Ghana Statistical Service in 2016/17. The Ghana Living Standard Survey (GLSS7) is a cross-sectional survey designed to generate information about the living conditions and well-being of households in Ghana. The aim is to allow government to have data on the trends in poverty and identify areas relevant for timely policy interventions. The GLSS7 collects detailed information households' location, socioeconomic status, consumption behavior, malnutrition, health status as well as food security. A total of 12,328 subjects who were 15 years and above were considered for the analysis. The present dataset has been aggregated into expenditure on medical care and health, recreation, food and beverages, clothing and footwear, household goods, operations and services, transport, communication, education, and miscellaneous (all other expenditures).

The dataset does not contain information on the quantities and prices of the aggregated purchases made by the household. This presents a major setback in the use of Living Standard surveys for demand analysis. There have been several approaches used by researchers to circumvent this limitation including the use of unit values (Cox & Wohlgenant, 1986) and consumer price indices (Kastens & Brester, 1996). However, these approaches have been found to be problematic not being able to account for spatial and household variability in purchases (Castellón et al., 2015). The present study uses the approach proposed by Castellón et al. (2015) based on the seminal work by Lewbel, (1989) to construct household level Stone-Lewbel price indices. The former found that S-L price indices allows for the accurate estimation of demand systems even in the absence of prices since the variations in prices are due to household heterogeneity and not the CPI. The CPIs for each group aggregate from the Ghana Statistical Service and the budget shares from the GLSS7 dataset were used as inputs to construct the Stone-Lewbel (SL) price indices for our commodity groups.

Table 1 shows a list of commodity aggregates purchased by the average household, along with their mean budget shares and estimated SL price indices. The mean budget share for food is about 46 per cent of the total household expenditure indicating that households in Ghana spend close to half of their expenditure on food consumption. Housingd and utilities are the second most

important commodities in household budget representing 17.4 of total expenditure, followed by clothing and footwear and education. Recreation, entertainment and cultural services and medical and health expenses represent the least in household expenditure (1 per cent). In summary, food and non-alcoholic beverages, housing and utilities, education, and clothing and footwear are the most important items in household expenditure, representing 82 per cent of the total budget share.

Table 1 Descriptive statistics (means of budget share, log prices) of each of the commodity aggregate.

Commodity aggregate	**Budget shares**	**Price indices**
Food and non-alcoholic beverages	0.462	0.478
Clothing and footwear	0.092	0.548
Housing and Utility	0.174	1.082
Household goods, operations and services	0.047	1.446
Medical care and health	0.009	0.879
Transportation	0.067	0.420
Communication	0.024	0.612
Recreation, entertainment and cultural services	0.014	0.170
Education	0.087	0.719
Miscellaneous goods and services	0.024	0.649
Log of real expenditure	8.913	

Source: Own computation 2023

Table 2 shows the percentage of households that did not spend on any of the 10 commodity aggregates. All households spend on housing and utilities indicated by the zero-percentage estimate. More than 60 percent of households do not spend on medical care and health. This figure indicates that majority of households in Ghana do not subscribe to the Government's National Health Insurance Scheme (NHIS) probably due to the desire to allocate the money to necessities like food and housing and utilities. About 22 per cent of households do not spend on transportation probably because they live in rural areas where there is no need for public or private transportation due to proximity to amenities. Also, less than 1 per cent of household stated that they did not spend on food and non-alcoholic beverages. This could be attributed to the fact that most people in rural areas are involved in subsistence agriculture. About a third of households did not spend on education whilst 15 and 25 per cent did not spend on communication, and recreation, entertainment and cultural services, respectively.

Table 2 The percentage of non-consuming food households

Commodity aggregate	Non-consuming households (%)
Food and non-alcoholic beverages	0.907
Clothing and footwear	2.791
Housing and Utility	0.000
Household goods, operations and services	3.598
Medical care and health	63.795
Transportation	22.400
Communication	15.740
Recreation, entertainment, and cultural services	25.298
Education	36.484
Miscellaneous goods and services	27.654

Source: Own computation 2023 based on GLSS7 dataset

Finally, Table 3 shows the mean and standard deviation of the demographic variables included in the demand model. About 68 per cent of the respondents interviewed were male indicating a larger proportion of males in the data than females. The average age of the respondents in the data was 46 years and the average household size was 4. A total of 55 per cent of respondents were married. Less than half of the respondents live in urban areas suggesting that rural folks have larger representation in the GLSS7. Finally, 79 per cent of the respondents had an active income generating activity.

Table 3 Mean values and standard deviations of socio-demographic characteristics of households

Demographic variable	Mean	Standard deviation
Gender (Male=1)	68.834%	0.463
Age	46.241	15.912
Marital status (married = 1)	55.100%	0.497
Household size	4.200	2.867
Employment status (employed=1)	79.149%	0.406
Location (Urban area=1)	42.958%	0.495

Source: Own computation 2023 based on GLSS7 dataset

Empirical Framework

Stone-Lewbel (S-L) price indices

The SL price indices are estimated based on the assumption that within group utility functions are weakly separable and the within group utility functions follow a Cobb-Douglas function. Castellón et al. (2015) specified the SL price[1] as

$$v_{li} = \frac{1}{k_i} \prod_{j=1}^{n_i} \left(\frac{p_{ij}}{w_{ij}} \right)^{w_{lij}} \quad (1)$$

where w_{lij} is the budget share for good (or commodity subgroup) j within commodity group i for a given household l; k_i is a scaling factor for commodity group i constructed using the subgroup budget shares of the reference household ($k_i = \prod_{j=1}^{n_i} \bar{w}_{ij}^{-\bar{w}_{ij}}$); and p_{ij} is the price for good j within commodity group i.

Estimation technique: LA/EASI demand system

The data has a high proportion of individuals reporting zero expenditure for 6 out of 10 commodity groups. This requires that the demand model estimated considers the impact of zero consumption responses. To address this limitation in the dataset, three steps were followed: 1) estimate a probit regression to determine the factors that influences the decision to spend or not to spend on a particular commodity group; 2) derive the probability density functions (cdf) and the cumulative density functions (cdf) from the estimated probit model; and 3) include the estimated cdf and pdf in the demand model to account for censoring.

Probit model or sample selection equation

This study used the two step procedure proposed by Shonkwiler & Yen, (1999) based on the systems of equations below:

$$w_{li}^* = f(p, z_l, x_l; \theta_i) + \varepsilon_{li}; \qquad d_{li}^* = s_l' \rho_i + u_{li} \quad (2)$$

$$d_{li} = \begin{cases} 1 \; if \; d_{li}^* > 0 \\ 0 \; if \; d_{li}^* \leq 0 \end{cases} \qquad w_{li} = d_{li} w_{li}^* \quad (3)$$

[1] Notation are from (Castellón et al., 2015)

$$i = 1,2, \dots, N; l = 1,2, \dots, L$$

w_{li}^* is the latent budget share for the *i*-th commodity group and the *l*-th household; d_{li}^* is the latent variable defining the sample selection in Equation 2; w_{li} and d_{li} are the observed budget share and the dummy variable. θ_i is a vector of parameter estimates, p is a vector of prices, z_l is a vector of socio-demographic characteristics including total expenditure, gender, marital status, household size, employment status, location or ecological zone (i.e. coastal, Accra, savannah or forest) and x_l is the total expenditure; s_i is a vector of socio-demographic characteristics explaining the sample selection equation; and ρ_i is the vector of parameters derived from the sample selection equation estimated using maximum likelihood (ML).

The second stage of the estimation involves calculating cumulative density functions $\widehat{\Phi}_{li}$ and probability density functions $\widehat{\emptyset}_{li}$ of the error term u_{li} using the parameters ρ_i from the sample selection probit equation.

LA/EASI demand system

The EASI demand system was chosen over the traditional AIDS model for the following reasons: 1) the error terms can be interpreted as unobserved household heterogeneity; 2) the Engel curves for each commodity is completely unrestricted; 3) the approximate version is close to the general form of the model; and 4) the unobserved heterogeneity have significant impact on the welfare calculations that would be derived subsequently.

The general specification of the EASI demand system is

$$w_l = \sum_{r=0}^{5} b_r y_l^r + Cz_l + \mathrm{D}z_l y_l + Ap_l + Bp_l y_l + \epsilon_l \quad (4)$$

Where w_l is the budget share for the *l*-th household, p_l is the vector of prices for the *l*-th household, z_l are the vector of demographic characteristics included in the model which are less than those in the sample selection equation in order to avoid multicollinearity, ϵ_l are the error terms which equates unobserved heterogeneity, the y_l is the vector of log of real expenditure estimated as

$$y_l = \ln(x_l) - p_l' w_l \quad (5)$$

To simplify the estimation which has already been complicated by censoring, interactions were removed and three polynomials of y_l were included in the final model. The censored LA/EASI demand model for household l incorporating the cdf and pdf was specified as:

$$w_l = \widehat{\Phi}_l(\sum_{r=0}^{3} b_r y_l^r + Cz_l + + Ap_l + \ + \epsilon_l) + \widehat{\emptyset}_l \delta + \varepsilon_l \quad (6)$$

where $\widehat{\Phi}_l$ and $\widehat{\emptyset}_l$ are nxn identity matrices where the ones have been replaced by the cdf and pdf values of μ_{li}, and δ is an n vector of parameters to be estimated. The final $n-1$ equations were estimated using iterative three-stage least squares (3SLS) to account for the *n*-th equation. Symmetry and homogeneity were imposed on the model.

The Hicksian own-price and expenditure elasticities were derived using

$$\xi = \varpi^{-1}\Phi(A) + \Omega\varpi - I \quad (6)$$

where ξ is an nxn matrix of own price elasticities, ϖ is an identity matrix where the ones have been replaced by the commodities' budget shares, Ω is an nxn matrix of ones and I is an identity matrix:

$$\text{and} \quad \eta = \varpi^{-1}(I + \Phi \mathfrak{b} \mathfrak{p}')^{-1}\Phi \mathfrak{b} + 1_n \quad (7)$$

whilst η is a vector of expenditure elasticities, $\mathfrak{b}$ is the expenditure semi-elasticities derived from the censored demand equation.

The matrix of Marshallian own-price elasticities τ were derived from Equation 6 and 7 as

$$\tau = \xi - \varpi\eta \quad (8)$$

The impact of price inflation on consumer welfare was estimated for the average household as well as for households living in urban versus rural areas. The calculation is best on the log of living cost index proposed by (Lewbel & Pendakur, 2009) derived using the semi-elasticities from the EASI demand model. The estimation follows the formula below:

$$C(p_1, u, z, \varepsilon) - C(p_0, u, z, \varepsilon) = (p_1 - p_0)'w_0 + \frac{1}{2}(p_1 - p_0)'(A)(p_1 - p_0) \quad (9)$$

The term $(p_1 - p_0)'w_0$ is the Stone index for the price change which are usually used when there are small price changes and also allows for unobserved heterogeneity across households (Lewbel & Pendakur, 2009). A is the matrix of the semi-elasticities derived from the estimated EASI demand model. The second term $\frac{1}{2}(p_1 - p_0)'(A)(p_1 - p_0)$ captures substitution effects in the model as a result considers large price changes whilst accounting for the importance of both observed and unobserved heterogeneity in the model.

Simulation

The simulation is based on the growth in the consumer price indices of the three commodities shown on Figure 3 as well all commodities considered in the model. The figure shows exponential growth in the consumer price indices for health and food and non-alcoholic beverage expenditure starting from the fourth quarter of 2021. Between January and September 2023, the consumer price indices for health and food and non-alcoholic beverages increased by 17 and 22 per cent, respectively. Transport prices grew by 4 per cent over the same period. The growths in the consumer price indices will have significant impact on the welfare of households especially those living in rural areas as well as low-income households. Four policy scenarios were considered: 1) the effects of the CPI increase in each of the three most vital commodities: Food and non-alcoholic beverage (S1), Medical care and health (S2), Transportation (S3); 2) the combine effects of the CPI increases on all three commodities; 3) the combine effect of the CPI increases in all commodities; and 4) the distributional effect on urban and rural households.

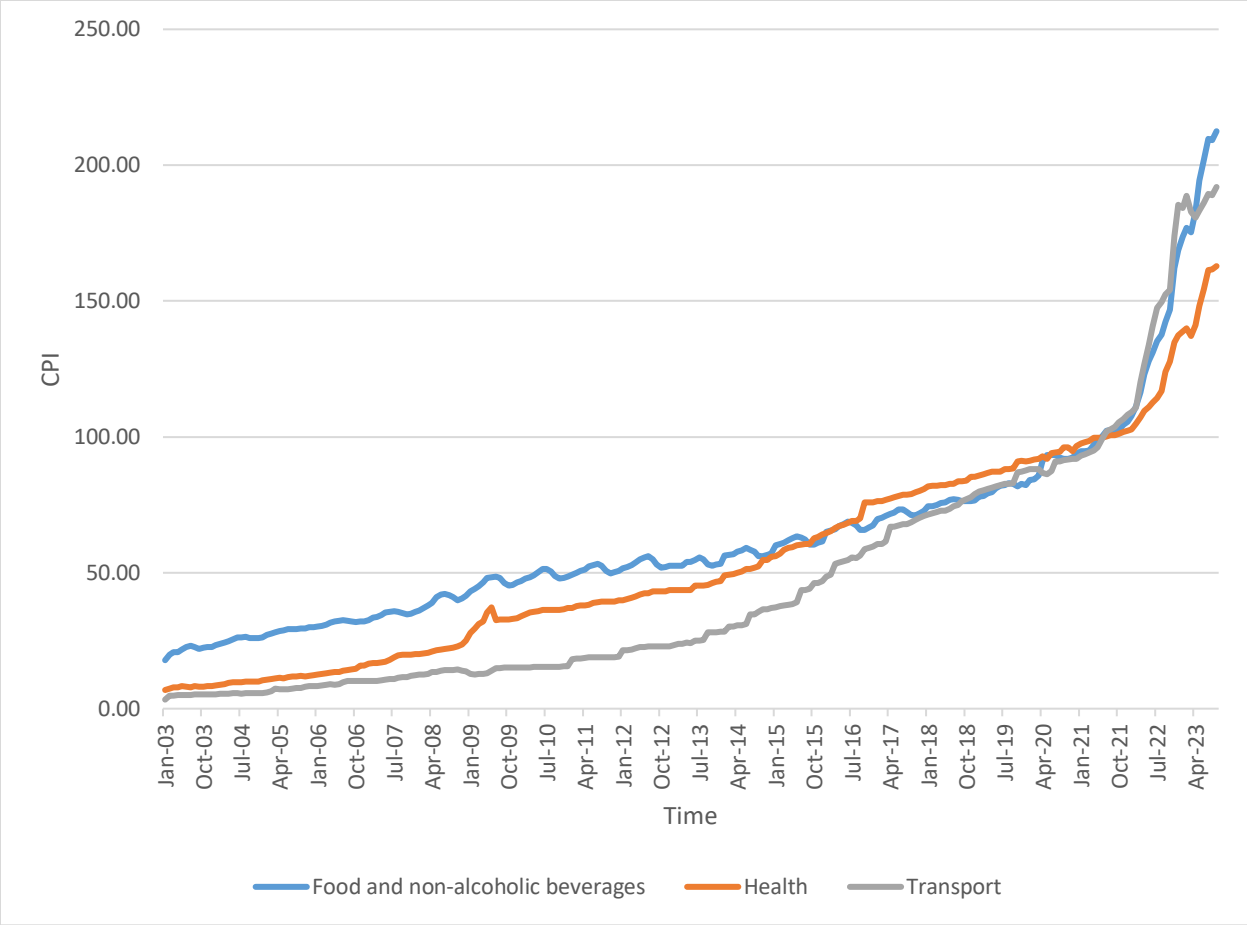

Figure 3 Trends in consumer price indices from January 2003 to September 2023
Source: Own computation

Table 4 shows the simulations scenarios. The impact of each scenario was accessed on purchases and consumer welfare (based on the log of cost living index). Under scenario S1 only the price increases in food and non-alcoholic beverage price increases were considered, holding all other prices as fixed. Under scenario S2, only medical care and health was considered whilst scenario S3 considered only transportation cost. S4 simulated the combine effect of S1, S2, and S3. The final scenario was based on the price increases for all commodity aggregates between January and September 2023. The estimated increase in the CPI is shown on the last column of Table 4. The CPI for food and non-alcoholic beverages had the largest increase between January and September 2023, followed by household goods, operations and services, and medical care and health expenses. Transportation cost had the lowest increase in CPI over the period.

Table 4 Simulation scenarios

Commodity aggregates	**(S1)**	**S2)**	**(S3)**	**(S4)**	**(S5)**	**Estimated CPI change: January-September 2023 (%)**
Food and non-alcoholic beverages	X			X	X	22.44
Clothing and footwear					X	15.54
Housing and Utility					X	12.38
Household goods, operations and services					X	22.10
Medical care and health		X		X	X	17.35
Transportation			X	X	X	4.17
Communication					X	9.35
Recreation, entertainment and cultural services					X	17.11
Education					X	9.04

Food and non-alcoholic beverage (S1); Medical care and health (S2); Transportation (S3); Food and non-alcoholic beverage, Health & Transportation (S4); and All commodities (S5)

3. Results and discussion

Table 4 shows the Marshallian prices and expenditure elasticities for the 10 commodity aggregates in our dataset. All own price elasticities were negative and significant at the 1 per cent level. The own price elasticities show the sensitivity of consumers to price changes in the aggregated commodities. A value less than 1 (inelastic) indicate lower sensitivity whilst a figure greater than 1 (elastic) show high sensitivity. All commodity groups were elastic except transportation and education cost. Among the elastic groups, consumers are more sensitive to price change in medical care and health (-5.09) than in food and non-alcoholic beverages (-1.20). The inelastic nature of transportation and education shows that consumers value them and cannot forgo them even when prices are high. Similarly, both long-run and short-run elasticities for automobile usage in the USA, Australia and UK were found to be price inelastic (Oum et al., 1992). Fouquet (2012) also found the long run land transport demand elasticity to be inelastic (-0.6). In a developing country like Mexico, demand for urban rail transport was also found to be inelastic (-0.23 to -0.32) (Davis, 2021). These results reveal the importance of transportation in day-to-day activities. The inelastic elasticity for education is supported by the work of (Kutortse, 2022) who used the same dataset to estimate the demand for education in Ghana. The author found that primary, secondary, and tertiary education were demand inelastic confirming that consumers are less responsive to changes in education cost. Food and non-alcoholic were significantly price elastic suggesting that consumers are highly responsive to price changes in this commodity. Evidence support that consumers in developing countries are more responsive to price changes in food than those in the developed world (Green et al., 2013). They will either shift to a lower quality product or refuse to buy the product when the price increases. The expenditure elasticity for this commodity is significant and less than 1 which means that consumers consider food and non-alcoholic beverages to be necessity. Other necessities are clothing and footwear; housing and utility, household goods, operations and services; and medical care and health. However, Transportation, communication, recreation, entertainment and cultural services, and education are considered as luxury commodities which are highly affordable for the affluent in the society.

Table 5 Marshallian price and expenditure elasticities

Commodity groups	1	2	3	4	5	6	7	8	9	10	Expenditure
Food and non-alcoholic beverages (1)	**-1.201**	0.010	0.106	-0.028	0.046	0.022	0.031	0.019	0.009	0.051	0.936
	(0.014)	(0.006)	(0.008)	(0.004)	(0.009)	(0.013)	(0.01)	(0.011)	(0.011)	(0.017)	(0.004)
Clothing and footwear (2)	0.080	**-1.305**	0.163	0.141	0.065	-0.259	-0.067	0.103	0.009	0.202	0.867
	(0.021)	(0.013)	(0.029)	(0.009)	(0.018)	(0.026)	(0.019)	(0.019)	(0.019)	(0.037)	(0.01)
Housing and Utility (3)	0.353	0.094	**-1.547**	0.017	0.128	0.175	-0.012	0.044	0.087	-0.121	0.782
	(0.021)	(0.013)	(0.029)	(0.009)	(0.018)	(0.026)	(0.019)	(0.019)	(0.019)	(0.037)	(0.01)
Household goods, operations and services (4)	-0.274	0.267	0.035	**-1.368**	-0.164	-0.091	0.010	0.228	-0.197	0.625	0.929
	(0.038)	(0.032)	(0.029)	(0.031)	(0.039)	(0.04)	(0.034)	(0.029)	(0.037)	(0.06)	(0.011)
Medical care and health (5)	0.969	0.263	0.955	-0.317	**-5.094**	0.467	-0.142	-0.040	1.207	0.935	0.797
	(0.162)	(0.134)	(0.137)	(0.075)	(0.377)	(0.203)	(0.148)	(0.128)	(0.155)	(0.335)	(0.239)
Transportation (6)	-0.270	-0.355	0.185	-0.090	0.118	**-0.592**	0.009	-0.176	-0.366	-0.250	1.787
	(0.107)	(0.039)	(0.066)	(0.023)	(0.056)	(0.11)	(0.053)	(0.053)	(0.063)	(0.078)	(0.208)
Communication (7)	0.356	-0.251	-0.151	0.001	-0.124	0.068	**-1.810**	0.058	0.458	0.124	1.271
	(0.228)	(0.102)	(0.132)	(0.06)	(0.124)	(0.164)	(0.224)	(0.142)	(0.149)	(0.221)	(0.447)
Recreation, entertainment and cultural services (8)	0.129	0.442	0.269	0.553	-0.062	-0.832	0.079	**-1.160**	-0.816	-0.312	1.709
	(0.332)	(0.136)	(0.225)	(0.09)	(0.169)	(0.247)	(0.226)	(0.252)	(0.218)	(0.347)	(0.598)
Education (9)	-0.077	-0.019	0.053	-0.078	0.203	-0.199	0.095	-0.102	**-0.960**	-0.103	1.188
	(0.037)	(0.021)	(0.023)	(0.013)	(0.028)	(0.036)	(0.03)	(0.029)	(0.052)	(0.042)	(0.021)
Miscellaneous goods and services (10)	1.088	0.636	-0.526	0.942	0.685	-0.557	0.134	-0.154	-0.345	**-2.065**	0.160
	(0.285)	(0.153)	(0.201)	(0.094)	(0.247)	(0.211)	(0.196)	(0.195)	(0.186)	(0.496)	(0.509)

Bootstrap standard errors are in brackets. Source: Own computation based GLSS7 data

Impact of price increases on demand

Figure 4 shows the impact of price increases on the demand for 9 commodities and 5 types of simulations. The increase in consumer price indices from January to September has significant negative impact across the major commodities bought by households. Under S1, the direct effect on the demand for food and non-alcoholic beverages is about 27 percent. There will negative indirect effect on Household goods, operations and services (6.16%), transportation (6.06%) and education (1.72%). Therefore rising food price inflation results in reduction in overall food consumption and disinvestment in education (Ruel et al., 2010). However, if the price of food increases whilst holding the prices of all other goods fixed, there was a positive impact on the remaining 6 commodities: the highest on medical care and health.

Under scenario S2, the direct effect of the rise in the consumer price index of medical care and health is approximately 88 per cent. The indirect effect is negative for Household goods, operations and services (-2.85%), Communication (2.16%), and Recreation, entertainment and cultural services (-1.07%) but positive for the remaining commodity aggregates. For instance, increases in medical care and health services charges will increase the demand for education by 3.52%. It is difficult to find a plausible explanation for this phenomenon as both own- and cross-price elasticities were considered in the estimation. The rise in food demand due to higher health cost could be due to the desire to eat healthily so consumers do not pay for higher health charges.

S3 has the least direct and indirect effects on demand. Between January and September, transportation cost increased by 4.17 per cent. This decreased the demand for transport services by 2.47 per cent. Similarly, clothing and footwear, Household goods, operations and services, Recreation, entertainment and cultural services, and Education declined by 1.08%, 0.38%, 3.47% and 0.83%, respectively. The remaining commodity aggregates increased marginally between 0.09% for Food and non-alcoholic beverages and 1.95% for medical care and health. In summary, higher transport cost will shift expenditure from clothing and footwear to food and non-alcoholic beverages.

S4 shows the impact of price increases in Food and non-alcoholic beverage, medical care and Health expenses, and Transportation cost. The direct effect of the price increases on demand are -26.07% for food and non-alcoholic beverages, -64.69% for medical care and health, and -6.49% for transportation cost. The indirect effects are negative for Household goods, operations and

services, and Recreation, entertainment and cultural services. However, increases in the three commodity aggregates whilst holding the price of the remaining aggregates fixed will have a positive effect on the demand for Clothing and footwear, Housing and Utility, Communication and Education.

The final simulation (S5) considers the impact of the increase in the consumer price indices on all commodity groups. The estimate shows that demand for Medical care and health (46.89%) is the most affected whilst housing and utility (5.02%) is affected the least. Assuming fixed income for consumers, consumer price inflation reduced food demand by 24.54% between January and September 2023. Similarly, the rise in consumer price indices for transportation over the same period would reduce demand by 11.42% and education by 9.95%.

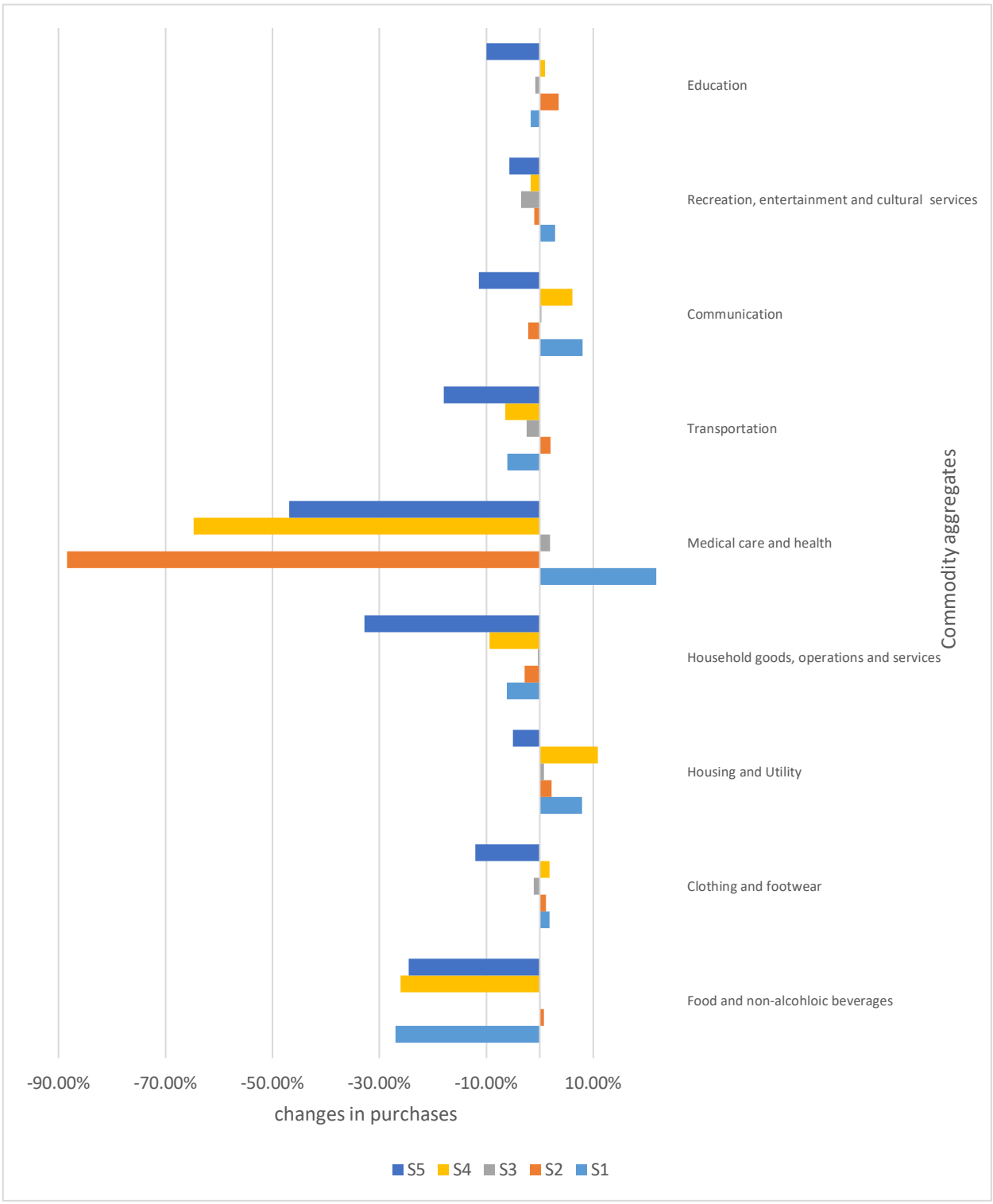

Figure 4 Changes in demand due to increases in consumer price indices from January to September 2023. Food and non-alcoholic beverage (S1); Medical care and health (S2); Transportation (S3); Food and non-alcoholic beverage, Health & Transportation (S4); and All commodities (S5)

Impact of price inflation on consumer welfare

Figure 5 shows the estimated average log of living cost index for the average households and compares with rural and urban households. The scenario with the least impact on welfare is S3 whilst the one with the largest impact is S5. In scenario S5, urban households are expected to be affected more by the rise in inflation than rural households. In September, rural households would expect 1.74 times increase in their initial expenditure to main the same consumption as in January whilst urban households would expect 1.79 times increase in their initial expenditure; 5 percent higher. However, the average household would expect 1.66 times increase in their September expenditure in order to consume the same goods as in January.

Under S3, rural households will save about 0.79 per cent in September if they decide to consume the same quantity of commodities as in January. However, urban households would require 3.85 per cent increase in September's expenditure in order to consume the same amount of commodities they consumed in January whilst the average household would require 1.20 per cent increase. This is not surprising since rural households are less affected by transportation increases due to lower use of public and private transport. In fact, most rural household either trek or ride to get things done.

Finally, rural households are most affected when food and non-alcoholic beverage prices increase. For instance, the estimate shows that, in September rural households would require 83.9 per cent increase in their initial expenditure in order to consume the same number of commodities consumed in January. The figure is 76.97 per cent for urban households and 80.92 per cent for the average population.

The welfare estimate shows that the effect of the recent consumer price inflation is astronomical, and consumers would be unable to survive without adequate price or income support from government. However, price and income support are lacking in developing countries (Abokyi et al., 2020).

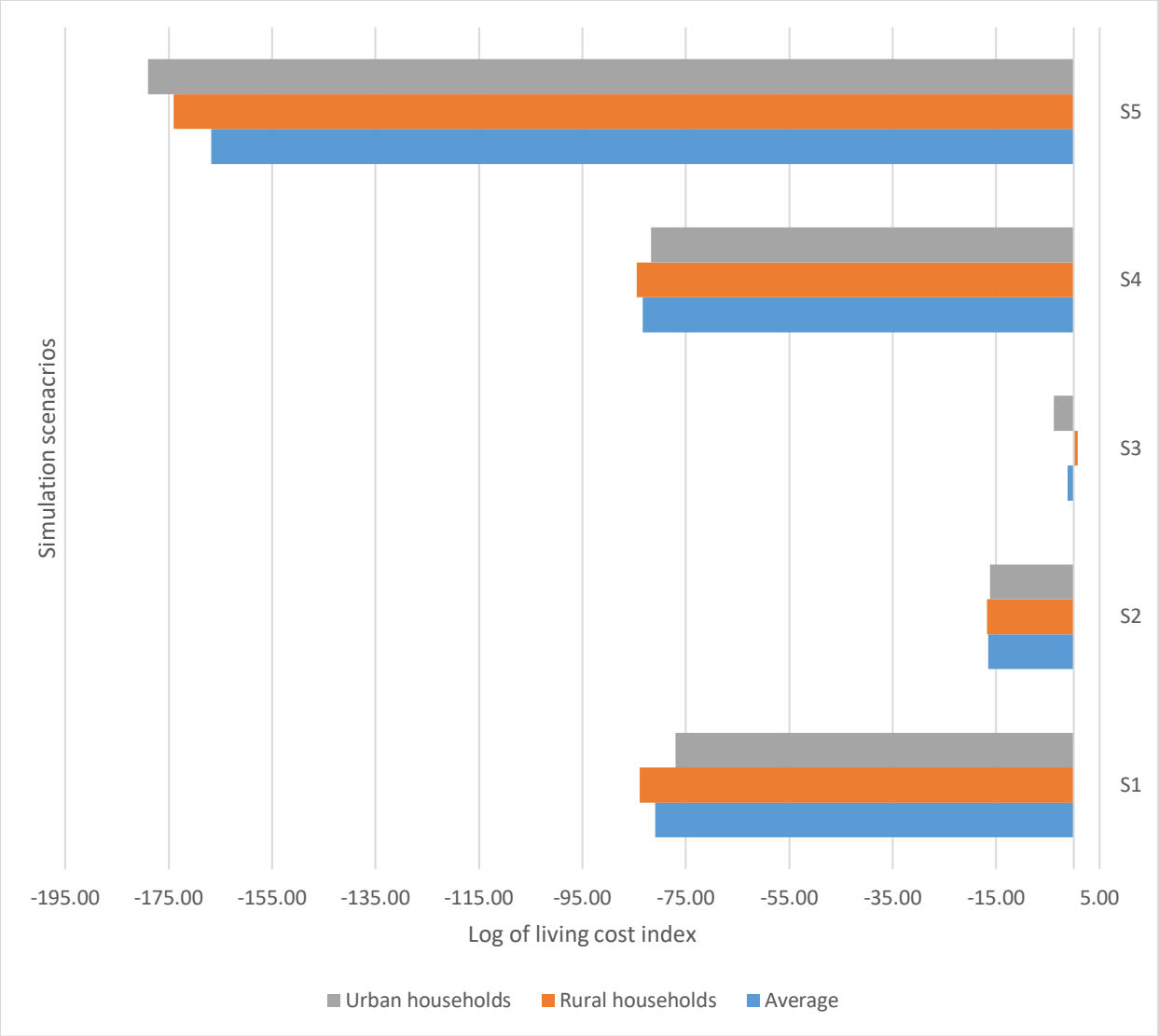

Figure 5 Welfare effect of price inflation on average, urban and rural households

Policy implications

The results about the impact of consumer price inflation shows a gloomy picture for household demand in Ghana. The significant fall in the demand for food and non-alcoholic beverages raises concerns for food and nutrition security in the country. There is the need for a price and/or income support policy to assist consumers to meet their daily consumption. However, there are no price and income support policies in Ghana to help consumers to deal with the current price increases. For instance, the government's school feeding program was brought to a halt because of lack of funds to keep it running (Schandorf, 2022). This situation has the potential to worsen the living condition for all households especially the poorest of the poor. The government needs to re-

introduce the National Nutrition Policy (NNP) program to assist households to deal with the current global crisis.

In addition, the significant fall in the demand for medical care and health resonant with the high price elasticity of demand. This situation raises concern about affordability of health care in Ghana especially among the poor. Although, the government's National Health Insurance Scheme (NHIS) is running, many households are still unable to afford the subscription fee. Most households resolve to unorthodox means to treat themselves. Many have lost their lives due to over reliance on spiritual or unorthodox means for healing. This situation is likely to increase if government fails to make healthcare accessible and affordable to all. Ghana's NHIS should be made free and accessible to all as it is in most advance economies.

The impact of the price increases on education demand is less than 10 per cent, however, the spiral effect on the labor force and literacy rate in the country cannot be overemphasized. Recent estimate shows that the literacy rate in Ghana rose from 57.9% in 2000 to 80.4% in 2020 (World Bank, 2023). This is a tremendous achievement. However, without any proper policy in place this achievement can easily be eroded. Households who prioritize Household goods, operations and services, and medical care and health expenses over education are likely to drop out of school just to meet their daily necessities. This situation could reverse the success that have been made over the years. Although, basic education is free in the country, it is not accessible and affordable due to the cost involve in maintaining students in boarding houses. Educational support schemes and policies or programs that make the cost of staying in educational institutions cheaper for students should be explored; free meals, cheap transportation, adequate housing infrastructure should be pursued.

Finally, the general rise in prices require about 80 per cent increase in total initial budget to meet current expenses. This is unprecedented and requires urgent policy support. The cost-of-living crisis will be felt hardest by lower income households and those in urban areas. Policies targeted at these groups of households is necessary and should be timely. Energy, educational and food support policies are required to lessen the cost-of-living crisis. For instance, food banks could be instituted to provide free food or meals to poor households. In addition, energy support schemes should be put in place to assist those who are unable to pay their housing and utilities due to reduced real income or loss of jobs.

4. Conclusion

The goal of the present study is to estimate the impact of the consumer price inflation between January and September 2023 on demand for 10 aggregate commodities in Ghana. The study relied on the Ghana Living Standard Survey data for 2018 which covers all expenses made by the household within the last 30 days of the sampling period. The lack of prices in the Living Standard Survey dataset presents a major challenge for empirical work. The study circumvented this limitation by following the seminal work of Castellón et al. (2015) to impute Stone-Lewbel (S-L) prices. Both SL prices and expenditure shares were used to estimate an Exact Affine Stone Index demand system for Ghana. The model was estimated in 3 stages due to the large number of censorings in the data: first, a probit selection equation was estimated; second, the probability density functions (pdf) and cumulative density functions (cdf) were derived; and third, the EASI demand system was augmented with the cdf and pdf to correct for zero consumption or censoring in the data.

Price and expenditure elasticities were estimated for the average household. All own-price and expenditure elasticities were significant at the 1 per cent level. Only Transportation and Education were found to be price inelastic indicating that consumers are insensitive to price changes within these two commodity groups. For expenditure, all commodities were expenditure inelastic except Transportation, Communication, Education, and Recreation, entertainment and cultural services. Food, housing, and medical services are considered as necessities by consumers whilst expenditure elastic commodities are luxury to consumers, for example Recreation, entertainment and cultural services.

To estimate how the recent rises in consumer price inflation has affected purchases and consumer welfare, 5 scenarios were considered; 1) inflation on food and non-alcoholic drinks only; 2) inflation on medical care and health; 3) inflation on transportation; 4) combine inflation on 1), 2) and 3); and 5) price inflation on all commodity aggregates.

The result shows that the welfare impact of the consumer price inflation between January and September 2023 is astronomical. Demand for food and non-alcoholic beverages reduced by about 25 per cent; demand for medical care and health reduced 47 per cent; while education reduced by about 10 per cent due to the price inflation. The situation is more regressive on consumers living in urban areas. The average consumer would require 1.7 times their January expenditure to

consume the same quantity of goods in September. This is worrying since there is no price and/or income support systems in Ghana for vulnerable consumers. Government and stakeholders concerned about food and nutrition security should be very concerned about the recent price inflation and take steps to protect consumers.

The study has various limitations that should be considered whilst interpreting the results. First, the data used is based on purchases made in 2017 and may not reflect current consumption patterns. Second, the data does not contain actual prices of the commodities used in the dataset as a result shadow prices based on SL price were used. This is likely to under/overestimate the prices where the CPI and demographic variables used are completely different. Finally, the dataset may not account for households that are living in inaccessible places in Ghana. This will underestimate the impact of the recent price inflation in Ghana.

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